Appendix E:

2015 UWMP Chapter 5

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5.0 SBX7-7 BASELINES AND TARGETS

In February 2008 Governor Arnold Schwarzenegger introduced a plan for improving the Sacramento-San Joaquin Delta, a component of which is to achieve a 20 percent reduction in per capita water use statewide by the year 2020. In November 2009 Senate Bill 7-7 (SBx7-7) was signed into law, addressing urban and agricultural water conservation. SBx7-7 requires water suppliers to calculate baseline per capita water use and per capita water use targets for 2015 and 2020 in the 2010 UWMP.

Beginning in 2016 retail water suppliers are required to comply with the water conservation requirements in SB X7-7 in order to be eligible for State water grants or loans.

5.1. Updating Calculations from 2010 UWMP

The water use target for 2020 was calculated in the 2010 UWMP based on the assumption that the Vacaville city limits were completely contained within the Sacramento River Hydrologic Region. Using the latest online tool provided by the DWR, a small percentage of the City's area was found to be in the San Francisco Bay Hydraulic Region. Per the 2015 Guidebook, the 2020 urban water use target was proportionally calculated to be 164 as shown in SB X7-7 Table 7-E in Section 5.6. This was a reduction from the 167 target calculated in the 2010 UWMP.

5.2. Baseline Period

The baseline period is the average annual per capita water use calculated over a period of ten years ending between 2004 and 2010. The City's ten year period was taken from 2000 to 2009. The determination of baseline per capita water use for the City is summarized in SB X7-7 Table 5 in Section 5.5.

The 5-year baseline period to confirm the selected 2020 target was calculated using a continuous 5-year period ending no earlier than 2007 and no later than 2010. The City's 5-year period was taken from 2004 to 2008 as shown in SB X7-7 Table 5.

5.3. Service Area Population

Vacaville city limits correspond to the service area boundary during the baseline period and the compliance year of 2015. The total population for the City of Vacaville was adjusted to remove the portion of the prison population that is served by SCWA as detailed on Page 3-1. The City Finance Department's population tables were adjusted to reflect the calculation described above to estimate population with the same incremental increase.

5.4. Gross Water Use

The City has continued to track the volume of water entering the distribution system for the last 15 years from all 3 sources as detailed in Chapter 6, System Supplies.

5.5. Baseline Daily Per Capita Water Use

As seen in SB X7-7 Table 5, the Daily per Capita Water Use is reported in gallons and is referred to as Gallons per Capita per Day (GPCD). The City's baseline per capita water use is 188 GPCD for the 10- year period ending in 2009.

SB X7-7 Table 5: Gallons Per Capita Per Day (GPCD)				
Baseline Year *Fm SB X7-7 Table 3*		Service Area Population *Fm SB X7-7 Table 3*	Annual Gross Water Use *Fm SB X7-7 Table 4*	Daily Per Capita Water Use (GPCD)
10 to 15 Year Baseline GPCD				
Year 1	2000	82,460	16,804	182
Year 2	2001	83,725	17,658	188
Year 3	2002	86,396	17,577	182
Year 4	2003	85,846	17,461	182
Year 5	2004	86,882	18,456	190
Year 6	2005	87,935	17,985	183
Year 7	2006	87,734	18,555	189
Year 8	2007	85,638	19,336	202
Year 9	2008	85,908	19,390	202
Year 10	2009	85,953	17,690	184
Year 11	0	-	-	
Year 12	0	-	-	
Year 13	0	-	-	
Year 14	0	-	-	
Year 15	0	-	-	
10-15 Year Average Baseline GPCD				188
5 Year Baseline GPCD				
Baseline Year *Fm SB X7-7 Table 3*		Service Area Population *Fm SB X7-7 Table 3*	Gross Water Use *Fm SB X7-7 Table 4*	Daily Per Capita Water Use
Year 1	2004	86,882	18,456	190
Year 2	2005	87,935	17,985	183
Year 3	2006	87,734	18,555	189
Year 4	2007	85,638	19,336	202
Year 5	2008	85,908	19,390	202
5 Year Average Baseline GPCD				193
2015 Compliance Year GPCD				
2015		89,627	13,204	132

5.6. 2015 and 2020 Per Capita Water Use Target

SBx7-7 requires cities to achieve a minimum amount of conservation regardless of the 2020 Per Capita Water Use Targets calculated by the four methods. This minimum amount of conservation is described in Section 10608.22 of SBx7-7. A water supplier may not use a per capita water use target greater than the water use target described in Section 10608.22.

The per capita water use target, which must be met by 2020, must be calculated using one of four methods described in the *Guidebook for Urban Water Suppliers to Prepare a 2015 Urban Water Management Plan* (UWMP Guidebook). The four methods are, in brief:

Method 1: 80 percent of Baseline Per Capita Water Use.

Method 2: Performance standard based on actual and estimated water use data including indoor residential water use; landscaping area; commercial, industrial, and institutional water use.

Method 3: 95 percent of the State Hydrologic Regional Target Water Use.

Method 4: Subtract water savings based on identified practices from Baseline Per Capita Water Use.

The City evaluated all four methods and determined that Methods 1 and 3 are the most appropriate methods to determine Vacaville's 2020 Per Capita Water Use Target. It is in the City's interest to use the highest target calculated by the four methods in order to minimize impacts to the water users of the City while still meeting established water use goals.
The City used Methods 1 and 3 to determine potential per capita water use targets. Using Method 1, the per capita water use target is 80 percent of the baseline per capita water use. The City's per capita water use target would be 151 gpcd using Method 1 as shown in SB X7-7 Table 7-A.

SB X7-7 Table 7-A: Target Method 1 20% Reduction	
10-15 Year Baseline GPCD	2020 Target GPCD
188	151

Using Method 3, the per capita water use target is 95 percent of the applicable state hydrologic region target as defined in the draft 20x2020 Water Conservation Plan. The majority of the City is located in hydrologic region 5 at 94 percent with 6 percent of the City within region 2. Region 5 has a hydrologic region target of 176 gpcd and region 2 has a target of 131. The City's per capita water use target, based on Method 3, is therefore 164 gpcd as calculated in SB X7-7 Table 7-E.

SB X7-7 Table 7-E: Target Method 3				
Agency May Select More Than One as Applicable	Percentage of Service Area in This Hydrological Region	Hydrologic Region	"2020 Plan" Regional Targets	Method 3 Regional Targets (95%)
		North Coast	137	130
		North Lahontan	173	164
	94%	Sacramento River	176	167
	6%	San Francisco Bay	131	124
		San Joaquin River	174	165
		Central Coast	123	117
		Tulare Lake	188	179
		South Lahontan	170	162
		South Coast	149	142
		Colorado River	211	200
Target *(If more than one region is selected, this value is calculated.)*				164

The 2020 Per Capita Water Use Target of 164 gpcd calculated by Method 3 is the preferred target, however further comparison to a maximum target figure is required. As seen in SB X7-7 Table 5, the average maximum water use target is determined using a baseline per capita water use calculated by averaging per capita water use over a 5-year period ending between 2007 and 2010. For the City, this period was from 2004 to 2008 and produced an average maximum water use of 193 gpcd. The maximum per capita water use target is 95 percent of this baseline per capita water use which corresponds to a maximum per capita water use target of 183 gpcd (95 percent of 193 gpcd). Because the maximum per capita water use target (183 gpcd) is greater than the per capita water use target calculated for 2020 using Method 3 (164 gpcd), the City is required to use the per capita water use target calculated with Method 3. The maximum per capita water use target calculation for the City is summarized in SB X7-7 Table 7-F.

SB X7-7 Table 7-F: Confirm Minimum Reduction for 2020 Target			
5 Year Baseline GPCD *From SB X7-7 Table 5*	Maximum 2020 Target[1]	Calculated 2020 Target[2]	Confirmed 2020 Target
193	183	164	164

[1] Maximum 2020 Target is 95% of the 5 Year Baseline GPCD [2] 2020 Target is calculated based on the selected Target Method, see SB X7-7 Table 7 and corresponding tables for agency's calculated target.

5.7. 2015 Compliance Daily Per Capita Water Use (gpcd)

The interim per capita water use target, which must be met in 2015, is defined as the midpoint between the baseline per capita water use and the 2020 per capita water use target. The City's 2015 interim per capita water use target is 176 gpcd as shown in SB X7-7 Table 8.

SB X7-7 Table 8: 2015 Interim Target GPCD		
Confirmed 2020 Target *Fm SB X7-7 Table 7-F*	10-15 year Baseline GPCD *Fm SB X7-7 Table 5*	2015 Interim Target GPCD
164	188	176

The City's 2015 actual gpcd fell to 132 which is well below the 2015 and 2020 targets. The per capita water use in the City is expected to slightly increase when the drought subsides but continue to stay below the 2020 target as a result of permanent landscaping modifications and more stringent building requirements for new development, such as mandatory measures of the 2013 California Green Building Standards Code. The City also plans to continue water conservation education and measures described in Chapter 9, Demand Management Measures.

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Appendix F:

2020 SBx7-7 Verification Forms (Amended)

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SB X7-7 Table 0: Units of Measure Used in 2020 UWMP* *(select one from the drop down list)*
Acre Feet
**The unit of measure must be consistent throughout the UWMP, as reported in Submittal Table 2-3.*
NOTES:

SB X7-7 Table 2: Method for 2020 Population Estimate	
Method Used to Determine 2020 Population (may check more than one)	
☑	**1. Department of Finance** (DOF) or **American Community Survey** (ACS)
☐	**2. Persons-per-Connection Method**
☐	**3. DWR Population Tool**
☐	**4. Other** DWR recommends pre-review
NOTES: DOF population is adjusted to exclude the portion of the California Medical Facility and California State Prison - Solano that is served by Solano Irrigation District (see UWMP Section 5.1).	

SB X7-7 Table 3: 2020 Service Area Population	
2020 Compliance Year Population	
2020	100,731
NOTES: DOF population is adjusted to exclude the portion of the California Medical Facility and California State Prison - Solano that is served by Solano Irrigation	

SB X7-7 Table 4: 2020 Gross Water Use							
Compliance Year 2020	2020 Volume Into Distribution System *This column will remain blank until SB X7-7 Table 4-A is completed.*	2020 Deductions					2020 Gross Water Use
		Exported Water *	Change in Dist. System Storage* (+/-)	Indirect Recycled Water *This column will remain blank until SB X7-7 Table 4-B is completed.*	Water Delivered for Agricultural Use*	Process Water *This column will remain blank until SB X7-7 Table 4-D is completed.*	
	18,295			-	-	-	**18,295**

*** Units of measure (AF, MG , or CCF)** must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.

NOTES:

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s), Meter Error Adjustment

Complete one table for each source.

Name of Source	Groundwater		
This water source is *(check one)* **:**			
☑	The supplier's own water source		
☐	A purchased or imported source		
Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional* *(+/-)*	Corrected Volume Entering Distribution System
	4,984	-	4,984

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s) Meter Error Adjustment

Complete one table for each source.

Name of Source	Solano Project		
This water source is *(check one)* **:**			
☐	The supplier's own water source		
☑	A purchased or imported source		
Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional* *(+/-)*	Corrected Volume Entering Distribution System
	9,159		9,159

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] ***Meter Error Adjustment -*** *See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES:

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s), Meter Error Adjustment

Complete one table for each source.

Name of Source	State Water Project

This water source is *(check one)* :

☐	The supplier's own water source
☑	A purchased or imported source

Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional* *(+/-)*	Corrected Volume Entering Distribution System
	2,875		2,875

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES:

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s), Meter Error Adjustment

Complete one table for each source.

Name of Source	Settlement Water

This water source is *(check one)* :

☐	The supplier's own water source
☑	A purchased or imported source

Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional* *(+/-)*	Corrected Volume Entering Distribution System
	1,277		1,277

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES:

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C: 2020 Process Water Deduction Eligibility (For use only by agencies that are deducting process water) Choose Only One	
☐	**Criteria 1**- Industrial water use is equal to or greater than 12% of gross water use. Complete SB X7-7 Table 4-C.1
☐	**Criteria 2** - Industrial water use is equal to or greater than 15 GPCD. Complete SB X7-7 Table 4-C.2
☐	**Criteria 3** - Non-industrial use is equal to or less than 120 GPCD. Complete SB X7-7 Table 4-C.3
☐	**Criteria 4** - Disadvantaged Community. Complete SB x7-7 Table 4-C.4
NOTES: The City is not deducting process water.	

SB X7-7 Table 5: 2020 Gallons Per Capita Per Day (GPCD)		
2020 Gross Water ***Fm SB X7-7 Table 4***	**2020 Population** ***Fm SB X7-7 Table 3***	**2020 GPCD**
18,295	100,731	**162**
NOTES:		

SB X7-7 Table 9: 2020 Compliance							
Actual 2020 GPCD[1]	Optional Adjustments to 2020 GPCD					2020 Confirmed Target GPCD [1, 2]	Did Supplier Achieve Targeted Reduction for 2020?
	Enter "0" if Adjustment Not Used			TOTAL Adjustments[1]	Adjusted 2020 GPCD [1] *(Adjusted if applicable)*		
	Extraordinary Events[1]	Weather Normalization[1]	Economic Adjustment[1]				
162	-	-	-	-	162	164	**YES**

[1] *All values are reported in GPCD*

[2] ***2020 Confirmed Target GPCD*** *is taken from the Supplier's SB X7-7 Verification Form Table SB X7-7, 7-F.*

NOTES:

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Appendix G:

Groundwater Supply Sufficiency Technical Memorandum

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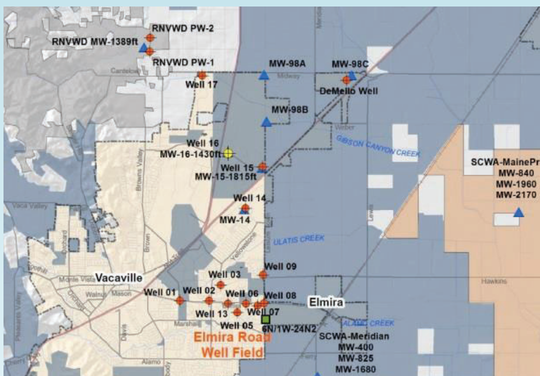
Technical Memorandum

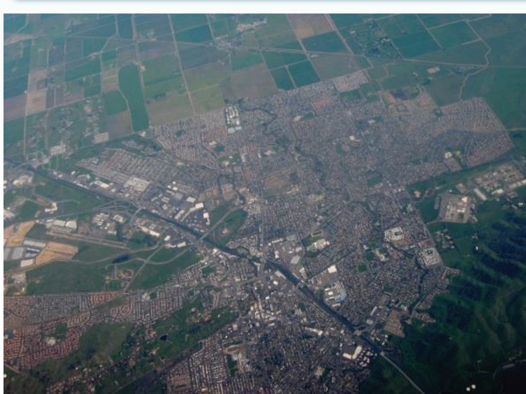
GROUNDWATER SUPPLY SUFFICIENCY

May 2016



Prepared for

City of Vacaville



Prepared by

Luhdorff & Scalmanini,
Consulting Engineers

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Technical Memorandum

Groundwater Supply Sufficiency

Prepared for

City of Vacaville

May 2016

Prepared by

Luhdorff & Scalmanini, Consulting Engineers

Job No. 15-1-116

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1 INTRODUCTION

1.1 CITY'S GROUNDWATER UTILIZATION

This Technical Memorandum describes the use and sufficiency of groundwater supplies beneath the City of Vacaville and vicinity to meet the City's historical and projected groundwater demands. This Memorandum summarizes subsurface hydrogeologic conditions and describes the City's approach to managing groundwater resources. This Memorandum also describes the sufficiency of groundwater pumped for the past 5 years and planned utilization of groundwater resources for a more than 20-year planning horizon (through 2040), including results of a groundwater flow model and the estimated pumpage for the principal aquifer in the northern Solano County area.

This Memorandum has been prepared in support of the City's *2015 Urban Water Management Plan Update* (City of Vacaville, 2016).

1.1.1 City Water Supplies

The City of Vacaville is located at the base of the Vaca Mountains, approximately halfway between Sacramento and San Francisco on Interstate 80 (**Figure 1-1**). Water demand has increased as the City's population grew from about 43,400 in 1980 to 71,500 in 1990, 92,000 in 2009, and almost 94,000 in 2014.

The City's water utility system was purchased from the Pacific Gas and Electric Company in 1959 by issuing voter-approved water revenue bonds (Nolte, 2005). Since that time, the City has systematically improved and upgraded the water utility system. Today, the City's system consists of transmission and distribution pipelines, storage reservoirs, wells, pumping facilities, and water treatment facilities. The system receives water from several sources, including Solano Project water from the Lake Berryessa Reservoir, State Water Project (SWP) water and Settlement Water from the North Bay Aqueduct (NBA), and groundwater from local City wells. The percentage of water used from each supply source varies due to the City's conjunctive management of its water resources. Prior to completion of the Solano Project, all water supplies provided for municipal purposes were developed from local groundwater. The City has received Solano Project water through an agreement with SCWA since 1959.

Some of the Solano Project and SWP water supply is based on the City's entitlement and some is based on other agreements and settlements. The City's surface water entitlements for 2015 totaled 27,173 acre-feet (AF). SWP deliveries are less than the entitlement in all but the wettest years. The availability of SWP water is approximately 83% of the entitlement in a normal year and is projected to decrease to 22% in a single-dry year and to 27% in a multiple-dry year. Surface water supplies are detailed in the technical memorandum "SCWA Water Supply Reliability Technical Memorandum" (Kennedy/Jenks Consultants, April 14, 2016).

The 2003 Recycled Water Plan will be updated in the next two years and is expected to provide future recycled water quantities that will be included in the 2020 UWMP update, there is no data at this time to support a volume projection in this 2015 UWMP (personal communication, Christina Castro, City of Vacaville, March 18, 2016).

In aggregate, the estimated water resources available to the City in the year 2040 total 42,198 AF, including about 8,100 AF of groundwater (about 20% of the total supply) during normal water years and more groundwater during drier years. Historically, the City has generally used less than 8,000 AFY of groundwater.

1.1.2 Groundwater Supply Sufficiency

With regard to the demonstration of groundwater supply sufficiency and reliability for purposes of Urban Water Management Plans (UWMPs), the California Water Code, Section 10631(b)(3) requires the water supplier to provide a "detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years." Water Code Section 10631(4)(c) further requires that the City "describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following:

(A) An average water year.
(B) A single-dry water year.
(C) Multiple-dry water years.

A "sufficient water supply" is defined in Government Code 66473.7 as "the total water supplies available during the normal, single-dry, and multiple-dry years within a 20-year projection that will meet the projected demand associated with the proposed subdivisions, in addition to existing and planned future uses, including, but not limited to, agricultural and industrial uses." The California Water Code Section 10644 also requires updating of the UWMP, including provisions relating to groundwater as part of the City's water supply.

Although three water year terms (normal, single-dry and multiple-dry years) are identified in Government Code 66473.7, definitions for these water years are not included in the Code. However, the "2015 Urban Water Management Plans Guidebook for Urban Water Suppliers" (March 2016, California Department of Water Resources) defines the types of years:

> ***Average (Normal) year***: A year, or an averaged range of years, that most closely represents the average water supply available to the agency. The UWMP Act uses the term "normal" conditions. The terms "normal" and "average" are used interchangeably within the guidebook.
>
> ***Single-Dry Year***: The single-dry year is the year that represents the lowest water supply available to the agency.
>
> ***Multiple-Dry Years***: The multiple dry year period is the period that represents the lowest average water supply availability to the agency for a consecutive multiple year period (three years or more). This is generally considered to be the lowest average runoff for a consecutive multiple year period (three years or more) for a watershed since 1903. DWR has interpreted "multiple dry years" to mean three dry years, however, water agencies may project their water supplies for a longer time period.

Water Code Section 10631(b)(1) specifies that a copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750) be supplied with the UWMP. The City recently adopted its *Groundwater Management Plan Update* (LSCE, 2011). This Memorandum summarizes information on hydrogeologic conditions, including the description of the groundwater basins from which the City of Vacaville pumps groundwater, along with an analysis of the City's historical use of groundwater and the groundwater levels observed in response to City and other pumpage in the northern Solano County area. This Memorandum also provides a summary of previous work performed to estimate the potentially sustainable level of annual pumpage.

This previous work involves an analytical groundwater model that was developed to simulate the response of the principal aquifer used by the City for meeting municipal demands under various pumping scenarios through the year 2035, including a climate-based scenario to evaluate increased pumpage during drier water years (e.g., single-dry year and/or multiple-dry water years). This Memorandum contains a summary of this modeling work and more details in Appendix B.

Finally, this Memorandum describes the groundwater monitoring data that will continue to be collected and used to evaluate future pumpage sustainability based on the criteria discussed below.

1.1.3 Memorandum Outline

This Memorandum summarizes the analyses necessary to address the groundwater supply sufficiency and reliability portions of the UWMP requirements, including:

- A summary of the geologic setting and groundwater basin;
- A summary of the City's historical and projected pumpage;
- A summary of groundwater conditions, including the hydrogeology of major water-producing units underlying the City;
- A summary of groundwater levels in and around the City;
- A summary of groundwater quality for major chemical constituents;
- A summary of land subsidence in and around the City; and
- A summary of the groundwater supply sufficiency for 2020-2040.

2 SUMMARY OF CITY WATER SUPPLIES AND GROUNDWATER CONDITIONS

2.1 GROUNDWATER BASIN DESCRIPTIONS

As shown on **Figure 2-1**, the City of Vacaville overlies portions of two DWR-designated groundwater basins. The City primarily overlies the northwestern portion of the Solano Subbasin, which is one of 18 subbasins in the Sacramento Valley Basin of the Sacramento River Hydrologic Region. A small area in the southern portion of the City overlies the Suisun-Fairfield Valley Basin in the San Francisco Bay Hydrologic Region. The western portion of the City, west of the Solano Subbasin boundary, is located in the Sacramento River Hydrologic Study Area but does not overlie any area currently designated by DWR as a groundwater basin or subbasin (**Figure 2-1**).

All of the City's existing and proposed municipal wells are located in the Solano Subbasin. **Figure 2-2** shows the other major purveyors in the northern portion of the subbasin. These include the City of Dixon, SID, Rural North Vacaville Water District (RNVWD), Maine Prairie Water District (MPWD), and Reclamation District 2068 (RD 2068). Descriptions of the Solano Subbasin and the Suisun-Fairfield Valley Basin are provided below. These descriptions are partly based on the information contained in *California's Groundwater, Bulletin 118 Update 2003* (DWR, 2003). For the Solano Subbasin, a more detailed groundwater basin description is posted on the DWR web site (DWR, 2016).

2.1.1 Sacramento Valley Basin, Solano Subbasin (Basin Number: 5-21.66)

The Solano Subbasin includes the southernmost portion of the Sacramento Valley Basin and extends into the northern portion of the Sacramento-San Joaquin Delta. Overall, population density within the subbasin is sparse, with the major cities being Vacaville, Dixon, and Rio Vista. Subbasin boundaries are defined by Putah Creek on the north, the Sacramento River on the east (from Sacramento to Walnut Grove), the North Mokelumne River on the southeast (from Walnut Grove to the San Joaquin River), and the San Joaquin River on the south (from the North Mokelumne River to the Sacramento River). The western subbasin boundary, which extends through a portion of the City, is partly defined by the groundwater divide between the San Francisco Bay and Sacramento River Hydrologic Regions as described by DWR (2010). DWR reports that the location of the divide is roughly delineated by the English Hills (a section of the Coast Range south of Putah Creek and north of Vacaville) and the Montezuma Hills. There is an area west of the Solano Subbasin between the subbasin boundary and the Lagoon Valley/Vaca Valley fault in which some groundwater development has occurred, but which does not lie within a designated basin or subbasin area.

2.1.2 Suisun-Fairfield Valley Basin (Basin Number: 2-3)

The Suisun-Fairfield Valley Basin is composed of low alluvial plains, with surrounding foothills and mountains, located immediately north of Suisun Bay. The foothills of the Coast Ranges, lying west of Green Valley, bound the basin on the west. The southern extent of the Vaca Mountains forms the northern boundary of the basin. The eastern extent of the basin is marked by low ridges of consolidated rock that appear near the City and extend southeast to the Montezuma Hills (Thomasson et al, 1960).

2.2 CITY OF VACAVILLE GROUNDWATER

Prior to 1997, all City pumpage was from the Elmira Road well field, primarily from wells completed in the basal zone of the Tehama Formation but also including a small amount of pumpage from City Well 1 completed in the Markley Formation. Concentrated pumpage in the Elmira Road area caused a localized cone of depression and declining groundwater levels in the basal zone. In order to alleviate this condition, the City began constructing new wells outside of the Elmira Road area in the mid-1990s. Beginning with the construction of Well 14, which came on line in 1997, some pumpage has been redistributed from Elmira Road to the northeastern portion of the City. Two other northeast sector wells have since been constructed in the basal zone. Well 15 came on line in 2004, and Well 16 came on line in 2007. The northeast sector wells produced almost 2,200 AF (40-42% of the total) in 2014 and 2015. The locations of existing City wells are shown on **Figure 2-3**.

The majority of the City's historical and current pumpage is from the basal zone of the Tehama Formation; Well 1 is the only non-basal zone well currently in operation. Total annual pumpage for the City from 1968 to 2015 is shown on **Figure 2-4** and **Table 2-1**. Annual pumpage from the City's wells is divided into four categories on **Figure 2-4**:

1) Basal zone pumpage from the Elmira Road well field (Wells 2 through 13);
2) Non-basal zone pumpage from Well 1 at Elmira Road (currently less than 100 AF per year);
3) Basal zone pumpage from northeast sector wells (currently Wells 14, 15, and 16);
4) Non-basal zone pumpage from the DeMello well in the northeast sector (maximum of 160 AF per year in 2003, offline as of 2005).

The City's annual groundwater pumpage was relatively constant from 1968 to 1974, ranging from 2,862 to 3,316 AF per year. All pumpage during this period was from Elmira Road wells but was not differentiated by zone. Pumpage began to increase in 1975 and reached a peak of 8,165 AF in 1983. Pumpage decreased to 6,088 AF in 1984 and ranged from 5,421 to 6,236 AF, with an average of about 5,800 AF, during 1984 to 1992. Pumpage decreased to 4,395 AF in 1993 and continued to decrease to a low of 3,230 AF in 1996. Pumpage increased from1996 to 2002, reaching 6,638 AF in 2002. From 2002 to 2007 pumping remained relatively constant, averaging 6,635 AF per year. Since 2007, the City of Vacaville has reduced the amount of groundwater it produces to 5,222 AF in 2015, which represents 40% of total water used (13,204 AF[1]) for that year. Water demand supplied by groundwater was 34% in 2007 and 31% in 2010.

[1] The actual volume of water supplies for 2015 was 13,204 AFY according to Table 6-8 Retail: Water Supplies – Actual, which lists the Solano Project Water at 6,214 AFY; State Project Water at 1,769 AFY; and groundwater at 5,222 AFY.

Table 2-1
City of Vacaville Annual Well Production (acre feet)

Year	Elmira Road			Northeast Sector			All Wells		
	Basal Zone (Wells 2-13)	Non-Basal Zone (Well 1)	Total	Basal Zone (Wells 14-16)	Non-Basal Zone (DeMello)	Total	Basal Zone (Wells 2-16)	Non-Basal Zone (Well 1 & DeMello)	Total
1968									2862
1969									3046
1970									2871
1971									3198
1972									3255
1973									3125
1974	2,870	446	3,316				2,870	446	3,316
1975	3,492	478	3,970				3,492	478	3,970
1976	4,525	440	4,965				4,525	440	4,965
1977	4,724	368	5,092				4,724	368	5,092
1978	5,300	407	5,707				5,300	407	5,707
1979	5,858	327	6,185				5,858	327	6,185
1980	6,594	395	6,989				6,594	395	6,989
1981	7,540	200	7,740				7,540	200	7,740
1982	7,428	254	7,682				7,428	254	7,682
1983	7,892	273	8,165				7,892	273	8,165
1984	6,066	22	6,088				6,066	22	6,088
1985	5,709	144	5,854				5,709	144	5,854
1986	5,594	229	5,823				5,594	229	5,823
1987	6,085	151	6,236				6,085	151	6,236
1988	5,291	129	5,420				5,291	129	5,420
1989	5,919	153	6,072				5,919	153	6,072
1990	5,520	106	5,626				5,520	106	5,626
1991	5,298	149	5,447				5,298	149	5,447
1992	5,405	126	5,531				5,405	126	5,531
1993	4,395	0	4,395				4,395	0	4,395
1994	3,888	4	3,892				3,888	4	3,892
1995	3,856	30	3,885				3,856	30	3,885
1996	3,128	102	3,230				3,128	102	3,230
1997	3,240	14	3,254	132		132	3,372	14	3,386
1998	3,369	34	3,403	502		502	3,871	34	3,905
1999	3,288	33	3,321	775		775	4,063	33	4,096
2000	4,221	52	4,330	811		811	5,089	52	5070
2001	5,162	113	5,275	939		939	6,101	113	6,214
2002	5,563	101	5,664	973		973	6,536	101	6,638
2003	5,455	93	5,549	919	160	1,079	6,374	253	6,628
2004	5,130	107	5,237	1,325	60	1,385	6,455	167	6562
2005	4,862	96	4,959	1,722	0	1,722	6,584	96	6,680
2006	4,840	95	4,934	1,701	0	1,701	6,541	95	6,635
2007	4,590	101	4,691	1,920	0	1,920	6,511	101	6,612
2008	3,575	93	3,668	2,116	0	2,116	5,692	93	5,784
2009	2,644	54	2,698	1,949	0	1,949	4,593	54	4,647
2010	2,894	69	2,963	2,091	0	2,091	4,985	69	5,054
2011	2,959	63	3,022	2,027	0	2,027	4,986	63	5,049
2012	3,243	82	3,326	1,816	0	1,816	5,059	82	5,142
2013	3,294	77	3,370	1,866	0	1,866	5,160	77	5,236
2014	3,129	59	3,188	2,157	0	2,157	5,287	59	5,345
2015	2,977	72	3,048	2,174	0	2,174	5,151	72	5,222

Source of data: City of Vacaville

2.2.1 City Groundwater Pumpage 2011 - 2015

Total groundwater pumping by the City for 2011 to 2015 ranged between 5,049 to 5,345 AF (**Table 2-2**).

Table 2-2
Groundwater — Volume Pumped[1]

Basin Name(s)	Aquifer Unit	2011	2012	2013	2014	2015
Sacramento Valley Basin/Solano Subbasin	Basal Zone	4,986	5,059	5,160	5,287	5,151
Sacramento Valley Basin/Solano Subbasin	Non-Basal Zone	63	82	77	59	72
Total groundwater pumped		5,049	5,142	5,236	5,345	5,222

Units: acre-feet per year
[1]Pumpage amount based on volumetric meter readings

2.2.2 Projected City Groundwater Pumpage 2020 - 2040

Based on normal water years, projected groundwater supplies are summarized in **Table 2-3**. Total City groundwater pumpage in normal years is projected to increase to 8,100 AF in 2040 as new City wells come on line.

Table 2-3
Groundwater — Volume Projected to be Pumped
(Normal Water Year)

Basin Name(s)	Aquifer Unit	2020	2025	2030	2035	2040
Sacramento Valley Basin/Solano Subbasin	Basal Zone	6,900	7,200	7,600	8,000	8,000
Sacramento Valley Basin/Solano Subbasin	Non-Basal Zone	100	100	100	100	100
Total groundwater projected[1]		7,000	7,300	7,700	8,100	8,100

Units: acre-feet per year
Includes future planned expansion
1. *Source Table 6-9 Retail Water Supplies – Projected (personal communication, Christina Castro, City of Vacaville, February 18, 2016)*

The City anticipates the addition of three new wells during the period from about 2020 to 2040 if the general plan is built out as predicted. With the existing demands, at least one new well is proposed in the next five years and another two wells are projected to be replaced by 2040. New wells will be geographically separated by a minimum distance of one-half mile for new and existing wells to minimize the impact to the aquifer. New development projects to the east of Leisure Town Road include new potential well sites. The City will drill test wells and conduct zone water quality sampling to determine the most desirable site for a new well. Well 7 is currently out of service and Well 8 is nearing the end of its useful life due to the cost of repairs outweighing the production value (personal communication, Christina Castro, City of Vacaville, March 18, 2016).

Projected water supply sources in future dry water years (single-dry and/or multiple-dry water years) are summarized in **Table 2-4**. Total City groundwater pumpage in dry years is projected to increase to 9,700 AF in 2040 as new City wells come on line. The City has the capability to increase the amount of groundwater extraction for a period of time should surface water not be available.

Table 2-4
Groundwater — Volume Projected to be Pumped
(Dry Water Years)

Basin Name(s)	Aquifer Unit	2020	2025	2030	2035	2040
Sacramento Valley Basin/Solano Subbasin	Basal Zone	8,220	8,640	9,060	9,600	9,600
Sacramento Valley Basin/Solano Subbasin	Non-Basal Zone	100	100	100	100	100
Total groundwater projected		8,320	8,740	9,160	9,700	9,700

Units: acre-feet per year
Includes future planned expansion, source: (personal communication, Christina Castro, City of Vacaville, February 18, 2016)

The City's conjunctive water management program allows it to adjust its groundwater production so that groundwater levels recover to spring 1992-1993 "base year" levels during normal years. As discussed further below, the base year water levels are used to define the "normal condition" referenced in the Master Water Agreement (SID and City, 1995). Groundwater levels may decline below base year levels during dry years with increased pumpage, but levels should remain above historical lows. Conjunctive water management is used to restore groundwater levels to base year conditions following a dry year (or multiple-dry years) when increased pumpage has occurred. Following dry years (i.e., in normal or wet years), surface water utilization is increased, while groundwater pumping is reduced in order to restore groundwater levels to base year conditions. During periods that follow a dry year, the City may target groundwater production amounts that are lower than the amounts shown in **Table 2-3** as surface water availability allows.

During the development of future City groundwater supplies and the replacement of its older wells, consideration will be given to optimizing the pumping distribution in the City's urban planning area. The optimal location of new and replacement wells will include consideration of such factors as maintaining groundwater levels above historical lows, reducing energy costs as feasible, and ensuring delivered water meets all applicable drinking water standards.

2.2.3 Other Pumpage in Northern Solano County

Prior to construction of the Solano Project, both municipal and agricultural users relied primarily on groundwater. Wells were perforated primarily in the Quaternary alluvium and the upper and middle zones of the Tehama Formation, and groundwater levels declined significantly in those zones. After completion of the Solano Project in 1958, most agricultural users switched to surface water, and groundwater levels recovered. Most growers in SID rely primarily on surface water, and growers in MPWD and RD 2068 use surface water exclusively (Solano Agencies, 2005).

After the City of Vacaville, SID, and the City of Dixon are the largest producers of groundwater in northern Solano County. SID operates wells to supplement surface water supplies and also to provide for drainage due to a high water table in certain areas. Although the amount of pumpage by privately owned wells in SID boundary is unknown, annual metered pumpage is available for SID-owned wells since 1964. SID's pumpage ranged from a low of 2,311 AF during a wet year (1983) to a high of 13,965 AF during the 1976 drought year. SID district pumping in 2014 was 10,184 AF.

The City of Dixon relies entirely on groundwater for its water supply. The City of Dixon is supplied with domestic water by California Water Service Company (Cal Water) and the City of Dixon Water Service. The City's water demand in 2015 was approximately 1,782 AF/year.

The RNVWD also produces groundwater from the basal zone of the Tehama Formation. RNVWD pumpage was about 40 AF in 2003 (LSCE, 2003). Pumpage by industrial and domestic wells in unincorporated portions of the Vacaville area is unmetered.

Groundwater development in the Vacaville area by others than the City and RNVWD has largely been from the upper part of the aquifer system rather than the basal zone of the Tehama Formation.

2.2.4 Conjunctive Water Use and Management

The City conjunctively manages its groundwater and surface water resources to most effectively use those resources during different water year types. This has been previously demonstrated to be an effective and flexible management approach. Continued conjunctive water management is expected to enable the City to meet its future water demands for a 20-year horizon and beyond. Groundwater-related objectives of the City's conjunctive water management approach are to:

1) Recognize and implement actions to prevent persistent water level declines, and
2) Continue to maintain water levels above historical lows when levels temporarily decline during dry years to minimize adverse consequences that would result from over pumping the aquifer system.

As discussed below, groundwater monitoring data collected by the City indicate the response of the aquifer system to variations in the City's annual pumping amounts. Spring groundwater levels measured during 1992-1993 were initially used to establish "base year" groundwater levels, or the levels to which the aquifer had recovered in response to an estimated sustainable level of pumpage. The 1992-1993 base year groundwater levels have been augmented with more complete data collected during 2002-2015. This base year groundwater level concept serves to guide conjunctive management of the City's water resources. The base year concept is used to define the “normal condition” referenced in the Master Water Agreement between the City of Vacaville and SID signed on May 25, 1995.

Base year water levels are not anticipated to be exceeded during normal water years in response to the pumpage associated with those years. The concept also recognizes that if pumpage is increased during single-dry or multiple-dry years, water levels would temporarily decline to below base year levels in response to increased pumpage. Following a short-term water level decline during a dry year with increased pumping, the base year groundwater levels provide a target to which to restore water levels.

In summary, the City’s conjunctive water management approach is based on the following:

1. Spring 1992-1993 groundwater levels represent base year spring groundwater recovery levels.

2. The base year groundwater levels are based on a historical level of pumpage for the Elmira Road well field that appears to be sustainable.

3. During dry years with increased pumpage, groundwater levels may be lower than base year groundwater levels and the reverse would generally occur during periods of reduced pumpage. Following a dry year condition where increased pumpage has occurred, conjunctive water management will be used to restore groundwater levels to base year conditions.

4. The 1992-1993 base year groundwater levels, in conjunction with the 2002-2015 levels which include more complete data during peak extraction periods, provide an important means for measuring aquifer system response to future pumping that occurs as part of the City’s conjunctive water management plan.

5. As the City’s well field expands to the urban planning area, additional groundwater monitoring will be necessary to evaluate water level responses to the additional groundwater development and provide a better understanding of spring groundwater level recovery.

Base year groundwater level conditions have only been established for the Elmira area. For purposes of this Memorandum, the modeling analysis summarized below (and included in more detail in **Appendix B**) is based on the assumption that areas north of the Elmira Road well field would respond similarly to pumping. The data from the Elmira Road well field are used to establish the drawdown occurring in response to normal water year pumpage for that area. However, the drawdown occurring at the Elmira location would not be applicable to areas outside the Elmira Road well field.

2.3 GROUNDWATER CONDITIONS

2.3.1 Hydrogeology

Most City and non-City wells in the Vacaville area are completed in the Tehama Formation, which has been subdivided into upper, middle, and basal zones. The City’s wells are largely completed in the basal zone of the Tehama Formation. City Well 1 is also partially completed in older pre-Tehama deposits. A geologic map is provided as **Figure 2-5** to illustrate the regional geology. A detailed discussion of the regional geologic setting, including geologic cross sections, is provided in *Hydrostratigraphic Interpretation and Groundwater Conditions of the Northern Solano County Deep Aquifer System* (LSCE, 2010). A brief summary of geologic conditions is provided below.

The four water bearing formations discussed in this document include the recent Quaternary alluvial deposits, and the underlying Pliocene and Pleistocene upper, middle, and basal zones of the Tehama Formation. Due to the proximity and limited amount of information for both the recent Quaternary alluvial deposits and the upper zone of the Tehama Formation, these units will generally be discussed together for the purposes of this report. As mentioned above the Tehama Formation is the primary aquifer for agricultural and municipal water supply in northern Solano County, including the Vacaville area. This formation consists of slightly to moderately consolidated fluvial, alluvial, and lacustrine deposits and includes interlayered clay, silt, sand, and gravel beds. A stiff blue lacustrine clay found near the upper boundary of the formation and other relatively continuous clay layers divide the formation into upper, middle, and basal zones.

In the Vacaville area, the continuous clay layers within the Tehama Formation appear to thin to the west-southwest, with some layers pinching out altogether. The Tehama Formation has a thickness of up to 2,200 feet in the vicinity of the City's eastern boundary and an outcrop area of over 35 square miles in the English Hills, north of the City, and continuing north toward the Solano County line (**Figure 2-5**). This outcrop serves as the primary recharge area for the Tehama Formation.

The Quaternary alluvium and upper and middle zones of the Tehama Formation are used for domestic and agricultural water supply. Southwest of the Highway 80/Midway Road junction, the upper and middle Tehama Formation zones are characterized by predominately thick, fine-grained silt and clay with a few thin sand and gravel beds. Northeast of this area, the number of coarser-grained beds appears to increase. In most western areas, the fine-grained nature, discontinuity of the sands, and generally low yields make these zones unsuitable for high capacity municipal water wells. Typically, these zones are only capable of producing 100 to 300 gallons per minute (gpm) with specific capacities of less than 2 gallons per minute per foot (gpm/ft), although some wells can produce up to 1,000 gpm. Aquifer test data in the upper zone are limited, but a transmissivity of only 1,500 gallons per day per foot (gpd/ft) was estimated based on a test of the City's DeMello well. Reliable transmissivity estimates are not available for the middle zone.

The basal zone of the Tehama Formation includes gravel and cobble deposits and layers of volcanic tuff and conglomerate cemented with calcium carbonate. The more permeable portions of the basal zone are comprised primarily of gravelly sand with calcium carbonate cementation in some areas. The basal zone occurs near the surface on the western edge of the City's Elmira Road well field and gradually deepens to the east (**Figure 2-6**, basal zone outlined in blue). The basal zone ranges in thickness from less than 400 feet in the Elmira Road area, to greater than 700 feet between Vacaville and Dixon (**Figure 2-7**). Up to 350 feet of this zone yields significant quantities of groundwater. The bottom of the basal zone occurs at a depth of about 2,400 feet in the vicinity of the City's Easterly Wastewater Treatment Plant and near the Midway Road/Highway 80 junction area. East of these areas, the basal zone appears to contain fine-grained sand beds. Detailed correlations using numerous oil and gas test holes with geophysical logs indicate that the basal zone extends beneath the Dixon area at a depth of 2,000-2,500 feet. The top of the basal zone was encountered at 1,980 feet below ground surface (bgs) during construction of a multiple completion monitoring well in the Dixon area for Solano County Water Agency (SCWA) (LSCE, 2010). Regional correlations suggest a finer-grained sandy zone extending eastward to beneath the Davis area at depths below existing municipal wells. However, the yield and water quality of this zone are presently unknown.

3 AQUIFER CHARACTERISTICS

Specific capacities of wells completed in the basal zone in the Vacaville area generally range from 4 to 24 gpm/ft, depending on the thickness of aquifer materials encountered by the well and included in the perforated interval. The City's municipal basal zone wells range in capacity from 500 to 1,800 gpm.

Table 3-1 summarizes aquifer characteristics estimated for the basal zone in the northeastern area based on pumping tests conducted in these wells. Constant-rate pumping tests have been conducted in the City's three northern water supply wells (Well 14, 15, and 16) and vary in duration from 4 hours to 19 days. Data from these tests have been used to determine the specific capacity of the wells and estimate aquifer characteristics, including transmissivities and aquifer storativities. Although more than one test has been conducted at some of these wells, only the results from the most recent test at each well are shown on **Table 3-1**.

As shown on **Table 3-1,** the mean transmissivities calculated for the three City of Vacaville wells completed in the basal zone of the Tehama Formation (Wells 14, 15, and 16), range from 39,700 to 56,600 gpd/ft, with an overall mean of 48,100 gpd/ft. The transmissivity is significantly lower to the north in the RNVWD wells (mean of about 17,000 gpd/ft). Storativities in the northern Solano County area range from 1.6×10^{-4} to 3.2×10^{-4}, with an overall mean of 2.2×10^{-4}.

Table 3-1
Aquifer Characteristics, Northeastern Area, City of Vacaville

Pumped Well	Observation Well	Distance	Start Date	Test Length	Discharge Rate	Depth to Water		Drawdown	24-hr Specific Capacity	Pumping Phase			Recovery Phase		Mean Values	
						(Start)	(End)			Transmissivity	Storativity	Method of Analysis	Transmissivity	Method of Analysis	Transmissivity	Storativity
		(ft)		(hrs)	(gpm)	(ft)	(ft)	(ft)	(gpd/ft)	(gpd/ft)	-		(gpd/ft)		(gpd/ft)	-
Well 14[a]	-	-	04/15/03	24	1,740	153.82	246.03	92.21	18.8	54,900	-	Cooper-Jacob	52,700	Theis	56,600	1.6E-04
	MW-14	183				151.96	175.30	23.35	-	61,800	1.6E-04	Cooper-Jacob	57,000	Theis		
	MW-15-1815'	4,530				141.09	140.26	-0.83	-	-	-	-	-	-		
	Well 15	4,580				138.57	138.95	0.38	-	-	-	-	-	-		
	MW-16-1400'	6,970				160.73	161.16	0.43	-	-	-	-	-	-		
	MW-98B	9,290				124.87	125.16	0.28	-	-	-	-	-	-		
Well 15[a]	-	-	04/14/03	10	1,790	135.32	216.15	80.83	20.8	48,900	-	Cooper-Jacob	40,000	Theis	39,700	3.2E-04
	MW-15-188'	112				16.78	16.53	-0.25	-	-	-	-	-	-		
	MW-15-508'	112				29.51	29.12	-0.39	-	-	-	-	-	-		
	MW-15-1815'	112				136.11	181.66	45.55	-	37,000	3.2E-04	Theis	33,000	Theis		
	MW-16-1400'	4,490				159.30	161.36	2.06	-	-	-	-	-	-		
	Well 14	4,580				153.15	154.02	0.86	-	-	-	-	-	-		
	MW-14	4,740				151.63	152.20	0.56	-	-	-	-	-	-		
	MW-98B	4,810				123.77	125.46	1.69	-	-	-	-	-	-		
Well 16[b]	-	-	Spring 07	19 days	2,230	178.65	359.15	180.50	15.7	-	-	-	-	-	-	-
	MW-16-(1430')	144				178.41	264.08	85.67	-	48,000	1.7E-04	Theis	48,000	Theis	48,000	1.7E-04
Mean (City of Vacaville basal zone wells 14, 15 and 16)															**48,100**	**2.2E-04**

a. Source: LSCE. 2006. *Evaluation of Hydrogeologic Conditions and Groundwater Supplies for SB 221/610 Requirements*, *Administrative Draft*, prepared for City of Vacaville.

b. Source: LSCE. 2008. *Technical Memorandum, Well 16 Aquifer Test, Spring 2007, City of Vacaville, Solano County, CA*, Prepared for City of Vacaville.

3.1.1 Groundwater Levels

Groundwater level data for the City's wells are available from the City's monitoring program. The monitoring program includes semi-annual manual water level measurements in 13 production wells and 11 monitoring wells. In addition to the manual measurements, nine production wells are also monitored electronically with transducers connected to the City's Supervisory Control and Data Acquisition (SCADA) system. Groundwater levels in other wells in and near the City are also monitored at least semi-annually by (or on behalf of) other entities, including SCWA, DWR, the U.S. Bureau of Reclamation (USBR), SID, and RNVWD (**Figure A-1**).

Appendix A provides well location maps (Figures A-1 and A-2), representative water level hydrographs for the Vacaville area, and water level contour maps (Figures A-3 to A-11). A complete set of hydrographs for all wells in the vicinity are provided in **Appendix C** for the wells shown on Figure A-1. The hydrographs included in **Appendix A** are organized according to the four primary formations in which the wells are completed: Quaternary alluvium and the upper, middle, and basal zones of the Tehama Formation (**Figure A-2**). Groundwater elevation contour maps prepared for the Quaternary alluvium and upper zone of the Tehama Formation and the basal zone of the Tehama Formation are also included in **Appendix A** (**Figures A-6** and **A-7** and **Figures A-9** and **A-10**) to indicate the hydraulic gradient and direction of groundwater flow beneath the City in the spring and fall of 2015.

Water levels in wells completed in Quaternary alluvium and the upper zone of the Tehama Formation (**Figures A-3, A-4 and A-5**) show similar trends. Water levels in those zones generally show declining levels from the 1940s to the early 1960s as a result of increasing groundwater pumpage. Beginning in the 1960s, water levels rose following the delivery of surface water from the Solano Project and corresponding reductions in groundwater pumpage. Water levels have remained relatively high since the late 1960s, largely unaffected by wet or dry climatic periods, with depths to water typically less than 10 feet. Several wells on the eastern side of the City show some declines in the early 2010s, associated with the recent drought, followed by recent recoveries in 2015. Groundwater levels in the Quaternary alluvium and upper zone of the Tehama Formation show small seasonal effects with slightly higher groundwater levels in the spring. Water levels in these relatively shallow aquifers appear to be unaffected by basal zone pumpage. Maps showing contours of equal groundwater elevation in the Quaternary alluvium and the upper zone of the Tehama Formation for the spring and fall of 2015 (**Figures A-6** and **A-7**) indicate generally eastward to northeastward flow directions.

Water level data are more limited for wells completed in the middle zone of the Tehama Formation. **Figure A-3** illustrates groundwater levels for two wells (6N/1W-23C1 and 7N/1W-34F1) monitored by DWR in the Vacaville area that had sufficient historical data to indicate water level trends in this zone. Groundwater level trends in these wells are generally similar to those observed in the upper zone of the Tehama Formation. Also shown in **Figure A-3** are two monitoring wells RNVWD MW-446 screened between 426 and 436 feet and RNVWD MW-594 screened between depths of 564 to 584 feet) located near RNVWD production Well No. 1. Groundwater levels in the RNVWD monitoring wells show declining groundwater levels until present. The trends in these wells are likely due to local pumping effects from the RNVWD water supply well and a higher level of hydraulic connectivity between the middle and deeper (basal) Tehama Formation deposits.

Water level data since 2000 for the basal zone of the Tehama formation are shown in **Figure A-8**. A response to reduced pumping since 2008 can be seen in most of the wells shown. A detailed hydrograph of City Well 8 at Elmira Road shows a typical water level response to pumpage for the City's basal zone wells since 1988 (**Figure 2-8**). In order to obtain generally static measurements, manual water level measurements in the City's wells since 1992 have been preceded by a three-day shutdown period that eliminated the most pronounced effects of recent pumping by one or more nearby wells to ensure consistent and generally static monitoring conditions. Beginning in 2002, selected transducer measurements from the City's SCADA system have been available to indicate the highest water levels in the spring and the lowest water levels during the summer.

As noted above, the City has considered 1992 to 1993 to represent a "base year" groundwater level condition. The maximum spring water levels in 2003 were approximately the same as 1992 for a similar level of Elmira Road pumpage (about 5,400 AF per year), and the spring 1993 and 2003 water levels are highlighted on **Figure 2-8**. Water level data from Well 8 reflect changes in the City's basal zone pumpage from the Elmira Road well field; specifically, water levels increase as pumpage decreases and vice versa.

The City has reduced its Elmira Road basal zone pumpage by shifting more pumpage to new wells constructed in the northeast sector (Wells 14, 15, and 16). As of 2015, 42% of groundwater production occurred in the northeast sector wells, up from 30% in 2007 and 16% in 2000. Overall, this has resulted in water level declines in the northeast sector wells and reduced drawdown in the Elmira Road well field. A hydrograph of Well 14, which has the longest period of record of the northeast sector production wells, is included in **Appendix A** (**Figure A-8**). Water levels in Well 14 declined at a faster rate between 1998 and 2005 than in the Elmira Road wells (about 50 feet in seven years), stabilized between 2005 and 2007, and have risen since 2007 to 2013. Recent declines seen between 2013 and 2015 are likely due to the recent drought and increased dependence on groundwater pumping.

Groundwater elevations in the basal zone of the Tehama Formation are much lower than in the middle and upper zones in the Vacaville area, ranging from about 20 feet above sea level in RNVWD to 70 to 80 feet below sea level (spring and fall 2015, respectively) in the vicinity of the City's main well field on Elmira Road (**Figures A-9 and A-10**). A pumping depression in the basal zone exists in the Elmira Road area (**Figures A-9** and **A-10**), and the gradient for groundwater flow is southerly toward this depression. North of the City, the gradient has a magnitude of approximately 47 feet per mile which is much steeper than the gradient in the Quaternary alluvium (**Figures A-6** and **A-7**). The gradient in the basal zone becomes less steep in the Elmira Road area, e.g., the gradient between Well 14 and the Elmira Road wells is only about 6 feet per mile. This is due to the northerly expansion of the cone of depression in the Elmira Road area as more pumpage has been shifted to Wells 14 and 15 in the northeast sector.

In general, water levels in wells completed in the basal zone of the Tehama Formation (**Figures A-3 and A-8)** show similar trends with a few exceptions. Water levels were relatively stable from the mid-1960s to the mid-1970s followed by a decline from the mid-1970s to the early 1980s when levels stabilized until the early 1990s. From the early 1990s water levels rose until about 2000 when levels declined in most wells until 2009 when levels stabilized through 2013 and then slightly declined until present. One exception to this trend is RNVWD1 with water levels that rose over 60 feet from 2010 to present.

3.1.2 Groundwater Quality

Every three years, the City performs water quality monitoring as required for all public water supply systems. The City also collects samples annually for nitrate analysis. Water quality is generally good at all City wells. Most of the historical data do not show signs of water quality degradation, and concentrations have remained stable. **Figure 2-9** shows a map of the locations of all wells with water quality data.

Although the City's monitoring wells are not used for public supply, they are good indicators of the types of water found in the aquifers below the City and therefore tapped by the City's supply wells (**Table 3-2**). Almost all of the monitoring well samples meet primary and secondary drinking water Maximum Contaminant Levels (MCLs) for general minerals[2]. One exception occurred in the recent sample from 2011 at DeMello MW-95ft, where the TDS level is at the secondary MCL value of 500 mg/L. Most of the concentrations of drinking water metals[3] were found to be below detection limits for historic and recent samples. Levels of chromium (total), iron, manganese, and thallium equaled or exceeded the primary and secondary MCLs in a few wells. Total chromium values for two samples in MW-16-1430 (11/19/02 and 7/5/07) were at the primary MCL of 50 µg/L, but the 2011 sample (1/18/11) was below, at 37 µg/L. MW-98A, MW-98B, and MW-98C all had concentrations above the secondary MCL of 300 µg/L for iron, as high as 1,290 µg/L (in MW- 98A on 11/23/99). The 2011 sample in MW-98C, however, was below the MCL at 210 µg/L. The 2011 sample in MW-98B, exceeded the secondary MCL for manganese of 50 µg/L with a concentration of 59 µg/L. This sample is similar but slightly higher than the previous concentration of 45.6 µg/L measured more than ten years before it in 1999. One historical sample in MW-15-508ft exceeded the primary MCL for thallium of 2 µg/L, at a concentration of 3.54 µg/L in 2000, but 2011was found to be at concentrations below the detection limit (<1 µg/L).

Arsenic, boron, chromium, iron, and manganese concentrations showed some spatial and aquifer zone relationships, and ranges of these analytes are included in **Figure 2-10**. Generally, the monitoring well water quality results indicate that arsenic, boron, chromium, iron, and manganese concentrations are higher at depths below 500 ft, in the basal zone compared to the shallower Quaternary alluvium and upper zone. Arsenic concentrations are found to be highest in wells completed in the basal zone, as high as 7.4 µg/L (the primary MCL is 10 µg/L). Boron concentrations more than double in concentration in the basal zone compared to the shallower wells, reaching values as high as 460 µg/L (in the 2011sample taken from MW-98C). Chromium concentrations are lower in the east compared to wells in the west, and generally higher in wells completed in the basal zone compared to shallower units. Iron concentrations are significantly higher in the basal zone wells to the north and east, with most wells having concentrations below the detection limit, except for the three MW-98-series wells. The highest value (and only detectible value) of iron in shallower wells is 150 µg/L, while as mentioned above, the maximum level measured in basal zone wells is 1,290 µg/L. Manganese has a similar spatial and aquifer zone relationship as iron, where the MW-98-series of basal zone wells have much higher concentrations of manganese compared to shallower and southwestern wells. The MW-98 wells have manganese concentrations ranging from 20 to 59 µg/L, whereas most shallow and southwestern wells have non-detectible concentrations to a maximum of 13.3 µg/L.

A summary of all available water quality data for selected constituents (total dissolved solids (TDS), nitrate, arsenic, and hexavalent chromium) is provided in **Appendix D** for wells in Solano County, including City wells. Total dissolved solids (TDS) concentrations in basal zone wells in Solano County range from 250 to 480 milligrams per liter (mg/L) between 1986 and 2014. The TDS concentration in

[2] General minerals include specific conductance, total dissolved solids, pH, Na, K, Mg, Ca, Cl, SO4, NO3, F, alkalinity series (total, CO3, HCO3, OH), and hardness.

[3] Drinking water metals include Ag, Al, As (total and dissolved), B, Ba, Be, Cd, Cr (total and dissolved), Hexavalent Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, Se, Tl, V, and Zn.

Table 3-2
City of Vacaville Monitoring Well Groundwater Quality Results

			DeMello MW-95ft		MW-15-188ft			MW-15-508ft		MW-16-117ft			MW-16-1166ft			MW-16-1430ft			MW-98A			MW-98B		MW-98C	
		Completion Information[e]:	QA - 65-85		QA_UT - 158-178			UT - 438-498		UT - 97-107			BT - 1136-1162			BT - 1264-1374			BT - 1727-1745, 1790-1830			BT - 1559-1579, 1700-1710, 1720-1730, 1778-1798		BT - 2152-2192, 2234-2264, 2285-2305	
	Units	MCL [a]	7/16/01	1/5/11	8/18/00	5/22/01	1/5/11	8/18/00	1/4/11	5/29/02	5/30/07	1/4/11	5/29/02	5/30/07	12/16/10	11/19/02	7/5/07	1/18/11	11/16/98	11/23/99	1/10/11	1/13/99	8/9/11	1/29/99	1/12/11
Field Parameters																									
Temp	deg C			19.2			20.3		21			19.5			20.4			22.4			21.1		21.9		20.4
pH	pH Units	6.5-8.5 [b]		7.46			7.59		7.42			7.68			7.43			7.39			7.89		8.2		**8.54**
SC	umhos/cm	900/1,600 [b]		799			350		530			430			480			490			490		500		530
Turbidity	NTU	5 [b]		0.61			2.04		0.19			0.24			0.23			0.14			1.71		1.3		0.34
DO	mg/L			3.01			4.13		1.19			4.69			3.21			1.32			0.72		1.89		0.09
ORP	mV			51			67		26			92			25			47			-6		-178		-180
General Minerals																									
SC	umhos/cm	900/1,600 [b]	560	790	425	380	350	543	530	390	430	430	450	458	480	460	470	490	500	477	490	494	500	506	530
TDS	mg/L	500/1,000 [b]	380	**500**	225	250	200	291	320	250	272	260	310	330	280	280	302	300	271	296	280	362	350	302	320
pH	pH Units	6.5-8.5 [b]	7.6	7.7	7.78	7.5	7.8	7.84	7.6	7.6	7.67	7.5	7.7	7.9	7.9	7.8		8	7.67	7.93	8	8.02	8.25	8.32	8.4
Na	mg/L		34	40	34.8	36	29	55.2	57	39	41	41	49	42	42	63	53.4	62	40.3	38.8	42	84	87	93.9	100
K	mg/L		<1	<1	1.39	1.2	1.2	1.72	1.3	<1	<1	1	5.7	5.3	5.9	2.7	2.5	2.6	3.15	3.18	3.5	5.22	5.1	1.86	1.6
Mg	mg/L		26	34	15	18	15	10.1	12	13	13	14	17	18	20	19	21	18	27.3	27.3	31	6.01	6.3	8.4	8
Ca	mg/L		54	72	28.4	31	27	38.6	45	40	36	37	35	30	31	18	19	21	21	21.6	23	13.6	16	11.1	10
Cl	mg/L	250/500 [b]	62	91	11.1	11	7.9	7.83	7.1	12	11.1	10	7.1	6.7	6.3	6.5	6.73	7.7	8.24	7.72	7.1	7.88	9.2	7.41	6
SO4	mg/L	250/500 [b]	19	26	6.17	4.9	5.7	24	23	6.3	7.6	7.5	17	17	17	19	15.94	26	16.8	16.4	15	25.6	26	43	40
NO3 (as NO3)	mg/L	45	14	27	4.32	4.1	3.2	4.86	4.8	4.2	1.1	4.5	4.1	1.1	4.6	2.1	0.63	2.5	2.24		2.3	<0.1	<0.44	0.32	<0.88
F	mg/L	2	<0.1	0.13	0.346	0.23	0.29	0.211	0.11	0.31	0.4	0.21	0.23	0.3	0.14	0.52	0.3	0.17	<1		0.14	0.151	0.14	0.11	0.13
Alkalinity Series																									
Total Alkalinity	mg/L			220		40	170		240	190	205	200	200	222	220	230	234	220			240		230		220
CO3	mg/L		150	<2	<1	<1	<2	<1	<2	<1		<2	<1		<2	<1		<2	<10	<1	<2	<1	2.9	<10	4.1
HCO3	mg/L		150	270	20.8	40	200	264	300	190	296	250	200	320	260	230	337	270	242	253	300	259	280	238	270
OH	mg/L		<1	<2	<1	<1	<2	<1	<2	<1		<2	<1		<2	<1		<2	<10	<1	<2	<1	<2	<10	<2
Hardness	mg/L		240	320	133	150	130	138	160	150	140	150	160	146	160	120	131	120	165	166	190	58.6	65	62.3	58
Drinking Water Metals																									
Ag	µg/L	100 [b]	<10	<0.5	<5		<0.5	<5	<0.5	<10	<0.5	<0.5	<10	<0.5	<0.5	<10	<0.5	<0.5	<5		<0.5	<5	<0.5	<5	<0.5
Al	µg/L	1,000	<50	<20	<50		96	<50	<20	<50	29	<20	<50	<20	<20	<50	<20	<20	<50		<20	<50	<20	<50	<20
As - Total	µg/L	10	2	3	<5	<2	1.3	<5	<1	<2	1.5	1.2	<2	5	4.5	7.4	2.3	1.9	<3		2.9	4.7	6.3	<2	3.5
As - Dissolved	µg/L	10		2.6			1.9		<1			1.1			4.7			1.8			2.6		6.7		3.2
B	µg/L	1,000 [c]	<50	<50	<50	<50	63	68.4	80	<100	<50	58	140	130	150	180		170	111		110	280	290	420	460
Ba	µg/L	1,000	100	140	99		99	105	110	<100	100	100	120	130	130	210	200	220	214		220	67.2	90	107	120
Be	µg/L	4	<1	<1	<4		<1	<4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5		<1	<0.5	<1	<0.5	<1
Cd	µg/L	5	<1	<0.5	<10		<0.5	<10	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Cr - Total	µg/L	50	<10	5.7	11.5		7.5	<5	2.2	<10	6.2	6.7	<10	15	14	**50**	**50**	37	24.2		19	<5	<1	<5	<1
Cr - Dissolved	µg/L	50		6.7			6.6		2.2			6.5			13			35			4.3		<1		<1
Hexavalent Cr	µg/L	50 [d]		5.3			6.5		2.2	5.9		6.7	15		16			39			4.1		<0.02		<0.05
Cu	µg/L	1,000 [b]	<50	<2	<5		<2	<5	<2	<50	3.4	<2	<50	5	<2	<50	<2	<2	<5	<5	<2	<5	<2	<5	<2
Fe	µg/L	300 [b]	<100	<20	<10	<100	150	<10	<20	<100	<20	<20	<100	<20	<20	<100		<20	**1000**	**1290**	**480**	**1010**	**460**	**788**	210
Hg	µg/L	2	<1	<0.2	<0.2		<0.2	<0.2	<0.2	<1	<0.2	<0.2	<1	<0.2	<0.2	<1	<0.2	<0.2	<0.2		<0.2	<0.2	<0.2	<0.2	<0.2
Mn	µg/L	50 [b]	<10	<2	9	<10	2.8	13.3	<2	<10	<2	<2	<10	<2	5	<10		<2	35.1	34	20	45.6	**59**	34	21
Ni	µg/L	100	26	<5	<20		<5	<20	<5	<10	<5	<5	<10	<5	<5	<10	<5	<5	<20		<5	<20	<5	<20	<5
Pb	µg/L	15	<5	<0.5	<3		<0.5	<3	<0.5	<5	<0.5	<0.5	<5	<0.5	<0.5	<25	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Sb	µg/L	6	<6	<1	<5		<1	<5	<1	<6	<1	<1	<6	<1	<1	<30	<1	<1	<1		<1	<1	<1	<1	<1
Se	µg/L	50	<5	<5	<5		<5	<5	<5	<5	<5	<5	<5	<5	<5	<25	<5	<5	<4		<5	<4	<5	<4	<5
Tl	µg/L	2	<1	<1	<2		<1	**3.54**	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<0.5		<1	<0.5	<1	<0.5	<1
V	µg/L	50 [c]		8.1			9.2		<3	<3	<3	<3	16	22	22	19	14	13			7.5		<3		3.9
Zn	µg/L	5,000 [b]	<50	<20	<5		<20	5.95	<20	<50	<20	<20	<50	<20	<20	<50	<20	<20	<5	<5	<20	34.5	<20	<5	<20

a - Maximum Contaminant Levels (MCLs) listed are primary unless otherwise noted.

b - Secondary MCL

c - Drinking Water Notification (Action) Level

d - Hexavalent Chromium is regulated under the Total Chromium MCL of 50 µg/L

e - Screened Intervals are listed (in feet below ground surface) and Aquifer Units are based on the zone of completion for each monitoring well, defined as follows: QA-Quaternary Alluvium; UT-Upper Tehama; and BT-Basal Tehama

Well 1, which is completed in the Markley formation, was 546 mg/L in 2008, which slightly exceeds the recommended secondary Maximum Contaminant Level (MCL) of 500 mg/L but not the upper secondary limit of 1,000 mg/L. **Figures 2-11** and **2-12** show the location of the maximum and average TDS concentrations (respectively) in the vicinity of Vacaville. Nitrate concentrations exhibit more variability from well to well than TDS, but concentrations have been stable at most wells. Nitrate (as N) in basal zone wells ranged from non-detect (<2 mg/L) to 5.2 mg/L as N (measured in Well 2 in 1996) between 1986 and 2015. Nitrate concentrations in Wells 1, 2, 5, and 13 have historically been over 2 mg/L as N, but not near the MCL of 10 mg/L as N. **Figures 2-13** and **2-14** show the location of the maximum and average nitrate concentrations (respectively) in the vicinity of Vacaville.

Concentrations of arsenic in basal zone wells in Solano County range from <2 ug/L to 25 ug/L between 1993 and 2015. The highest average arsenic concentrations in the basal zone are found in Rural North Vacaville wells (RNVWD Well 02 and RNVWD MW-862ft), and are above the MCL of 10 ug/L with average concentrations of 15.8 and 13 ug/L. **Figures 2-15** and **2-16** show the location of the maximum and average arsenic concentrations (respectively) in the vicinity of Vacaville. Concentrations of hexavalent chromium in basal zone wells in Solano County range from <1 ug/L to 24 ug/L between 2001 and 2015. Several basal zone wells have average hexavalent chromium concentrations (September 2013 to March 2016) above the MCL of 10 ug/L (City Wells 3, 9, 14, 15, and 16). Many other wells of unknown completion also have average hexavalent chromium concentrations above the MCL of 10 ug/L, mostly located in the vicinity of Dixon. **Figures 2-17** and **2-18** show the location of the maximum and average hexavalent chromium (chromium VI) concentrations (respectively) in the vicinity of Vacaville.

There have been localized instances of impacts to shallow groundwater quality due to hazardous chemical contamination, but existing or potential municipal supplies have not been affected. Analyses for volatile organic compounds (VOCs) and other manmade constituents in the City's water supply wells have all been non-detect.

3.1.3 Subsidence

Land subsidence is a documented problem in parts of California and the Central Valley. In particular, land subsidence due to groundwater pumping is of major concern, especially during periods of drought or dry years when the aquifers are being stressed more than usual. Land subsidence activity can be measured and monitored, usually with continuous global positioning systems (Continuous GPS, or CGPS), extensometers (which pinpoint vertical movement of particular depths of the subsurface), and InSAR data (Interferometric Synthetic Aperture Radar, which compares the height of the land surface from satellite imagery taken at different times). The following discussion includes data from SCWA subsidence stations in Dixon and Vacaville, data from other nearby CGPS stations, and data from an extensometer outside of Solano County.

3.1.3.1 SCWA Subsidence Stations

As of June 2012, land surface elevations are being monitored at two continuous global positioning system stations (CGPS). These stations are located at the SCWA groundwater monitoring site in Dixon (DIXN) and City of Vacaville MW-16 (VCVL) (**Figure 2-19**). Data from the DIXN site show an annual trend, marked by a generally sinusoidal pattern (**Figure 2-20**). The land elevation remains relatively stable over the period of record. The data from the VCVL site show similar trends (**Figure 2-21**), with mostly stable conditions during its record between June 2012 and February 2016. A linear trend line fit to the two stations' land surface elevation values yields an approximation of the rate of ground surface change over the period of record. Over the last 3.707 years of available record at these two sites, DIXN experienced an average yearly rate of [downward] land subsidence of 0.00735 feet/year (or 2.240 mm/year or 0.088 inches/year) and VCVL experienced an average yearly rate of subsidence of 0.00564 feet/year (or 1.719 mm/year or 0.068 inches/year). Over the almost four years of available record, this translates to a total of 0.027 feet (0.33 inches) of land subsidence at DIXN and a total of 0.021 feet (0.25 inches) of land subsidence at VCVL.

3.1.3.2 Nearby CGPS Stations

In order to put the two SCWA CGPS stations' records into context, data from other nearby CGPS stations were collected and presented in **Figure 2-22**. These stations show that the land surface elevation fluctuates seasonally in this area, typically less than 0.05 feet. The nearby CGPS stations also yield insight into land subsidence rates typical of this area. Fitting a linear trend line to each nearby CGPS station land surface elevation values, the rate of ground surface change can be approximated. The table below summarizes the rate of land surface elevation change over the period of available record, where a negative land surface elevation change indicates net land subsidence (Table 3-3). For example, the site P265, which is located about 9 miles north of the VCVL site, showed on average a decrease of approximately 0.109 feet (1.3 inches) of its land surface over the last almost 10.5 years (from fall 2005 to present), resulting in an estimated rate of land surface elevation change of -0.01034 ft/year[4].

Table 3-3
Rates of Land Surface Elevation Change for Nearby CGPS Stations

Station ID	Years of Record	Rate of Land Surface Elevation Change (ft/yr)	Rate of Land Surface Elevation Change (mm/yr)
P261	11.729	-0.00195	-0.594
P265	10.496	-0.01034	-3.152
P266	10.770	-0.00255	-0.777
P267	10.882	-0.00837	-2.553
P268	10.874	-0.00829	-2.527
P271	11.718	-0.03238	-9.869

3.1.3.3 Extensometer Data

Land subsidence rates in Solano County and vicinity range from 0.00195 to 0.03238 ft/year (0.594 to 9.869 mm/year) over about the last 10 to 11 years. Another way to measure land subsidence is with a tool called an extensometer. Extensometers provide site- and depth-specific measurements of land deformation using a borehole equipped with instrumentation that is deep enough to span stratigraphic units susceptible to land subsidence. The distance between the bottom of the borehole to the land surface is recorded, and any changes indicate land deformation. Typically extensometers are paired with groundwater monitoring wells in order to relate changes in groundwater elevation associated with groundwater extraction to changes in the expansion or contraction of the subsurface. No extensometers exist in the vicinity of the City of Vacaville, nor in Solano County. The nearest extensometer is in Yolo County, at the Conaway Extensometer site 15 miles northeast of the DIXN CORS site; this site is

[4] There is no evidence to suggest that this amount of land subsidence indicates inelastic or elastic subsidence conditions. Further evaluation would be necessary to determine the nature of the subsidence seen at that location.

maintained by the California Department of Water Resources (DWR)[5]. Records from this site indicate a rate of land subsidence of approximately 0.0588 ft/year between 1992 and 2013 occurring between land surface and 716 feet below ground surface; more recent extensometer data reflect greater depths to water resulting in much greater rates of subsidence at this location. The average rate of land subsidence for 2014 and 2015 is approximately 0.7003 ft/year. The average annual rate of subsidence at the Conaway extensometer site for its entire period of record from 1992 to present (0.1123 ft/year) is higher than those observed as land surface elevation declines in CORS sites in the Solano County area described in Table 3-3 above.

3.1.3.4 SCWA CGPS Stations and Groundwater Level Data

Groundwater levels reflect changes in climate in addition to anthropogenic influences including pumping. Groundwater levels and land surface elevations can sometimes be correlated depending on the depth of the well and the unit(s) responsible for subsurface compaction and/or expansion. **Figures 2-23** and **2-24** show the trends in land surface elevation and corresponding groundwater monitoring well water levels at the DIXN and VCVL sites. At the DIXN site, the monitoring well completed at 2,212 feet below ground surface (SCWA-Dixon MW-2212) exhibits the same seasonal trend seen in the land surface elevation changes (**Figure 2-23**). For the DIXN site, the land surface elevations were plotted with those at site P267 in order to provide a longer period of record to compare the groundwater levels to, since the trends in P267 are most similar to those seen at the DIXN site. Recent drought conditions are exhibited in the groundwater elevations in this well, showing lower spring groundwater elevations in 2014 and 2015. The land surface shows similar seasonal fluctuations, but exhibits full recovery in the spring[6].

The land surface trends at the VCVL site are similar to groundwater levels at the monitoring well completed at 1,430 feet below land surface (MW16-1430) (**Figure 2-24**). For the VCVL site, the land surface elevations are complemented by those at CORS site P266, since trends in measurements at this site are similar to the shorter period of record at VCVL. The land surface data and the groundwater elevations show stable to slightly decreasing elevation conditions.

Groundwater monitoring efforts are a critical component of managing water resources in and around the City of Vacaville. Monitoring land subsidence paired with groundwater level measurements leads to a deeper understanding about the water resource and the general conditions of the aquifer underlying the City of Vacaville. There is land subsidence occurring in and around Solano County, though at relatively low rates (between 0.00195 to 0.03238 ft/year, or 0.594 to 9.869 mm/year) over about the last 11 years. Further evaluation would be needed to determine: a) whether this subsidence is elastic or inelastic, and b) which subsurface unit or units are responsible for the compaction. Additional investigation will also help assess what affects groundwater pumping activities are having on land subsidence. The dewatering of clays can take decades to occur, long after reductions in pumping may alleviate groundwater level elevations in particular aquifer units. This means that land subsidence may continue to occur long into the future due to historical pumping stresses. Continuous GPS combined with water level data can be used for an analysis of stress and strain, which can make it possible to compute the elastic and inelastic subsidence components. The VCVL subsidence monitoring station will

[5] Conaway Extensometer data can be downloaded from DWR's Water Data Library at http://www.water.ca.gov/waterdatalibrary/docs/Hydstra/index.cfm?site=09N03E08C004M

[6] The inability of groundwater levels in Dixon MW-2212 to recover from seasonal lows during a drought period is common. The relationship seen in the land surface indicates that there is little to no subsidence at this location due to declining groundwater levels.

prove to be an excellent tool for continuous management of the groundwater resource beneath the City of Vacaville.

3.1.4 SGMA and CASGEM

In September 2014, the California Legislature passed the Sustainable Groundwater Management Act (Act). SGMA changes how groundwater is managed in the state. SGMA defines “sustainable groundwater management” as the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results (Section 10721 (u)). Undesirable results, as defined by SGMA, means one or more effects caused by groundwater conditions occurring throughout the basin (Section 10721 (w)).

SGMA applies to basins or subbasins that DWR designates as medium- or high-priority basins. Previously under the California Statewide Groundwater Elevation Monitoring Program (CASGEM), DWR classified California’s groundwater basins and subbasins as either high, medium, low, or very low priority (Section 10933). The priority classifications are based on eight criteria that include the overlying population, the reliance on groundwater, and the number of wells in a basin or subbasin. In Solano County, the Solano Subbasin was ranked medium priority. The Suisun-Fairfield Valley Basin was ranked as very low-priority.

For most basins designated by DWR as medium or high priority, SGMA requires the designation of groundwater sustainability agencies (GSA) and the adoption of groundwater sustainability plans (GSP); however, there is an alternative to a GSP, provided that the local entity (entities) can meet certain requirements. When required, GSPs must be developed to eliminate overdraft conditions in aquifers and to return them to a condition that assures their long-term sustainability within twenty years of GSP implementation. SGMA does not require the development of a GSP for basins that DWR ranks as low- or very low-priority basins; GSPs are voluntary for these basins.

As applicable, SGMA requires that a GSA be identified for medium- and high-priority groundwater basins by June 30, 2017. Counties are presumed to be the GSA for unmanaged areas of medium and high priority basins (Section 10724). However, counties are not required to assume this responsibility. When no entity steps forward, this can lead to state intervention (Section 10735 *et seq*.).

SGMA requires GSAs for medium- and high-priority basins to adopt a GSP by January 31, 2022 (Section 10720.7). For basins subject to critical overdraft conditions, the GSP must be adopted by January 31, 2020. Upon adoption of a GSP, the designated GSA must submit the GSP to DWR for review. SGMA requires that DWR develop regulations for evaluating GSPs by June 1, 2016. On February 18, 2016, DWR released draft GSP regulations. The public comment period for the draft GSP regulations is set to close on April 1, 2016.

In addition to imposing a number of new requirements on local agencies related to groundwater management, SGMA also provides for state intervention – a “backstop” – when local agencies are unwilling or unable to manage their groundwater basin (Section 10735 *et seq*.).

Upon completion of its review of a GSP, DWR has the power to request changes to the GSP to address deficiencies. DWR is required to re-evaluate GSPs every five years to ensure continued compliance and sufficiency. After adoption of a GSP, the GSA must submit to DWR an annual compliance report containing basin groundwater data, including groundwater elevation data, annual aggregated extraction data, surface water supply for or available for use for groundwater recharge or in-lieu use, total water use, and any changes in groundwater storage (Section 10728).

Solano County is currently conducting outreach to stakeholders and seeking input from the County Board of Supervisors while preparing for multiple paths forward pending the content of the final GSP regulations.

On November 4, 2009 the State Legislature amended the Water Code with SBx7-6, which mandates a statewide groundwater elevation monitoring program to track seasonal and long-term trends in groundwater elevations in California's groundwater basins. To achieve that goal, the amendment requires collaboration between local monitoring entities and Department of Water Resources (DWR) to collect groundwater elevation data. Collection and evaluation of such data on a statewide scale is an important fundamental step toward improving management of California's groundwater resources. In accordance with this amendment to the Water Code, DWR developed the CASGEM program. The City of Vacaville cooperates with Solano County Water Agency (the designated Monitoring Entity for the Solano Subbasin) by coordinating and reporting water level data for a network of 11 monitoring wells within the City on a semi-annual basis. This network of wells includes 7 monitoring wells screened in the Basal Tehama, 2 monitoring wells in the Upper Tehama, and 2 monitoring wells in the Quaternary Alluvium/Upper Tehama.

Local Well Designation	Aquifer Designation
MW-98A	Basal Tehama
MW-98B	Basal Tehama
MW-98C	Basal Tehama
DeMello MW-95ft	Quaternary Alluvium
MW-14	Basal Tehama
MW-15-188ft	Quaternary Alluvium/Upper Tehama
MW-15-508ft	Upper Tehama
MW-15-1815ft	Basal Tehama
MW-16-117ft	Upper Tehama
MW-16-1166ft	Basal Tehama
MW-16-1430ft	Basal Tehama

3.1.5 Considerations for Additional Groundwater Development

Constituents such as total chromium and hexavalent chromium are naturally occurring throughout the state of California, including Solano County and nearby Yolo County. California has established an MCL for total chromium of 50 µg/L, while at the federal level USEPA has established a higher MCL for total chromium of 100 µg/L. On July 1, 2014, a new MCL for hexavalent chromium of 10 µg/L became effective in California. This presents a challenge for the development of new groundwater supplies in regions such as northern Solano County where total chromium and hexavalent chromium are naturally present in groundwater.

The City of Vacaville water supply well and monitoring well data, complemented by other local area data, suggest that there are some potential factors that contribute to the occurrence and distribution of total chromium and hexavalent chromium in groundwater in northern Solano County. This information, together with site-specific conditions at sites where new groundwater development is planned to occur (e.g., between the City boundary and eastward to the urban growth boundary, **Figure 3-1**), will be important to minimize chromium concentrations.

Historically, the City has successfully managed its surface water and groundwater supplies. Through managed utilization of both surface water and groundwater resources, including the planned distribution of groundwater pumping in the basal zone of the Tehama Formation, groundwater levels associated with local pumping depressions have been managed and have remained stable relative to "base year" groundwater conditions established in 1992-1993 for the Elmira well field area.

Groundwater monitoring efforts are a critical component of managing water resources in and around the City of Vacaville. Monitoring land subsidence paired with groundwater level measurements leads to a deeper understanding about the water resource and the general conditions of the aquifer underlying the City of Vacaville. There is land subsidence occurring in and around Solano County, though at relatively low rates (between 0.00195 to 0.03238 ft/year, or 0.594 to 9.869 mm/year) over about the last 11 years. It will be important as new groundwater supplies are developed in northern Solano County to optimize the locations selected for new wells in order to minimize groundwater level declines, particularly to ensure groundwater levels remain at elevations above historical levels to avoid the potential for land subsidence.

3.1.6 Groundwater Development – Current and Future

An analytical groundwater flow model was created and used to assess water level impacts from current demands and future increases in groundwater pumpage by the City of Vacaville to meet future water demands. The model was developed to simulate the incremental increase in drawdown in the northern Solano County area in response to groundwater pumpage for several different scenarios. The model is based on the Hantush-Jacob (1955) groundwater equation, which calculates drawdown in a confined aquifer that allows for leakage from overlying subsurface materials. The model allows for incorporating well cycling on and off within one day and also seasonal pumping variations.

The model was calibrated using a period from January to December 2006, as this period had sufficient water level measurements, and the availability of data from production and monitoring wells outside of the Elmira Road well field was sufficient. The full details about the analytical model and all of the various future scenarios are included in **Appendix B**. The future scenarios developed initially are still pertinent to City planning with the future projected City groundwater pumpage for 2020, 2025, 2030, 2035, and 2040 for normal and dry years (**Table 3-4**). **Appendix B** contains two tables, **Table B-2** and **Table B-3** that summarize the simulated drawdown results for pumping at levels similar to those projected for 2020-2040. This work applies to the 2020 to 2040 projected pumpage and supply sufficiency extrapolated and the only difference would be localized water level changes (e.g., cone of depression) around the new well location. The analytical model results indicate that there is sufficient water for the proposed future increased demand. Although the analytical model places future production wells in the north and northeast, the results of the analytical model are relevant if the exact location of future production wells varies slightly. A new analysis of well interference, water level drawdown, and water quality implications would be performed on any new production wells considered for installation. For purposes of discussion of groundwater supply sufficiency for current and future demands, the analytical model remains an applicable tool. A discussion of the simulated drawdown results of projected pumping amounts similar to those prepared originally for 2015-2035 is found in **Appendix B, Section B.2.1**.

Table 3-4
Basal Zone Pumping for Analytical Model Inputs and Projected City Demands

Original Model Year	City Basal Pumping (AFY) – Normal Year	City Basal Pumping (AFY) – Dry Year	Projected Year	City Basal Pumping (AFY) – Normal Year	City Basal Pumping (AFY) – Dry Year
2015	6,850	8,220	2020	6,900	8,220
2020	6,850	8,220	2025	7,200	8,640
2025	7,200	8,640	2030	7,600	9,060
2030	7,550	9,060	2035	8,000	9,600
2035	8,000	9,600	2040	8,000	9,600

4 SUMMARY OF GROUNDWATER SOURCE SUFFICIENCY

4.1 GROUNDWATER SUPPLY SUFFICIENCY FOR 2020-2040

The analytical model results generally show that water levels in the Elmira Road well field for all future scenarios would be similar to or higher than the 2006 baseline scenario results. It appears that groundwater (from the non-basal and basal zones of the aquifer system) can be used by the City on a sustained basis at an amount of about 8,000 acre-feet (including basal and non-basal zone pumpage) to meet normal year demands through 2040. On a short-term basis for a single-dry year condition, basal and non-basal zone pumpage up to 9,700 acre-feet, pending the pumpage distribution, would result in increased water level drawdown, especially in year 2020, but water level drawdown in the Elmira area is anticipated in future years (2020 to 2040) to become comparable to that simulated with the 2006 baseline scenario. Correspondingly, as more groundwater development occurs in future years in the urban growth boundary, the drawdown increases.

Based on available data and the model results, annual groundwater pumpage for normal, single-dry, and multiple-dry year types are summarized in **Table 4-1**.

Table 4-1
City of Vacaville
Groundwater Supply Sufficiency Years 2020-2040[1]

Water Supply Year	Normal Year (acre-feet/year)	Single-Dry Year (acre-feet/year)	Multiple-Dry Year (acre-feet/year)
2020	7,000	8,300	8,300
2025	7,300	8,700	8,700
2030	7,700	9,200	9,200
2035	8,100	9,700	9,700
2040	8,100	9,700	9,700

1. Groundwater quantities include non-basal and basal pumpage.

As shown on **Table 4-1**, the total normal year sustained pumpage amount for the City is projected to increase from 7,000 acre-feet in 2020 to 8,100 acre-feet by 2040. The single-dry year pumpage increases from 8,300 acre-feet in 2020 to 9,700 acre-feet by 2040. The pumpage levels shown in **Table 4-1** for multiple-dry years are recommended based on the available monitoring data and current understanding of the response of the aquifer system to pumping stresses. The multiple-dry year pumpage levels range from 8,300 acre-feet in 2020 to 9,700 acre-feet in 2040. The likely impact of this level of pumpage for multiple years is still unknown because the model does not simulate recharge variations necessary for multi-year simulations. When pumpage at these amounts occurs over a multiple-dry year period, it is recommended that the portion of the pumpage occurring in the Elmira Road well field be limited (at least initially) to about 5,100 acre-feet, or about 10 percent above the presently identified level of sustained pumpage for that area (about 4,600 acre-feet based on 2006 baseline scenario results, **Table B-2**). Total City pumpage for multiple-dry year periods would thus be comprised of basal pumpage from the Elmira Road area; City Wells 14 through 16 and other new wells; and also non-basal pumpage from Well 1. As new City wells are constructed (**Figure 3-1**), more is known about the nature of the aquifer system, and further analysis occurs with the use of a numerical groundwater model, then the additional information (particularly information about spring water level recovery in the northern portion of the study area) will allow further determination of the pumpage that can be sustained during single-dry year and multiple-dry year periods.

4.2 CITY'S CONJUNCTIVE WATER MANAGEMENT AND MONITORING PROGRAM

Maximizing the groundwater supply without causing significant impacts requires distribution of pumpage to prevent excessive water level drawdown and to ensure that persistent water level declines do not occur. Conjunctive water management of surface and groundwater has allowed groundwater levels to recover in the Elmira Road area to base year water levels.

Although short-term pumpage by the City at amounts of 9,700 acre-feet, or possibly more, is possible during single-dry year or multiple-dry year periods, analysis of existing data indicates that this level of pumpage would increase significantly the maximum (or summertime) drawdown in the northeastern county area. The conjunctive water management plan which is being employed by the City would be used to reduce drawdown during normal and wet water years. Specifically, short-term pumpage occurring at increased levels to meet demand during dry years would be offset in subsequent years through a corresponding reduction in pumpage and increased utilization of surface-water supplies.

Continued groundwater level monitoring is important for ensuring that when pumpage is increased for multiple dry-year periods, levels, particularly in the Elmira Road well field, do not drop below historical low levels during summer months and recover to base year spring levels after the dry period is over. Continuation of the groundwater monitoring program is described in the City's *Groundwater Management Plan Update* (LSCE, 2011). The amount of pumpage considered to be sustainable may change in the future as a result of ongoing evaluation of monitoring data, managed extraction from the basal zone, continued application of conjunctive water management, and further analysis of the pumpage that can be sustained during dry-year periods by the creation and implementation of a numerical model.

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FIGURES

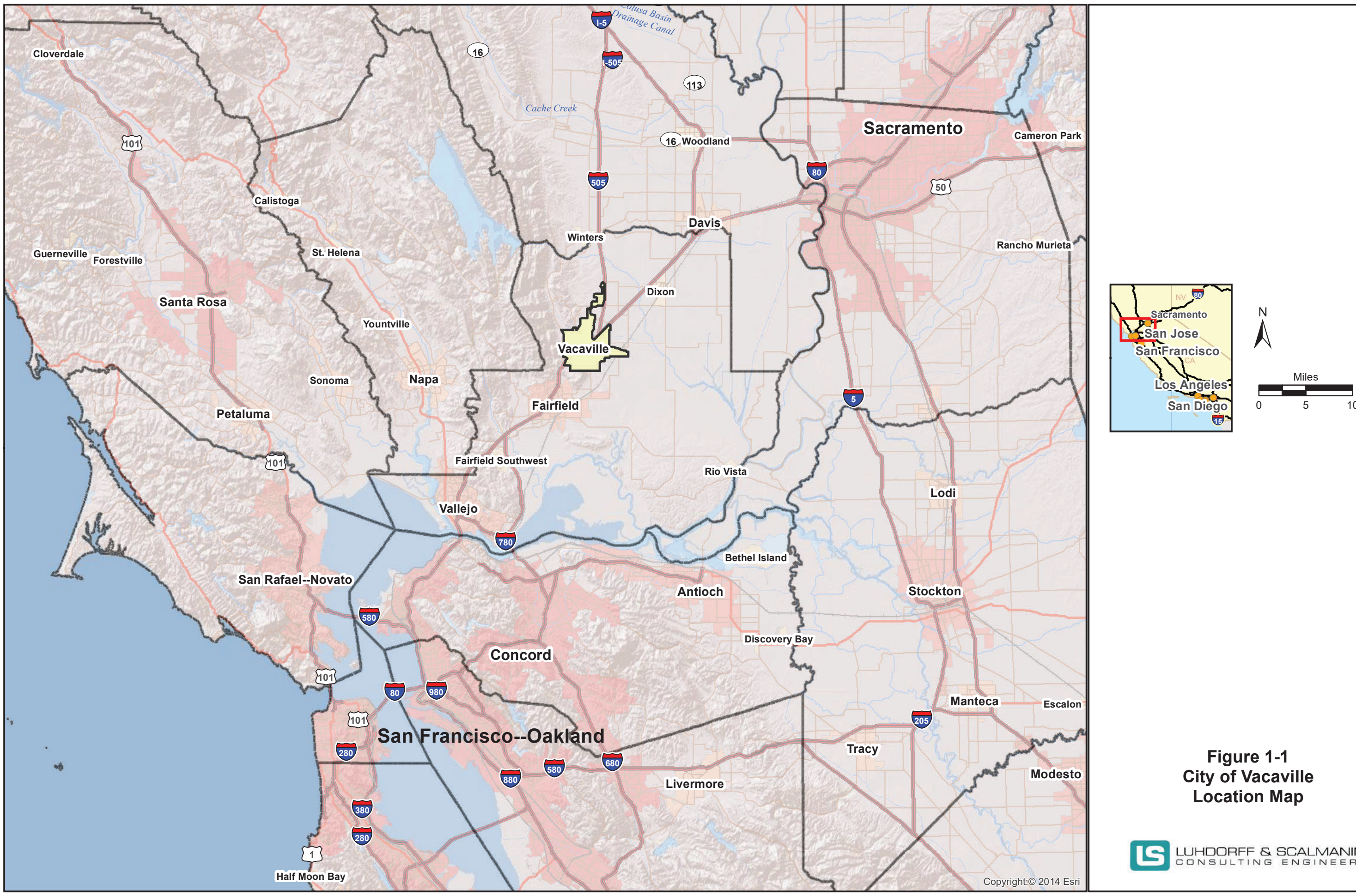

Figure 1-1
City of Vacaville
Location Map

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

File: X:\2015 Job Files\15-116 City of Vacaville General Services\GIS\Map Files\Figure 1-1 City of Vacaville Location Map.mxd Date: 3/23/2016

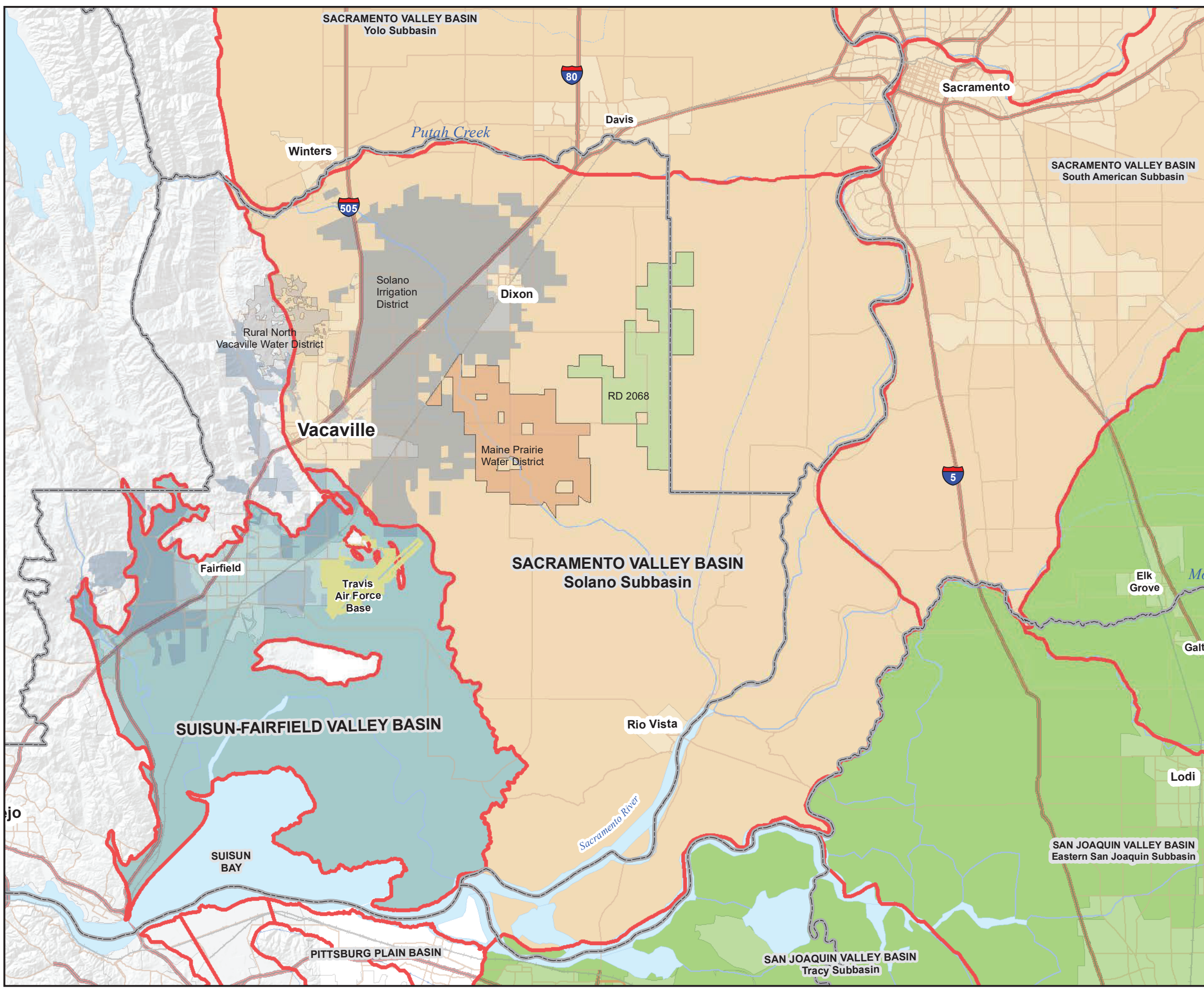

Figure 2-1
Groundwater Basins and Subbasins

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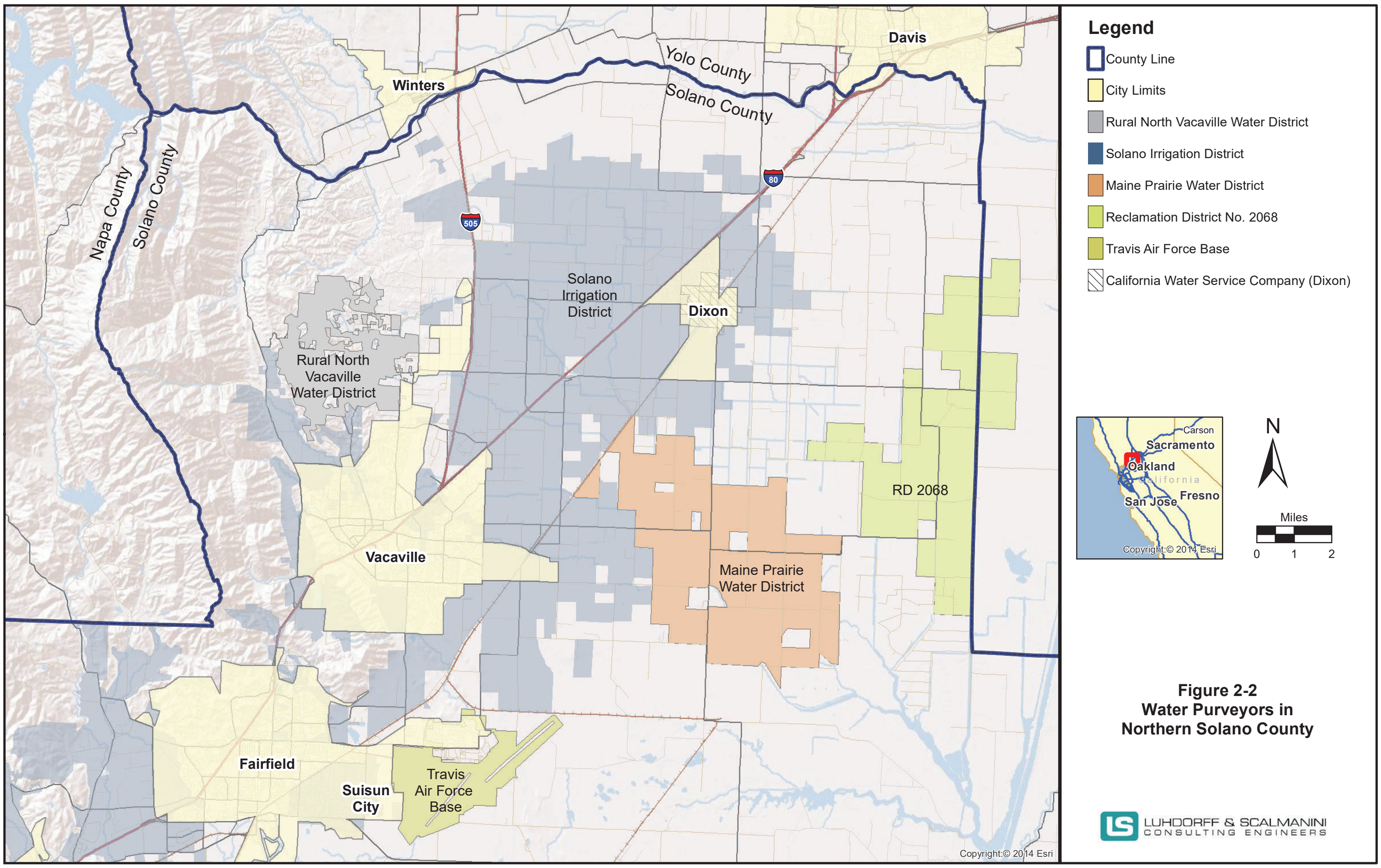

Figure 2-2
Water Purveyors in Northern Solano County

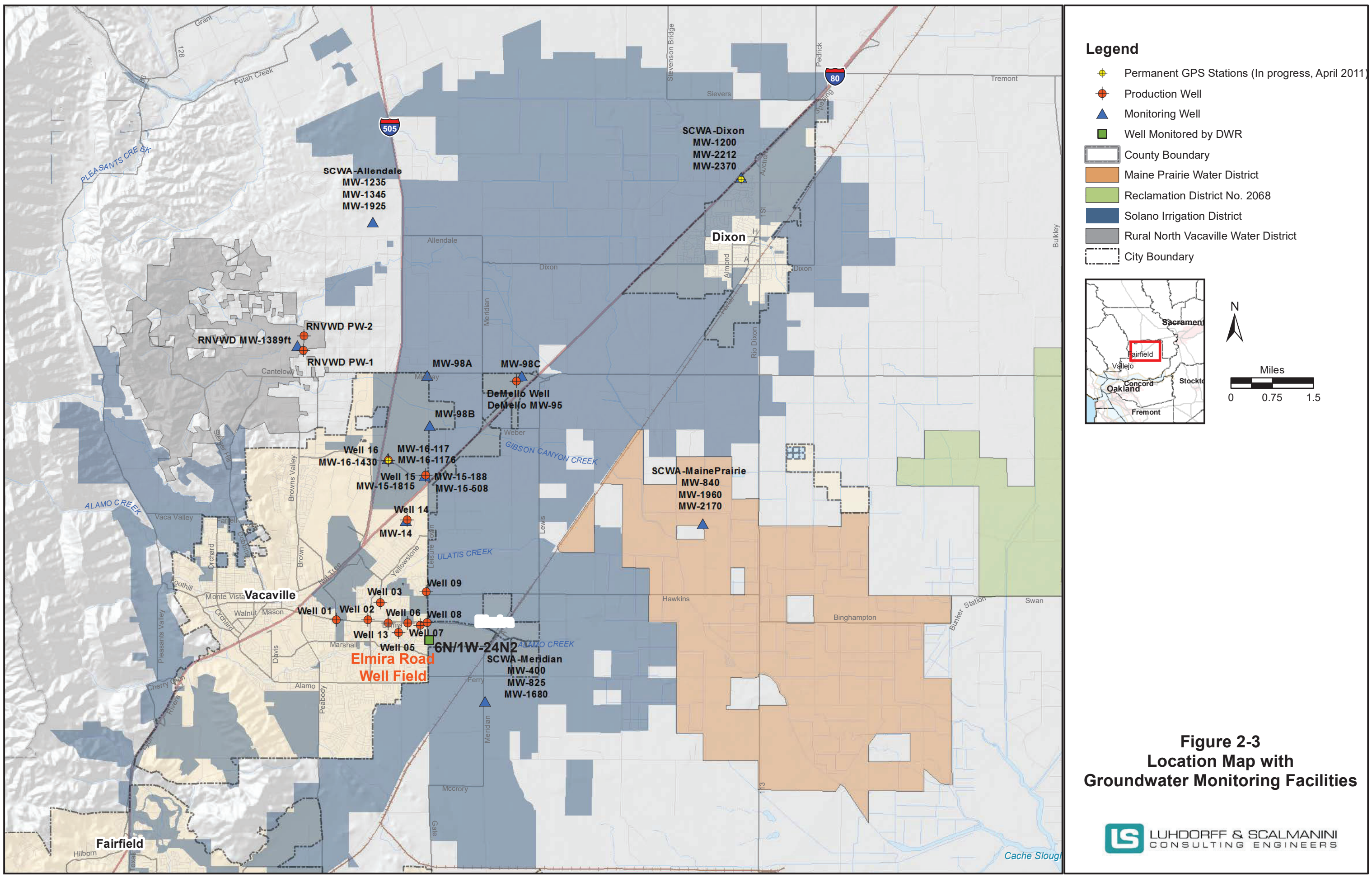

Figure 2-3
Location Map with
Groundwater Monitoring Facilities

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File: X:\2010 Job Files\10-101\2010 UWMP\UWMP_GW_2010 UPDATE\Figures\Figure 2-3 Location Map with GW Mon Facilities.mxd Date: 3/24/2016

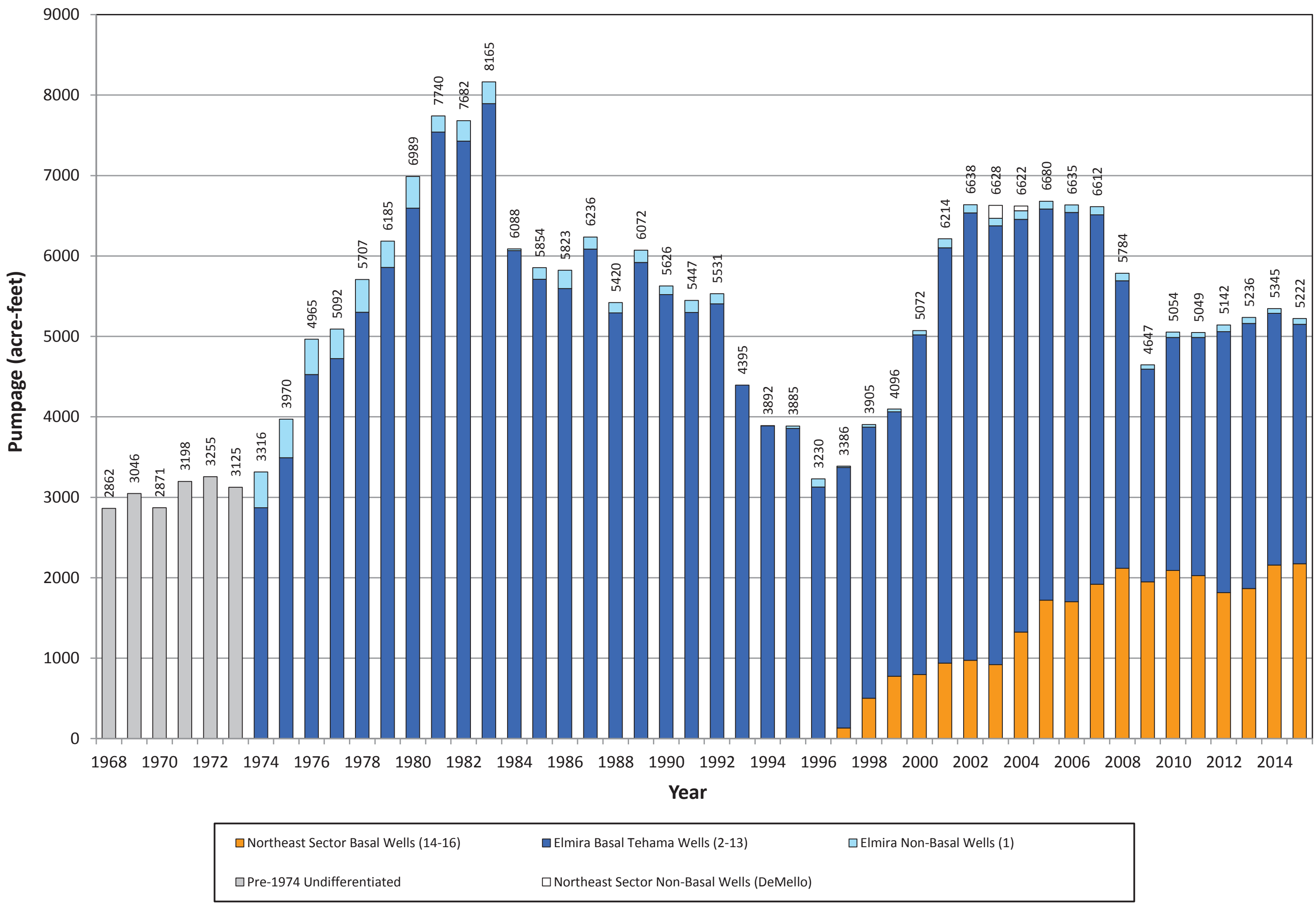

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Figure 2-4
City of Vacaville Annual Groundwater Pumpage

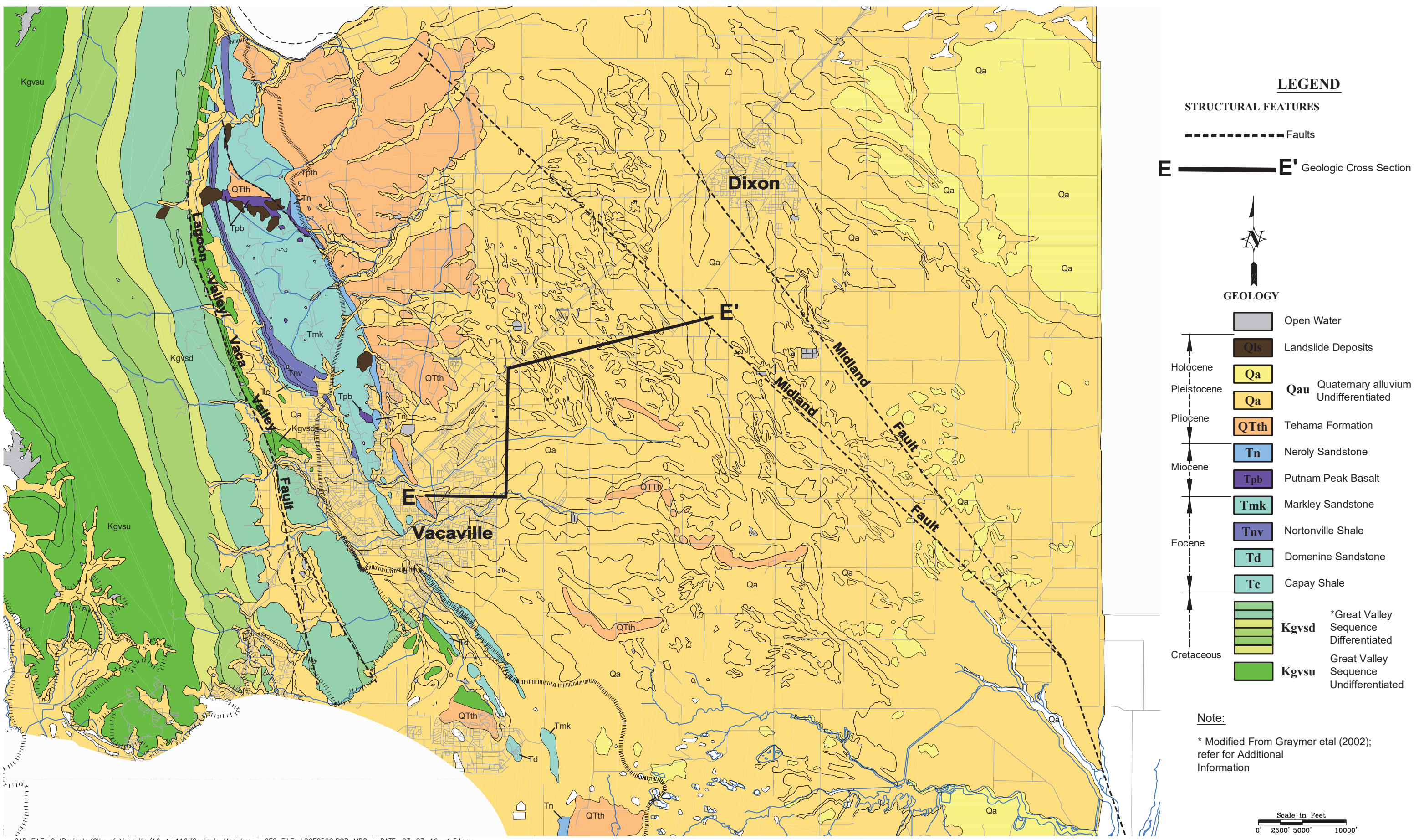

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Figure 2-5
Surficial Geologic Map of Solano County

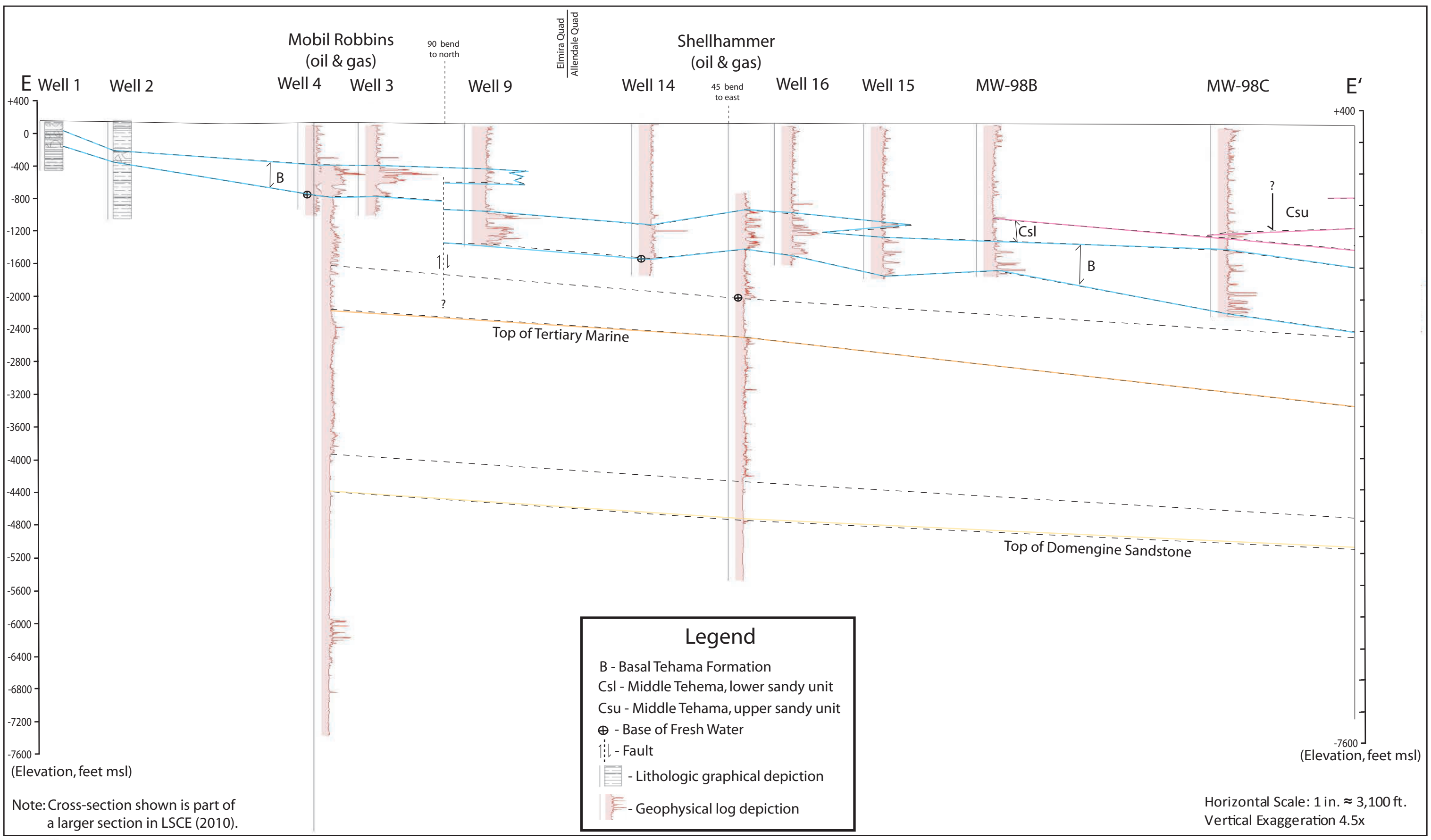

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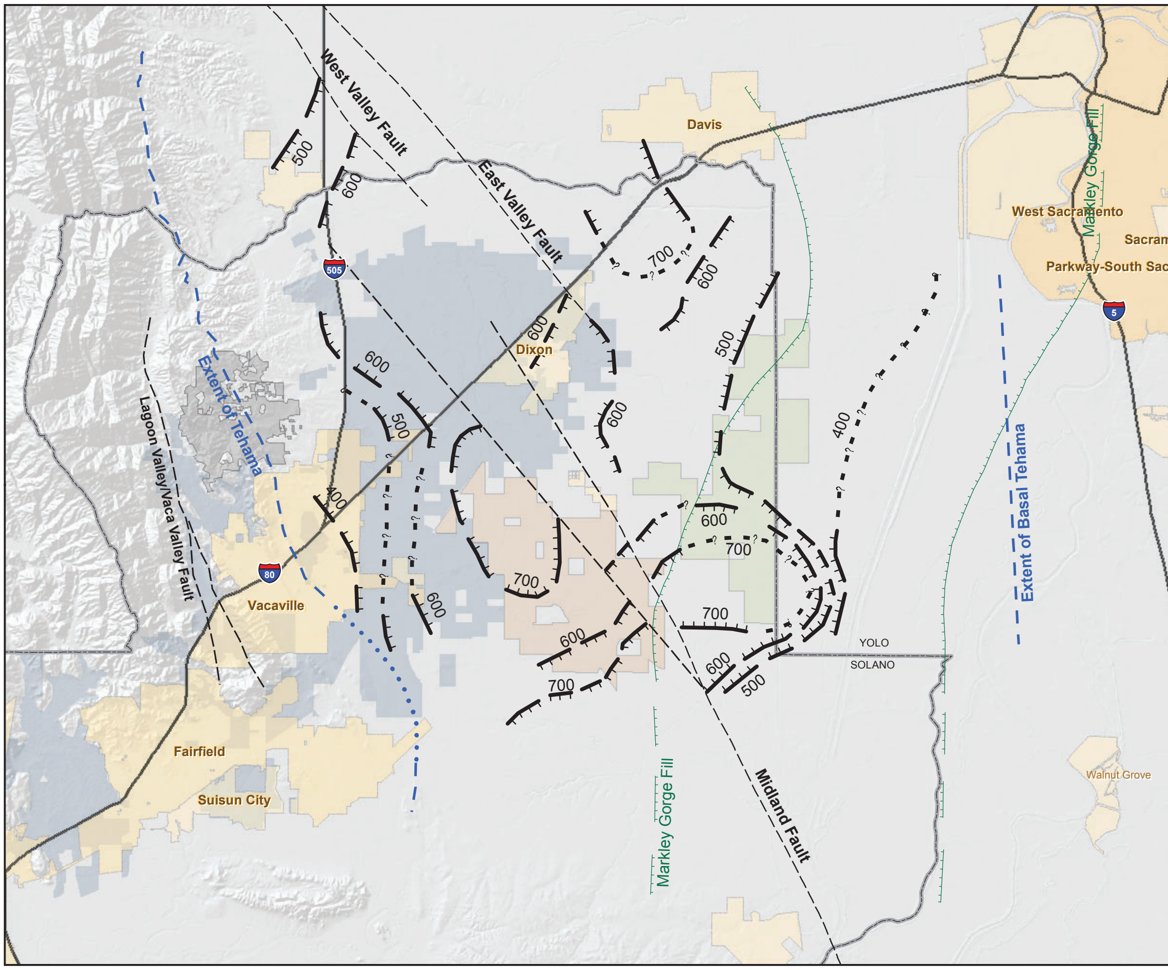
Figure 2-6
Cross-Section E-E'



Legend

- Basal Tehama Isopach Contours (feet)
- Regional Fault Zone
- Solano County Boundary
- Maine Prairie Water District
- Reclamation District No. 2068
- Solano Irrigation District
- Rural North Vacaville Water District

N

Miles
0 1.5 3

Figure 2-7
Isopach Contour Map
Basal Tehama Formation

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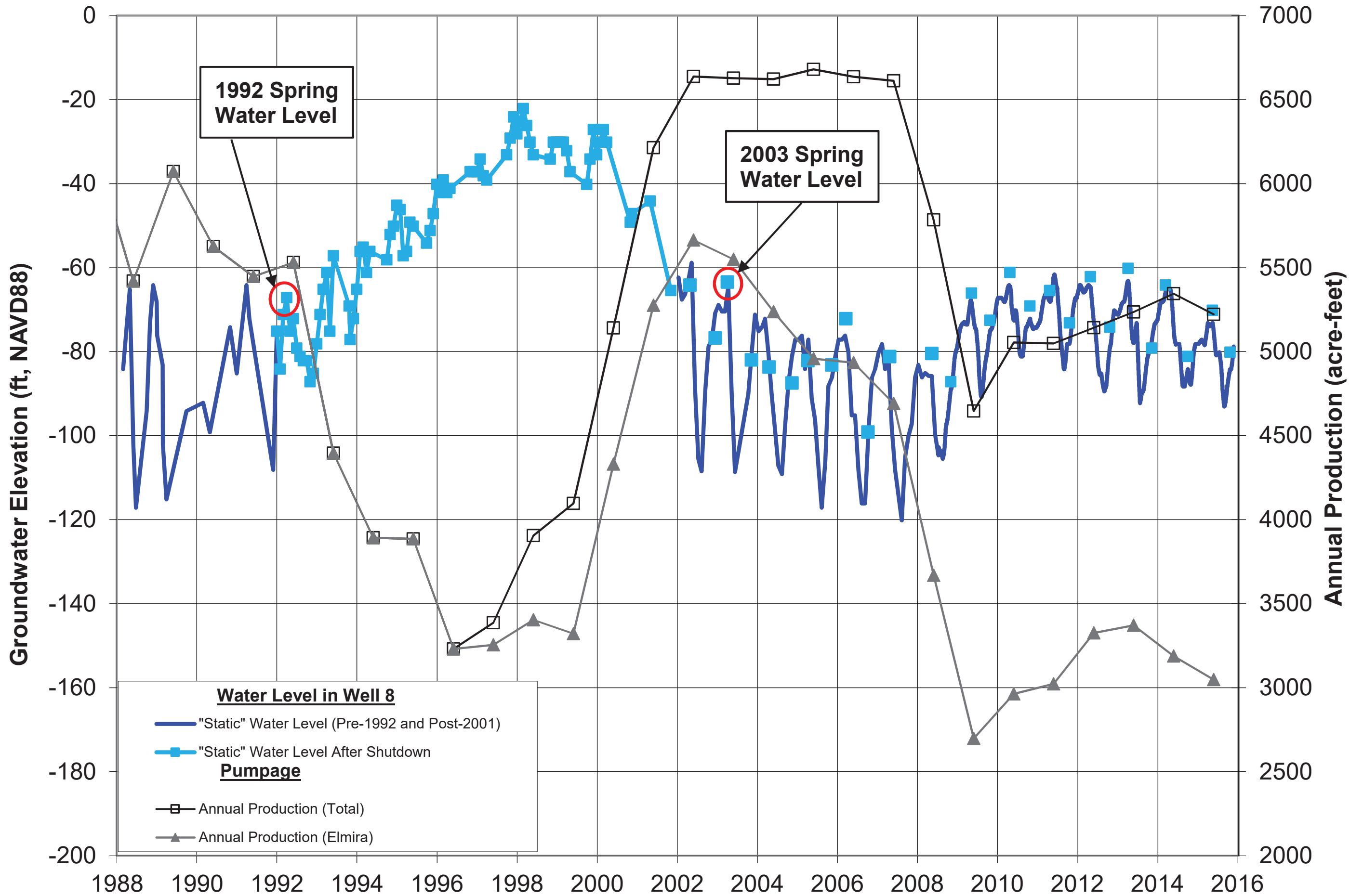

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Figure 2-8
Groundwater Level Hydrograph
City of Vacaville Well 8 and Total Annual Production

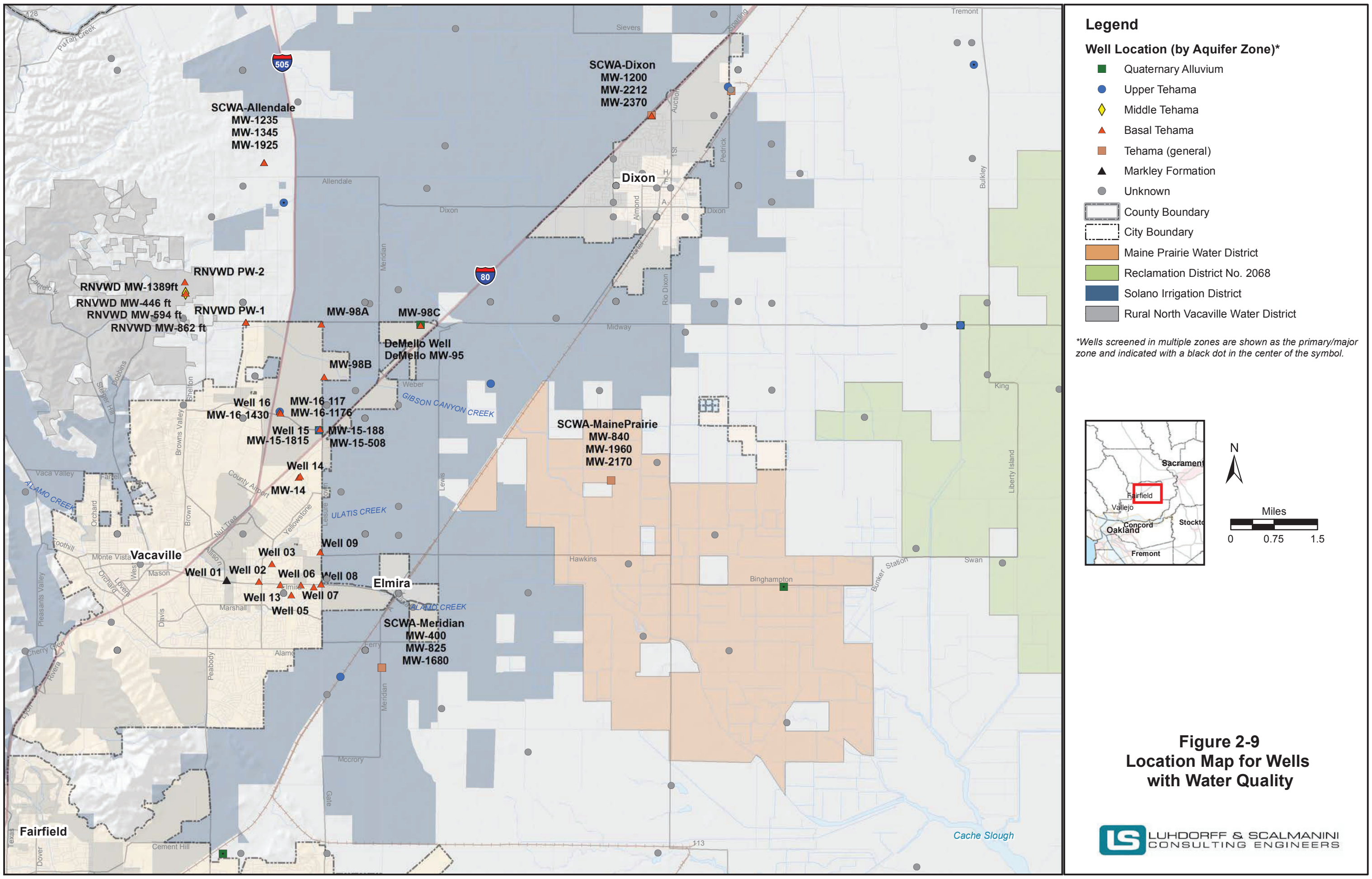

Figure 2-9
Location Map for Wells with Water Quality

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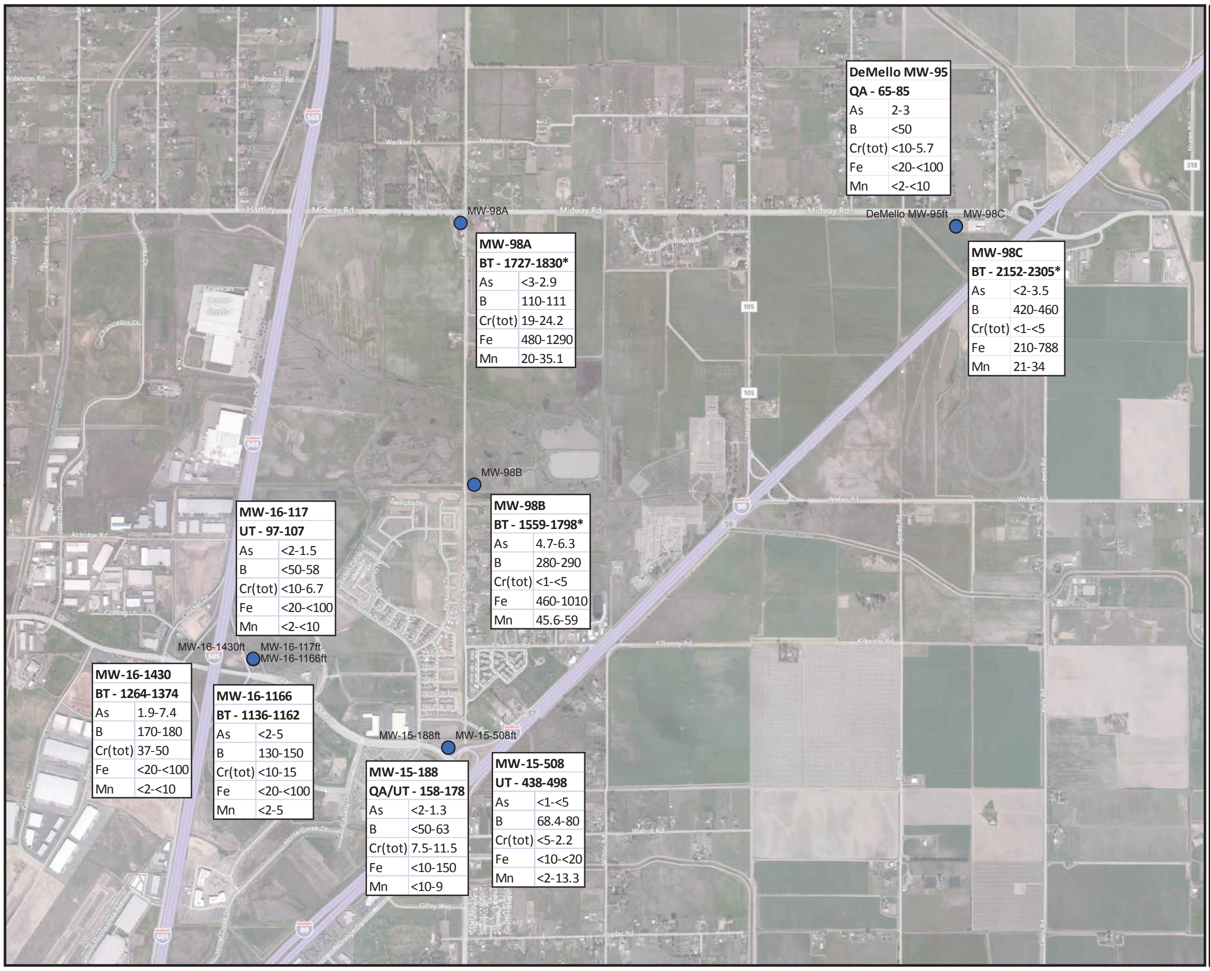

Legend

City of Vacaville

● Monitoring Well Location with Aquifer Unit, Screen Depths (ft), and WQ Data (concentration units ug/L)

Notes:
QA - Quaternary Alluvium;
UT - Upper Tehama;
BT - Basal Tehama
* indicates multiple screen openings within the range listed

N

0 0.25 0.5 1
Miles

Figure 2-10
Select Groundwater Quality Contituents

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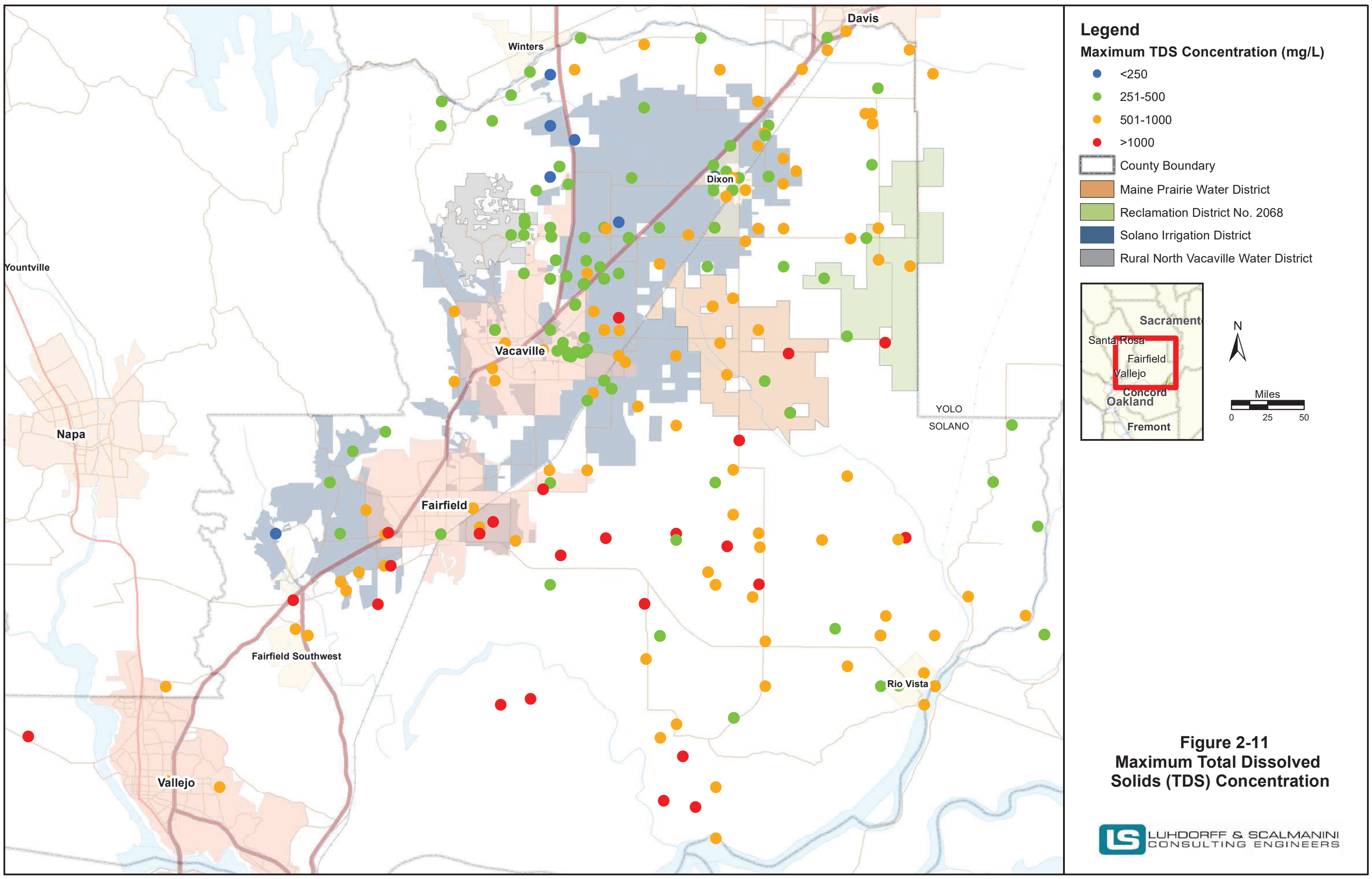

Figure 2-11
Maximum Total Dissolved Solids (TDS) Concentration

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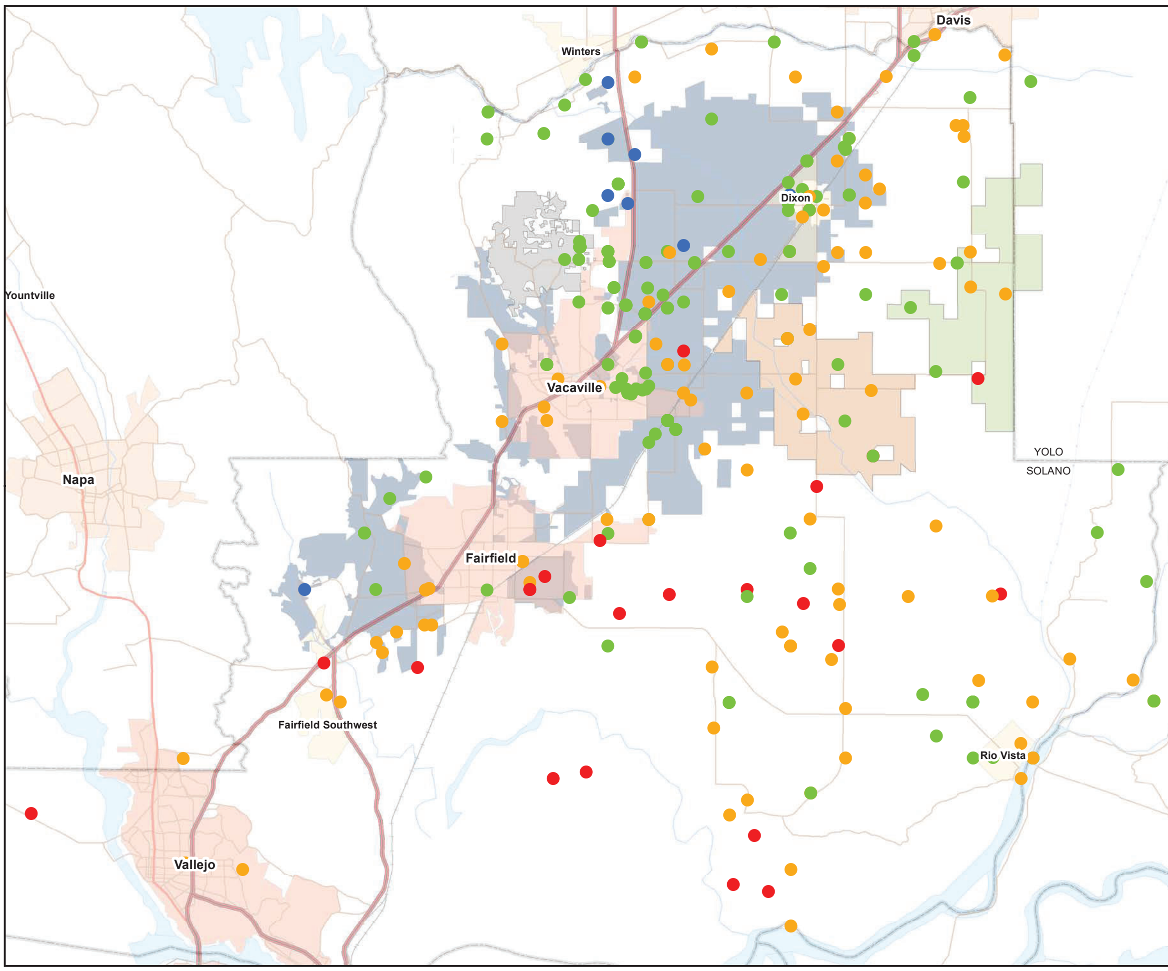

Figure 2-12
Average Total Dissolved Solids (TDS) Concentration

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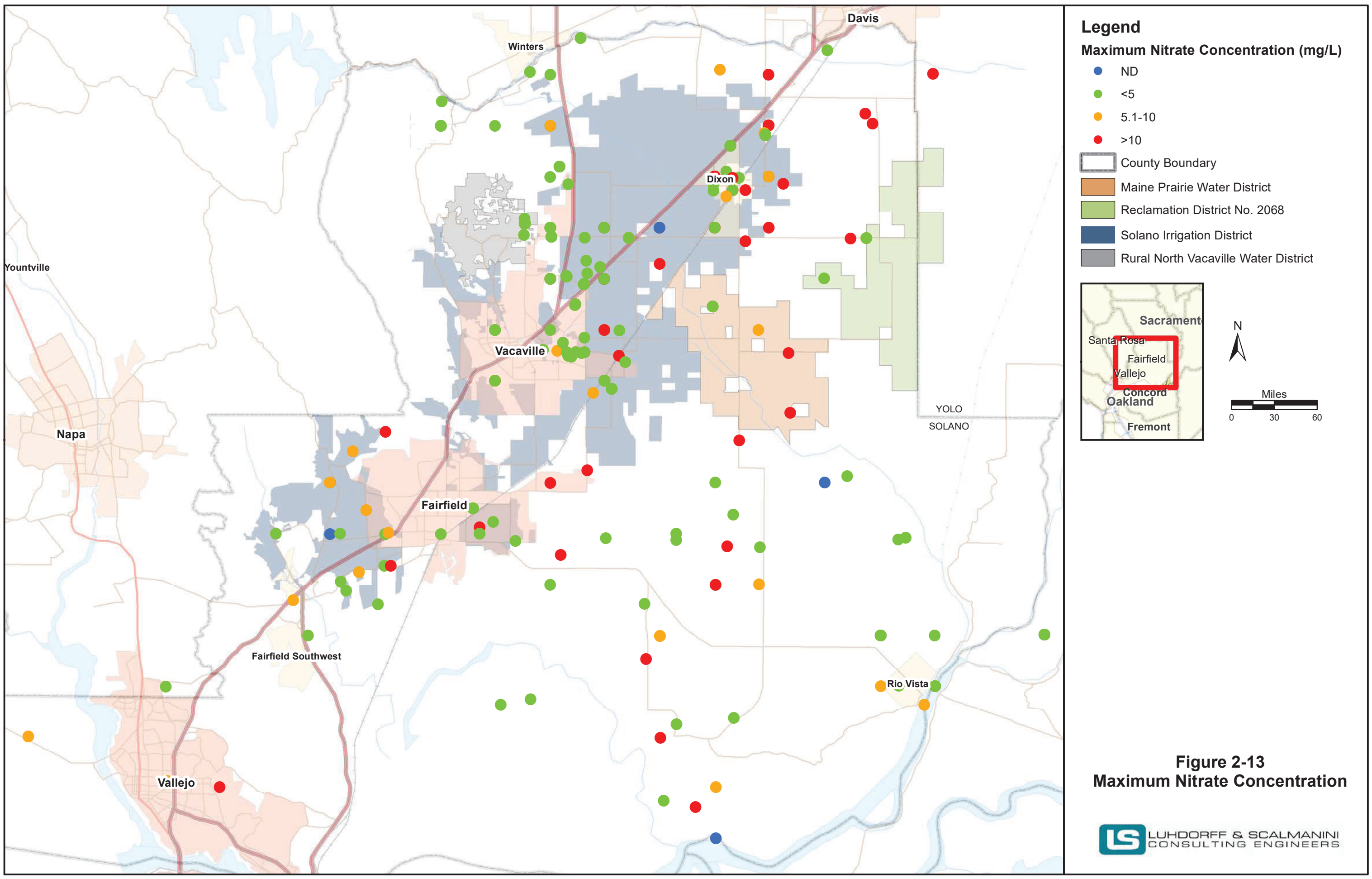

Figure 2-13
Maximum Nitrate Concentration

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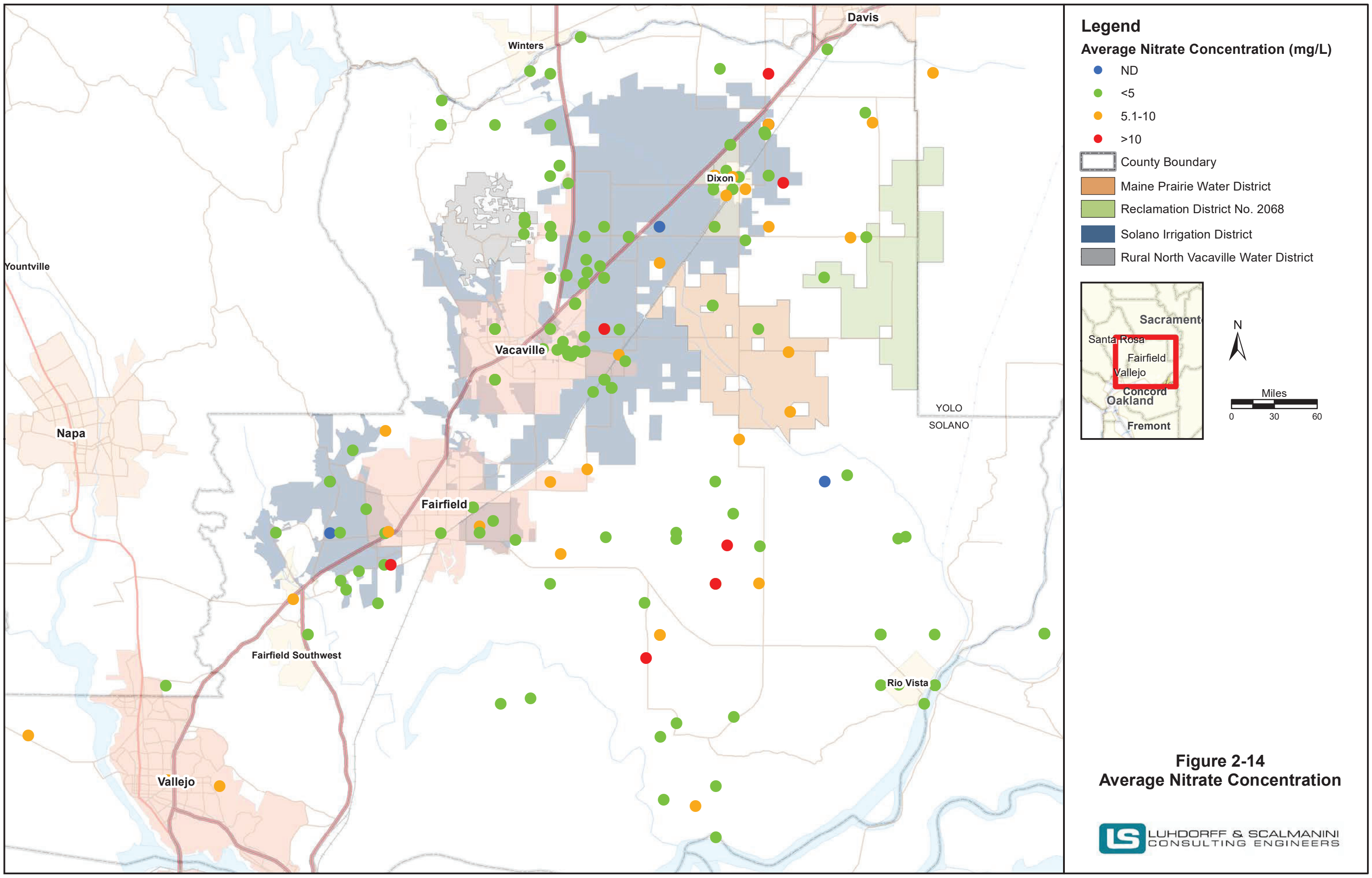

Figure 2-14
Average Nitrate Concentration

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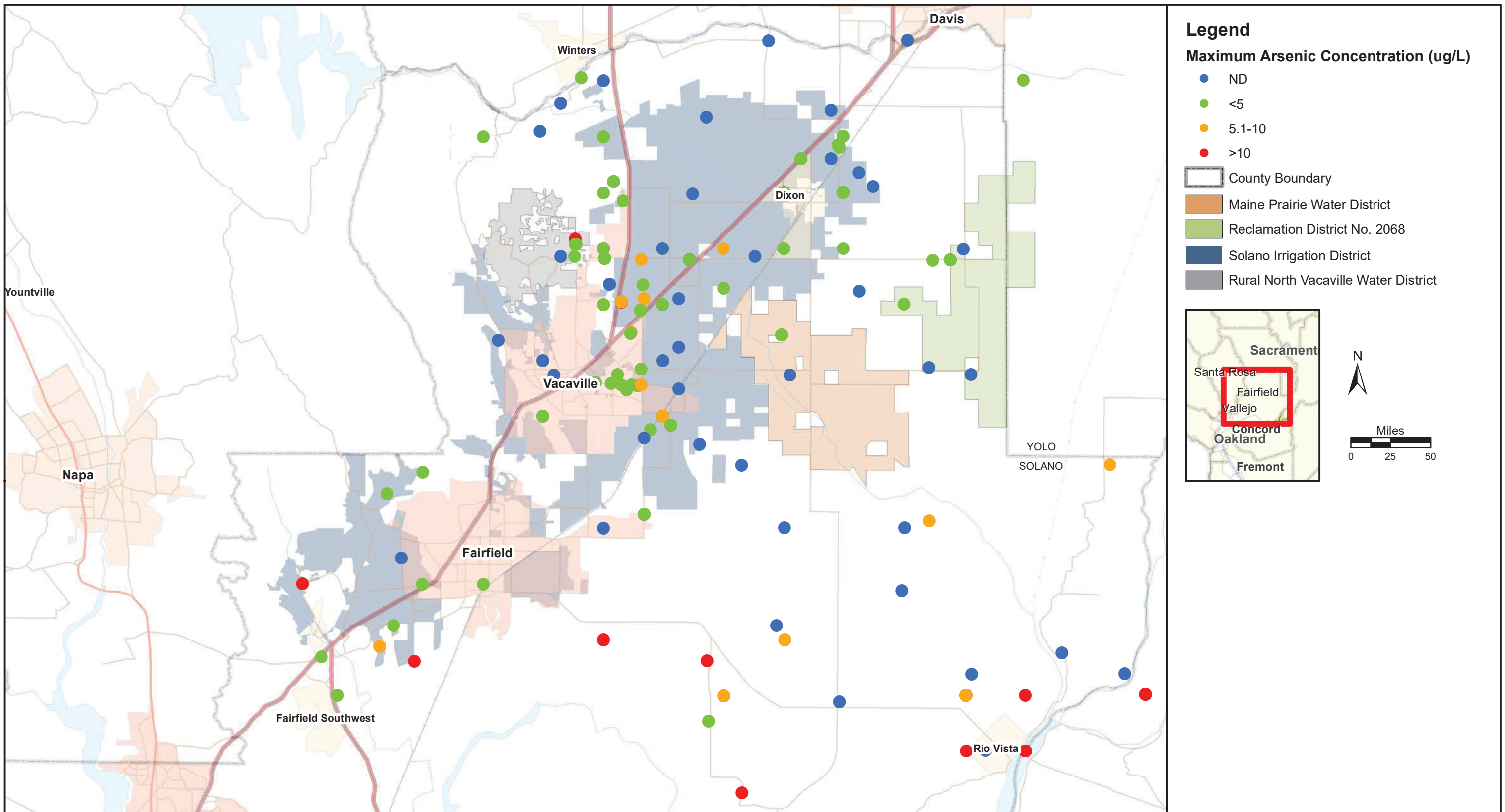

Figure 2-15
Maximum Arsenic Concentration

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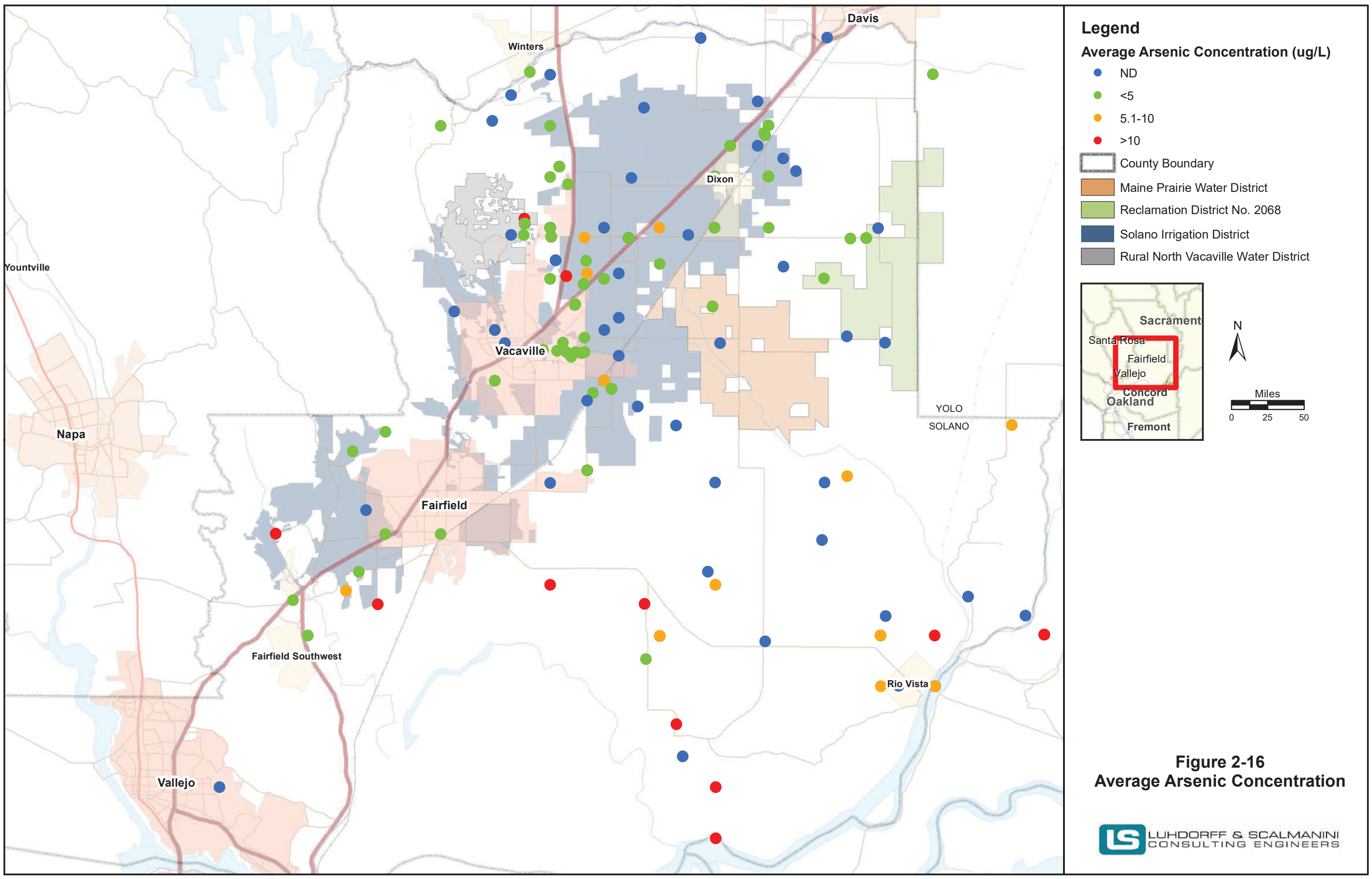

Figure 2-16
Average Arsenic Concentration

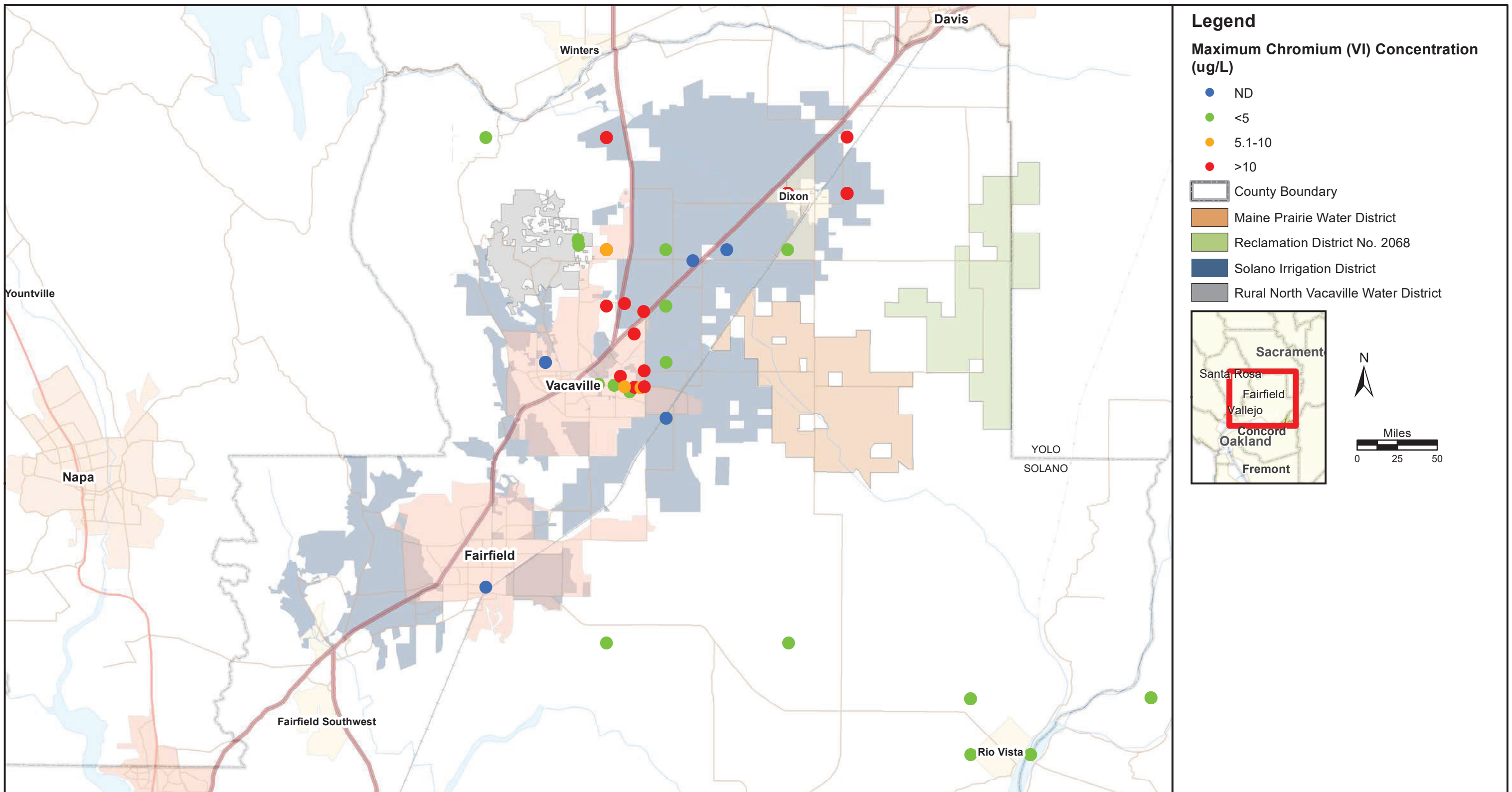

Figure 2-17
Maximum Chromium (VI) Concentration

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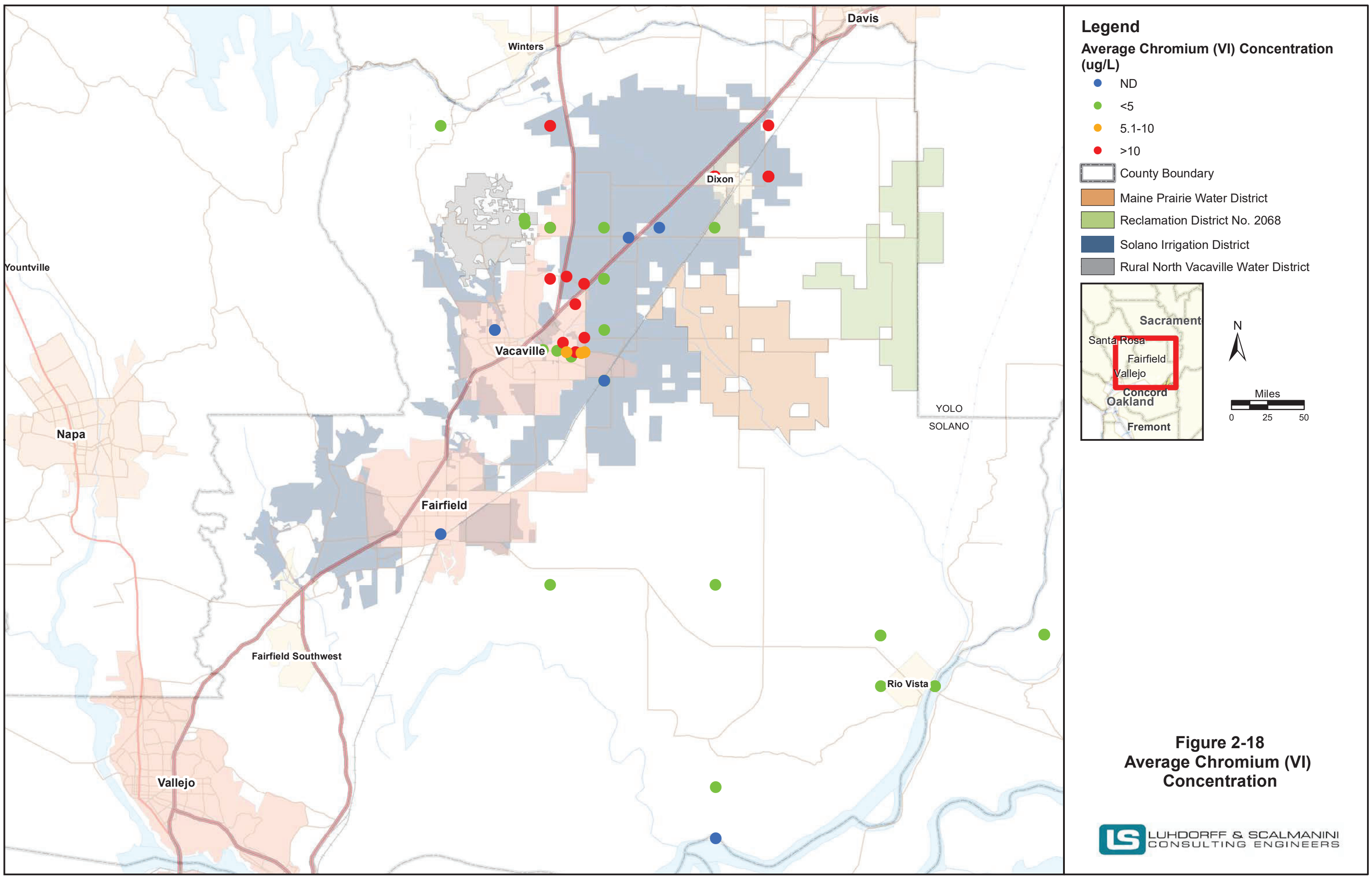

Figure 2-18
Average Chromium (VI) Concentration

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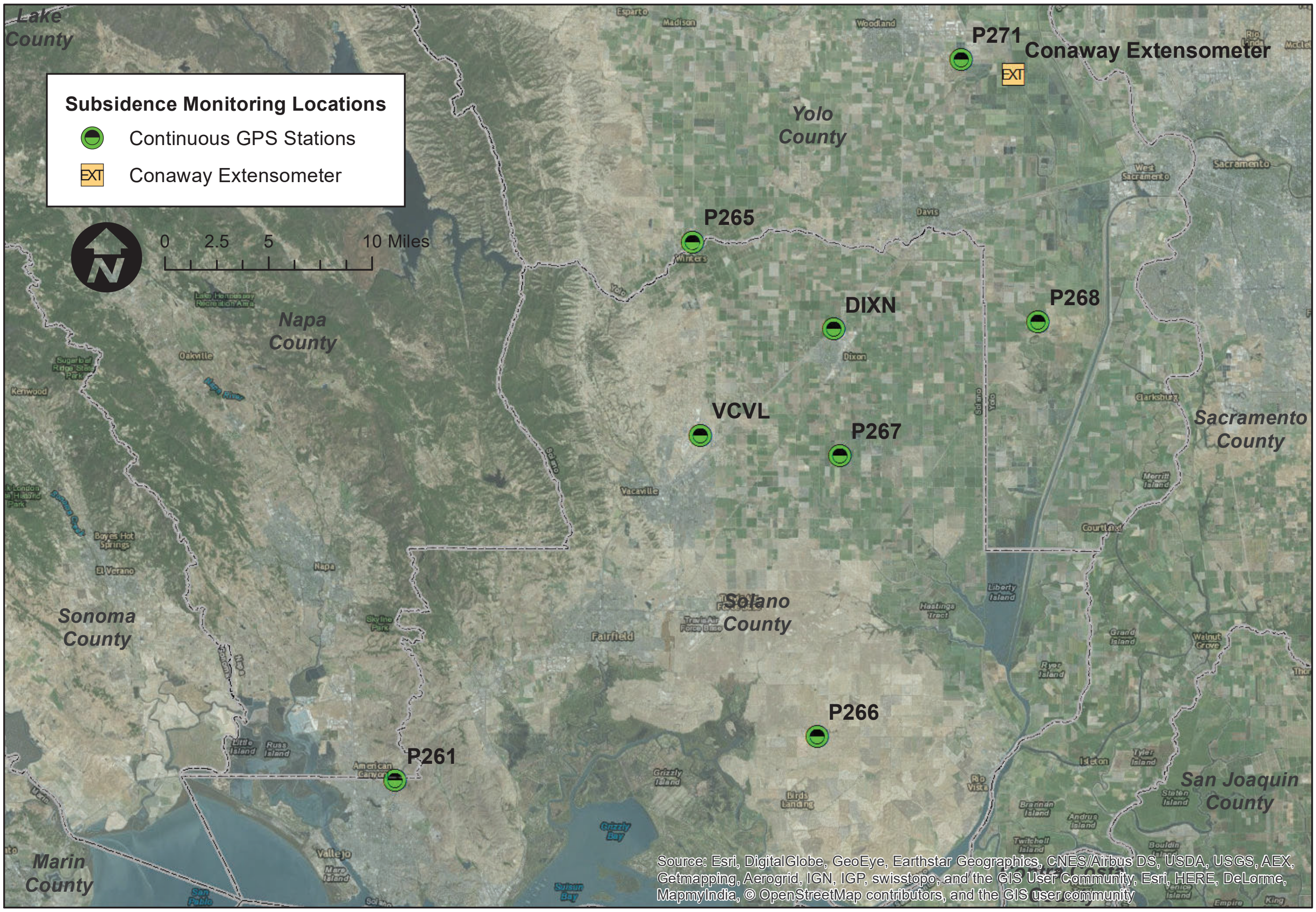

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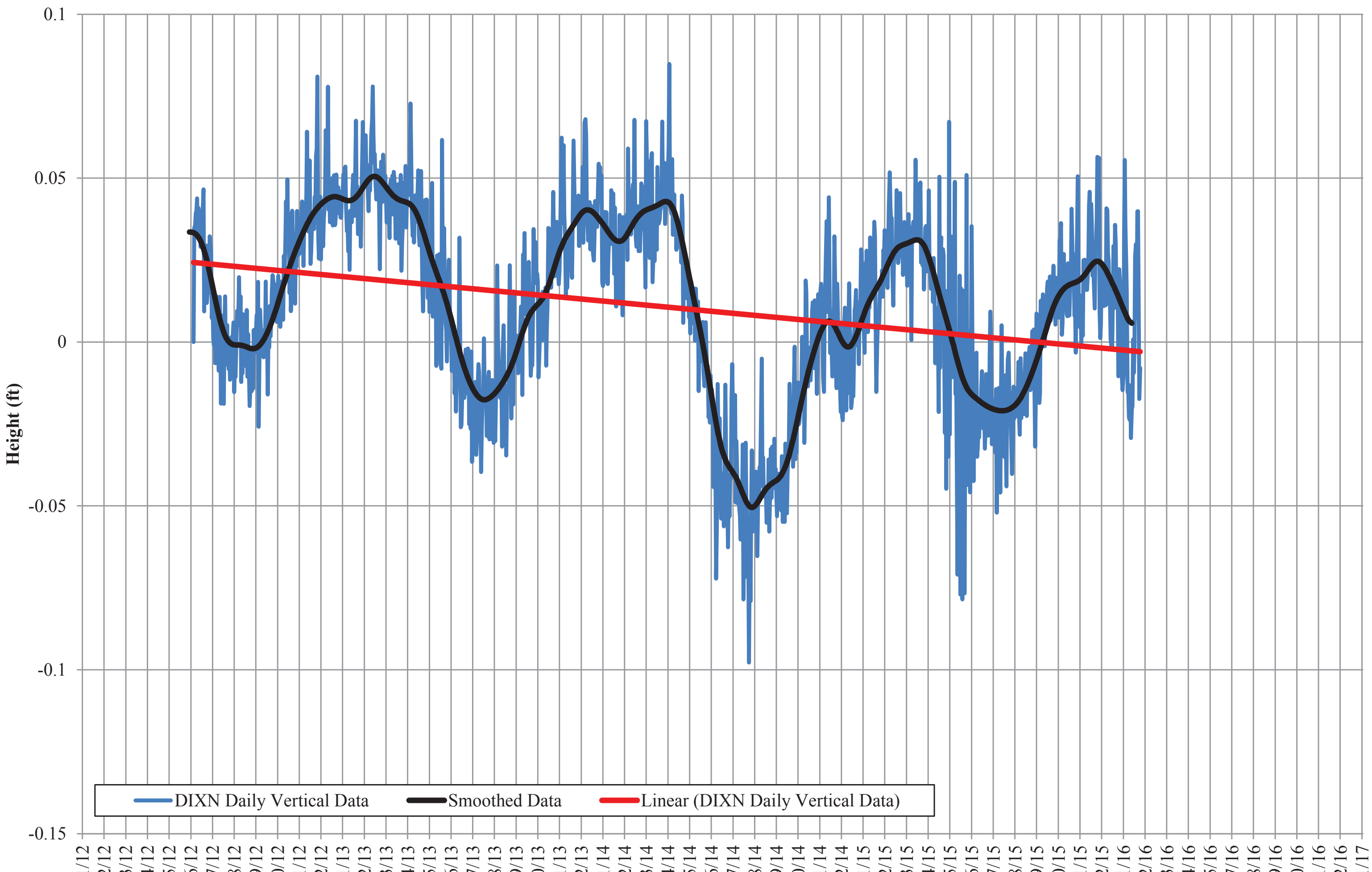
Figure 2-19
Subsidence Monitoring Locations
Solano County and Nearby Yolo County Sites



DIXN; DixonCity_CA2012; 38.4687154840N -121.8286422934E

y = -0.000020136563x + 0.851247742307

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Figure 2-20
SCWA Subsidence Station in Dixon
DIXN Station

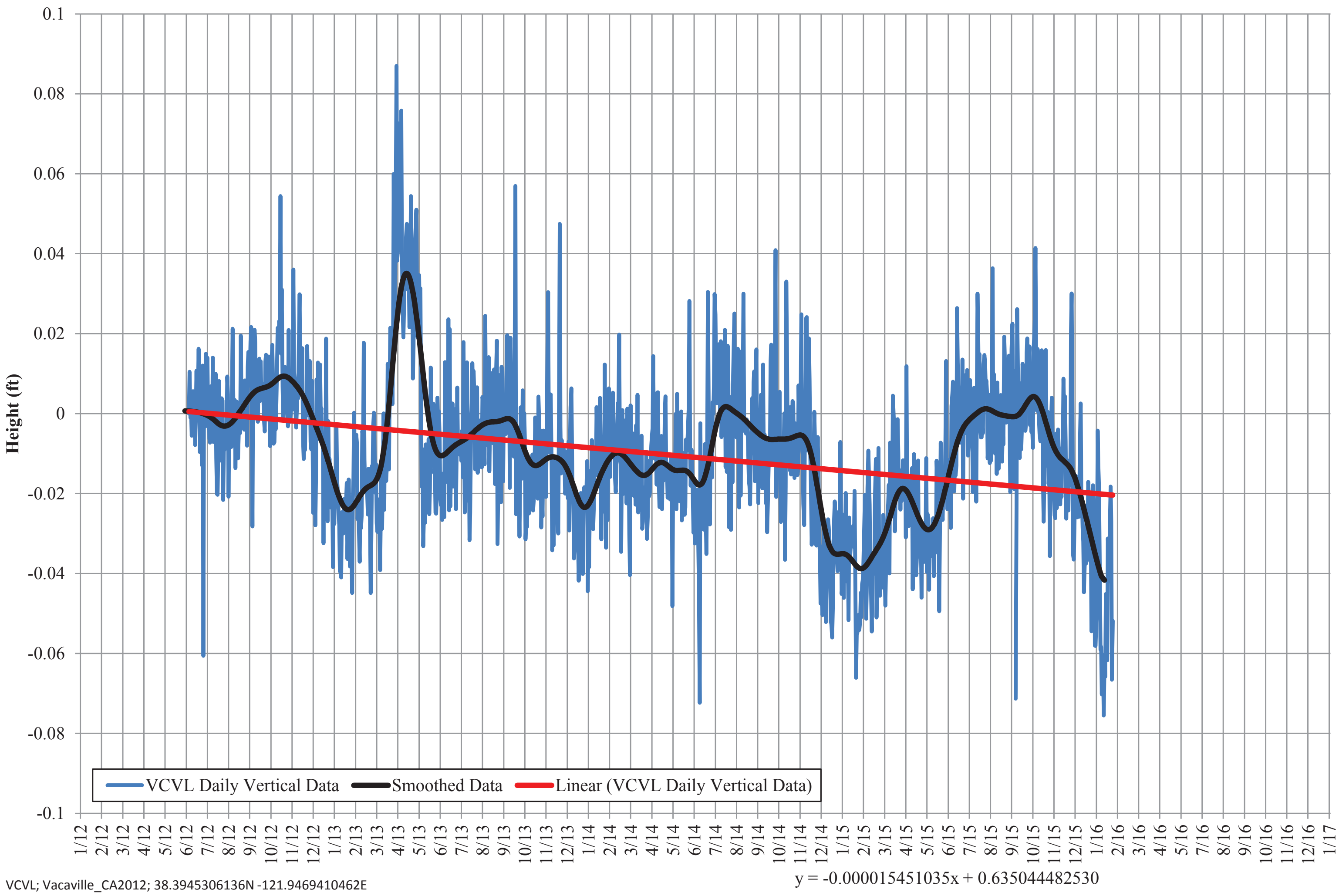

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Figure 2-21
SCWA Subsidence Station in Vacaville
VCVL Station

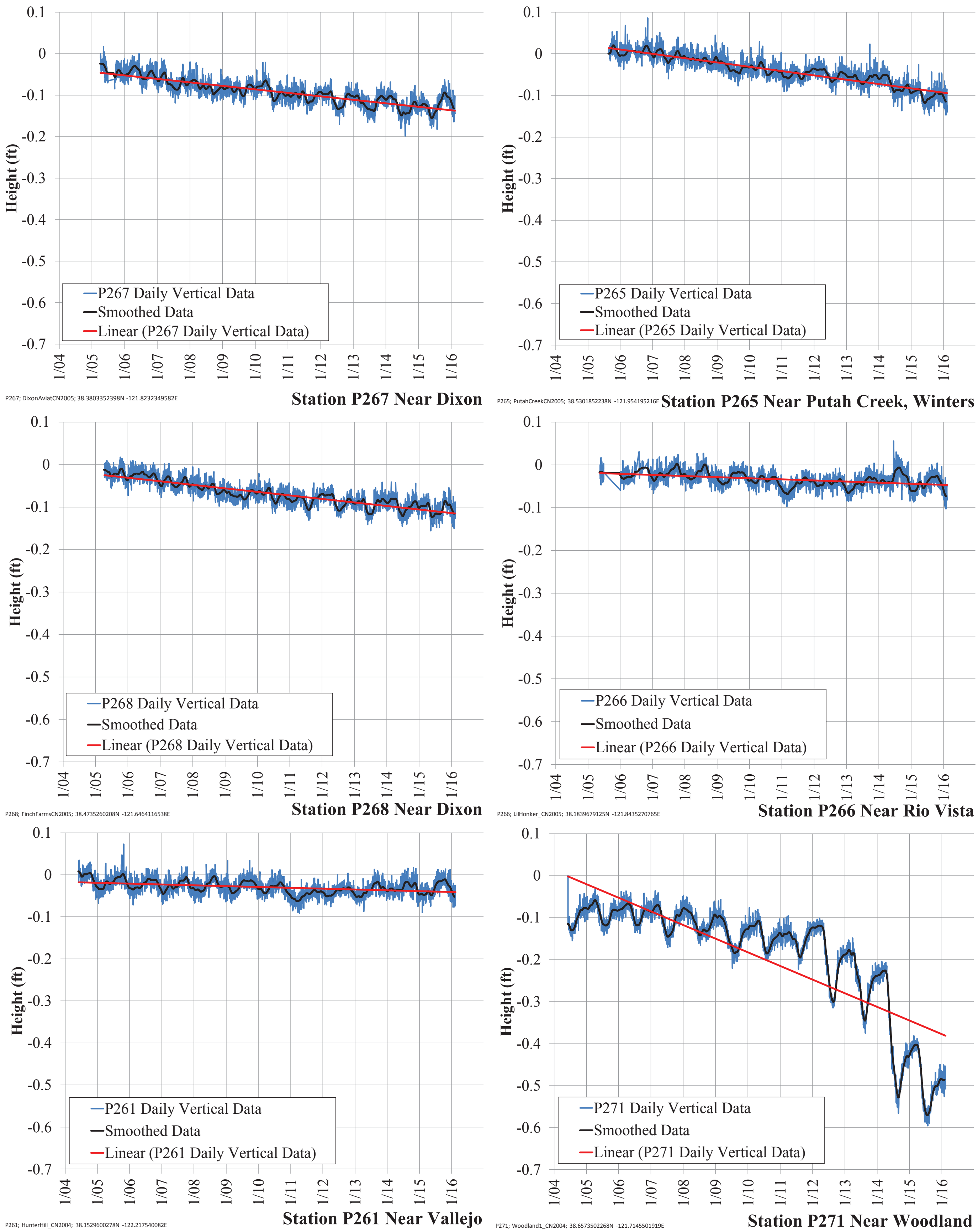

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Figure 2-22
Continuous GPS Data from Stations in Solano County and Nearby Yolo County Plate Boundary Observatory UNAVCO

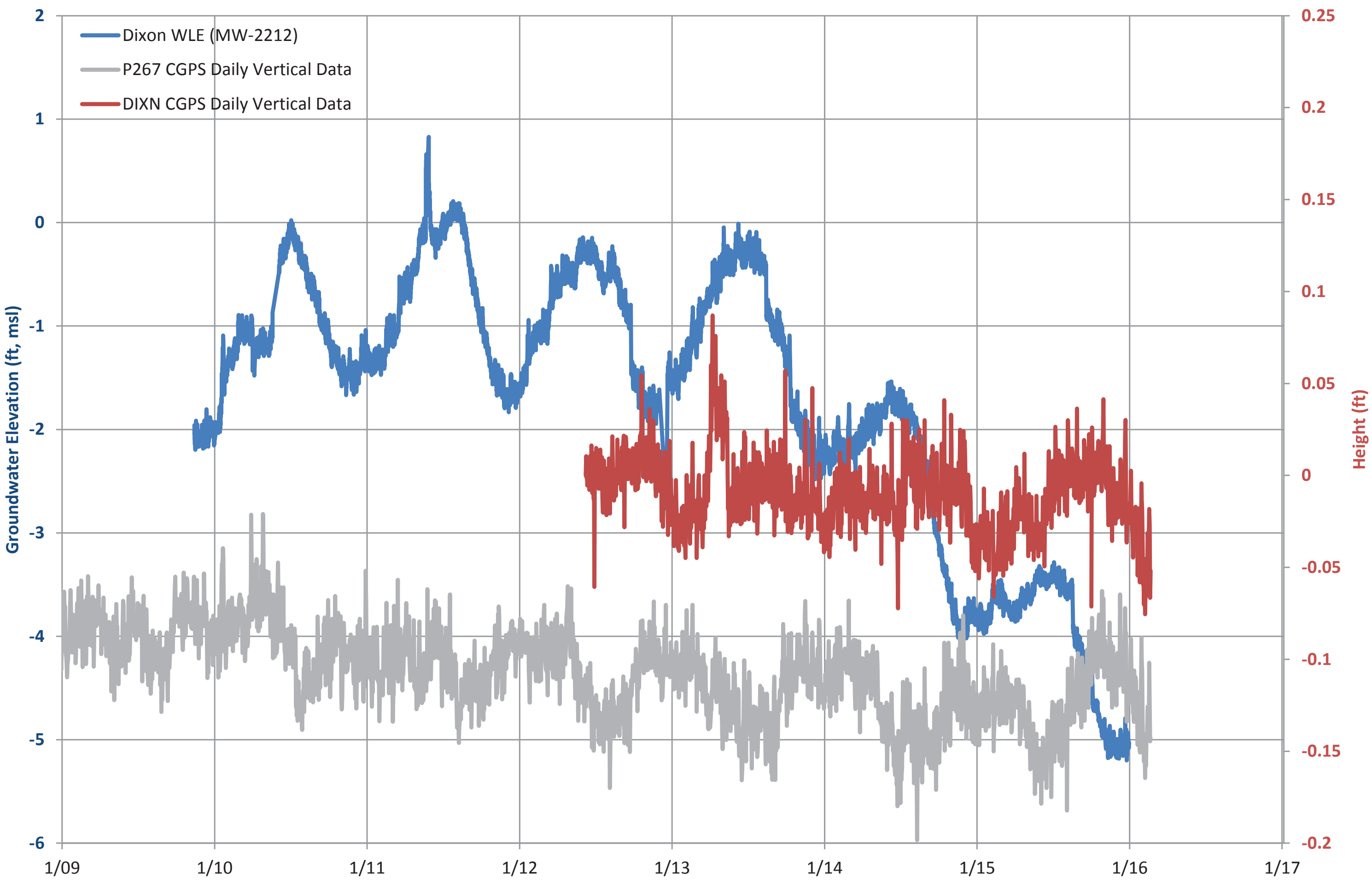

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Figure 2-23
Water Level and Continuous GPS Data
SCWA Dixon Site (and P267)

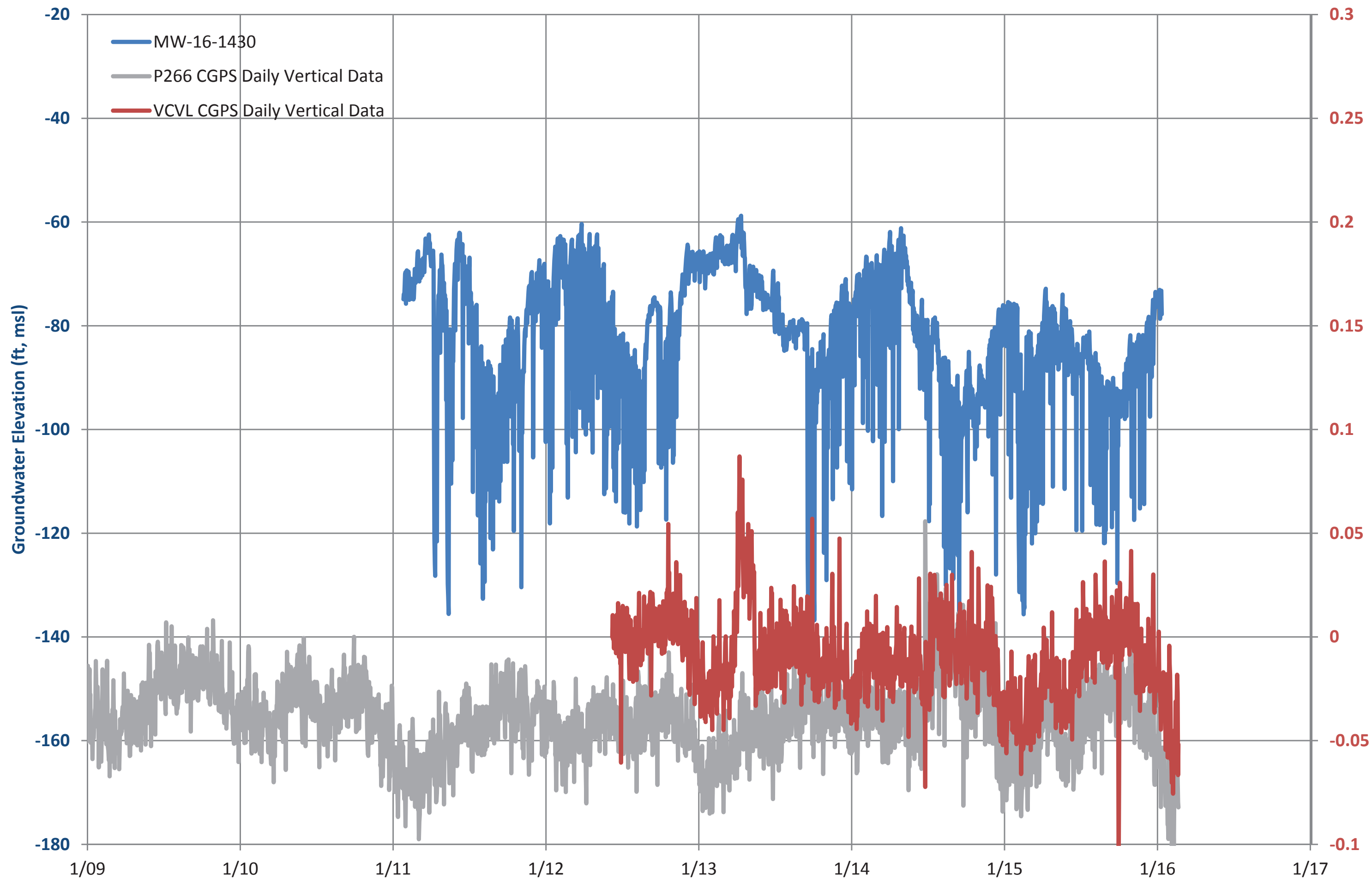

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Figure 2-24
Water Level and Continuous GPS Data
SCWA Vacaville Site (and P266)

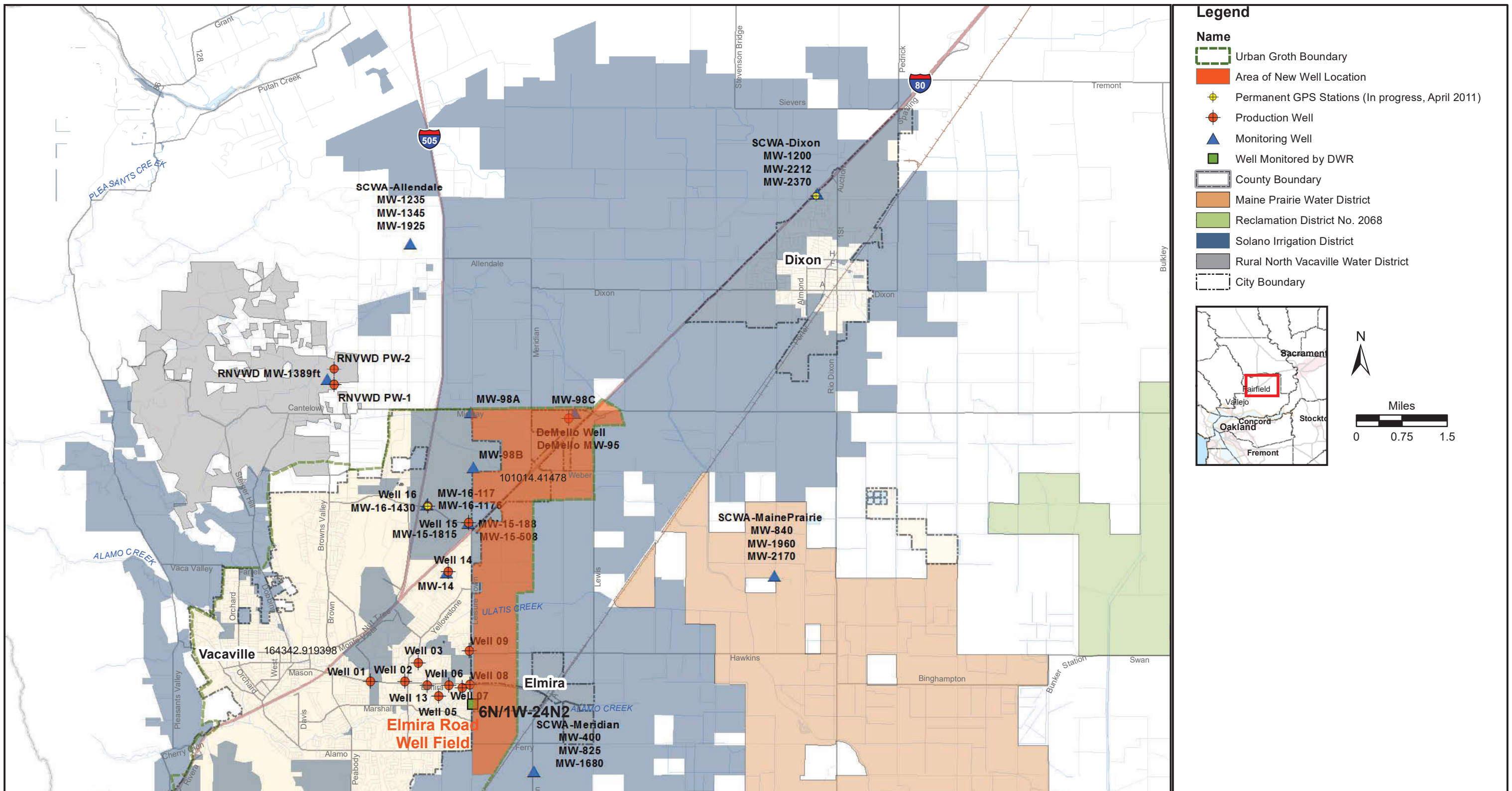
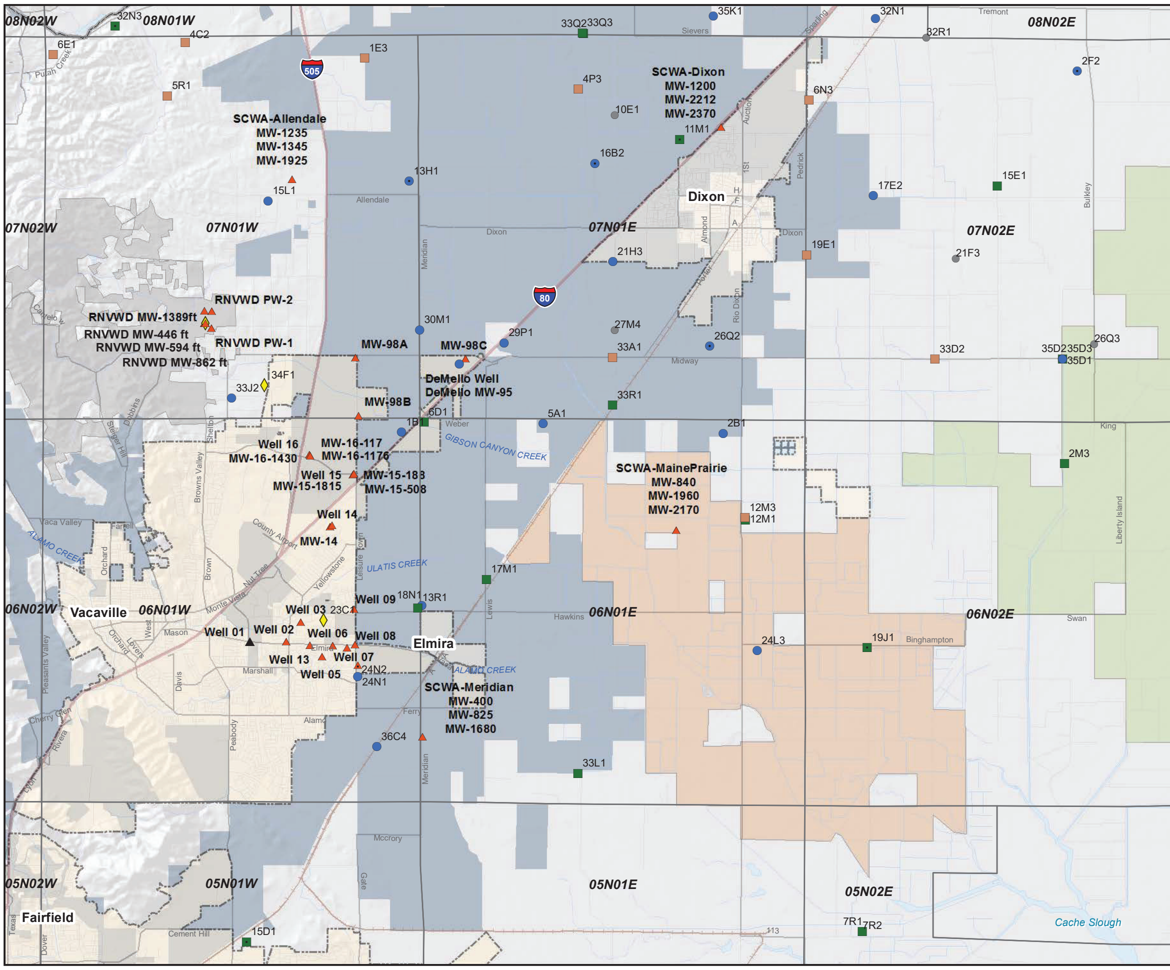


Figure 3-1
Future Production Well Location
City of Vacaville

APPENDIX A



Legend

Well Location (by Aquifer Zone)*

- Quaternary Alluvium
- Upper Tehama
- Middle Tehama
- Basal Tehama
- Tehama (general)
- Markley
- Unknown
- t_r_s_dissolveNov2014
- County Boundary
- City Boundary
- Maine Prairie Water District
- Reclamation District No. 2068
- Solano Irrigation District
- Rural North Vacaville Water District

**Wells screened in multiple zones are shown as the primary/major zone and indicated with a black dot in the center of the symbol.*

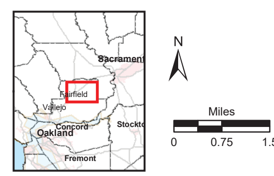


Figure A-1
Location Map for Wells with Water Level Data

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File: X:\2015 Job Files\15-116 City of Vacaville General Services\GIS\Map Files\Well Location Map by zone.mxd Date: 3/24/2016

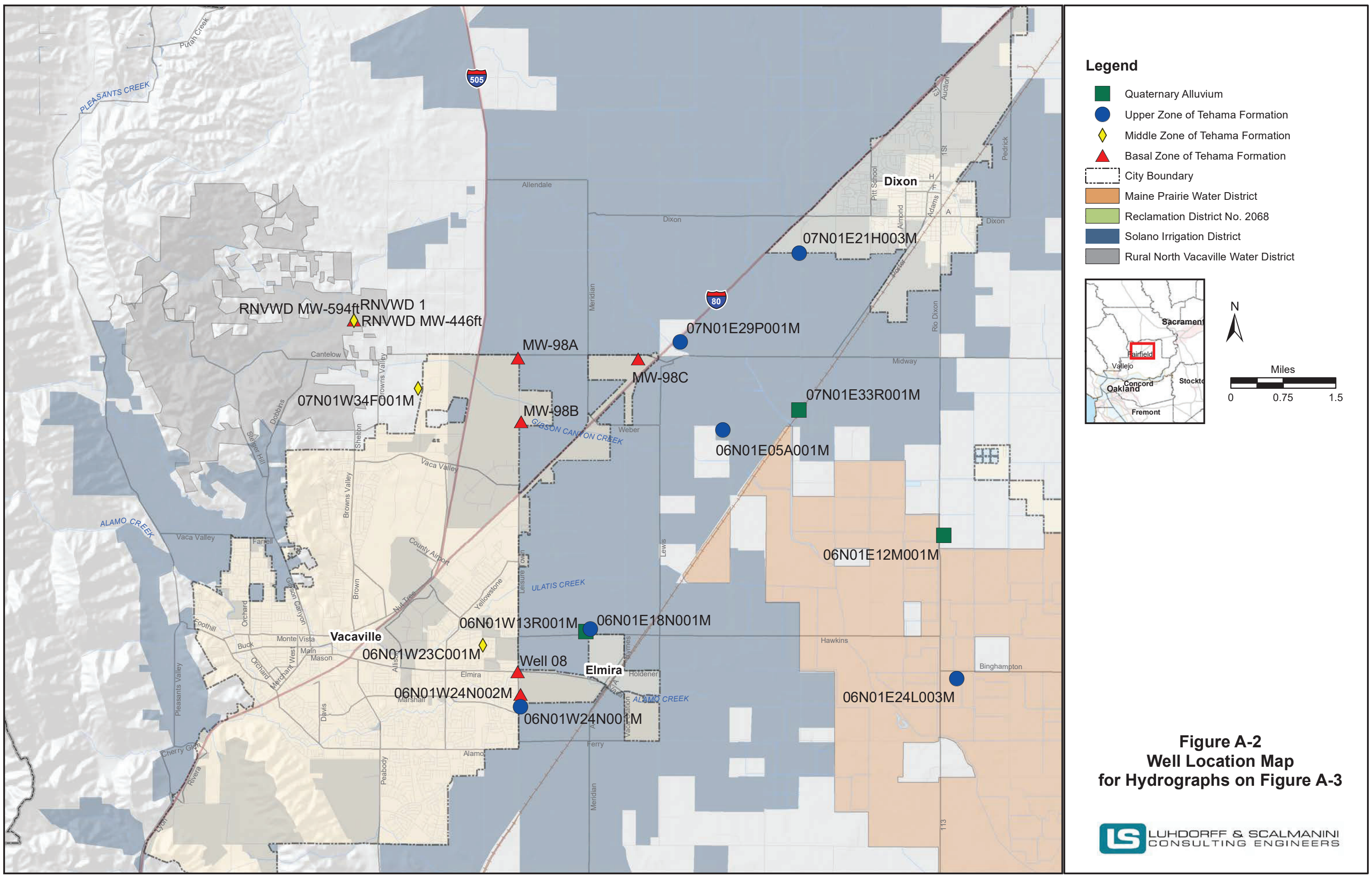

Figure A-2
Well Location Map
for Hydrographs on Figure A-3

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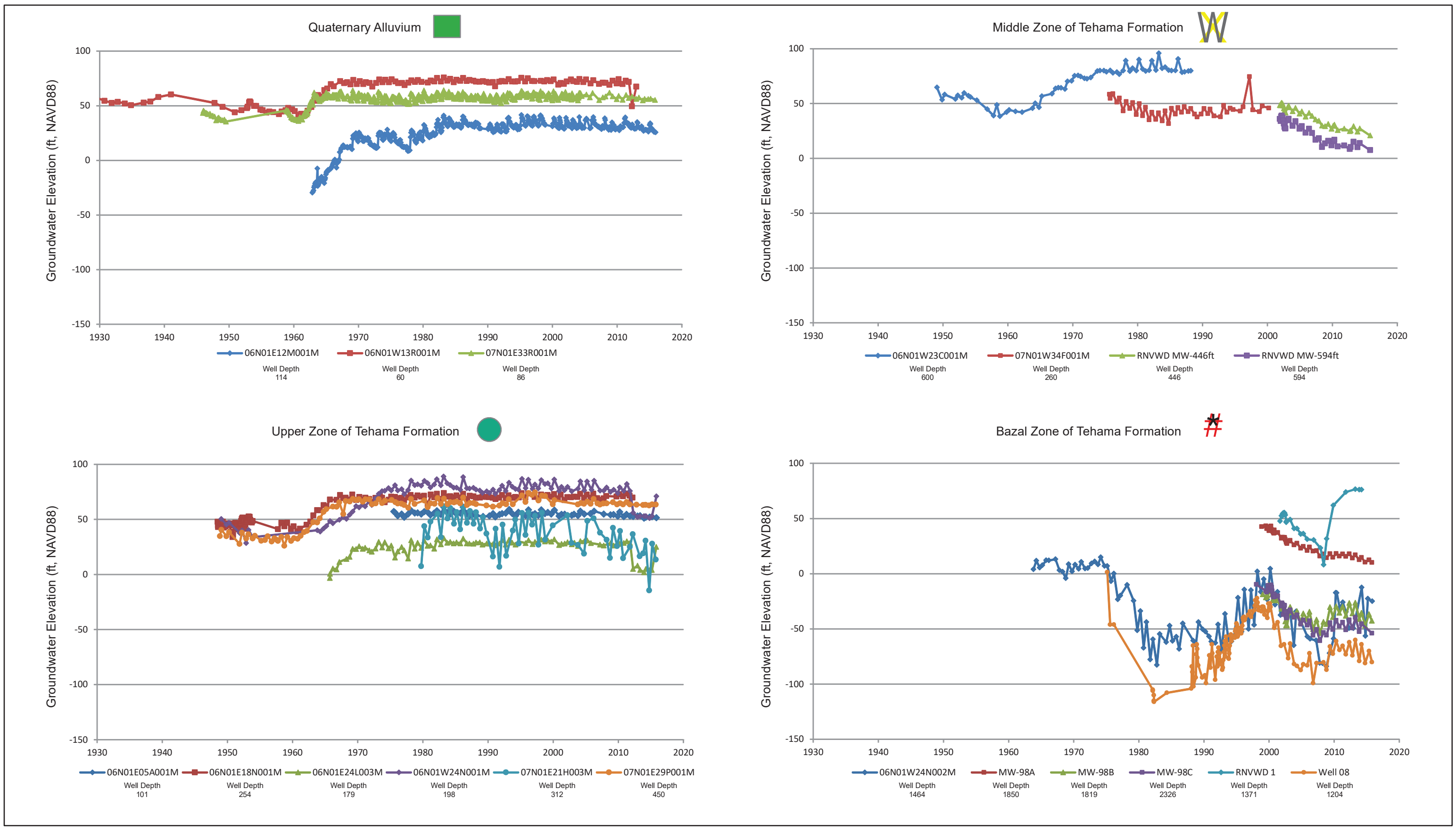
File: X:\2015 Job Files\15-116 City of Vacaville General Services\GIS\Map Files\Well_Location_ALL_ZONE_hydrographs_20160229.mxd Date: 3/10/2016



File: X:\2015 Job Files\15-116 City of Vacaville General Services\GIS\Map Files\Hydrograph_for_all_zones_20160229.mxd Date: 3/24/2016

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Figure A-3
Hydrographs of Groundwater Elevations by Zone

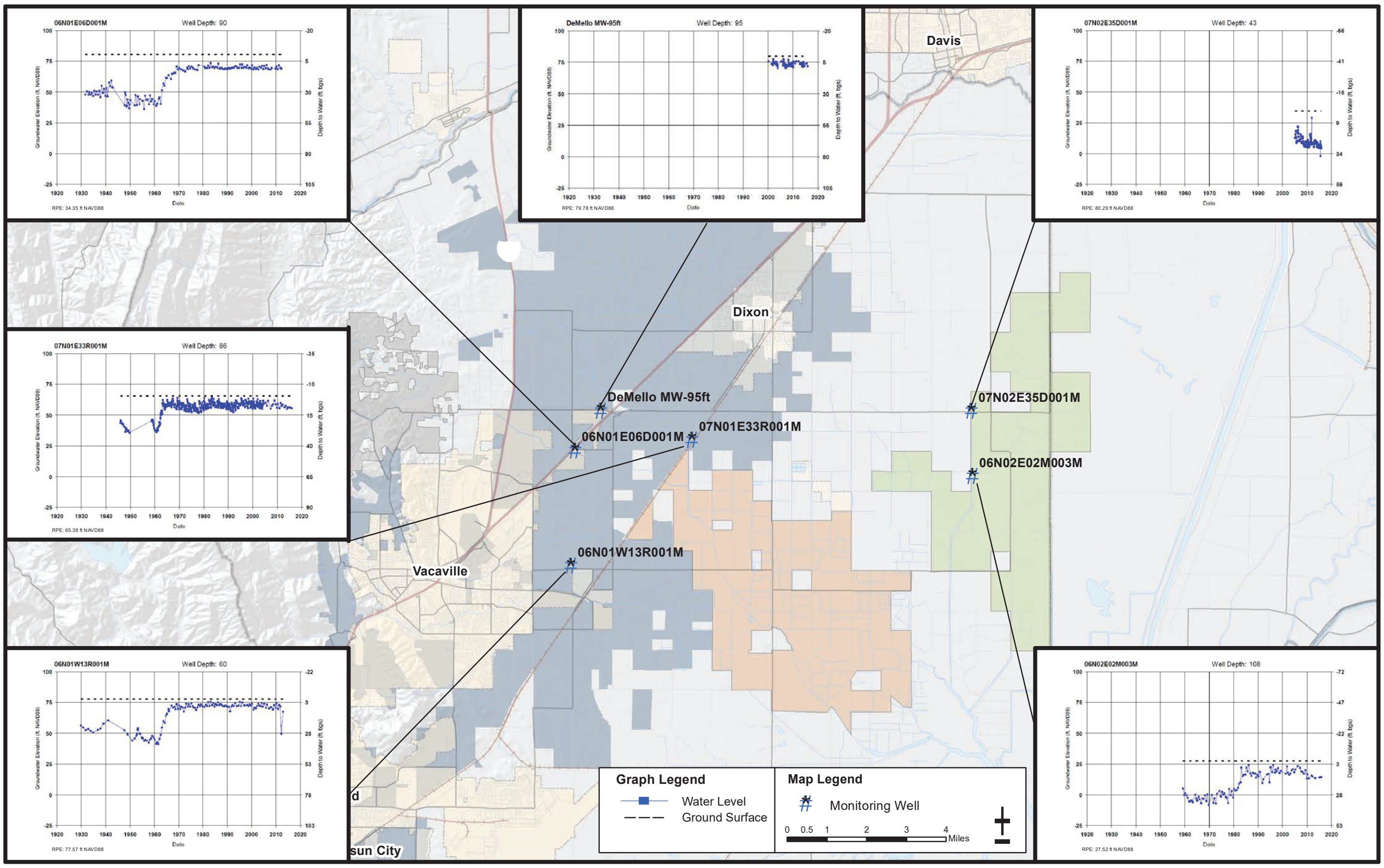

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Figure A-4
Representative Hydrographs of Alluvial Zone Wells

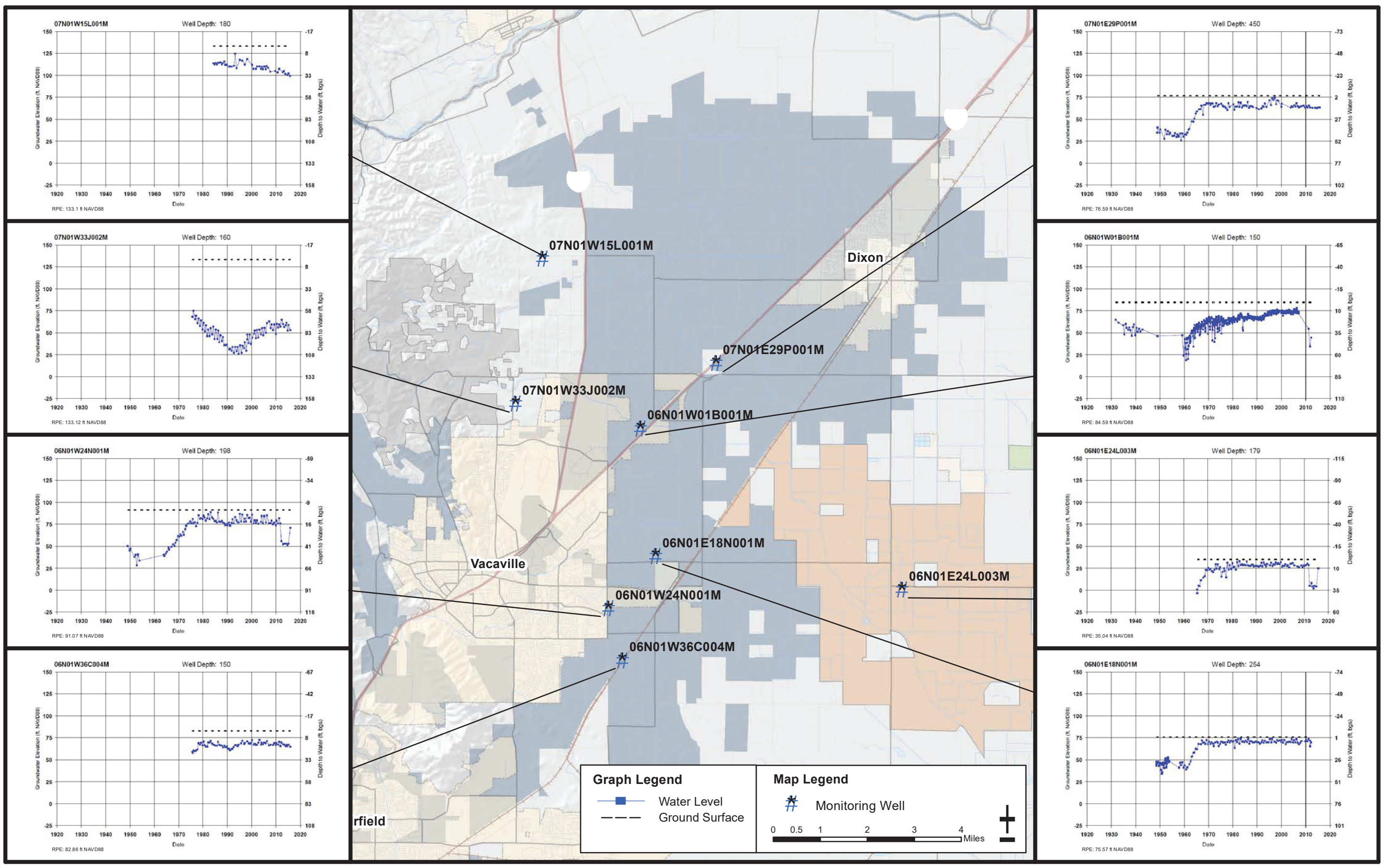

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Figure A-5
Representative Hydrographs of Upper Zone Wells

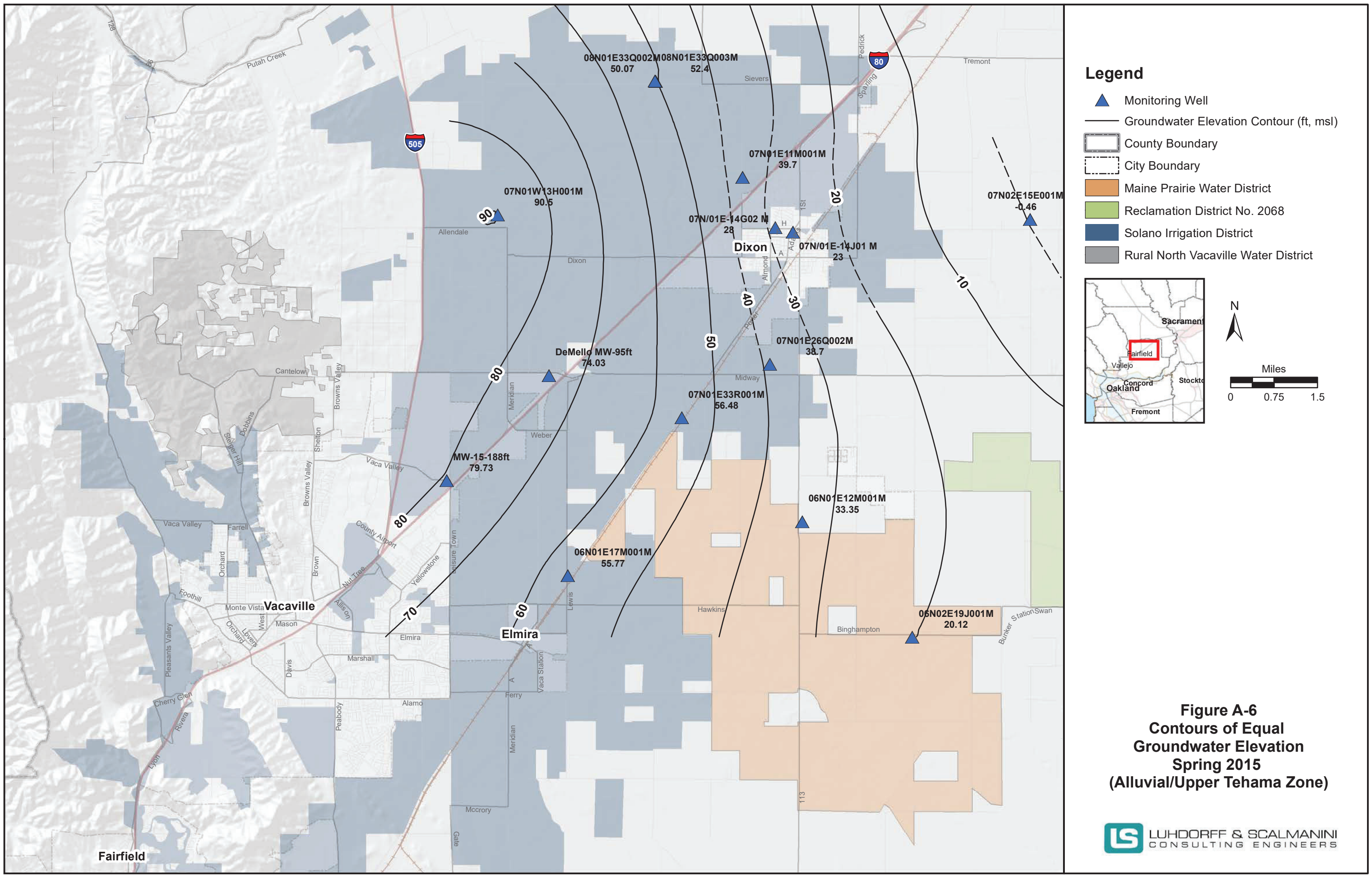

Figure A-6
Contours of Equal Groundwater Elevation
Spring 2015
(Alluvial/Upper Tehama Zone)

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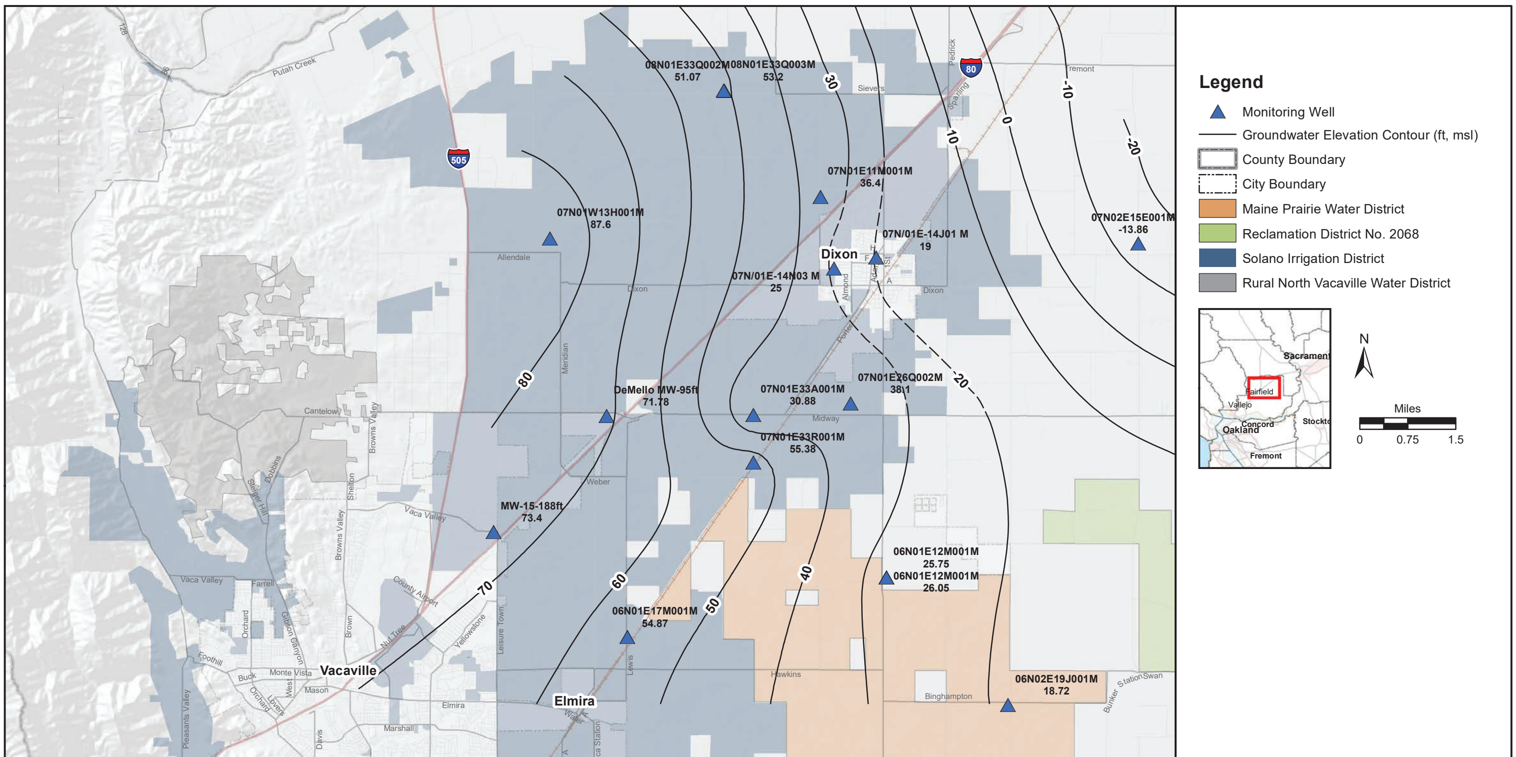

Figure A-7
Contours of Equal Groundwater Elevation
Fall 2015
(Alluvial/Upper Tehama Zone)

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File: X:\2015 Job Files\15-116 City of Vacaville General Services\GIS\X2015 Job Files15-116 City of Vacaville General ServicesGIS\WL_Contours_Fall 2015JL.mxd Date: 4/8/2016

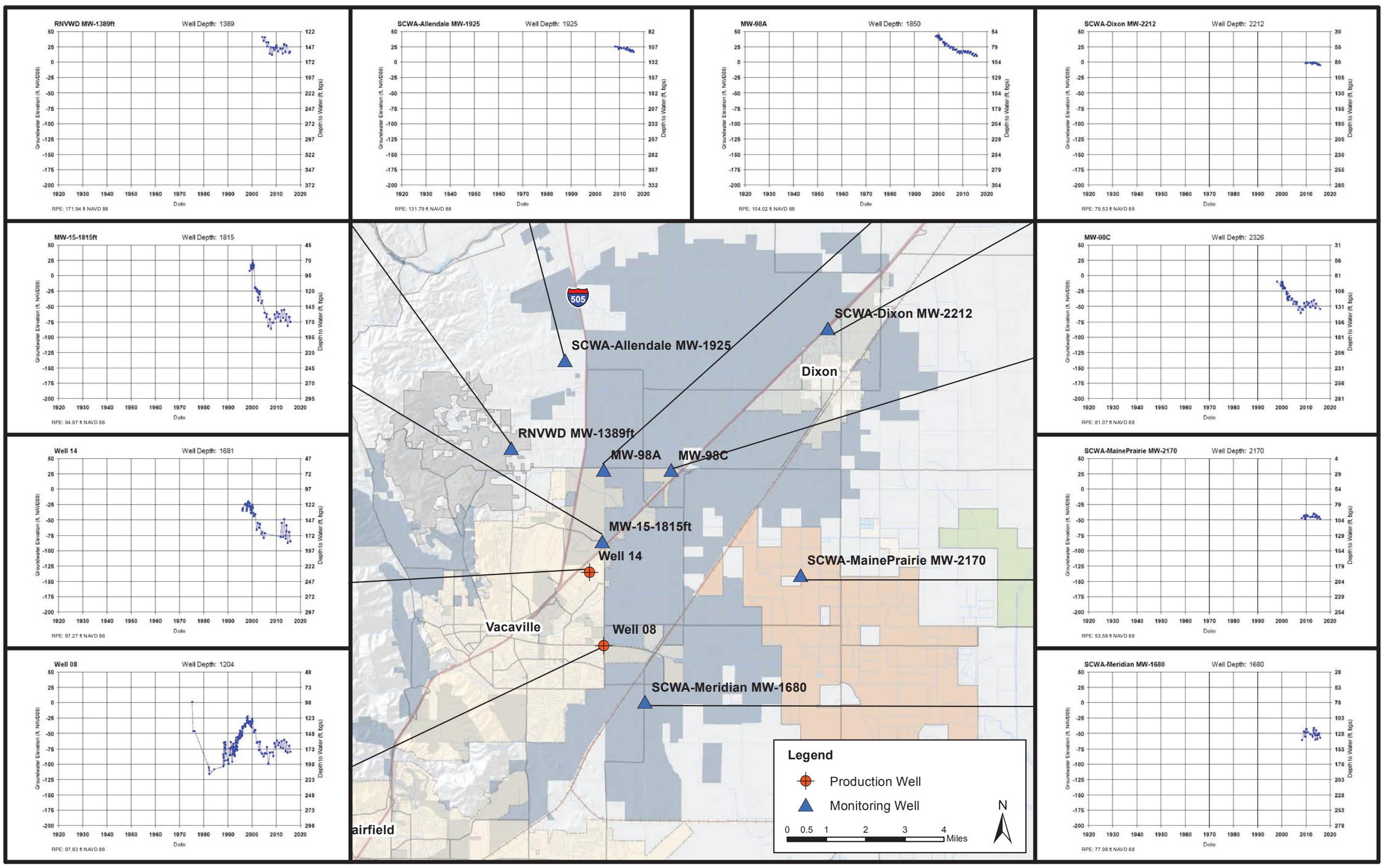

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Figure A-8
Representative Hydrographs of Basal Zone Wells

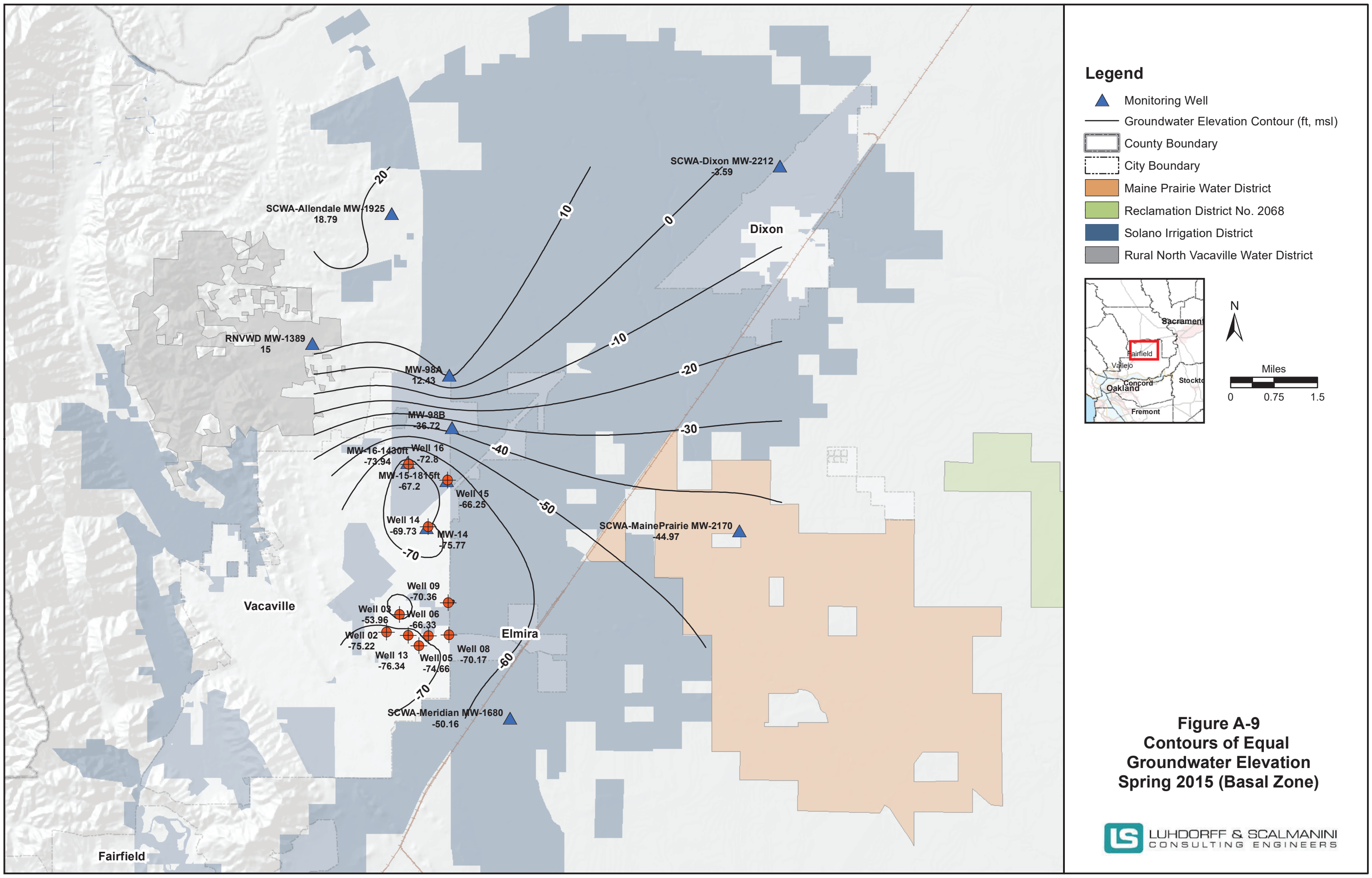

Figure A-9
Contours of Equal Groundwater Elevation Spring 2015 (Basal Zone)

File: X:\2015 Job Files\15-116 City of Vacaville General Services\GIS\Map Files\WL_Contours_Spring 2015 Basal Zone.mxd Date: 3/24/2016

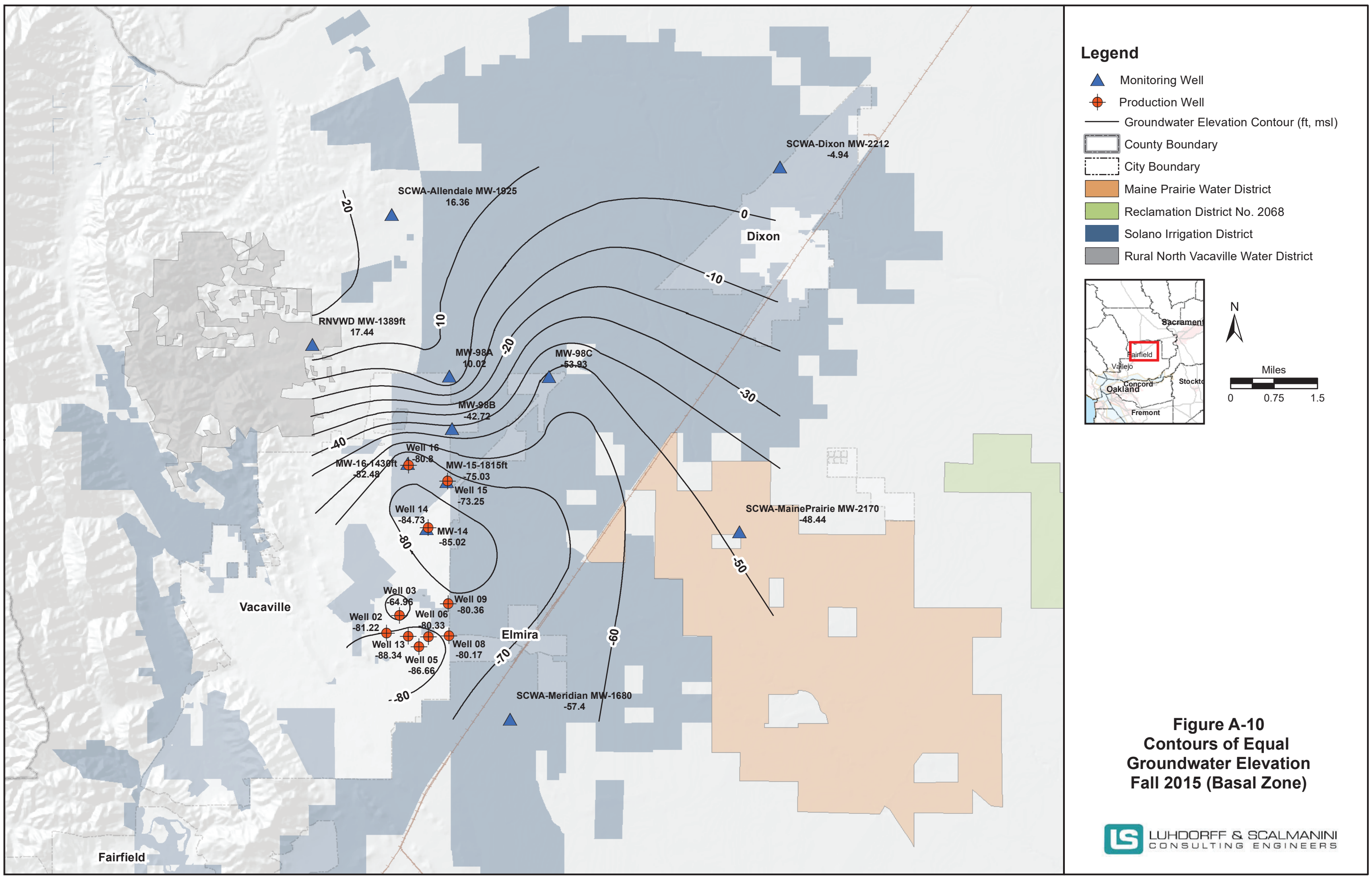

Figure A-10
Contours of Equal Groundwater Elevation Fall 2015 (Basal Zone)

File: X:\2015 Job Files\15-116 City of Vacaville General Services\GIS\Map Files\WL_Contours_Fall 2015 Basal Zone.mxd Date: 3/24/2016

APPENDIX B

APPENDIX B Groundwater Flow Model

An analytical groundwater flow model was used to assess water level impacts from future increases in groundwater pumpage by the City of Vacaville to meet future water demands. The modeling effort included simulations of a baseline scenario and ten future pumping scenarios in which pumpage would be increased and/or redistributed within the study area. The ten future scenarios include normal and dry water year pumpage considerations. The well locations for the baseline and future pumping scenarios, including existing wells and four potential new well locations in the north and northeast, are shown in **Figure B-1**. The model results provide a basis for estimating the average annual sustainable pumpage amount that could be used in conjunction with surface water to meet the City's future water demands. The exact location of potential future wells may be different than indicated in Figure B-1. This does not make the results of the analytical model irrelevant. The analytical model is a tool that shows what the water level impacts might be with an increased demand caused by increased groundwater withdrawal. The locations of any new proposed City production wells would have to be carefully considered to ensure that no water quality issues exist, and that potential well interference and water level drawdowns are not an issue. The application of the analytical model presented in this section involved three tasks, including: 1) preparation of the data needed to develop and calibrate the model, 2) model development and calibration, and 3) design and simulation of the future pumping scenarios. The development of the analytical model and the modeling results are summarized below. As a tool, the analytical model could be used to estimate water level drawdowns and potential well interference on any new production well locations proposed by the City.

B.1 GROUNDWATER FLOW MODEL

An analytical model was used to simulate the incremental increase in drawdown in the northern Solano County area in response to projected City pumpage to the year 2040. The model is based on the Hantush-Jacob (1955) equation as programmed by Walton (1985). The Hantush-Jacob equation calculates drawdown in a confined aquifer that allows for leakage from overlying subsurface materials. Because the Hantush-Jacob model simulates vertical leakage (recharge) to the underlying aquifer, it simulates recovery after pumping periods due to this same mechanism. For purposes of this model application, a no-flow boundary was incorporated to represent the extent of the basal Tehama Formation in the west (**Figure B-1**). The analytical model allows for incorporating well cycling on and off within one day and also seasonal pumping variations.

Input parameters for this analytical model were as follows: transmissivity 40,000 gpd/ft and storativity 0.0002 (from LSCE's 2006 and 2008 reports for the average City of Vacaville basal wells and Well 16's aquifer test in 2007); leakage factor of 20,000 feet (used in previous analytical model efforts by LSCE). The analytical model is not applicable for simulating multiple-year periods because it does not include recharge other than from vertical leakage contributed from overlying zones of the Tehama Formation.

B.1.1 Model Calibration and Baseline and Future Pumping Scenarios

<u>Calibration and Baseline Scenario</u>

The period from January through December 2006 (2006) was selected as the model calibration period because of the relative frequency of water level measurements, and the availability of data from production and monitoring wells outside of the Elmira Road well field. **Figure B-2** shows a representative calibration hydrograph for Well 8 in the Elmira Road well field. The simulated drawdown and recovery show good correlation to observed water level trends; therefore, the model is considered appropriate for assessing the potential water level impacts of projected pumpage on a year-to-year basis. The model calibration simulation also served as the baseline scenario. The total City pumpage for the baseline scenario was 6,500 AFY for ten wells. Additional pumpage for the Gibson Canyon Area and by RNVWD is also included in the simulation at fixed rates (**Table B-1**). The monthly and annual pumpage amounts for the baseline scenario and the ten future scenarios through 2035 are included in **Attachment A**.

The baseline scenario provides a basis for comparison with the future pumping scenarios. **Figure B-2** shows the 2006 baseline scenario results, including the relationship between the "simulated groundwater elevations" compared to those actually observed in 2006. The simulated groundwater elevations portray the relative simulated month-to-month drawdown pattern in response to pumpage consistent with the 2006 pumpage amount; actual groundwater levels showed a similar overall pattern.

Ten possible future pumping scenarios were developed to evaluate the aquifer response to increased, decreased, and redistributed pumpage in the basal zone, including pumpage at new well locations to the north and northeast (**Figure B-1**). **Table B-1** summarizes the total City pumpage and pumpage by location for each scenario modeled (additional pumpage information is contained in **Attachment A**). As noted on the table, the scenarios also include estimations of other pumpage from the basal zone, including from the RNVWD wells and wells in the Gibson Canyon area. The results of the analytical model are relevant, even if the exact location of future production wells is somewhat different than was estimated in this previous modeling work. As new production wells are sited, the analytical model could be rerun to estimate what the water level drawdowns would be associated with particular new locations.

Table B-1 Summary of Current and Future Basal Tehama Pumping Scenarios							
Scenario[1]	**Elmira Well Field (AFY)**	**Number of Elmira Wells**	**Other City Basal Zone (AFY)**	**Number of Other City Basal Zone Wells**	**Total City Basal Pumping[2] (AFY)**	**Total Basal Pumpage[3] (AFY)**	**Notes[4]**
Baseline	4,550	7	1,950	3	**6,500**	**6,684**	Existing wells with Well 7 out of service
Scenario 1 - 2015	4,359; 5,231	7	2,491; 2,340	4	**6,850; 8,220**	**7,034; 8,404**	Add Potential Well (Midway/Eubanks)
Scenario 2 - 2020	3,736; 4,484	6	3,114; 3,736	5	**6,850; 8,220**	**7,034; 8,404**	Add Potential Well (Meridian Road/Well 7 abandoned and Replacement)
Scenario 3 - 2025	3,600; 4,320	6	3,600; 4,320	6	**7,200; 8,640**	**7,384; 8,824**	Add Potential Well (Willow Drive)
Scenario 4 - 20130	3,146; 3,775	5	4,404; 5,285	7	**7,550; 9,060**	**7,734; 9,244**	Add Potential Well (Weber/Byrnes)
Scenario 5 - 2035	2,909; 3,491	4	5,091; 6,109	7	**8,000; 9,600**	**8,184; 9,784**	Increase to 8,000 AFY production

Notes

1. Each scenario includes pumping that represents average precipitation years ("normal" years, shown by the first number listed) and low precipitation years ("dry" years, the second number listed) with the possibility that the City may pump their wells as usual during normal years and may decide to increase their groundwater well pumping during dry years when sufficient surface water supplies are not available. The "dry" year amount is repeated for the Multiple Dry Year simulations.

2. When any well is out of service all other available wells will be operated (pumped) to make up for the loss of production. 100 AFY from Well 1 is not included in the simulations, as this well is not completed in the Basal Tehama.

3. Other entities known to have wells completed in the Basal Tehama (RNVWD and commercial pumping in the Gibson Canyon Area) add an estimated 184 AFY to the annual pumping in the area simulated.

4. Wells in the Elmira Well Field will be removed from service according to the order of the City's well replacement schedule.

B 2 MODEL RESULTS AND GROUNDWATER SUPPLY SUFFICIENCY

Figures B-3 to B-7 illustrate the simulated drawdown for six representative locations in the northern Solano County area for the 2015 and 2035 future pumping scenarios (normal water year). The six locations include City Well 8, City Well 16, the Potential Well (Midway/Eubanks), the Potential Well (Meridian Rd/Well 7 Replacement), Maine Prairie nested deep monitoring wells location, and Dixon nested deep monitoring wells location. Each figure also displays the simulated drawdown for the 2006 baseline scenario so that drawdowns based on current and projected pumpage volumes for 2015 and 2035 can be compared. **Table B-2** summarizes the predicted minimum and maximum drawdown for the ten future pumping scenarios in relation to the minimum and maximum drawdown occurring with the 2006 baseline scenario. The results show that groundwater levels in the Elmira Road well field for all future normal water year scenarios would be generally similar to or higher than the 2006 baseline scenario during both minimum and maximum periods of drawdown. This result was expected because the pumpage simulated for the Elmira Road area was similar to or less than the 2006 pumpage for all future normal water year scenarios. The opposite occurs in the northern portion of Solano County, where future groundwater levels (normal and dry water years) are projected to be significantly lower than 2006 levels. This is due to increased pumpage in this area and redistribution of City pumpage away from the Elmira Road well field to the north/northeast at the four potential well locations.

Comparison of the simulated drawdown for future pumping scenarios to the results of the 2006 baseline scenario provides the basis for developing an estimate of the potentially sustainable annual pumpage. This comparison is particularly of interest for wells located in the Elmira Road well field where, as described above, base year groundwater levels are used to evaluate the response of the aquifer system to future pumpage. The base year groundwater levels provide a basis for measuring the response of the aquifer system that is particularly important during single-dry and multiple-dry year periods when the City, as part of its conjunctive water management plan, increases pumpage above normal year levels. Similarly, these water levels also provide a basis for measuring the response of the aquifer system when the City offsets the increase with reduced pumpage in subsequent years. The model results also provide a basis for the recommended maximum pumpage amount for relatively short-term use, i.e., pumpage that could occur during a single-dry year condition.

Although the analytical model is capable of reasonably predicting drawdown during peak pumping periods, it is limited in its ability to accurately predict recovery at the end of each year. Specifically, the model results show essentially complete recovery for all scenarios. However, the actual amount of vertical leakage into the basal zone is unknown and other forms of recharge are not simulated with the model. A multi-year calibration period would be required before a numerical model (rather than the current analytical model) could be used for multi-year simulations.

B 2.1 Basal Zone Pumpage Simulations for 2015 and 2035

The model results indicate that, with the present and planned location of groundwater development through 2015, annual total pumpage in an amount of about 6,850 acre-feet by the City (and a total pumpage of 7,034 acre-feet when the City and also other pumpers are included) could be sustained for meeting normal water year demands. As shown in **Table B-1**, this total pumpage is comprised of groundwater extracted primarily from the basal zone, but also includes some pumpage by the City from other zones. At this amount of pumpage, some water level recovery is anticipated to occur in the Elmira Road well field due to the pumpage decrease relative to the baseline scenario (**Table B-2**). Existing Wells 14, 15, and 16 show similar levels to slight drawdown compared to the baseline scenario. The

Table B-2 Simulated Drawdown Results for the Basal Tehama - Normal Years

		Simulated Drawdown Results for the Basal Tehama - Normal Years											
				Incremental Difference in Simulated Drawdown Compared to Baseline [1]									
		Baseline Scenario: 6,500 AFY		Scenario 1 - 2015: 6,850 AFY		Scenario 2 - 2020: 6,850 AFY		Scenario 3 - 2025: 7,200 AFY		Scenario 4 - 2030: 7,550 AFY		Scenario 5 - 2035: 8,000 AFY	
	Well Name	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)
City of Vacaville Production Wells	Well 01	30.5	84	-0.3	-1.4	-3	-7.6	-2.7	-7.5	-4.3	-6.9	-5.3	-11
	Well 02	38.7	112.2	-0.6	-2.7	-2.9	-9.8	-3	-10.8	-4.5	-9.5	-12.4	-34.7
	Well 03	39.7	113.4	-0.7	-2.7	-3.7	-9.7	-3.8	-10.5	-5.3	-9.1	-4.5	-7.3
	Well 05	40	111.8	-0.9	-3	-4.9	-13	-5.1	-14	-7.6	-14.3	-6.5	-11.4
	Well 06	39.3	107.4	-0.8	-2.8	-10.8	-30.7	-10.7	-30.8	-14.2	-33	-13.8	-32.5
	Well 07	31.9	83.2	-0.5	-1.9	-4	-11.6	-3.9	-11.5	-9.2	-16.2	-8.7	-15.5
	Well 08	38.9	92.5	-0.9	-2.3	-3.5	-10.5	-3.6	-10.9	-17.1	-28.4	-16.5	-27.5
	Well 09	37.4	97.5	-0.6	-2.1	-3.7	-8.1	-3.5	-8.2	-5.6	-8	-3.3	-2.6
	Well 13	40.7	116.1	-0.8	-3.1	-5.1	-12	-5.2	-13	-7.3	-12.5	-6.7	-10.8
	Well 14	30.9	83.3	0.1	-0.5	-0.4	-2.7	0.6	-0.9	1.5	2.8	4.7	10.1
	Well 15	31.7	68.6	0.3	0.7	-0.6	0.3	1.6	4.8	3.3	10	7.5	17.9
	Well 16	28.6	72.8	1	1.5	1	1.1	2.3	3.4	3.8	8.2	7.5	16.6
	Well 17 (Midway/Eubanks)	10.7	26.8	13.9	29.5	14.1	30.1	14.5	31.2	16.1	35.3	19.5	42.5
	Well 18 (Meridian Rd/Well7Replace)	6.5	17.5	0.7	1.5	13.7	31.1	14.3	32.3	16.9	38.6	20.2	45.8
	Well 19 (Willow Drive)	16.6	40	0.7	1.6	0.4	2.2	13.6	29.6	16	36.1	20	44.4
	Well 20 (Weber/Byrnes)	10.2	25.9	0.7	1.5	1.8	4.8	3.6	8.6	17.7	38.9	21.3	46.6
City of Vacaville Monitoring Wells	MW-14	26.4	68.8	0.3	0.1	-0.3	-2.2	0.9	0.1	1.5	3.1	4	8.1
	MW-15-1815ft	26.8	60	0.4	1.1	-0.4	0.7	1.9	5.5	3.4	10.2	6.8	16.8
	MW-16-1614ft	20	48.7	1.5	2.9	0.8	2.6	2.2	5.6	3.4	9.5	5.8	14.5
	MW-98A	10	25.4	2	4.1	2.5	6	3.7	8.6	5.3	12.9	7	16.5
	MW-98B	14.6	35.6	1.4	3	1.4	4.1	3.6	8.7	5.4	13.6	7.6	18.2
	MW-98C	6.9	18.4	0.7	1.6	4.7	10.9	5.6	13	8	18.7	9.9	22.8
Peripheral Monitoring Wells	Allendale MW-1925	3.4	10.2	1	2.2	1.3	3	1.6	3.8	2.1	5.3	2.7	6.8
	Dixon MW-2212	0.7	3.2	0.1	0.4	0.4	0.8	0.5	1.1	0.7	1.7	0.8	2.2
	Maine Prairie MW-2170	3.5	10.6	0.1	0.2	0.1	0.5	0.4	1.2	0.7	2.3	1	3.3
	Meridian MW-1680	14.2	36.5	-0.2	-0.6	-2.5	-3.7	-2.3	-3.4	-3.6	-4	-3.4	-3.6
Other Basal Tehama Pumping Locations	RNVWD 1	8.3	21.6	2.3	4.8	2.2	5.1	2.7	6.4	3.4	8.5	4.5	11
	RNVWD 2	7.8	20.3	2.1	4.5	2.1	4.9	2.6	6.2	3.2	8.2	4.3	10.6
	11 #3 AHF (Mariani)	16.7	38.8	2.5	5.3	2.2	5.5	3.3	8	4.4	11.5	6.3	15.6
	1 #5 AHF (Mariani)	16	37.2	2.7	5.7	2.5	6.1	3.6	8.6	4.8	12.1	6.7	16.2

1. Total AFY listed for each scenario represents pumping in the Basal Tehama aquifer unit by the City of Vacaville during a normal year. A negative incremental difference indicates that less drawdown was simulated compared to the baseline scenario.

largest additional drawdown (13.9 to 29.5 feet) occurs at the Potential Well (Midway/Eubanks) location. During dry water years, as would be expected, additional drawdown compared to the baseline drawdown occurs both in and away from the Elmira Road well field (**Table B-3**).

At the amount of pumpage simulated for 2015 (normal water years), groundwater levels in the basal zone are anticipated to remain at or above the 1992-1993 base year and 2002-2003 water levels in the Elmira Road well field. However, the distribution of pumpage in the basal zone is very important. It is recommended that normal-year basal zone pumpage in the Elmira Road well field be limited to not more than occurred during 1992 and 2002 (i.e., about 5,600 acre-feet). The balance of the normal year supply from groundwater sources would result from pumpage elsewhere in the northern to northeastern part of Solano County. In 2015, the total sustainable City pumpage, including groundwater from basal and non-basal zones, is estimated to be about 6,950 acre-feet.

In future years, at year 2035, shifting pumpage to proposed City well locations sited away from the Elmira Road well field would reduce drawdown in the Elmira Road area (**Tables B-2** and **B-3**). Similarly, management of the timing and distribution of pumpage would ensure that water levels in the basal zone remain at or above the 1992-1993 base year and 2002-2003 water levels. Managed pumpage from the basal zone would also allow the level of sustainable pumpage within the northern Solano County area to be increased. However, as other groundwater sources outside the Elmira Road well field are developed, the influence of the basal zone pumpage in other areas on groundwater levels at the Elmira Road well field and elsewhere in northern Solano County must also be considered. For the normal water year 2035 scenario with a pumpage total of 8,184 acre-feet, some water level recovery is anticipated to occur in the Elmira Road well field due to the pumpage decrease relative to the baseline scenario (**Table B-2**). Existing Wells 14, 15, and 16 show increased levels of drawdown compared to the 2015 scenario. The largest additional drawdown (more than 40 feet maximum drawdown difference) compared to the baseline scenario occurs at the four potential new well locations. During dry water years, as would be expected, additional drawdown compared to the baseline drawdown occurs both in and away from the Elmira Road well field (**Table B-3**).

Minimum and maximum simulated drawdowns were also evaluated at locations farther from the City's pumping. Particularly, **Tables B-2** and **B-3** summarize drawdown compared to the baseline scenario for locations at four SCWA monitoring well sites (Allendale MW-1925; Dixon MW-2212; Maine Prairie MW-2170; and Meridian MW-1680). Comparative drawdown amounts are also illustrated for two of these locations (Dixon and Maine Prairie) on **Figure B-3** for the 2015 (normal water year) and 2035 (normal and dry water years) scenarios. As shown in **Tables B-2** and **B-3** and **Figure B-3**, little drawdown occurs at these locations (up to 3.3 feet maximum simulated drawdown at the Maine Prairie location for a normal water year simulation in 2035).Slightly more drawdown (up to 6 feet maximum drawdown at Maine Prairie) is simulated at these locations for the 2035 (dry year) scenario (**Table B-3**).

The results for the normal water year 2035 scenario indicate the overall lowering of hydraulic heads in the northern to northeastern Solano County area and a shift in the position of the cone of depression. Levels are also likely to decrease below historical levels, especially in areas where there has been little to no prior development of groundwater supplies from the basal Tehama Formation. Groundwater levels are anticipated to reach a new equilibrium between extraction and recharge. However, at some stage of total groundwater level development from this deep unit, levels may continue to decline reflecting a net deficit in the overall groundwater budget.

Table B-3 Simulated Drawdown Results for the Basal Tehama - Dry Years

		Simulated Drawdown Results for the Basal Tehama - Dry Years											
				Incremental Difference in Simulated Drawdown Compared to Baseline [1]									
		Baseline Scenario: 6,500 AFY		Scenario 1 - 2015: 8,220 AFY		Scenario 2 - 2020: 8,220 AFY		Scenario 3 - 2025: 8,640 AFY		Scenario 4 - 2030: 9,060 AFY		Scenario 5 - 2035: 9,600 AFY	
	Well Name	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)	Minimum Simulated Drawdown (ft)	Maximum Simulated Drawdown (ft)
City of Vacaville Production Wells	Well 01	30.5	84	5.7	15	2.5	7.6	2.7	7.7	0.9	8.4	***-0.3***	3.4
	Well 02	38.7	112.2	6.9	19.1	4.2	10.5	4.1	9.4	2.3	10.9	***-7.1***	***-19.3***
	Well 03	39.7	113.4	7.1	19.3	3.4	10.9	3.4	10	1.5	11.6	2.5	13.8
	Well 05	40	111.8	6.9	18.7	2.1	6.7	1.9	5.5	***-1.3***	5.1	0.2	8.6
	Well 06	39.3	107.4	6.8	18	***-5.1***	***-15.4***	***-5***	***-15.5***	***-9.3***	***-18.2***	***-8.8***	***-17.6***
	Well 07	31.9	83.2	5.7	14.3	1.5	2.7	1.7	2.7	***-4.8***	***-2.9***	***-4.1***	***-2.1***
	Well 08	38.9	92.5	6.7	15.7	3.5	5.8	3.4	5.4	***-12.8***	***-15.7***	***-12.1***	***-14.6***
	Well 09	37.4	97.5	6.7	16.9	3	9.7	3.2	9.5	0.7	9.7	3.5	16.3
	Well 13	40.7	116.1	7.1	19.5	2.1	8.8	1.9	7.5	***-0.7***	8.2	0.1	10.1
	Well 14	30.9	83.3	6.2	15.9	5.6	13.3	6.8	15.4	7.8	19.8	11.6	28.6
	Well 15	31.7	68.6	6.5	14.3	5.6	13.8	8.1	19.3	10.2	25.4	15.2	35
	Well 16	28.6	72.8	6.7	16.1	6.8	15.6	8.2	18.4	10.2	24.1	14.6	34.1
	Well 17 (Midway/Eubanks)	10.7	26.8	18.6	40.5	18.8	41.2	19.3	42.5	21.2	47.5	25.2	56
	Well 18 (Meridian Rd/Well7Replace)	6.5	17.5	2.1	5.1	17.8	40.7	18.4	42.2	21.6	49.8	25.4	58.3
	Well 19 (Willow Drive)	16.6	40	4	9.7	3.7	10.4	19.5	43.4	22.4	51.1	27.2	61.1
	Well 20 (Weber/Byrnes)	10.2	25.9	2.8	6.9	4.1	10.8	6.3	15.4	23.2	51.8	27.5	61
City of Vacaville Monitoring Wells	MW-14	26.4	68.8	5.5	13.7	4.8	11	6.2	13.7	7	17.2	9.9	23.3
	MW-15-1815ft	26.8	60	5.8	13.1	4.8	12.6	7.5	18.4	9.3	24	13.4	32
	MW-16-1614ft	20	48.7	5.6	12.9	4.8	12.6	6.5	16.2	7.8	20.8	10.7	26.8
	MW-98A	10	25.4	4.2	9.8	4.8	12	6.3	15.2	8.2	20.3	10.3	24.7
	MW-98B	14.6	35.6	4.4	10.5	4.5	11.8	7.1	17.3	9.2	23.2	11.8	28.7
	MW-98C	6.9	18.4	2.2	5.5	6.9	16.7	8.1	19.2	10.9	26.1	13.1	30.9
Peripheral Monitoring Wells	Allendale MW-1925	3.4	10.2	1.8	4.5	2.1	5.5	2.5	6.5	3.1	8.3	3.9	10
	Dixon MW-2212	0.7	3.2	0.3	1	0.6	1.6	0.7	2	0.9	2.7	1.1	3.3
	Maine Prairie MW-2170	3.5	10.6	0.8	2.3	0.8	2.7	1.2	3.6	1.5	4.9	1.9	6
	Meridian MW-1680	14.2	36.5	2.6	6.6	***-0.1***	2.8	0.1	3.2	***-1.6***	2.5	***-1.3***	3
Other Basal Tehama Pumping Locations	RNVWD 1	8.3	21.6	4.1	9.6	4	10	4.7	11.6	5.5	14.1	6.8	17.1
	RNVWD 2	7.8	20.3	3.8	9.1	3.8	9.6	4.4	11	5.2	13.5	6.5	16.4
	11 #3 AHF (Mariani)	16.7	38.8	5.7	13.3	5.3	13.5	6.7	16.5	8	20.7	10.3	25.6
	1 #5 AHF (Mariani)	16	37.2	5.9	13.5	5.6	13.9	7	16.9	8.3	21.1	10.6	26

1. Total AFY listed for each scenario represents pumping in the Basal Tehama aquifer unit by the City of Vacaville during a normal year. A negative incremental difference indicates that less drawdown was simulated compared to the baseline scenario.

The modeled basal zone pumpage of 8,184 acre-feet for the 2035 normal year scenario and 9,784 acre-feet for the 2035 dry-year scenario include pumpage in the Elmira Road well field at a lesser amount than occurred during 1992, 2002, and also the 2006 baseline scenario. Based on the model results for the 2035 normal year scenario, City pumpage for future normal years appears to be sustainable at about 8,000 acre-feet for all pumpage from the basal zone. As discussed below, ongoing groundwater monitoring and use of a numerical flow model to refine the estimated sustainable pumpage are recommended.

It is suggested that the 2035 dry year total pumpage for the City of 9,600 acre-feet (as shown in **Table B-1**) be considered only in the context of short-term use as part of a conjunctive water management program. Until additional monitoring data are gathered outside of the Elmira Road area and water level responses to expanded groundwater development and recharge mechanisms are better understood, it is recommended that higher pumpage levels (e.g., dry-year amount) be offset through continued conjunctive water management by reducing pumpage in wet years and allowing water levels to recover.

B 3 ONGOING GROUNDWATER MONITORING AND FUTURE SUSTAINABLE PUMPAGE ESTIMATE

Planning for additional groundwater development has preliminarily involved the use of an analytical groundwater flow model. Monitoring data have been and will continue to be utilized to assess the actual response to pumping (particularly within the basal zone) so that operations can be adjusted as necessary, i.e., to avoid progressive groundwater level declines.

As part of the conjunctive management of surface water and groundwater to meet the City's requirements, it is recognized that there will be variations in the amount of available surface water supplies from year to year, particularly since a large fraction of the supply is imported from outside the subbasin. Similarly, there are expected to be variations in groundwater conditions as a function of the local hydrogeology that affect, among other things, the natural recharge to the groundwater basin from year to year. Local hydrology, which affects local groundwater conditions in the basal zone, may be considerably different from the hydrology in a distant (Central Sierra Nevada) location that directly affects the availability of imported surface water in any given year.

Recharge to the basal zone is expected to occur primarily east of the English Hills and north of the Vacaville area where the Tehama Formation outcrops. A significant portion of the recharge is probably the result of leakage from the overlying Quaternary alluvium and the upper zone of the Tehama Formation in the outcrop areas. Thus, conjunctive water management by the City necessitates particular attention to groundwater level recovery from year to year to ensure that water levels in the basal zone are maintained to meet a regular component of the City's water supply in normal and wet years and a larger component of the water supply during dry periods that affect supplemental surface water availability.

B 3.1 Future Refinement of Sustainable Pumpage Estimate

Ongoing evaluation of sustainable pumpage, particularly for the basal zone of the Tehama Formation, will be required to accomplish the main objectives of operating within the yield of the groundwater basin and avoiding overdraft.

Further understanding and quantification of sustainable pumpage from the Tehama Formation (especially the basal zone), which accounts for variations in hydrologic conditions and the location and amount of pumpage, is recommended so that groundwater development and use can be managed in such a way to meet an appropriate fraction of total water demand while avoiding over pumping that could result in overdraft conditions.

The City's historical operating experience, complemented by observed groundwater conditions, has served as the initial basis for determining available groundwater supplies. However, it is possible to refine the analysis to determine values or ranges of yield under varying hydrologic conditions, and to assess the impacts of various management actions that might be implemented in the basin. Development of a numerical groundwater flow model is recommended to determine the yield of the subbasin under existing land use and groundwater and surface water development conditions. Such a model could also be used to assess the yield of the subbasin under future land use conditions as well as future ranges of surface water importation, groundwater development, and recycled water use through varying hydrologic conditions, i.e., wet and dry periods that affect the availability of imported surface water. Among the modeling scenarios examined with a numerical model would be simulation of the effects of redistributing pumpage between the Elmira and northern Solano County areas to reduce the degree to which drawdown in the basal zone occurs at either location.

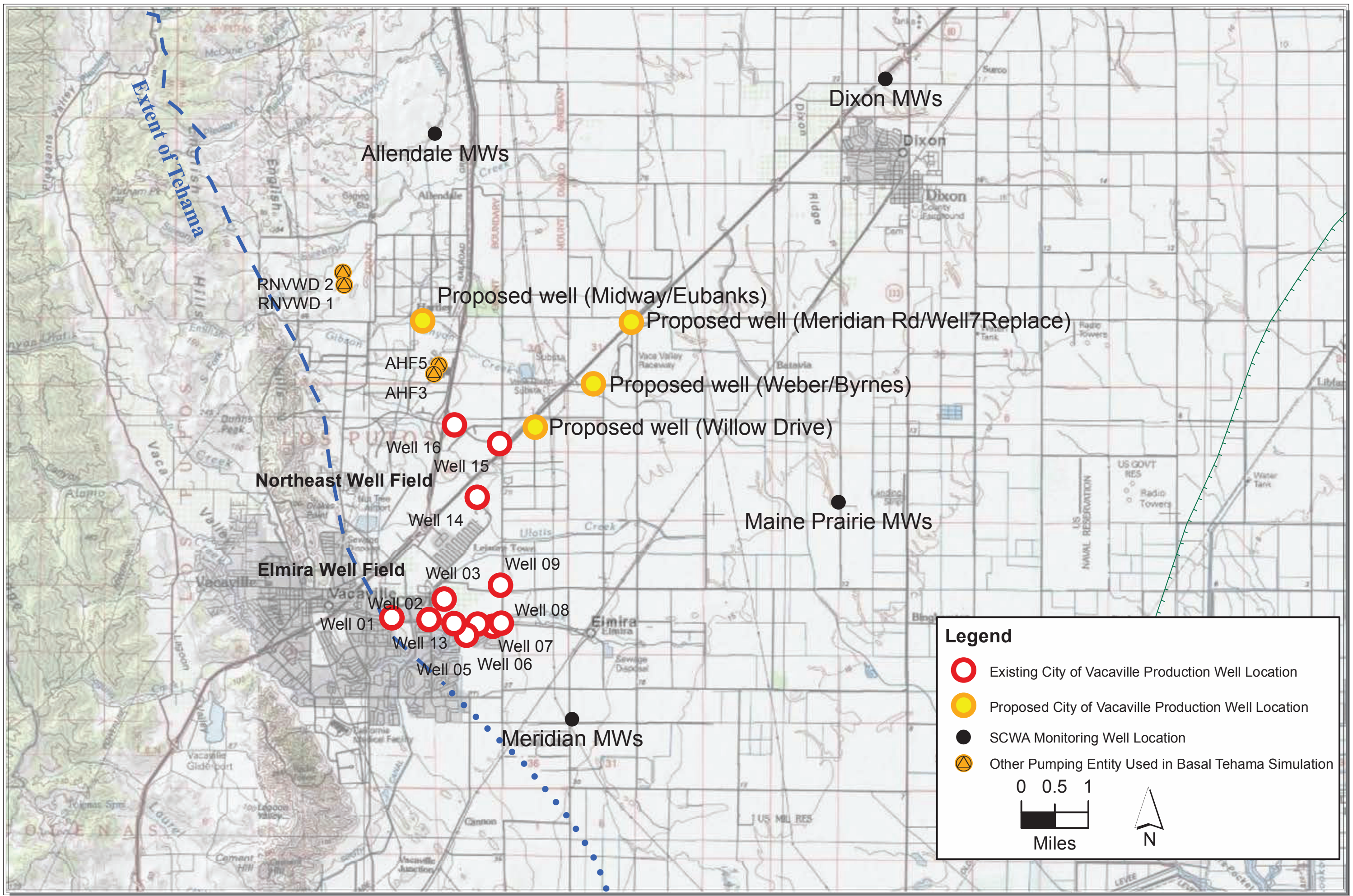

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Figure B-1
Well Location Map

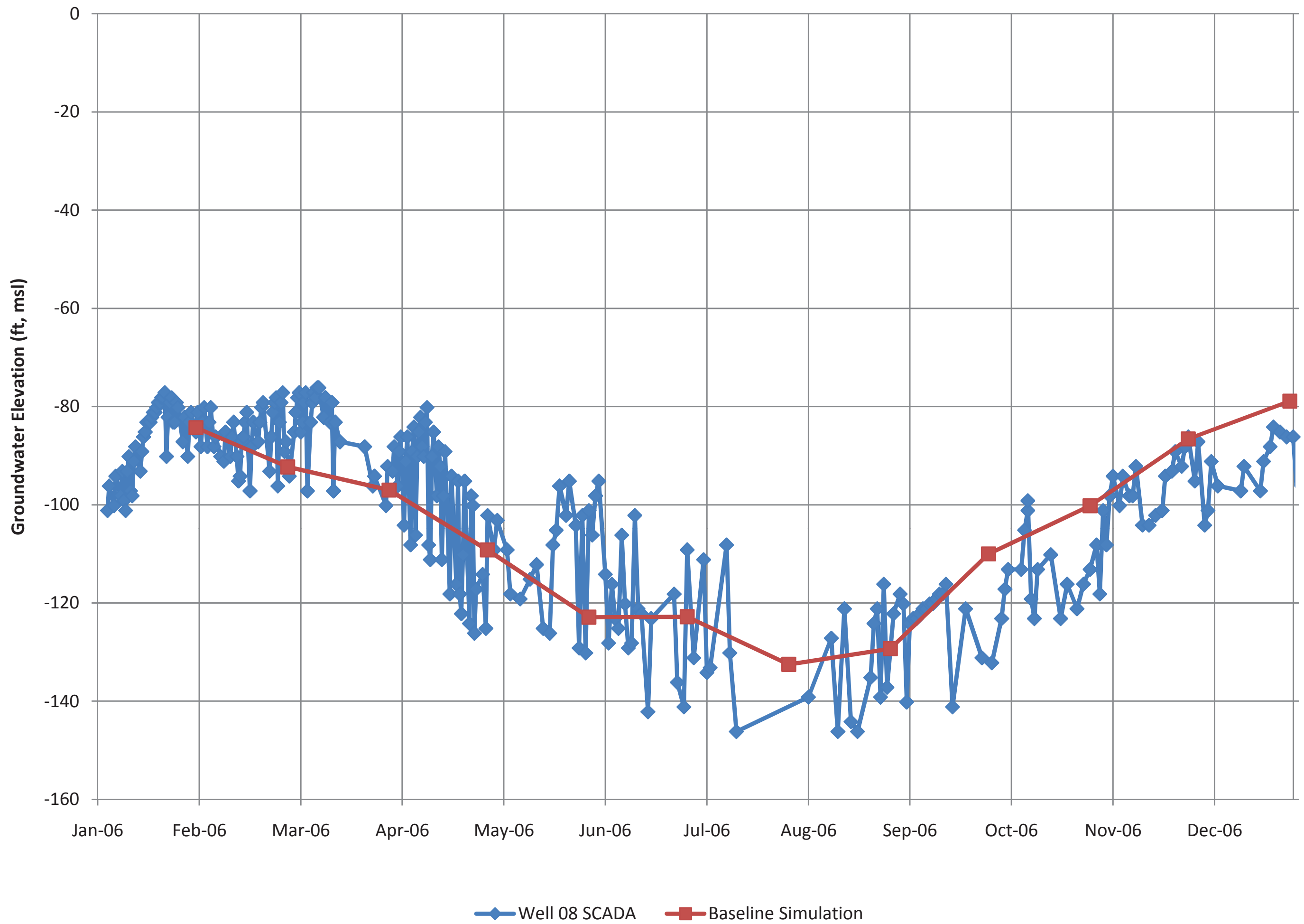

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Figure B-2
Measured Groundwater Elevation and Simulated Water Levels for Calibration, Well 08

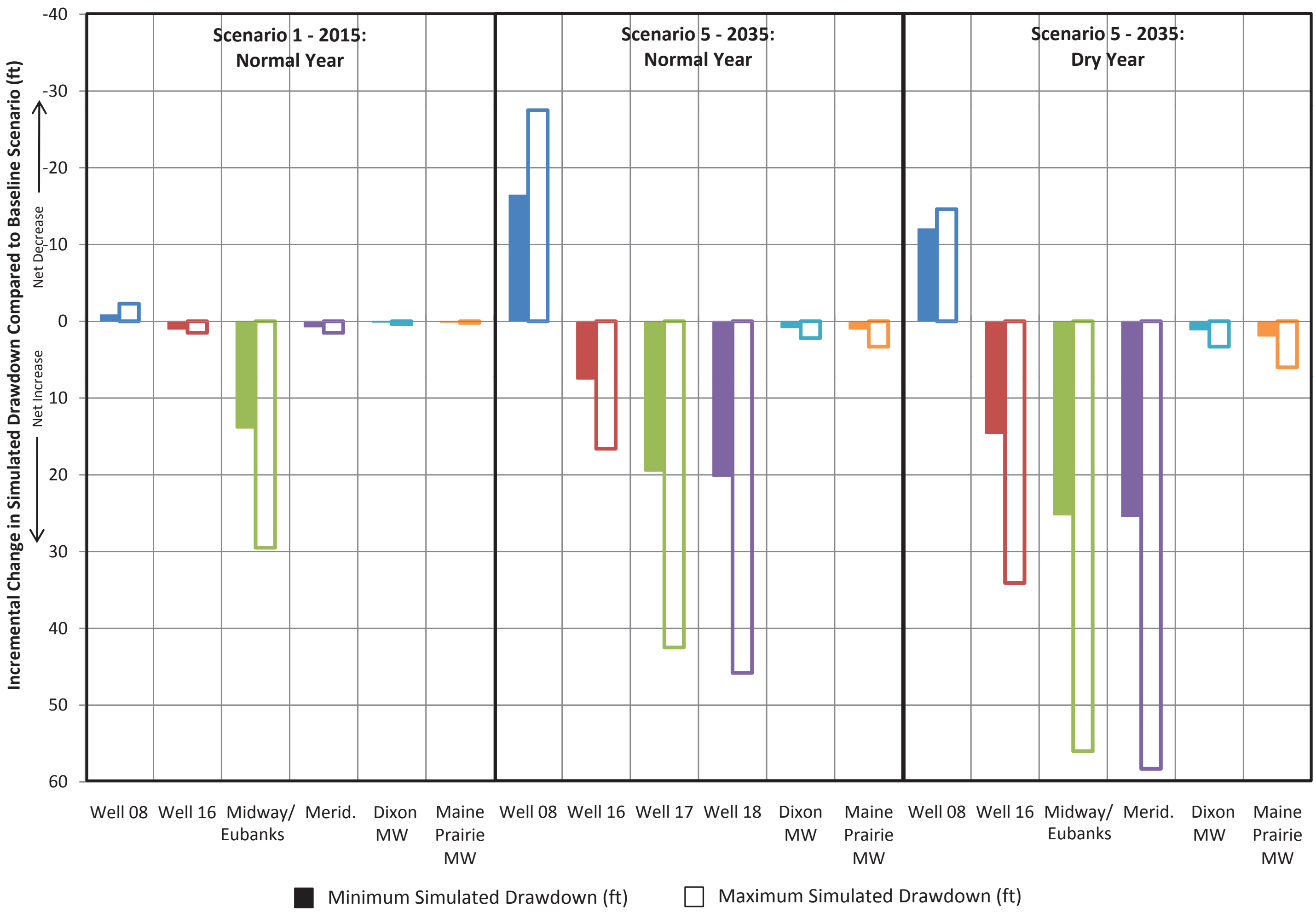

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Figure B-3
Incremental Change in Simulated Drawdown
2015 and 2035 Normal Years and 2035 Dry Year

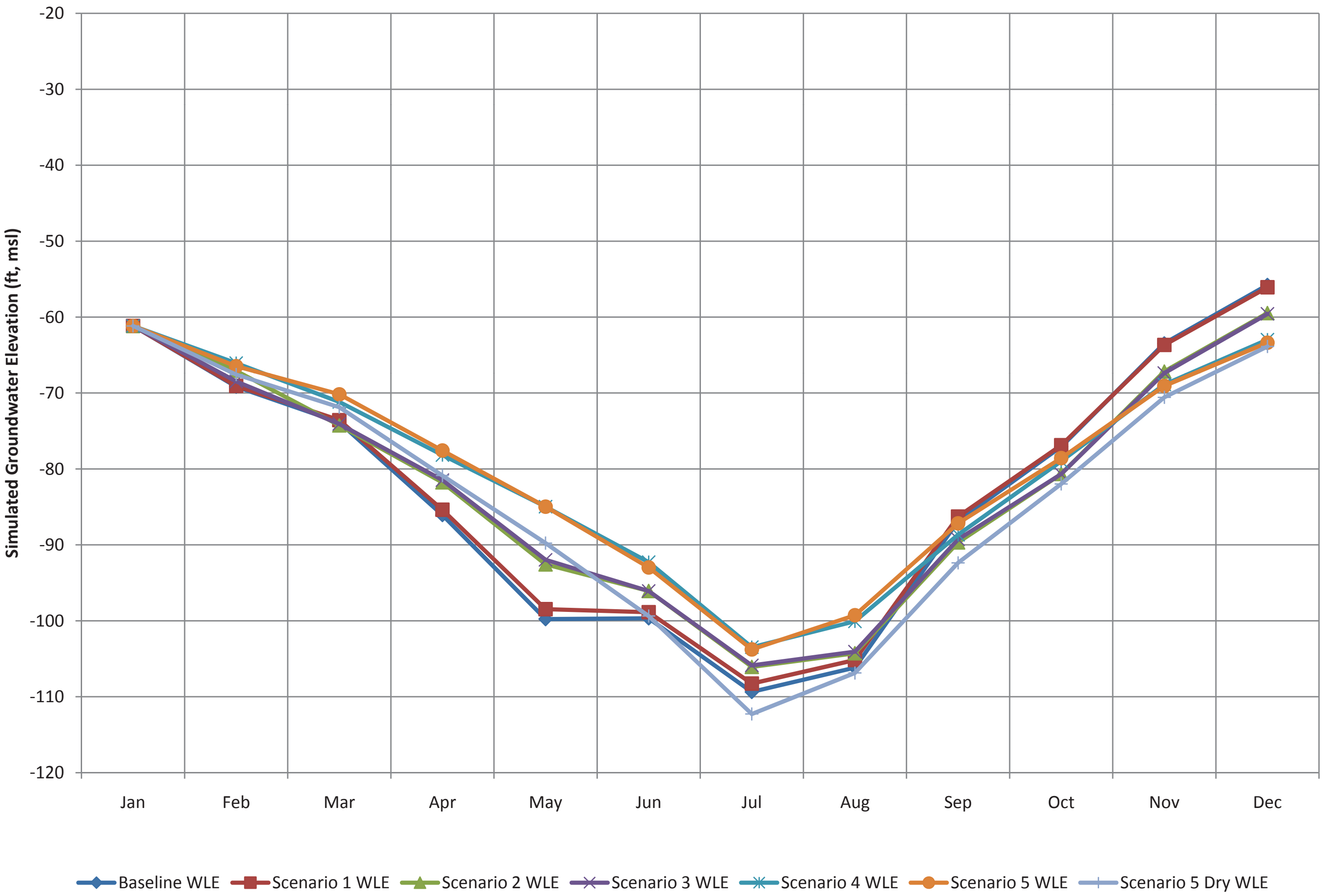

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Figure B-4
Simulated Groundwater Elevations
Well 08

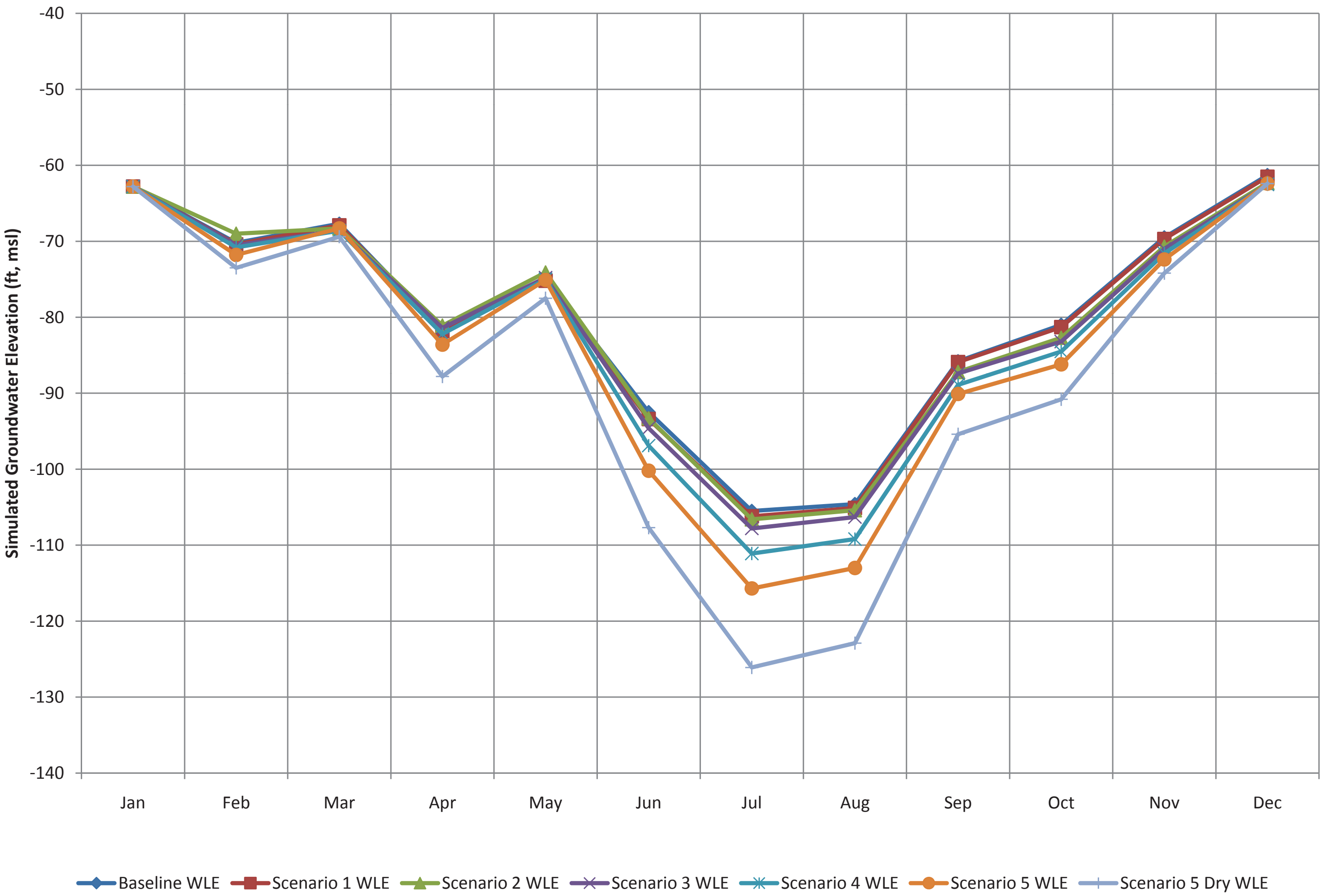

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Figure B-5
Simulated Groundwater Elevations
Well 16

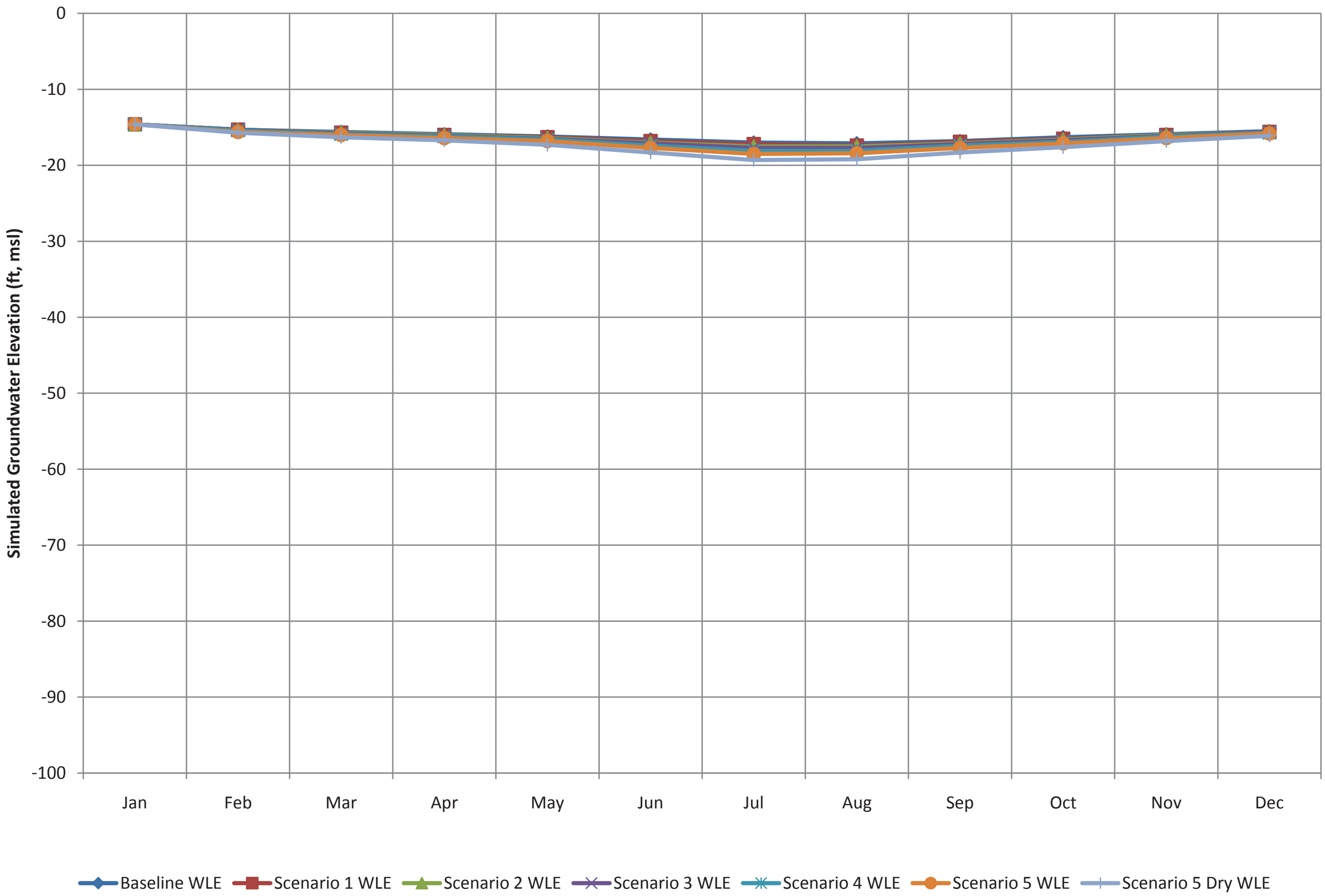

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Figure B-6
Simulated Groundwater Elevations
Dixon MW

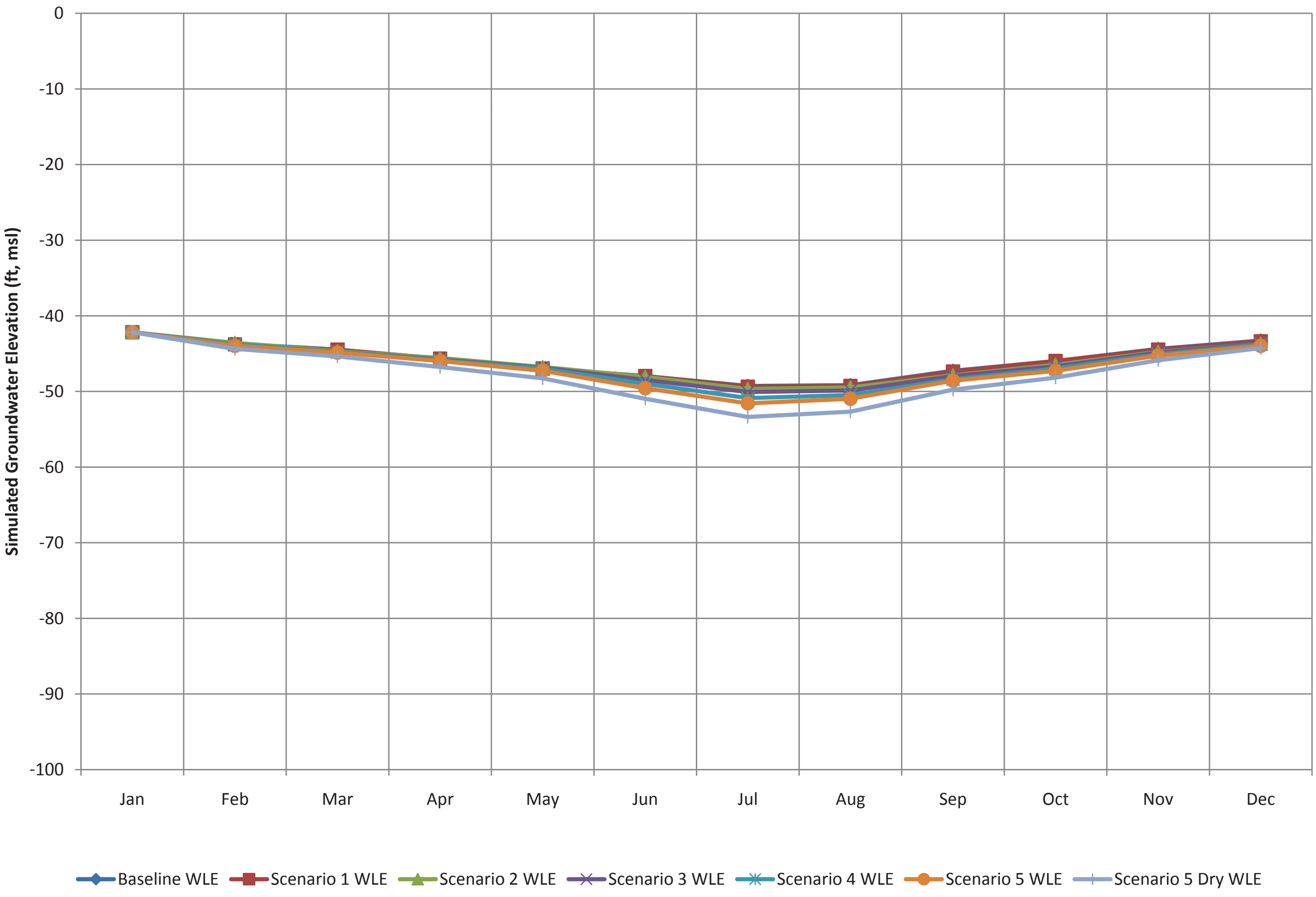

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Figure B-7
Simulated Groundwater Elevations
Maine Prairie MW

Attachment A Monthly and Annual Pumpage Amounts, Baseline and Future Scenarios

City of Vacaville Monthly Pumping Distribution (AF) for Baseline Scenario

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	27.50	26.74	51.79	55.24	60.69	63.33	85.25	90.86	76.71	54.70	33.07	24.13	650.00
Well 03	28.79	27.70	36.00	39.38	50.39	53.28	96.32	99.64	85.06	62.76	41.61	29.06	650.00
Well 05	28.94	31.91	45.04	52.74	62.50	73.21	88.85	79.54	67.72	53.27	37.65	28.62	650.00
Well 06	53.05	52.30	47.87	80.95	103.39	75.09	75.56	62.46	26.20	23.98	23.46	25.69	650.00
Well 08	46.69	49.06	56.14	56.63	69.69	60.95	61.34	64.76	50.91	54.34	42.26	37.22	650.00
Well 09	33.98	37.37	51.87	53.41	69.51	75.07	91.85	79.30	60.52	38.18	23.49	35.45	650.00
Well 13	24.87	25.46	30.19	62.87	83.95	74.03	90.00	80.18	54.93	54.69	41.71	27.12	650.00
												Elmira Annual Total:	**4550.00**
Well 14	41.54	43.98	51.52	48.38	79.25	98.29	87.56	71.07	50.63	23.07	27.56	27.17	650.00
Well 15	41.25	39.02	45.64	36.98	48.63	64.92	71.72	63.82	39.24	87.21	60.71	50.86	650.00
Well 16	37.17	43.14	34.69	62.28	29.23	64.50	90.12	93.21	62.21	59.25	42.50	31.69	650.00
Well Midway/Eubanks Dr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Meridian Rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Willow Drive	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Weber/Byrnes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
												Northeast Annual Total:	**1950.00**
												Annual Total:	**6500.00**

City of Vacaville Monthly Pumping Distribution (AF) for Scenario 1

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	26.34	25.62	49.62	52.92	58.14	60.67	81.68	87.05	73.49	52.40	31.68	23.12	622.73
Well 03	27.59	26.54	34.49	37.73	48.28	51.04	92.28	95.46	81.49	60.13	39.86	27.84	622.73
Well 05	27.73	30.57	43.15	50.53	59.87	70.14	85.12	76.20	64.88	51.04	36.07	27.42	622.73
Well 06	50.82	50.11	45.86	77.55	99.05	71.94	72.39	59.84	25.10	22.97	22.48	24.61	622.73
Well 08	44.73	47.00	53.78	54.26	66.77	58.39	58.76	62.04	48.78	52.06	40.49	35.66	622.73
Well 09	32.55	35.81	49.69	51.17	66.60	71.92	87.99	75.97	57.98	36.57	22.50	33.97	622.73
Well 13	23.83	24.39	28.93	60.23	80.42	70.92	86.23	76.81	52.62	52.40	39.96	25.99	622.73
												Elmira Annual Total:	**4359.09**
Well 14	39.80	42.13	49.36	46.35	75.93	94.17	83.88	68.08	48.51	22.10	26.40	26.03	622.73
Well 15	39.52	37.38	43.72	35.43	46.59	62.20	68.71	61.14	37.60	83.55	58.16	48.73	622.73
Well 16	35.61	41.33	33.24	59.67	28.00	61.80	86.34	89.30	59.60	56.77	40.72	30.36	622.73
Well Midway/Eubanks Dr	38.31	40.28	42.10	47.15	50.17	72.72	79.64	72.84	48.57	54.14	41.76	35.04	622.73
Well Meridian Rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Willow Drive	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Weber/Byrnes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
												Other City Annual Total:	**2490.91**
												Annual Total:	**6850.00**

Attachment A Monthly and Annual Pumpage Amounts, Baseline and Future Scenarios

City of Vacaville Monthly Pumping Distribution (AF) for Scenario 2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	26.34	25.62	49.62	52.92	58.14	60.67	81.68	87.05	73.49	52.40	31.68	23.12	622.73
Well 03	27.59	26.54	34.49	37.73	48.28	51.04	92.28	95.46	81.49	60.13	39.86	27.84	622.73
Well 05	27.73	30.57	43.15	50.53	59.87	70.14	85.12	76.20	64.88	51.04	36.07	27.42	622.73
Well 06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 08	44.73	47.00	53.78	54.26	66.77	58.39	58.76	62.04	48.78	52.06	40.49	35.66	622.73
Well 09	32.55	35.81	49.69	51.17	66.60	71.92	87.99	75.97	57.98	36.57	22.50	33.97	622.73
Well 13	23.83	24.39	28.93	60.23	80.42	70.92	86.23	76.81	52.62	52.40	39.96	25.99	622.73
												Elmira Annual Total:	**3736.36**
Well 14	39.80	42.13	49.36	46.35	75.93	94.17	83.88	68.08	48.51	22.10	26.40	26.03	622.73
Well 15	39.52	37.38	43.72	35.43	46.59	62.20	68.71	61.14	37.60	83.55	58.16	48.73	622.73
Well 16	35.61	41.33	33.24	59.67	28.00	61.80	86.34	89.30	59.60	56.77	40.72	30.36	622.73
Well Midway/Eubanks Dr	38.31	40.28	42.10	47.15	50.17	72.72	79.64	72.84	48.57	54.14	41.76	35.04	622.73
Well Meridian Rd	37.18	34.51	51.74	50.22	64.37	69.94	83.03	61.04	55.81	48.07	31.58	35.22	622.73
Well Willow Drive	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Weber/Byrnes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
												Other City Annual Total:	**3113.64**
												Annual Total:	**6850.00**

City of Vacaville Monthly Pumping Distribution (AF) for Scenario 3

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	25.38	24.68	47.81	50.99	56.02	58.46	78.70	83.87	70.81	50.49	30.52	22.27	600.00
Well 03	26.58	25.57	33.23	36.35	46.52	49.18	88.91	91.97	78.51	57.93	38.41	26.83	600.00
Well 05	26.72	29.46	41.58	48.68	57.69	67.58	82.02	73.42	62.51	49.17	34.75	26.42	600.00
Well 06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 08	43.10	45.29	51.82	52.28	64.33	56.26	56.62	59.78	47.00	50.16	39.01	34.36	600.00
Well 09	31.36	34.50	47.88	49.30	64.17	69.30	84.78	73.20	55.87	35.24	21.68	32.73	600.00
Well 13	22.96	23.50	27.87	58.03	77.49	68.34	83.08	74.01	50.70	50.49	38.50	25.04	600.00
												Elmira Annual Total:	**3600.00**
Well 14	38.34	40.59	47.55	44.66	73.16	90.73	80.82	65.60	46.74	21.29	25.44	25.08	600.00
Well 15	38.08	36.02	42.13	34.13	44.89	59.93	66.20	58.91	36.22	80.50	56.04	46.95	600.00
Well 16	34.31	39.82	32.02	57.49	26.98	59.54	83.19	86.04	57.42	54.69	39.23	29.25	600.00
Well Midway/Eubanks Dr	36.91	38.81	40.57	45.43	48.34	70.07	76.74	70.18	46.79	52.16	40.24	33.76	600.00
Well Meridian Rd	35.82	33.25	49.86	48.38	62.02	67.39	80.00	58.81	53.78	46.32	30.43	33.93	600.00
Well Willow Drive	36.91	38.81	40.57	45.43	48.34	70.07	76.74	70.18	46.79	52.16	40.24	33.76	600.00
Well Weber/Byrnes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
												Other City Annual Total:	**3600.00**
												Annual Total:	**7200.00**

Attachment A Monthly and Annual Pumpage Amounts, Baseline and Future Scenarios

City of Vacaville Monthly Pumping Distribution (AF) for Scenario 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	26.62	25.88	50.13	53.47	58.74	61.30	82.52	87.95	74.25	52.95	32.01	23.36	629.17
Well 03	27.87	26.81	34.84	38.12	48.78	51.57	93.24	96.45	82.33	60.75	40.28	28.13	629.17
Well 05	28.02	30.89	43.60	51.05	60.49	70.86	86.00	76.99	65.55	51.56	36.44	27.70	629.17
Well 06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 09	32.89	36.18	50.21	51.70	67.29	72.67	88.90	76.76	58.58	36.95	22.74	34.32	629.17
Well 13	24.07	24.64	29.23	60.85	81.25	71.66	87.12	77.61	53.17	52.94	40.37	26.25	629.17
												Elmira Annual Total:	3145.83
Well 14	40.21	42.57	49.87	46.83	76.71	95.14	84.75	68.79	49.01	22.33	26.67	26.30	629.17
Well 15	39.93	37.77	44.18	35.79	47.07	62.84	69.42	61.77	37.99	84.41	58.76	49.23	629.17
Well 16	35.98	41.76	33.58	60.28	28.29	62.44	87.23	90.22	60.21	57.35	41.14	30.68	629.17
Well Midway/Eubanks Dr	38.71	40.70	42.54	47.64	50.69	73.47	80.47	73.59	49.07	54.70	42.19	35.40	629.17
Well Meridian Rd	37.56	34.87	52.28	50.74	65.04	70.67	83.89	61.67	56.39	48.57	31.91	35.58	629.17
Well Willow Drive	38.71	40.70	42.54	47.64	50.69	73.47	80.47	73.59	49.07	54.70	42.19	35.40	629.17
Well Weber/Byrnes	38.71	40.70	42.54	47.64	50.69	73.47	80.47	73.59	49.07	54.70	42.19	35.40	629.17
												Other City Annual Total:	4404.17
												Annual Total:	7550.00

City of Vacaville Monthly Pumping Distribution (AF) for Scenario 5

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 03	32.22	30.99	40.28	44.06	56.38	59.61	107.78	111.48	95.17	70.22	46.56	32.52	727.27
Well 05	32.38	35.71	50.40	59.01	69.92	81.91	99.42	89.00	75.77	59.60	42.13	32.02	727.27
Well 06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 09	38.01	41.82	58.04	59.76	77.78	84.00	102.77	88.72	67.72	42.71	26.28	39.67	727.27
Well 13	27.83	28.48	33.78	70.34	93.92	82.83	100.70	89.71	61.46	61.20	46.67	30.35	727.27
												Elmira Annual Total:	2909.09
Well 14	46.48	49.20	57.64	54.13	88.68	109.98	97.96	79.51	56.65	25.81	30.83	30.40	727.27
Well 15	46.16	43.66	51.06	41.38	54.41	72.64	80.25	71.40	43.91	97.57	67.93	56.91	727.27
Well 16	41.59	48.27	38.82	69.68	32.71	72.17	100.84	104.29	69.60	66.30	47.55	35.46	727.27
Well Midway/Eubanks Dr	44.74	47.04	49.17	55.06	58.60	84.93	93.02	85.07	56.72	63.23	48.77	40.92	727.27
Well Meridian Rd	43.42	40.31	60.43	58.65	75.18	81.69	96.97	71.29	65.18	56.15	36.89	41.13	727.27
Well Willow Drive	44.74	47.04	49.17	55.06	58.60	84.93	93.02	85.07	56.72	63.23	48.77	40.92	727.27
Well Weber/Byrnes	44.74	47.04	49.17	55.06	58.60	84.93	93.02	85.07	56.72	63.23	48.77	40.92	727.27
												Other City Annual Total:	5090.91
												Annual Total:	8000.00

Attachment A Monthly and Annual Pumpage Amounts, Baseline and Future Scenarios

City of Vacaville Monthly Pumping Distribution (AF) for Scenario 1 Dry Year

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	31.61	30.74	59.55	63.50	69.77	72.81	98.01	104.46	88.19	62.89	38.02	27.74	747.27
Well 03	33.10	31.85	41.39	45.27	57.93	61.25	110.74	114.55	97.79	72.15	47.84	33.41	747.27
Well 05	33.28	36.69	51.78	60.63	71.85	84.17	102.15	91.44	77.86	61.24	43.29	32.90	747.27
Well 06	60.99	60.13	55.03	93.06	118.86	86.33	86.86	71.81	30.12	27.57	26.97	29.54	747.27
Well 08	53.68	56.40	64.54	65.11	80.12	70.07	70.52	74.45	58.53	62.47	48.59	42.80	747.27
Well 09	39.06	42.97	59.63	61.40	79.92	86.31	105.59	91.16	69.58	43.89	27.00	40.76	747.27
Well 13	28.59	29.27	34.71	72.28	96.51	85.11	103.47	92.18	63.15	62.88	47.95	31.18	747.27
												Elmira Annual Total:	**5230.91**
Well 14	47.75	50.56	59.23	55.62	91.11	113.00	100.66	81.70	58.21	26.52	31.68	31.23	747.27
Well 15	47.43	44.86	52.47	42.51	55.91	74.64	82.45	73.37	45.12	100.26	69.79	58.48	747.27
Well 16	42.73	49.59	39.88	71.60	33.60	74.16	103.61	107.16	71.52	68.12	48.86	36.44	747.27
Well Midway/Eubanks Dr	45.97	48.34	50.53	56.58	60.21	87.26	95.57	87.41	58.28	64.97	50.11	42.05	747.27
Well Meridian Rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Willow Drive	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Weber/Byrnes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
												Other City Annual Total:	**2989.09**
												Annual Total:	**8220.00**

City of Vacaville Monthly Pumping Distribution (AF) for Scenario 2 Dry Year

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	31.61	30.74	59.55	63.50	69.77	72.81	98.01	104.46	88.19	62.89	38.02	27.74	747.27
Well 03	33.10	31.85	41.39	45.27	57.93	61.25	110.74	114.55	97.79	72.15	47.84	33.41	747.27
Well 05	33.28	36.69	51.78	60.63	71.85	84.17	102.15	91.44	77.86	61.24	43.29	32.90	747.27
Well 06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 08	53.68	56.40	64.54	65.11	80.12	70.07	70.52	74.45	58.53	62.47	48.59	42.80	747.27
Well 09	39.06	42.97	59.63	61.40	79.92	86.31	105.59	91.16	69.58	43.89	27.00	40.76	747.27
Well 13	28.59	29.27	34.71	72.28	96.51	85.11	103.47	92.18	63.15	62.88	47.95	31.18	747.27
												Elmira Annual Total:	**4483.64**
Well 14	47.75	50.56	59.23	55.62	91.11	113.00	100.66	81.70	58.21	26.52	31.68	31.23	747.27
Well 15	47.43	44.86	52.47	42.51	55.91	74.64	82.45	73.37	45.12	100.26	69.79	58.48	747.27
Well 16	42.73	49.59	39.88	71.60	33.60	74.16	103.61	107.16	71.52	68.12	48.86	36.44	747.27
Well Midway/Eubanks Dr	45.97	48.34	50.53	56.58	60.21	87.26	95.57	87.41	58.28	64.97	50.11	42.05	747.27
Well Meridian Rd	44.62	41.42	62.09	60.26	77.25	83.93	99.63	73.25	66.97	57.69	37.90	42.26	747.27
Well Willow Drive	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Weber/Byrnes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
												Other City Annual Total:	**3736.36**
												Annual Total:	**8220.00**

Attachment A Monthly and Annual Pumpage Amounts, Baseline and Future Scenarios

City of Vacaville Monthly Pumping Distribution (AF) for Scenario 3 Dry Year

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	30.46	29.62	57.37	61.18	67.22	70.15	94.44	100.64	84.97	60.59	36.63	26.73	720.00
Well 03	31.90	30.68	39.87	43.62	55.82	59.02	106.70	110.37	94.22	69.52	46.09	32.19	720.00
Well 05	32.06	35.35	49.89	58.42	69.23	81.09	98.42	88.11	75.02	59.01	41.71	31.70	720.00
Well 06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 08	51.72	54.34	62.18	62.73	77.19	67.51	67.94	71.74	56.40	60.19	46.81	41.23	720.00
Well 09	37.63	41.40	57.46	59.16	77.00	83.16	101.74	87.84	67.04	42.29	26.02	39.27	720.00
Well 13	27.55	28.20	33.44	69.64	92.99	82.00	99.70	88.81	60.84	60.58	46.20	30.05	720.00
												Elmira Annual Total:	**4320.00**
Well 14	46.01	48.71	57.06	53.59	87.79	108.88	96.99	78.72	56.08	25.55	30.52	30.09	720.00
Well 15	45.70	43.22	50.55	40.96	53.87	71.91	79.44	70.69	43.47	96.60	67.25	56.34	720.00
Well 16	41.17	47.78	38.43	68.99	32.38	71.45	99.83	103.25	68.91	65.63	47.08	35.11	720.00
Well Midway/Eubanks Dr	44.29	46.57	48.68	54.51	58.01	84.08	92.09	84.22	56.15	62.60	48.28	40.51	720.00
Well Meridian Rd	42.99	39.90	59.83	58.06	74.43	80.87	96.00	70.57	64.53	55.58	36.52	40.72	720.00
Well Willow Drive	44.29	46.57	48.68	54.51	58.01	84.08	92.09	84.22	56.15	62.60	48.28	40.51	720.00
Well Weber/Byrnes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
												Other City Annual Total:	**4320.00**
												Annual Total:	**8640.00**

City of Vacaville Monthly Pumping Distribution (AF) for Scenario 4 Dry Year

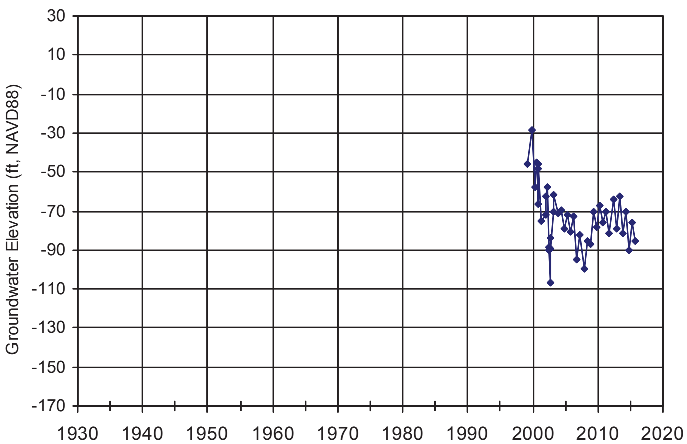
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	31.94	31.06	60.16	64.16	70.49	73.56	99.03	105.54	89.10	63.54	38.41	28.03	755.00
Well 03	33.45	32.18	41.81	45.74	58.53	61.89	111.88	115.73	98.80	72.90	48.33	33.76	755.00
Well 05	33.62	37.07	52.32	61.26	72.59	85.04	103.21	92.39	78.66	61.88	43.73	33.24	755.00
Well 06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 09	39.46	43.41	60.25	62.04	80.74	87.20	106.68	92.11	70.30	44.34	27.28	41.18	755.00
Well 13	28.89	29.57	35.07	73.02	97.51	85.99	104.54	93.13	63.80	63.53	48.44	31.51	755.00
												Elmira Annual Total:	**3775.00**
Well 14	48.25	51.08	59.84	56.20	92.06	114.17	101.70	82.55	58.81	26.80	32.01	31.55	755.00
Well 15	47.92	45.32	53.01	42.95	56.48	75.41	83.30	74.13	45.58	101.29	70.52	59.08	755.00
Well 16	43.17	50.11	40.30	72.34	33.95	74.92	104.68	108.27	72.26	68.82	49.37	36.81	755.00
Well Midway/Eubanks Dr	46.45	48.84	51.05	57.16	60.83	88.17	96.56	88.31	58.88	65.64	50.63	42.48	755.00
Well Meridian Rd	45.08	41.84	62.74	60.88	78.04	84.80	100.66	74.00	67.67	58.29	38.29	42.70	755.00
Well Willow Drive	46.45	48.84	51.05	57.16	60.83	88.17	96.56	88.31	58.88	65.64	50.63	42.48	755.00
Well Weber/Byrnes	46.45	48.84	51.05	57.16	60.83	88.17	96.56	88.31	58.88	65.64	50.63	42.48	755.00
												Other City Annual Total:	**5285.00**
												Annual Total:	**9060.00**

City of Vacaville Monthly Pumping Distribution (AF) for Scenario 5 Dry Year

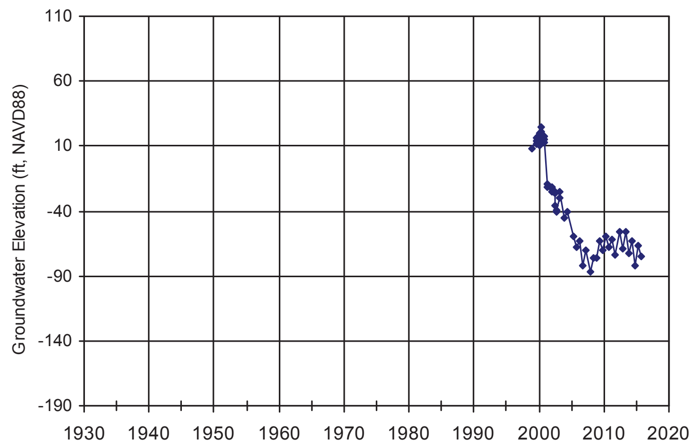
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Well 02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 03	38.66	37.19	48.33	52.88	67.66	71.54	129.33	133.78	114.20	84.27	55.87	39.02	872.73
Well 05	38.86	42.85	60.48	70.81	83.91	98.30	119.30	106.79	90.93	71.53	50.55	38.42	872.73
Well 06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well 09	45.62	50.18	69.65	71.71	93.33	100.80	123.32	106.47	81.26	51.26	31.54	47.60	872.73
Well 13	33.39	34.18	40.54	84.41	112.71	99.40	120.84	107.65	73.75	73.43	56.00	36.42	872.73
												Elmira Annual Total:	**3490.91**
Well 14	55.77	59.04	69.17	64.96	106.41	131.97	117.56	95.42	67.98	30.97	37.00	36.47	872.73
Well 15	55.39	52.39	61.28	49.65	65.29	87.17	96.29	85.68	52.69	117.09	81.51	68.29	872.73
Well 16	49.91	57.92	46.58	83.62	39.25	86.61	121.00	125.15	83.52	79.56	57.06	42.55	872.73
Well Midway/Eubanks Dr	53.69	56.45	59.01	66.08	70.32	101.91	111.62	102.08	68.06	75.87	58.52	49.11	872.73
Well Meridian Rd	52.11	48.37	72.52	70.38	90.21	98.02	116.36	85.54	78.22	67.37	44.26	49.36	872.73
Well Willow Drive	53.69	56.45	59.01	66.08	70.32	101.91	111.62	102.08	68.06	75.87	58.52	49.11	872.73
Well Weber/Byrnes	53.69	56.45	59.01	66.08	70.32	101.91	111.62	102.08	68.06	75.87	58.52	49.11	872.73
												Other City Annual Total:	**6109.09**
												Annual Total:	**9600.00**

APPENDIX C

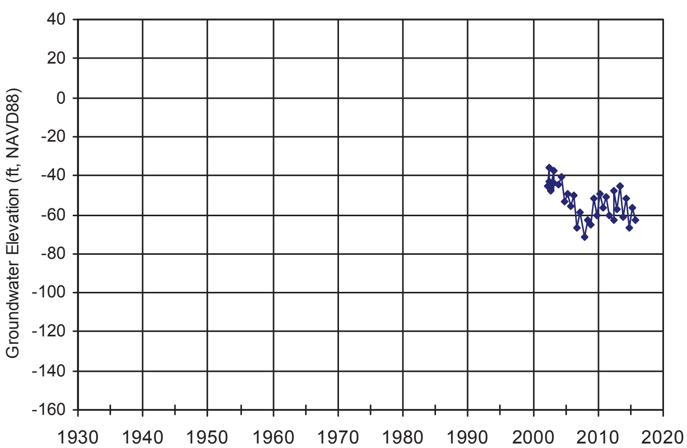
WellID: **MW-14** Source: CofV RPE: 92.98 ft, NAVD88
Aquifer Zone: Basal Tehama



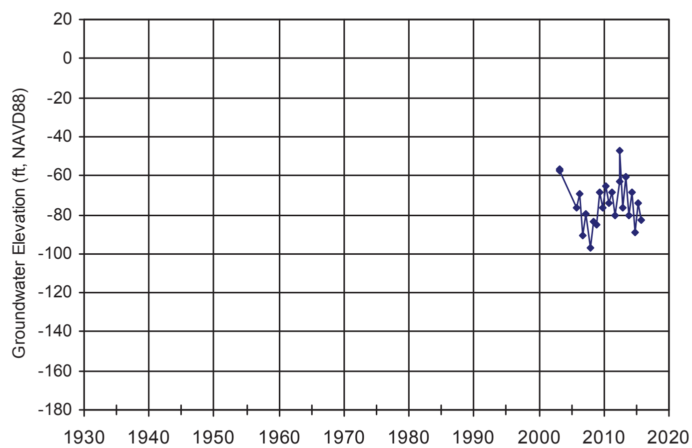
WellID: **MW-15-1815ft** Source: CofV RPE: 94.97 ft, NAVD88
Aquifer Zone: Basal Tehama



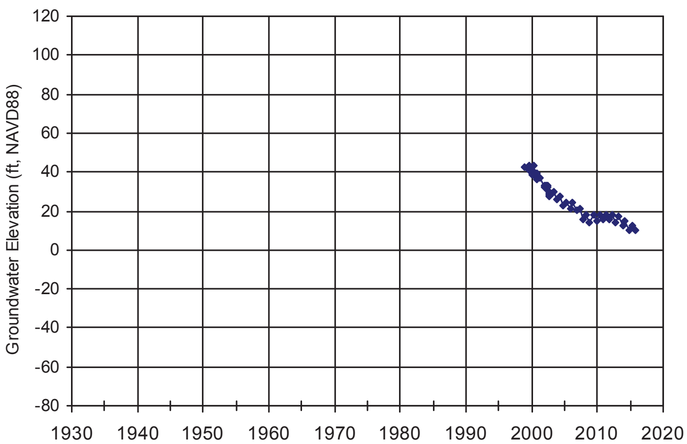
WellID: **MW-16-1166ft** Source: CofV RPE: 103.33 ft, NAVD88
Aquifer Zone: Basal Tehama



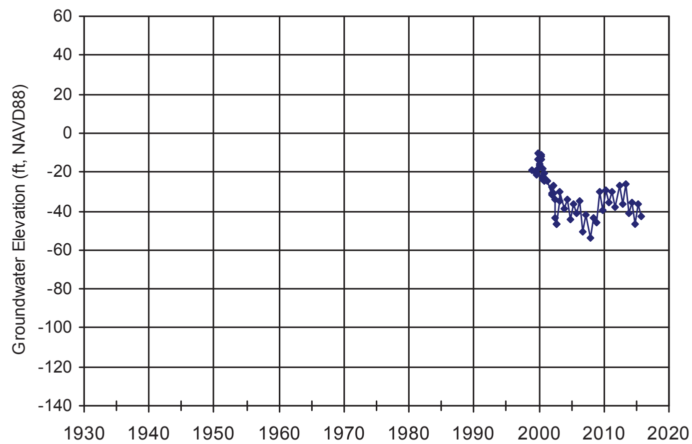
WellID: **MW-16-1430ft** Source: CofV RPE: 103.52 ft, NAVD88
Aquifer Zone: Basal Tehama



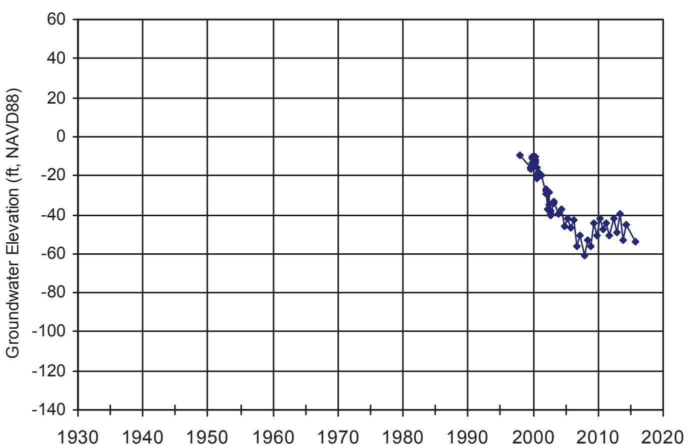
WellID: **MW-98A** Source: CofV RPE: 104.02 ft, NAVD88
Aquifer Zone: Basal Tehama



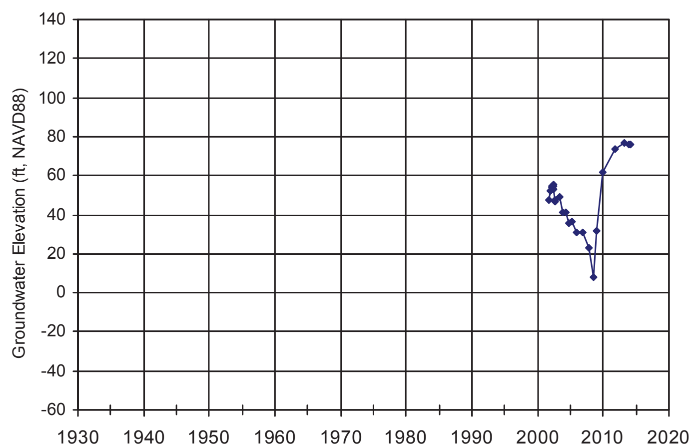
WellID: **MW-98B** Source: CofV RPE: 95.28 ft, NAVD88
Aquifer Zone: Basal Tehama



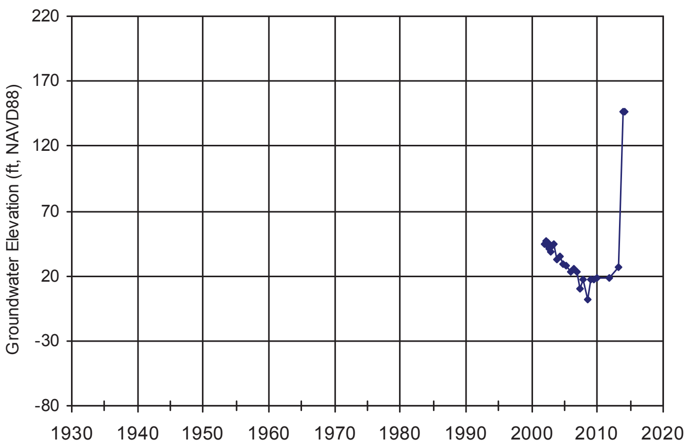
WellID: **MW-98C** Source: CofV RPE: 81.07 ft, NAVD88
Aquifer Zone: Basal Tehama



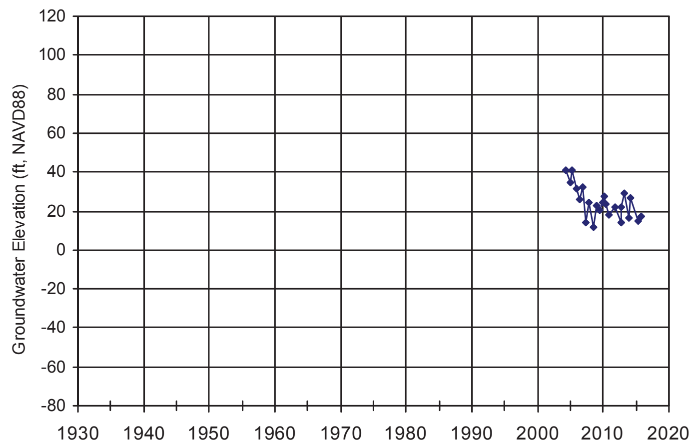
WellID: **RNVWD 1** Source: RNVWD RPE: 173.55 ft, NAVD88
Aquifer Zone: Basal Tehama



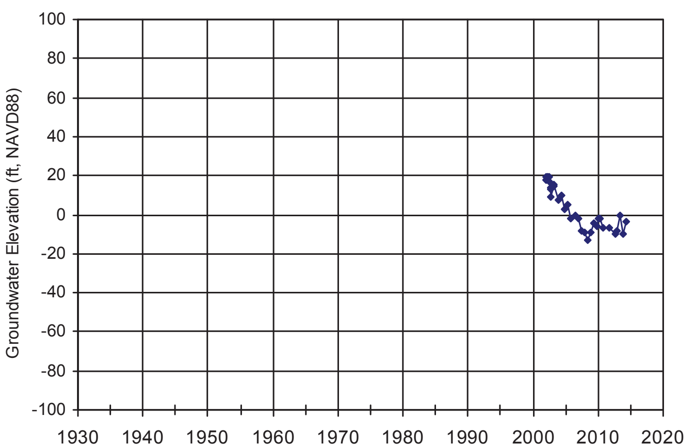
WellID: **RNVWD 2** Source: RNVWD RPE: 170.29 ft, NAVD88
Aquifer Zone: Basal Tehama



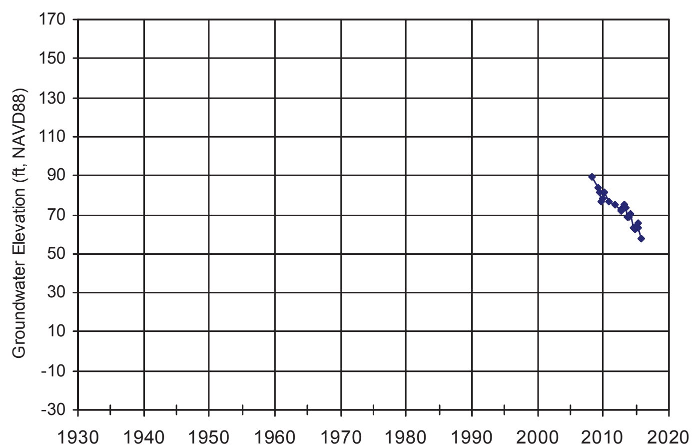
WellID: **RNVWD MW-1389ft** Source: RNVWD RPE: 171.94 ft, NAVD88
Aquifer Zone: Basal Tehama



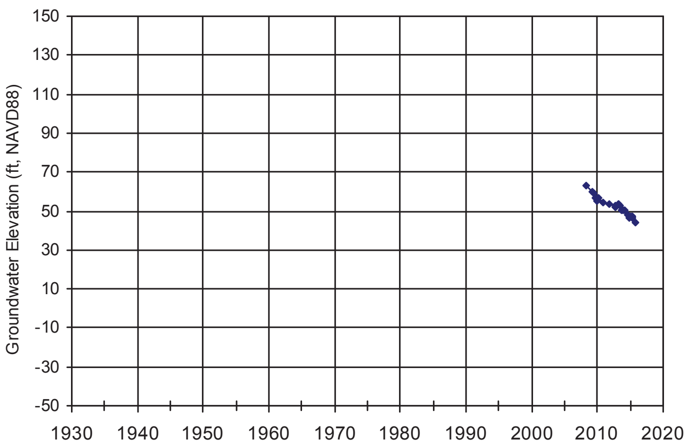
WellID: **RNVWD MW-862ft** Source: RNVWD RPE: 171.78 ft, NAVD88
Aquifer Zone: Basal Tehama



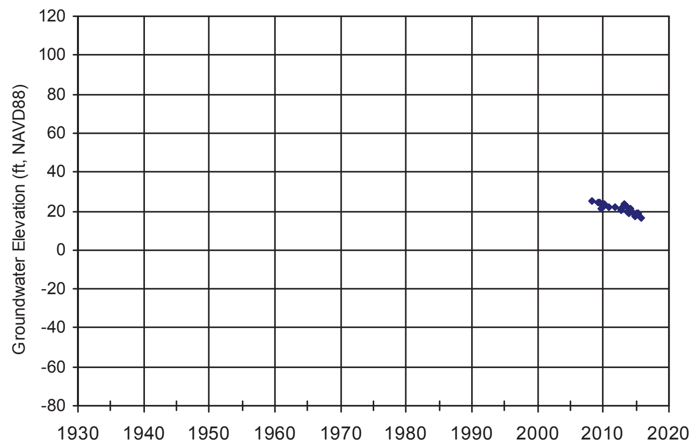
WellID: **SCWA-Allendale MW-1235** Source: SCWA RPE: 132.81 ft, NAVD88
Aquifer Zone: Basal Tehama



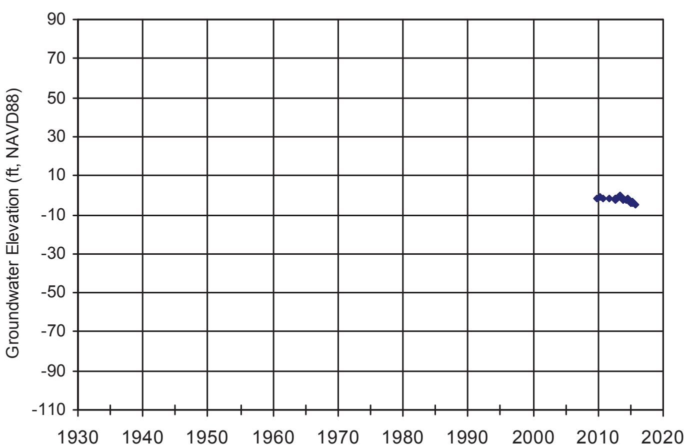
WellID: **SCWA-Allendale MW-1345** Source: SCWA RPE: 132.31 ft, NAVD88
Aquifer Zone: Basal Tehama



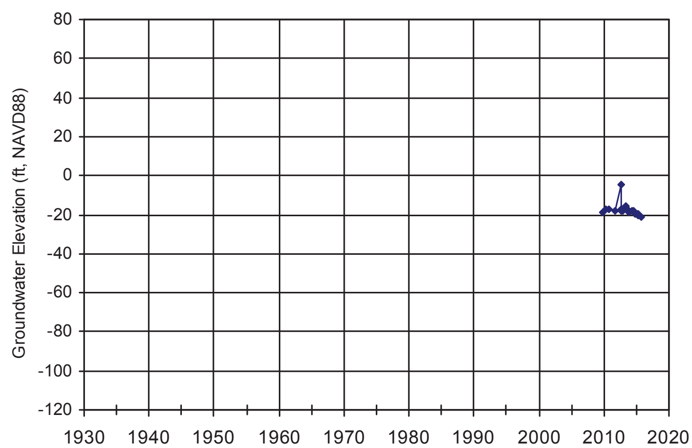
WellID: **SCWA-Allendale MW-1925** Source: SCWA RPE: 131.79 ft, NAVD88
Aquifer Zone: Basal Tehama



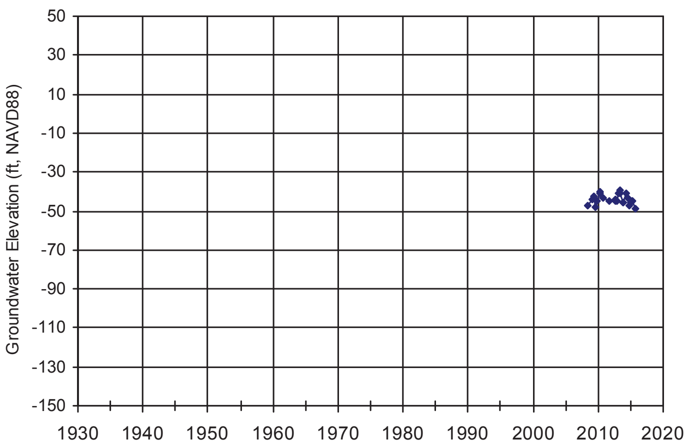
WellID: **SCWA-Dixon MW-2212** Source: SCWA RPE: 79.53 ft, NAVD88
Aquifer Zone: Basal Tehama



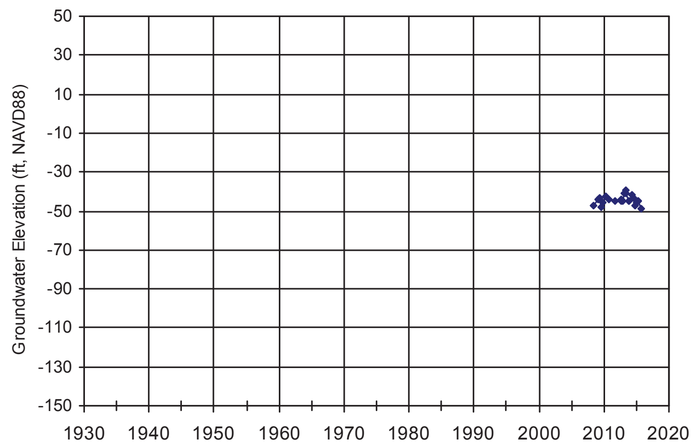
WellID: **SCWA-Dixon MW-2370** Source: SCWA RPE: 79.23 ft, NAVD88
Aquifer Zone: Basal Tehama



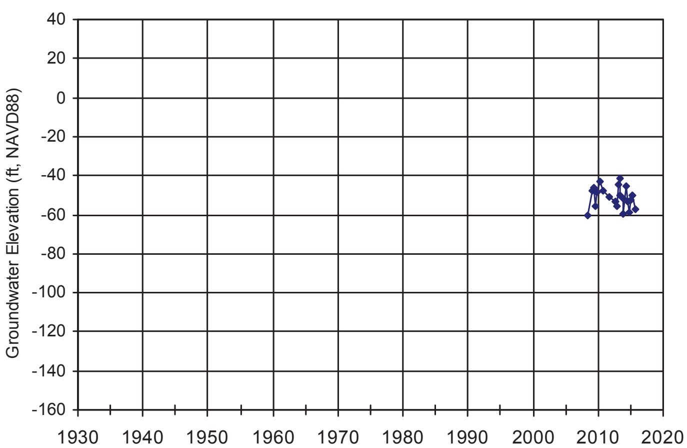
WellID: **SCWA-MainePrairie MW-1960** Source: SCWA RPE: 53.35 ft, NAVD88
Aquifer Zone: Basal Tehama



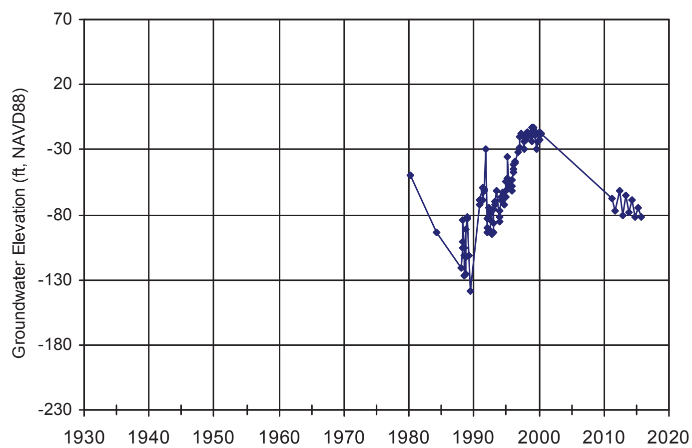
WellID: **SCWA-MainePrairie MW-2170** Source: SCWA RPE: 53.58 ft, NAVD88
Aquifer Zone: Basal Tehama



WellID: **SCWA-Meridian MW-1680** Source: SCWA RPE: 77.98 ft, NAVD88
Aquifer Zone: Basal Tehama

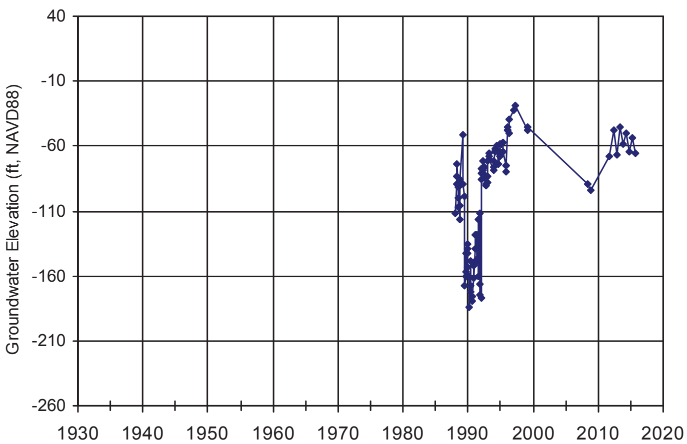


WellID: **Well 02** Source: CofV RPE: 120.78 ft, NAVD88
Aquifer Zone: Basal Tehama



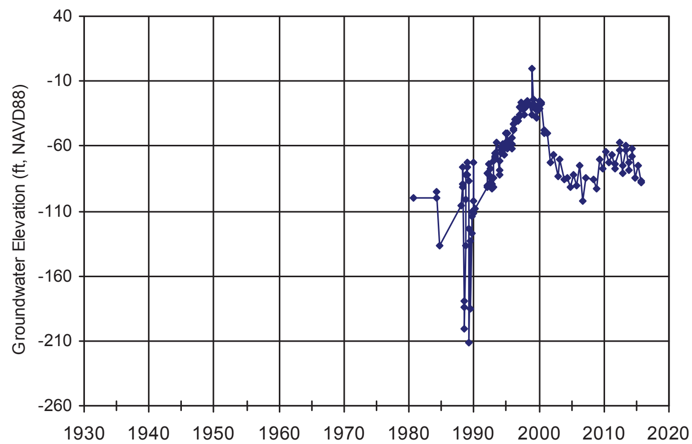
WellID: **Well 03** Source: CofV RPE: 111.04 ft, NAVD88

Aquifer Zone: Basal Tehama



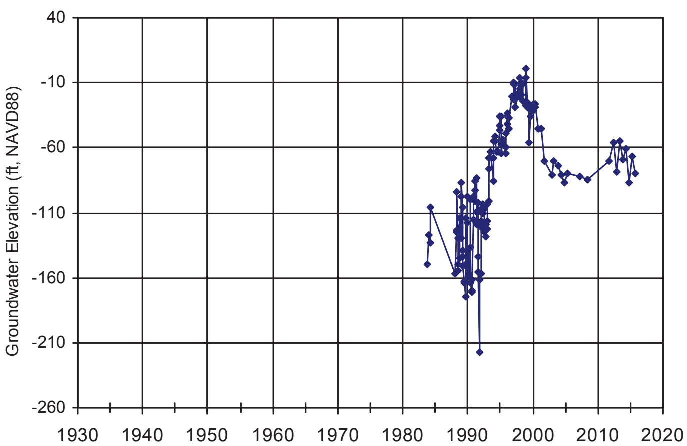
WellID: **Well 05** Source: CofV RPE: 106.34 ft, NAVD88

Aquifer Zone: Basal Tehama



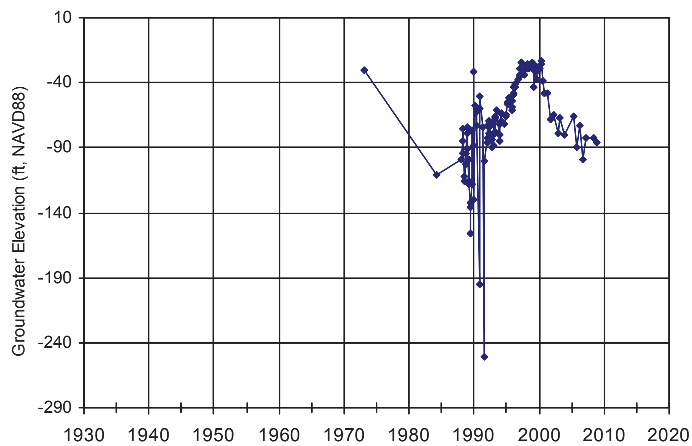
WellID: **Well 06** Source: CofV RPE: 100.67 ft, NAVD88

Aquifer Zone: Basal Tehama

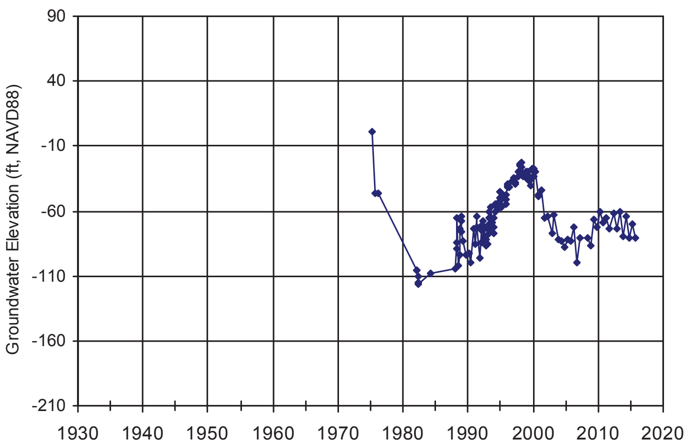


WellID: **Well 07** Source: CofV RPE: 99.41 ft, NAVD88

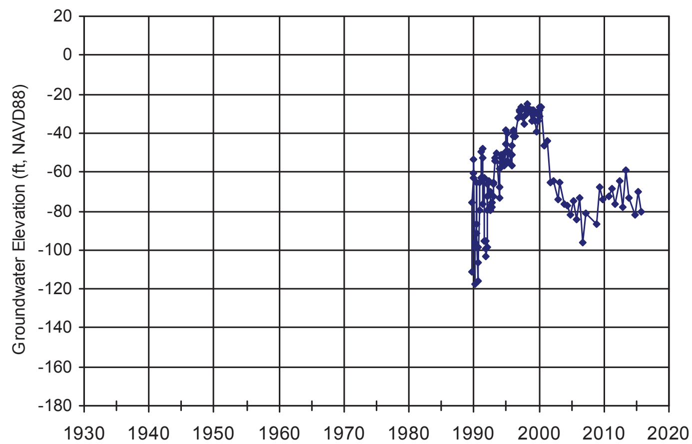
Aquifer Zone: Basal Tehama



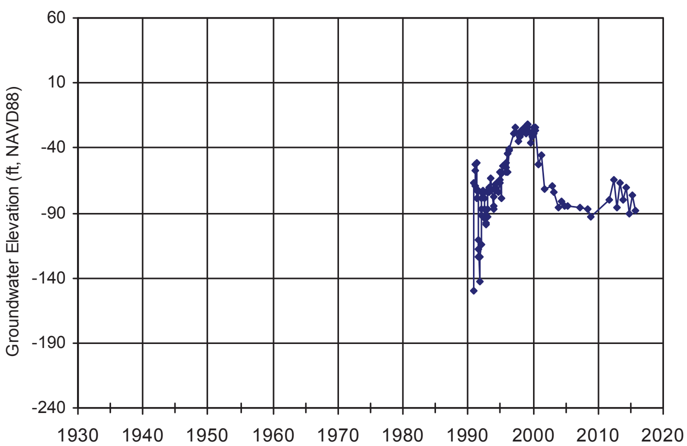
WellID: **Well 08** Source: CofV RPE: 97.83 ft, NAVD88
Aquifer Zone: Basal Tehama



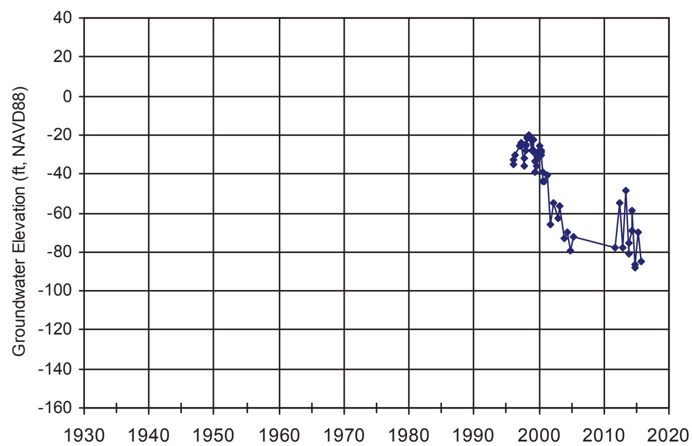
WellID: **Well 09** Source: CofV RPE: 96.64 ft, NAVD88
Aquifer Zone: Basal Tehama



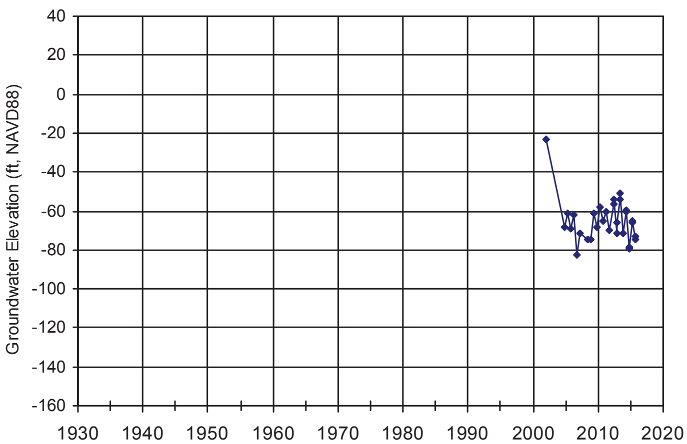
WellID: **Well 13** Source: CofV RPE: 105.66 ft, NAVD88
Aquifer Zone: Basal Tehama



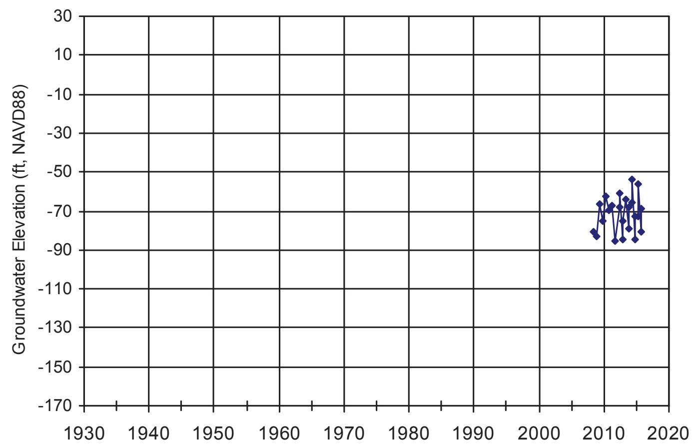
WellID: **Well 14** Source: CofV RPE: 97.27 ft, NAVD88
Aquifer Zone: Basal Tehama



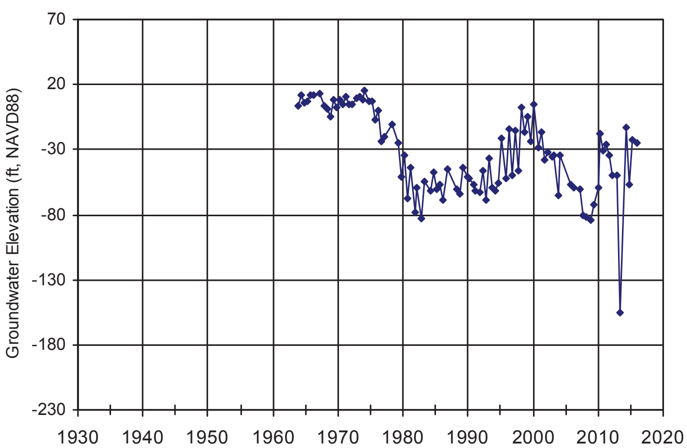
WellID: **Well 15** Source: CofV RPE: 96.75 ft, NAVD88
Aquifer Zone: Basal Tehama



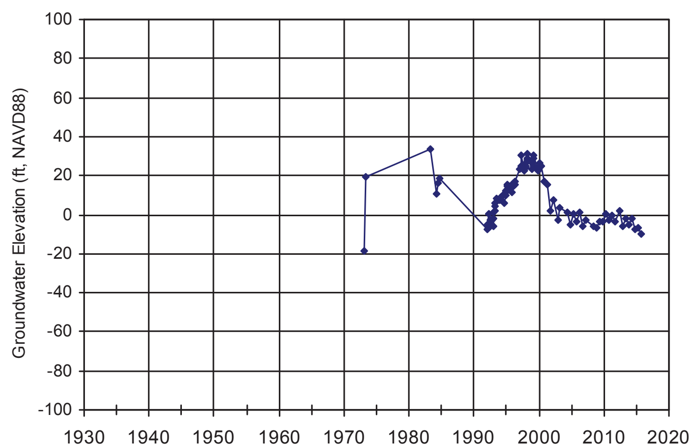
WellID: **Well 16** Source: CofV RPE: 106.2 ft, NAVD88
Aquifer Zone: Basal Tehama



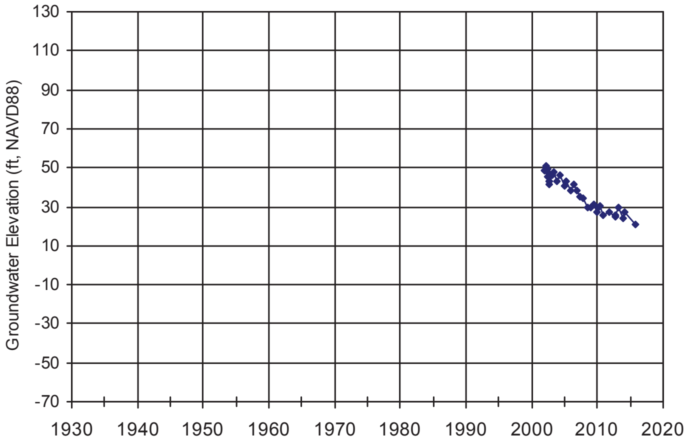
WellID: **06N01W24N002M** Source: DWR RPE: 93.57 ft, NAVD88
Aquifer Zone: Basal Tehama (primary) & Middle Tehama



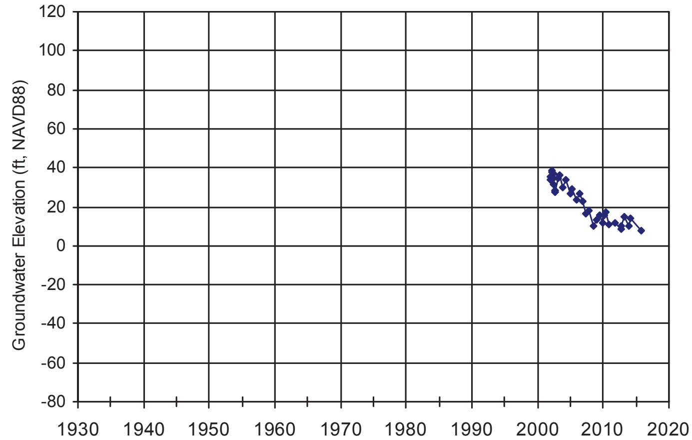
WellID: **Well 01** Source: CofV RPE: 133.23 ft, NAVD88
Aquifer Zone: Markley Formation



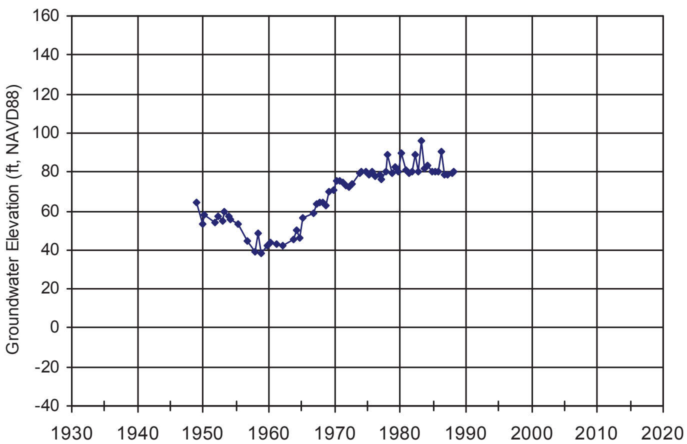
WellID: **RNVWD MW-446ft** Source: RNVWD RPE: 171.78 ft, NAVD88
Aquifer Zone: Middle Tehama



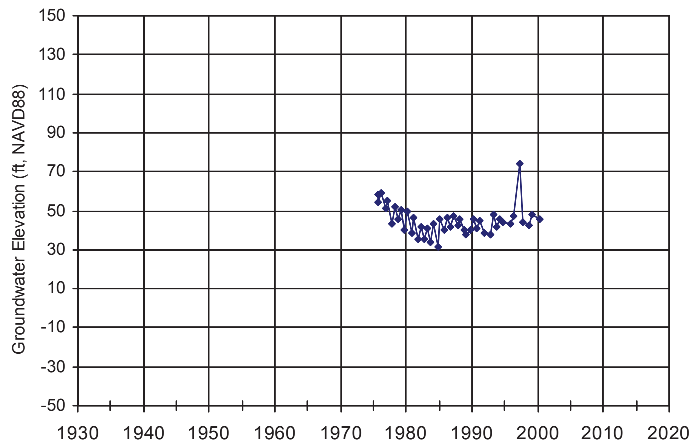
WellID: **RNVWD MW-594ft** Source: RNVWD RPE: 171.78 ft, NAVD88
Aquifer Zone: Middle Tehama



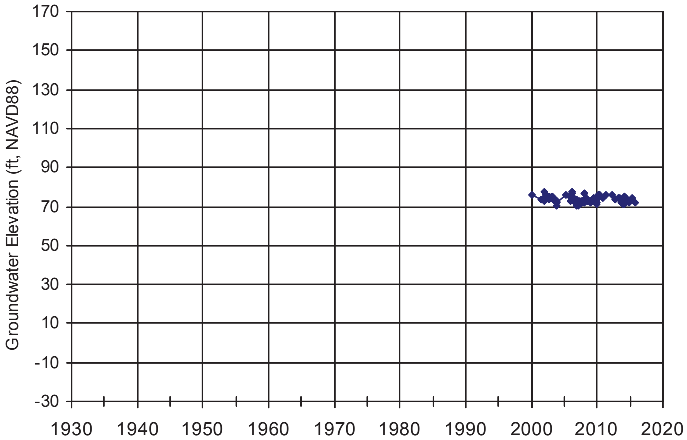
WellID: **06N01W23C001M** Source: DWR RPE: 103.6 ft, NAVD88
Aquifer Zone: Middle Tehama



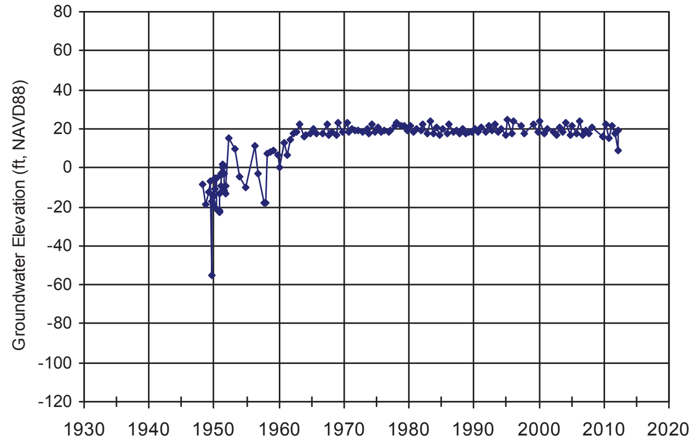
WellID: **07N01W34F001M** Source: DWR RPE: 143.3 ft, NAVD88
Aquifer Zone: Middle Tehama



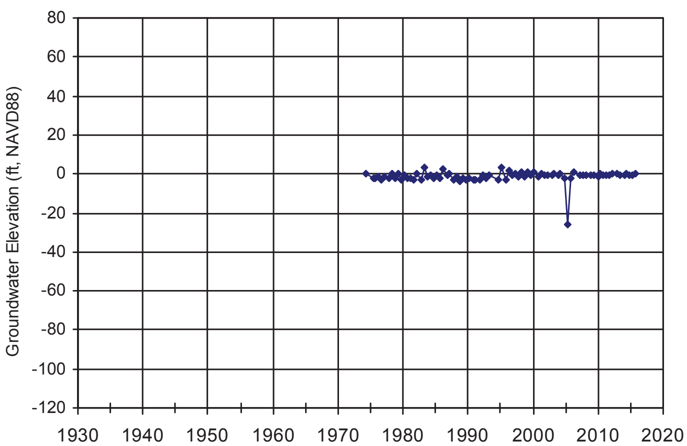
WellID: **DeMello MW-95ft** Source: CofV RPE: 79.78 ft, NAVD88
Aquifer Zone: Quaternary Alluvium



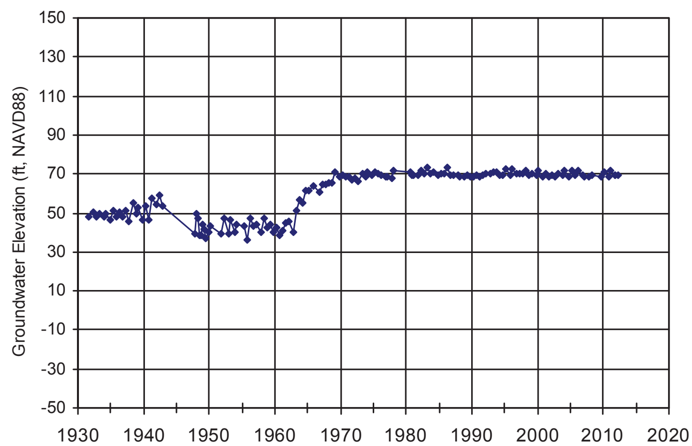
WellID: **04N02W04D002M** Source: DWR RPE: 29.11 ft, NAVD88
Aquifer Zone: Quaternary Alluvium



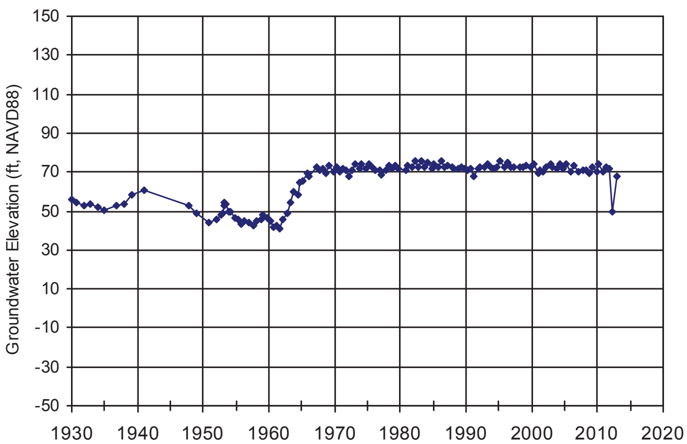
WellID: **05N02E25K001M** Source: DWR RPE: 3.55 ft, NAVD88
Aquifer Zone: Quaternary Alluvium



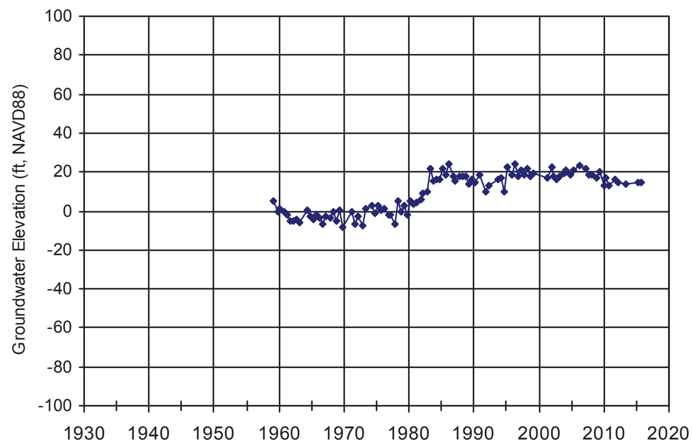
WellID: **06N01E06D001M** Source: DWR RPE: 80.29 ft, NAVD88
Aquifer Zone: Quaternary Alluvium



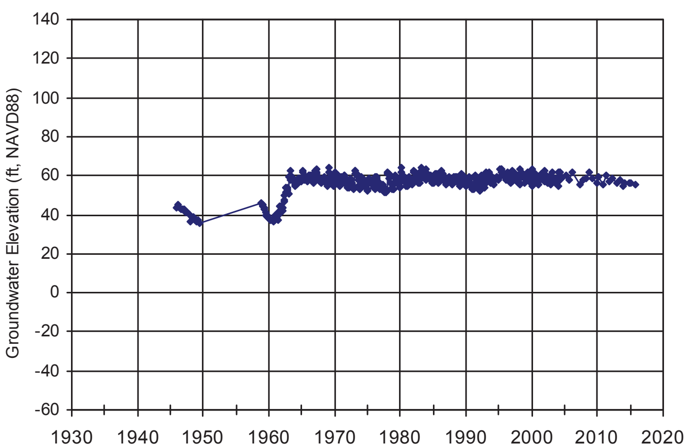
WellID: **06N01W13R001M** Source: DWR RPE: 77.57 ft, NAVD88
Aquifer Zone: Quaternary Alluvium



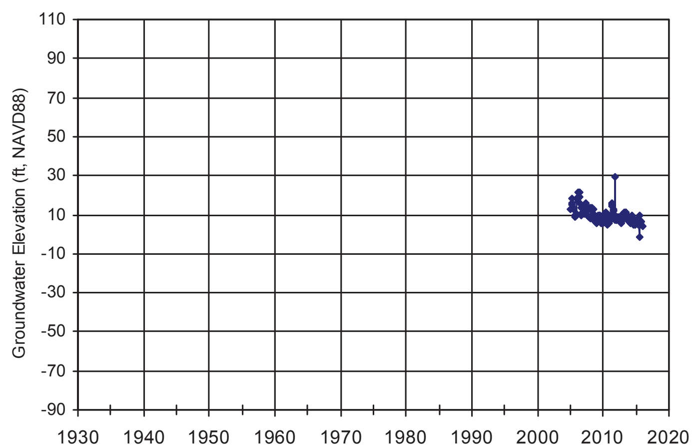
WellID: **06N02E02M003M** Source: DWR RPE: 27.52 ft, NAVD88
Aquifer Zone: Quaternary Alluvium



WellID: **07N01E33R001M** Source: DWR RPE: 65.38 ft, NAVD88
Aquifer Zone: Quaternary Alluvium

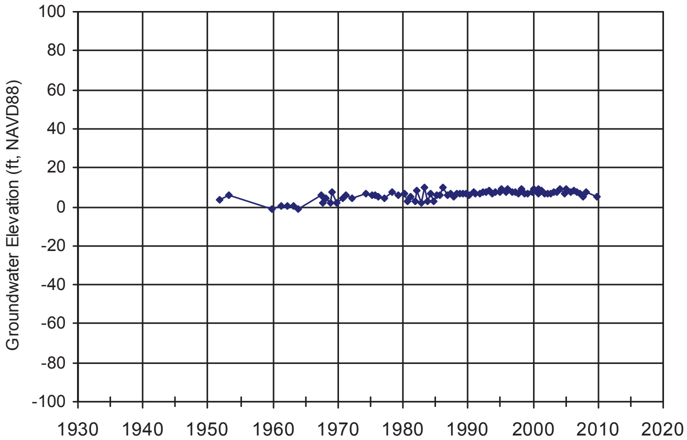


WellID: **07N02E35D001M** Source: DWR RPE: 34.35 ft, NAVD88
Aquifer Zone: Quaternary Alluvium



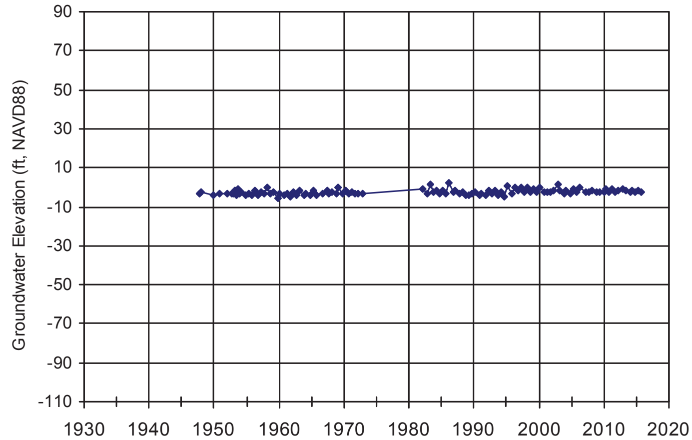
WellID: **05N02E07R001M** Source: DWR RPE: 19.8 ft, NAVD88

Aquifer Zone: Quaternary Alluvium (possible)



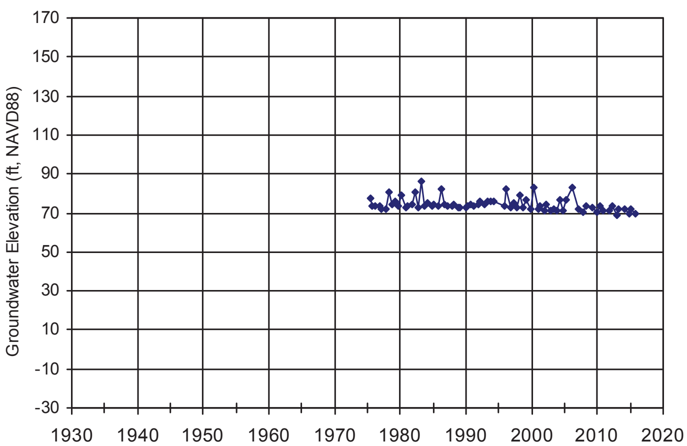
WellID: **05N02E36N001M** Source: DWR RPE: 3.65 ft, NAVD88

Aquifer Zone: Quaternary Alluvium (possible)



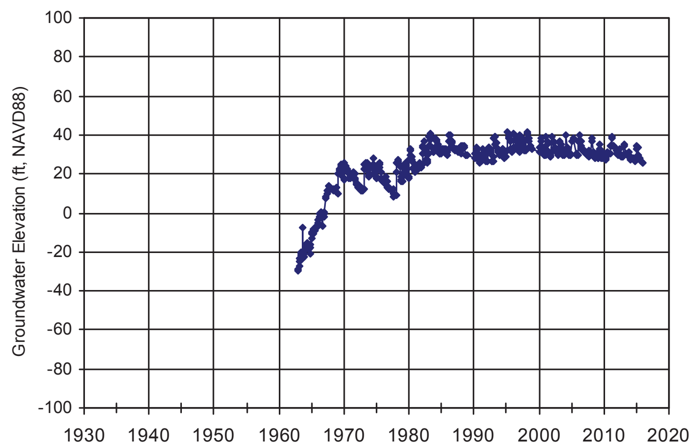
WellID: **05N02W19H004M** Source: DWR RPE: 89.93 ft, NAVD88

Aquifer Zone: Quaternary Alluvium (possible)

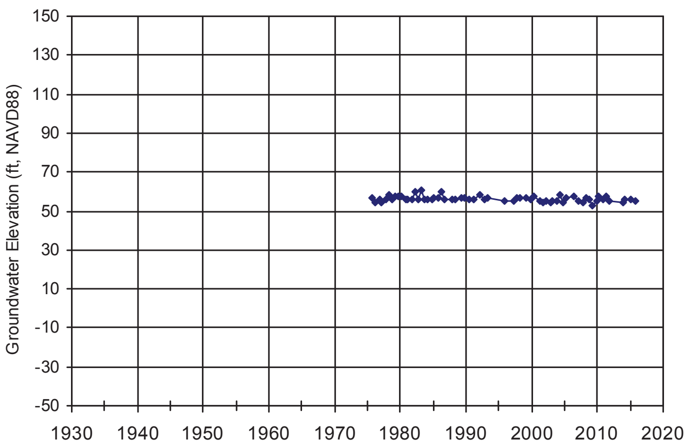


WellID: **06N01E12M001M** Source: DWR RPE: 42.55 ft, NAVD88

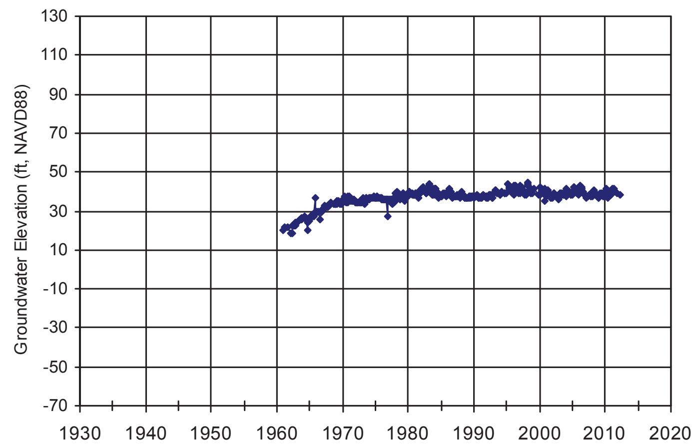
Aquifer Zone: Quaternary Alluvium (possible)



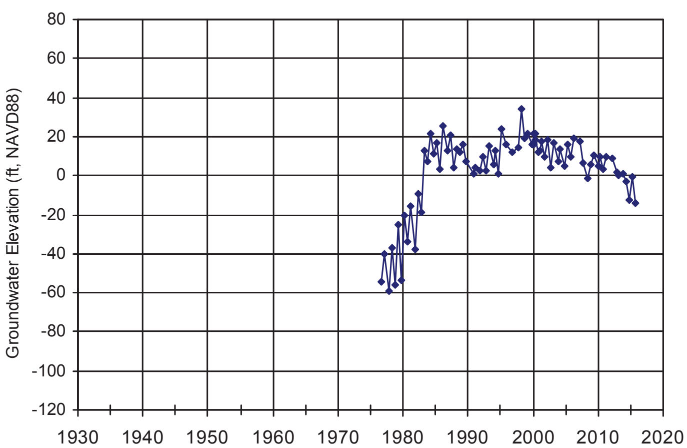
WellID: **06N01E17M001M** Source: DWR RPE: 66.27 ft, NAVD88
Aquifer Zone: Quaternary Alluvium (possible)



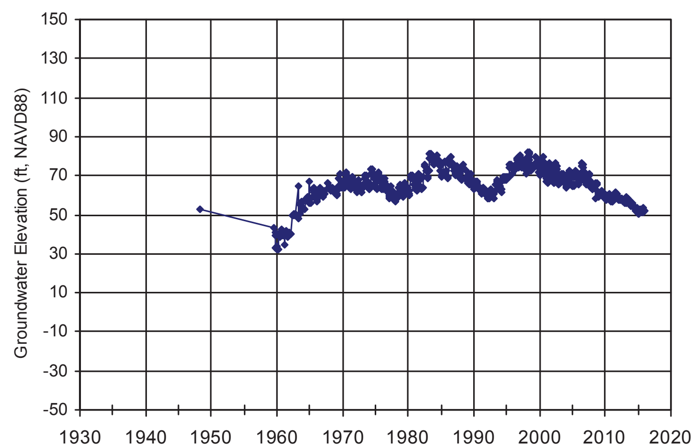
WellID: **06N01E33L001M** Source: DWR RPE: 47.54 ft, NAVD88
Aquifer Zone: Quaternary Alluvium (possible)



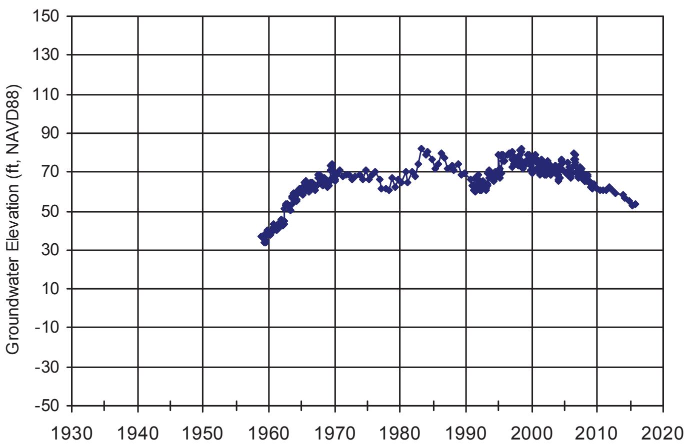
WellID: **07N02E15E001M** Source: DWR RPE: 44.54 ft, NAVD88
Aquifer Zone: Quaternary Alluvium (possible)



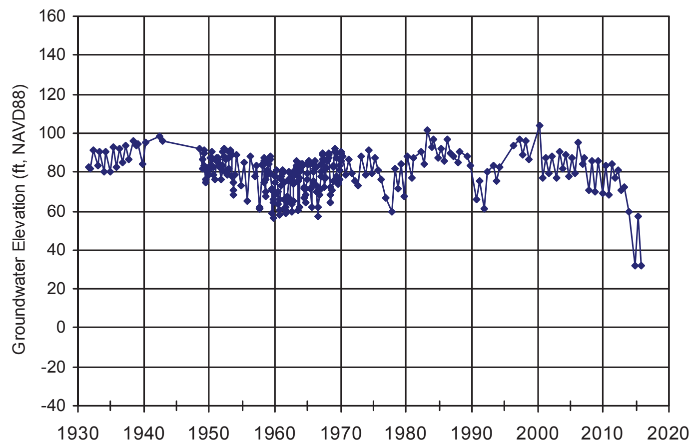
WellID: **08N01E33Q002M** Source: DWR RPE: 89.07 ft, NAVD88
Aquifer Zone: Quaternary Alluvium (possible)



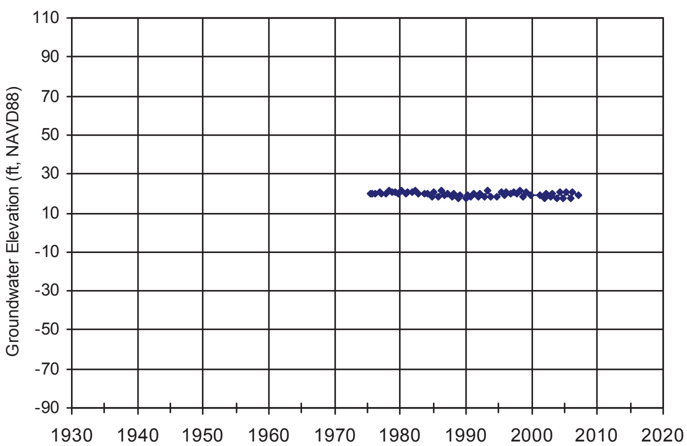
WellID: **08N01E33Q003M** Source: DWR RPE: 88.57 ft, NAVD88
Aquifer Zone: Quaternary Alluvium (possible)



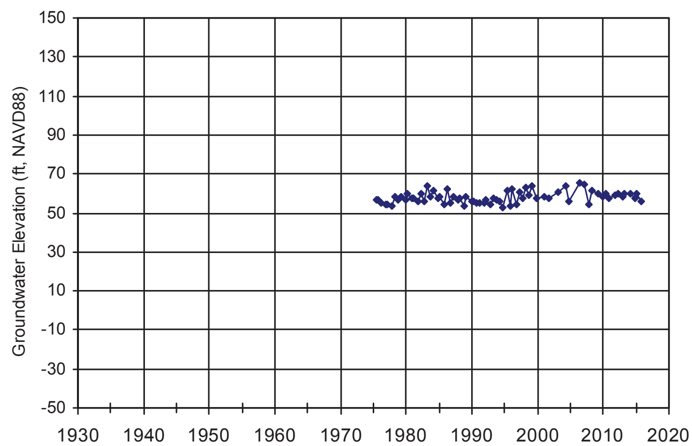
WellID: **08N01W22P001M** Source: DWR RPE: 132.3 ft, NAVD88
Aquifer Zone: Quaternary Alluvium (possible)



WellID: **04N02W04F003M** Source: DWR RPE: 22.6 ft, NAVD88
Aquifer Zone: Quaternary Alluvium (primary) & undifferentiated Cretaceous Rock (possible)

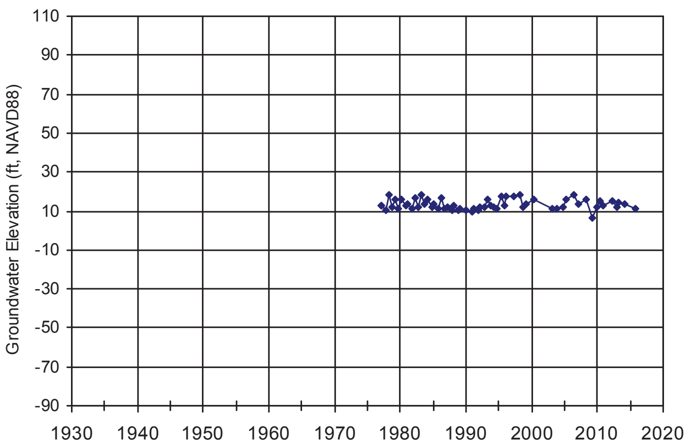


WellID: **05N01W15D001M** Source: DWR RPE: 73.57 ft, NAVD88
Aquifer Zone: Quaternary Alluvium (primary) & undifferentiated Cretaceous Rock (possible)



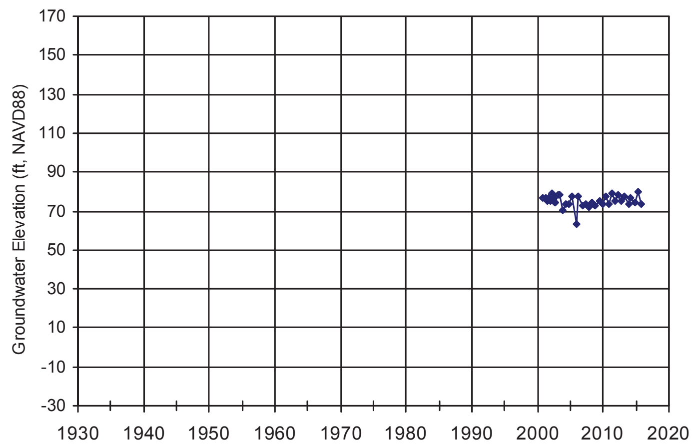
WellID: **05N01W35E001M** Source: DWR RPE: 21.86 ft, NAVD88

Aquifer Zone: Quaternary Alluvium (primary) & undifferentiated Cretaceous Rock (possible)



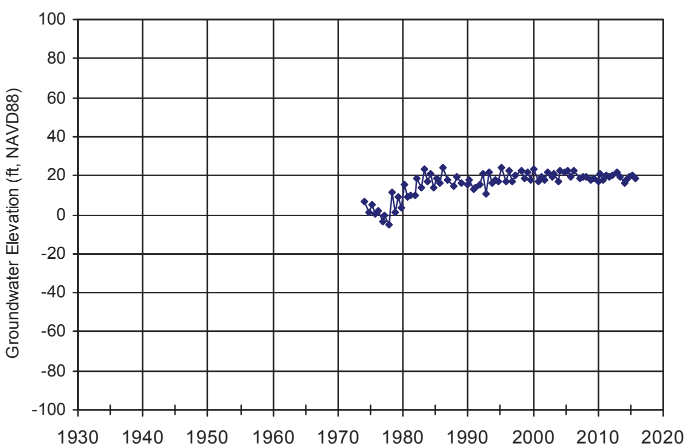
WellID: **MW-15-188ft** Source: CofV RPE: 95.4 ft, NAVD88

Aquifer Zone: Quaternary Alluvium (primary) & Upper Tehama



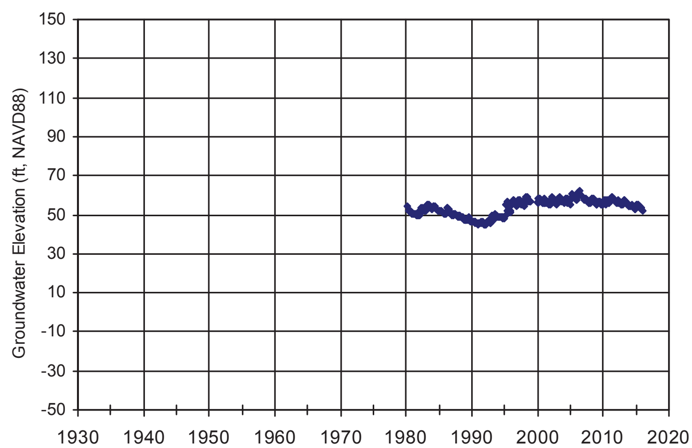
WellID: **06N02E19J001M** Source: DWR RPE: 26.02 ft, NAVD88

Aquifer Zone: Quaternary Alluvium (primary) & Upper Tehama



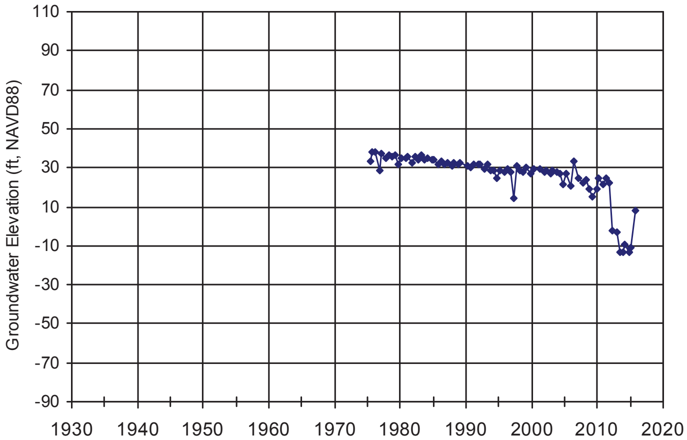
WellID: **04N01E02E001M** Source: DWR RPE: 62.52 ft, NAVD88

Aquifer Zone: Quaternary Alluvium (primary) & Upper Tehama (possible)



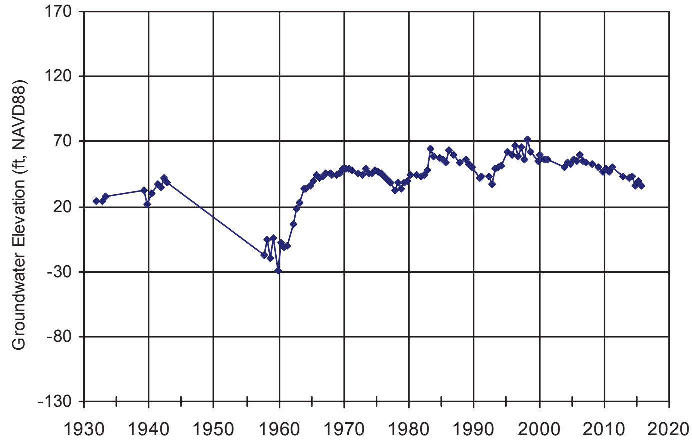
WellID: **04N02E22P001M** Source: DWR RPE: 72.87 ft, NAVD88

Aquifer Zone: Quaternary Alluvium (primary) & Upper Tehama (possible)



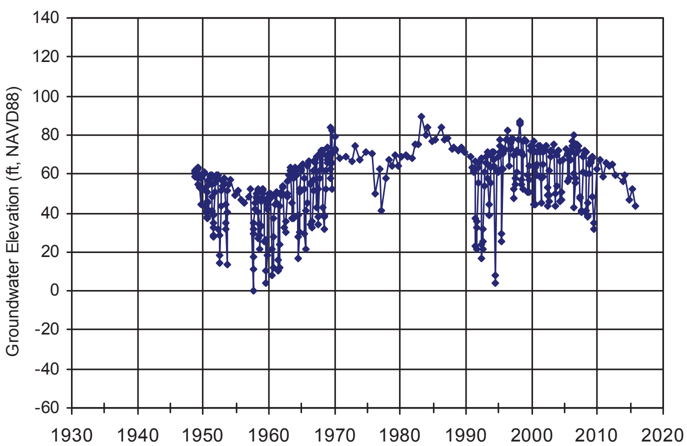
WellID: **07N01E11M001M** Source: DWR RPE: 78.1 ft, NAVD88

Aquifer Zone: Quaternary Alluvium (primary) & Upper Tehama (possible)



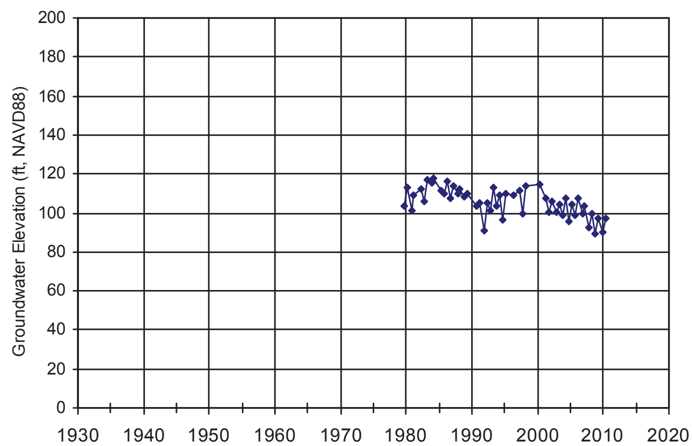
WellID: **08N01E32E001M** Source: DWR RPE: 102.88 ft, NAVD88

Aquifer Zone: Quaternary Alluvium (primary) & Upper Tehama (possible)

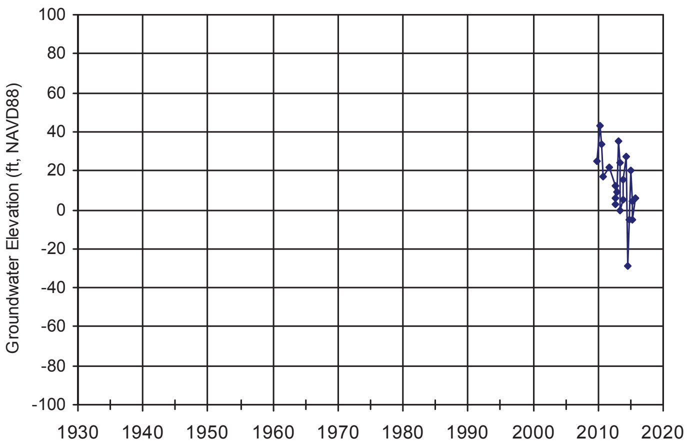


WellID: **08N01W32N003M** Source: DWR RPE: 184.6 ft, NAVD88

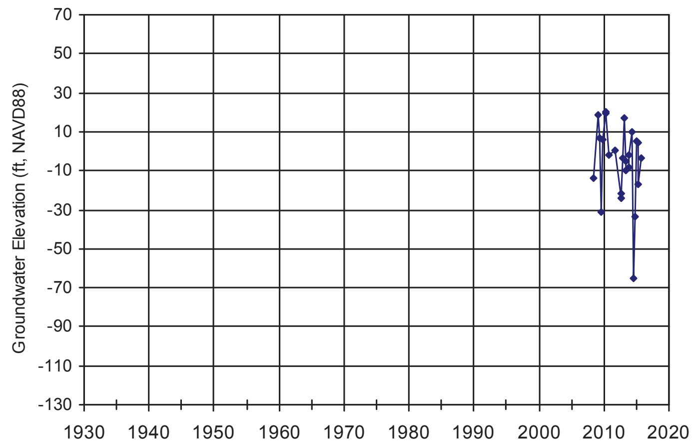
Aquifer Zone: Quaternary Alluvium (primary) & Upper Tehama (possible)



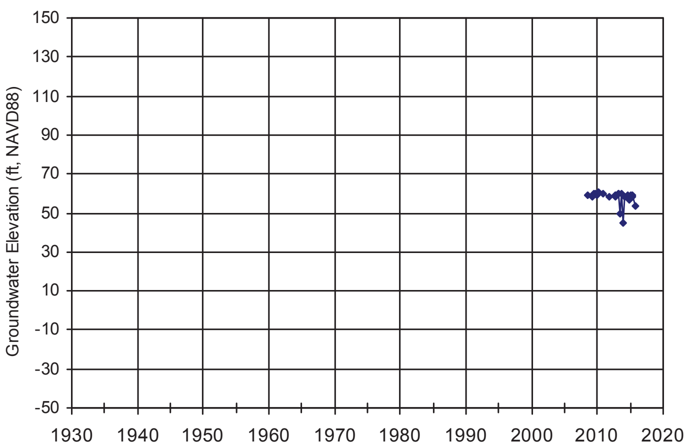
WellID: **SCWA-Dixon MW-1200** Source: SCWA RPE: 79.23 ft, NAVD88
Aquifer Zone: Tehama (general)



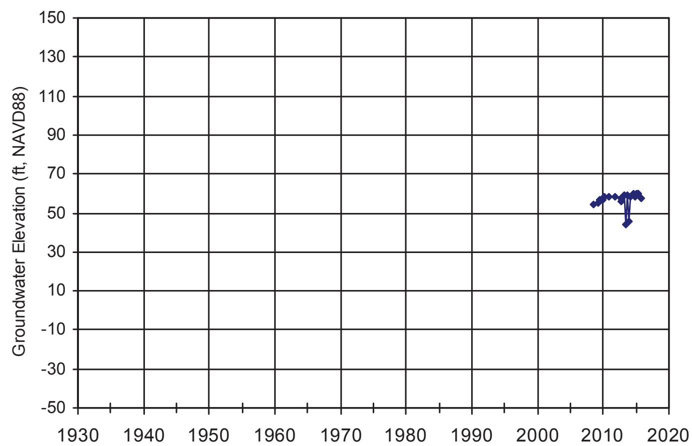
WellID: **SCWA-MainePrairie MW-840** Source: SCWA RPE: 52.76 ft, NAVD88
Aquifer Zone: Tehama (general)



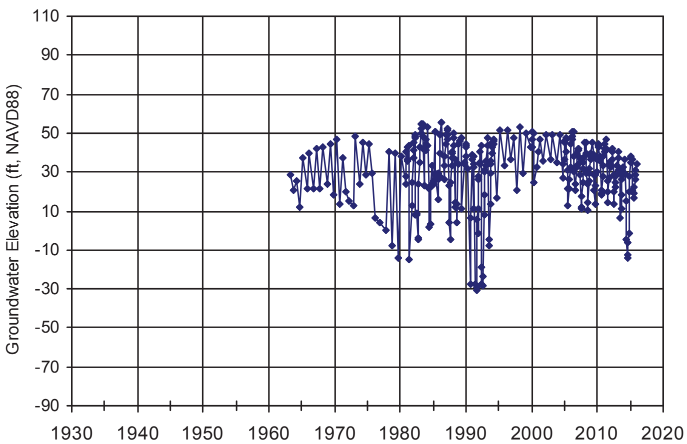
WellID: **SCWA-Meridian MW-400** Source: SCWA RPE: 77.27 ft, NAVD88
Aquifer Zone: Tehama (general)



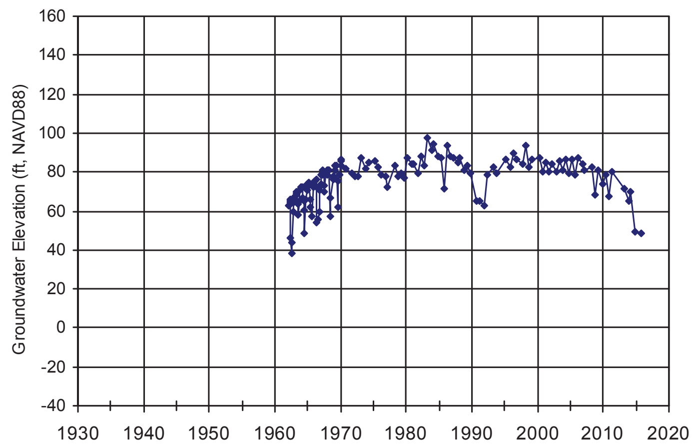
WellID: **SCWA-Meridian MW-825** Source: SCWA RPE: 77.19 ft, NAVD88
Aquifer Zone: Tehama (general)



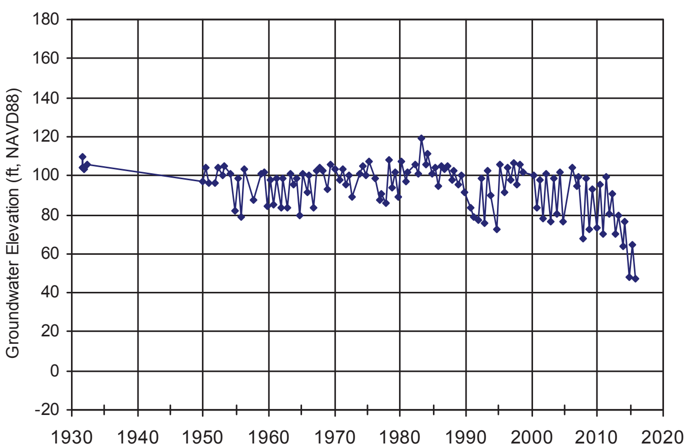
WellID: **07N01E33A001M** Source: DWR RPE: 70.58 ft, NAVD88
Aquifer Zone: Tehama (general)



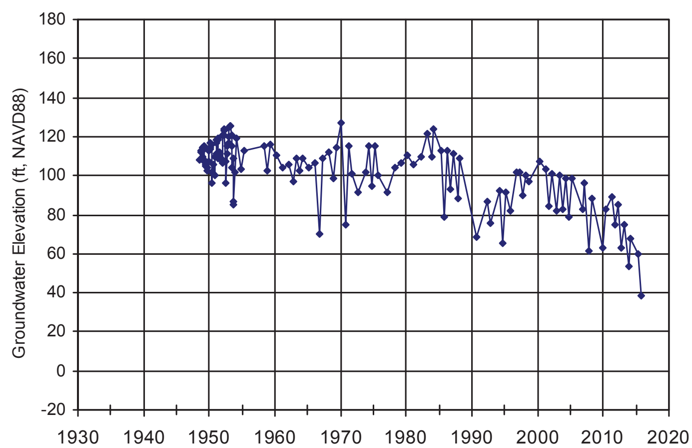
WellID: **07N01W01E003M** Source: DWR RPE: 108.3 ft, NAVD88
Aquifer Zone: Tehama (general)



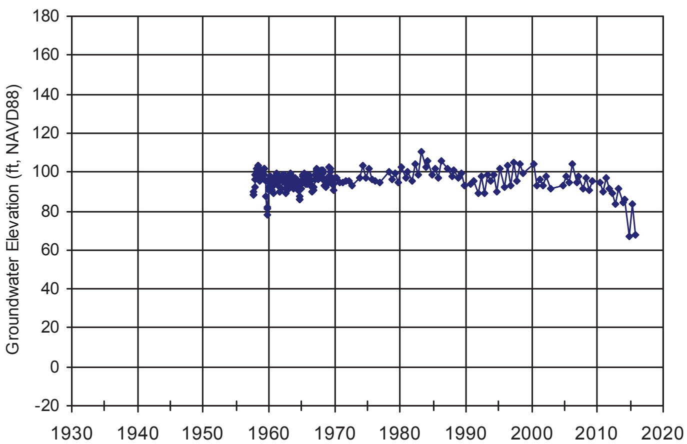
WellID: **07N01W04C002M** Source: DWR RPE: 148.4 ft, NAVD88
Aquifer Zone: Tehama (general)



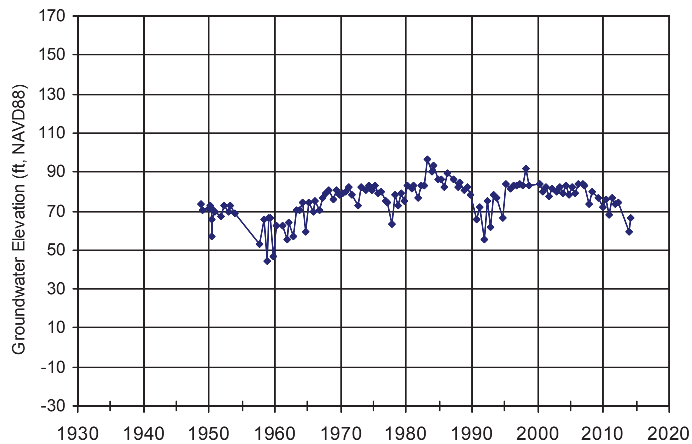
WellID: **07N01W05R001M** Source: DWR RPE: 173.1 ft, NAVD88
Aquifer Zone: Tehama (general)



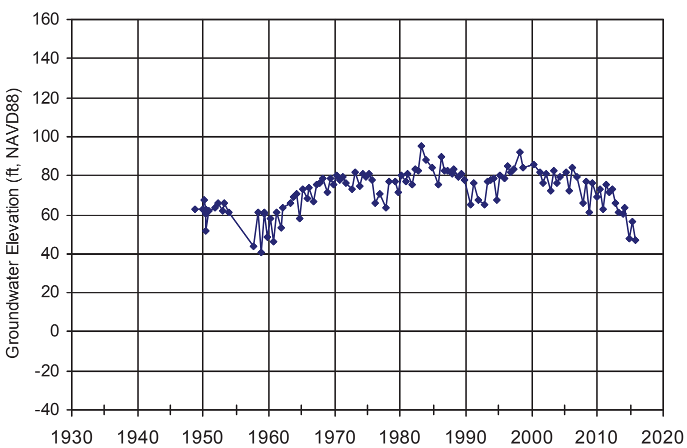
WellID: **08N01W33A001M** Source: DWR RPE: 137.8 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium



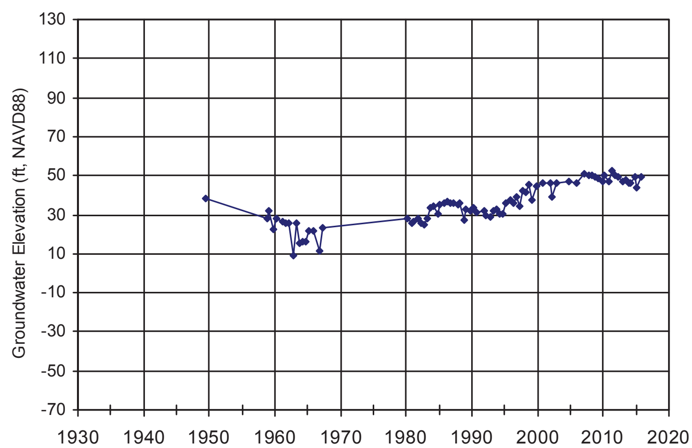
WellID: **08N01W35G002M** Source: DWR RPE: 114.09 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium



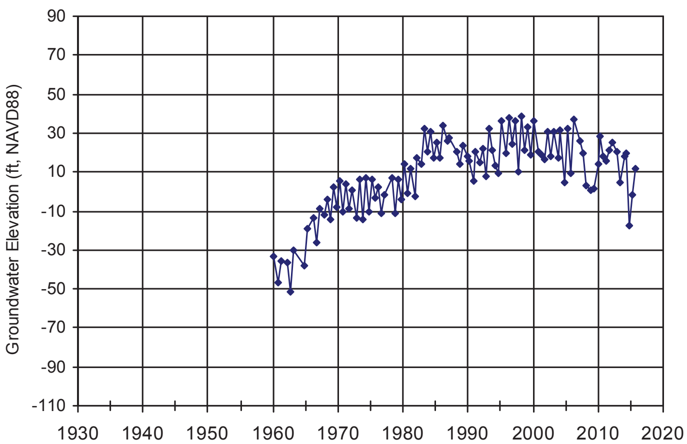
WellID: **08N01W36H001M** Source: DWR RPE: 106.59 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium



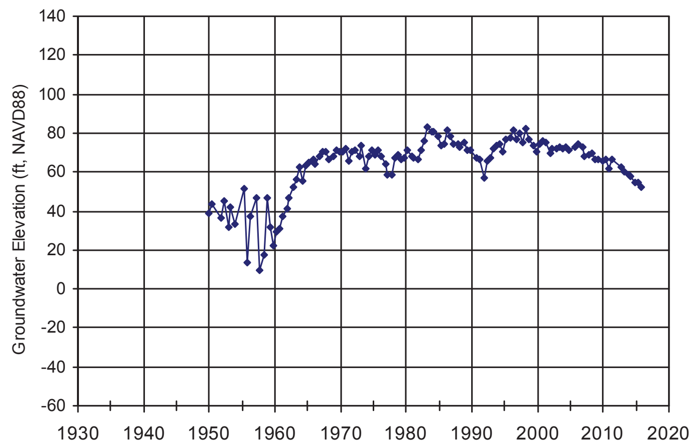
WellID: **04N01E02G001M** Source: DWR RPE: 73.52 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



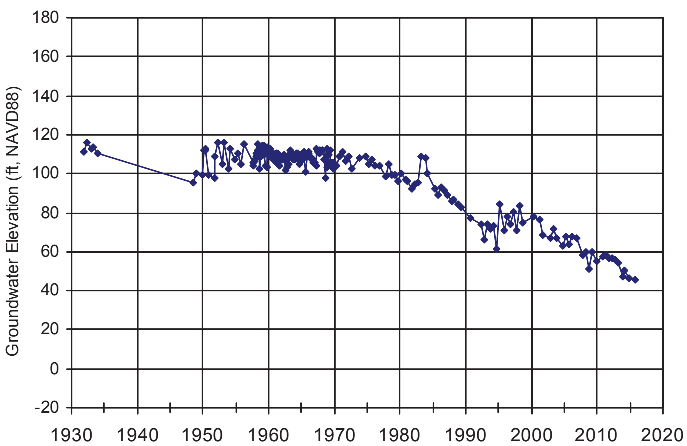
WellID: **06N01E12M003M** Source: DWR RPE: 42.55 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



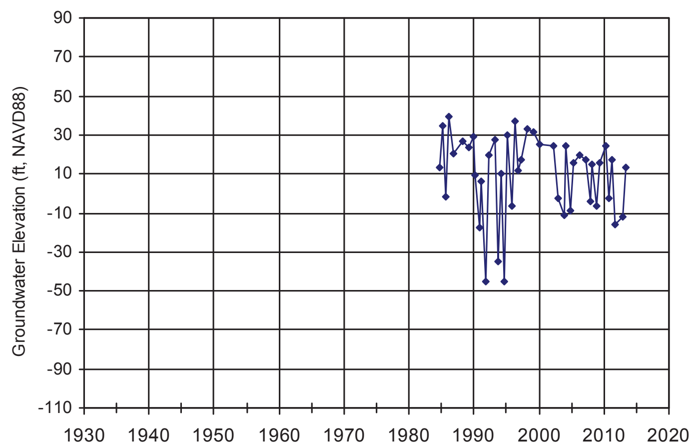
WellID: **07N01E04P003M** Source: DWR RPE: 92.6 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



WellID: **07N01W06E001M** Source: DWR RPE: 160.15 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)

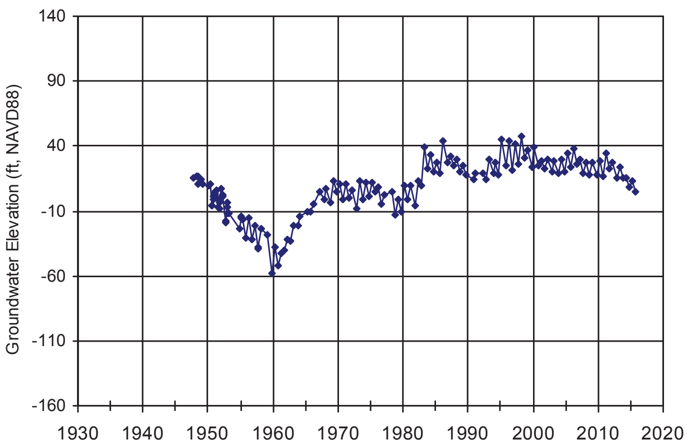


WellID: **07N02E06N003M** Source: DWR RPE: 63.05 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



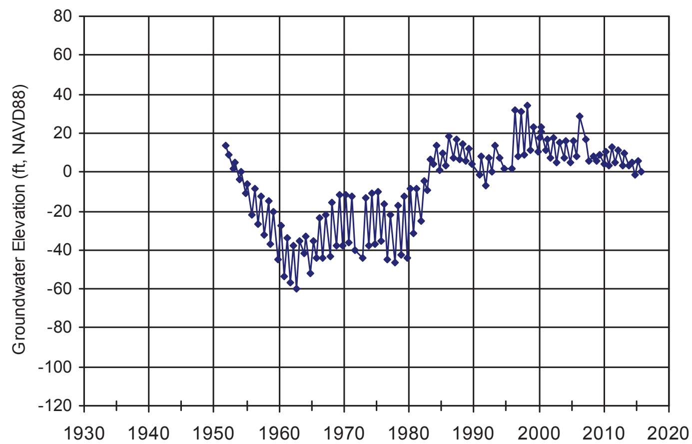
WellID: **07N02E19E001M** Source: DWR RPE: 53.26 ft, NAVD88

Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



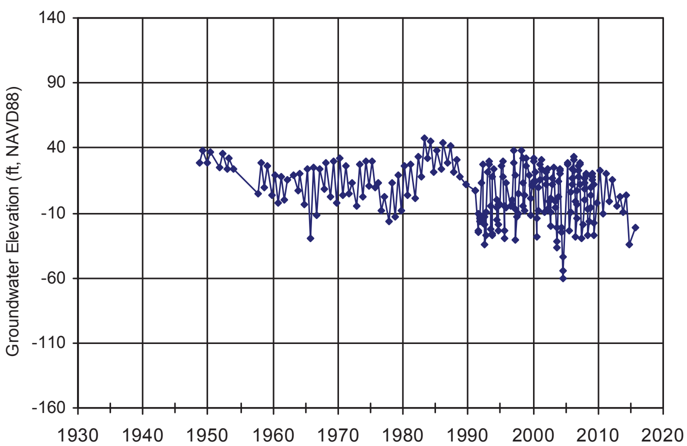
WellID: **07N02E33D002M** Source: DWR RPE: 36.04 ft, NAVD88

Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



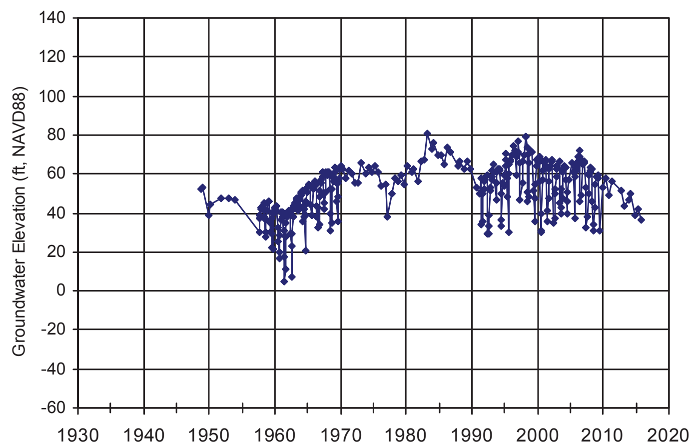
WellID: **08N01E24Q001M** Source: DWR RPE: 71 ft, NAVD88

Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)

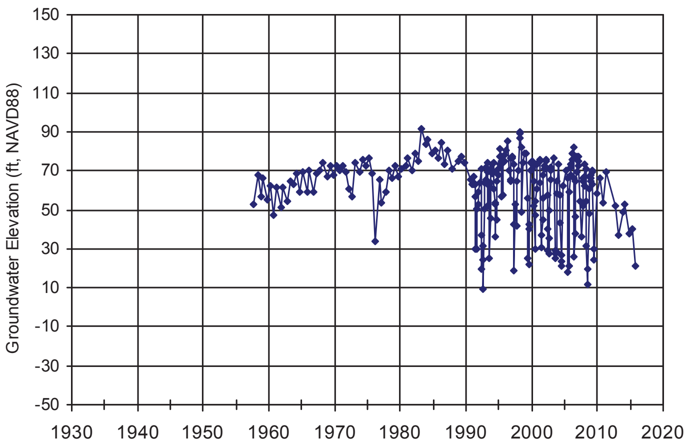


WellID: **08N01E28G001M** Source: DWR RPE: 96.1 ft, NAVD88

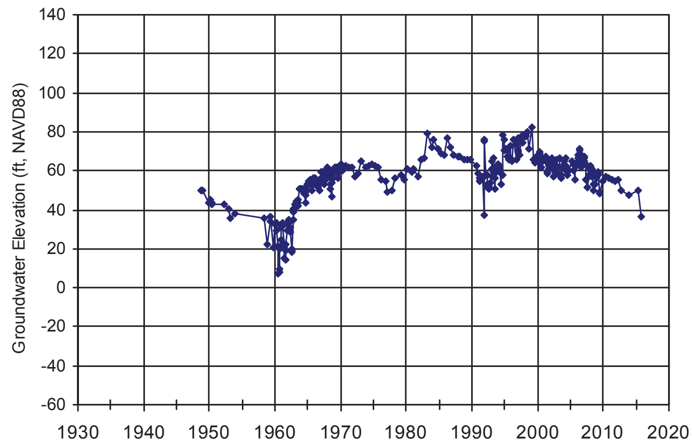
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



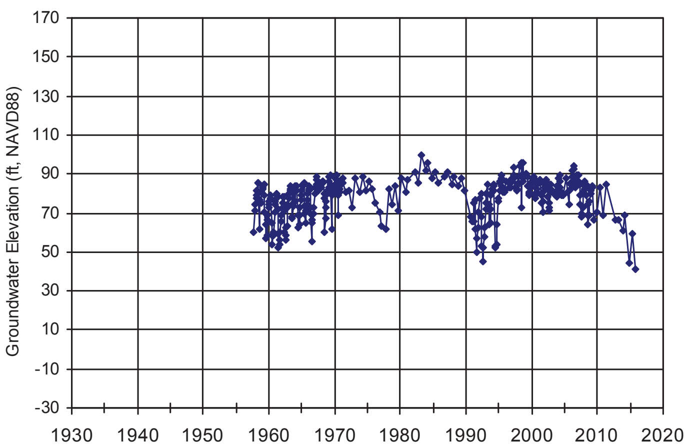
WellID: **08N01E30G002M** Source: DWR RPE: 112.8 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



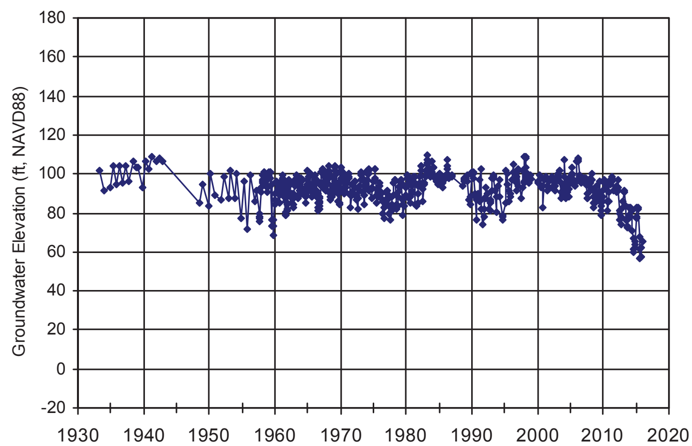
WellID: **08N01E33H001M** Source: DWR RPE: 84.57 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



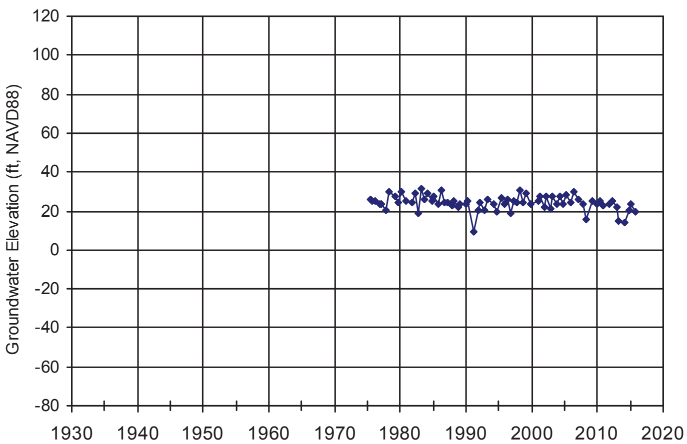
WellID: **08N01W26D005M** Source: DWR RPE: 129.2 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



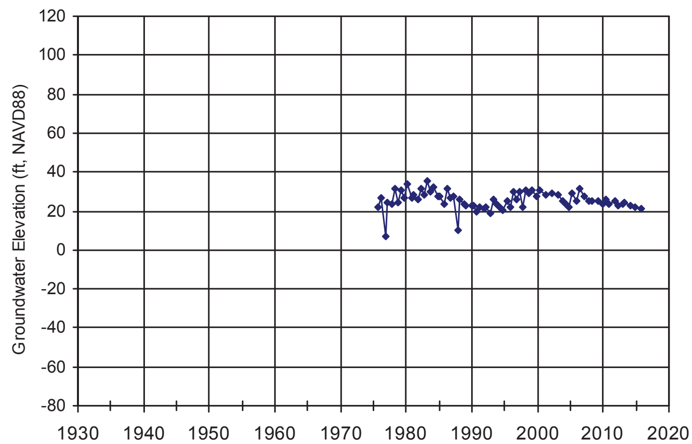
WellID: **08N01W28J001M** Source: DWR RPE: 141.61 ft, NAVD88
Aquifer Zone: Tehama (general, primary) & Quaternary Alluvium (possible)



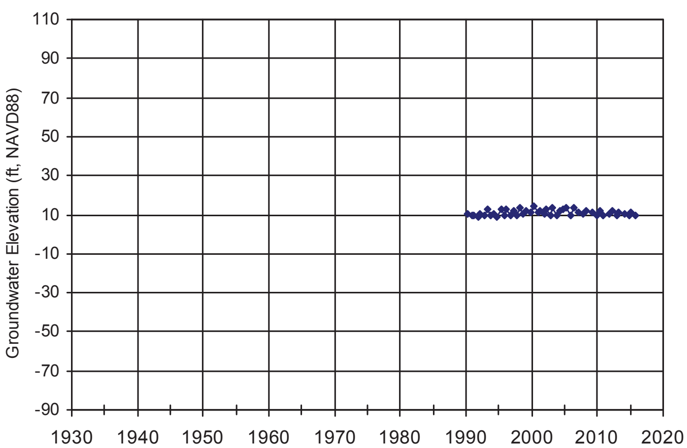
WellID: **04N01E17Q002M** Source: DWR RPE: 41.53 ft, NAVD88
Aquifer Zone: Unknown



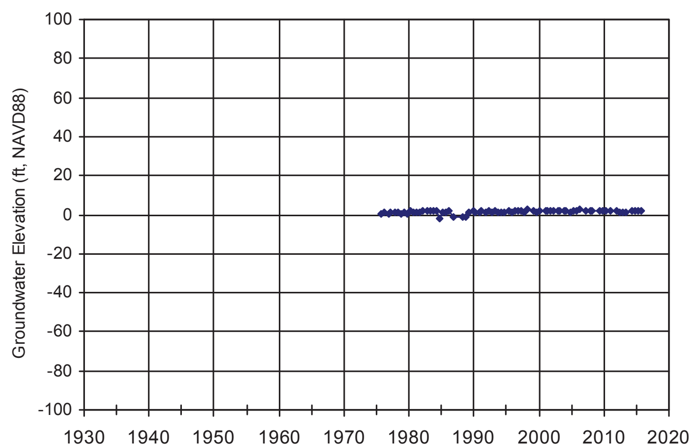
WellID: **04N01E20F001M** Source: DWR RPE: 46.83 ft, NAVD88
Aquifer Zone: Unknown



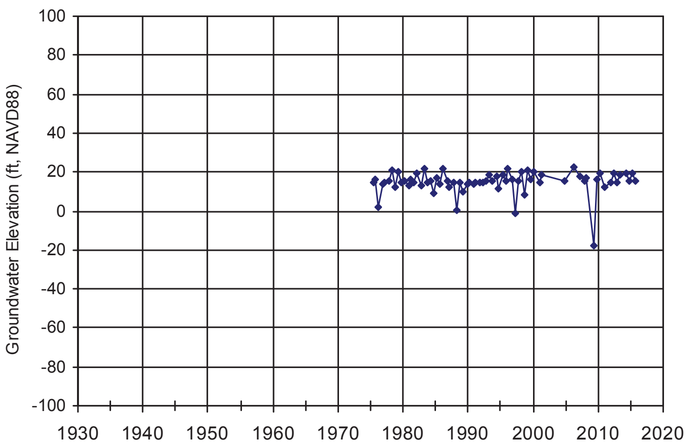
WellID: **04N01W03J001M** Source: DWR RPE: 22.56 ft, NAVD88
Aquifer Zone: Unknown



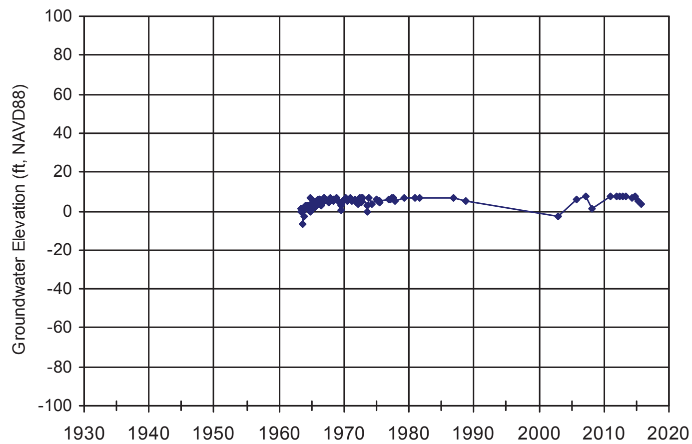
WellID: **04N01W32G001M** Source: DWR RPE: 3.94 ft, NAVD88
Aquifer Zone: Unknown



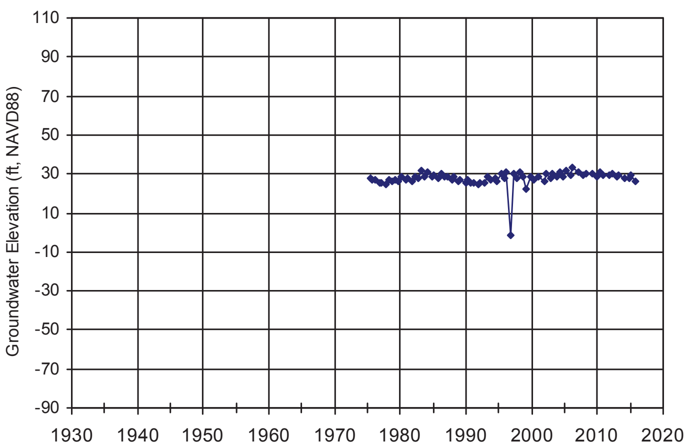
WellID: **04N02W05L007M** Source: DWR RPE: 23.6 ft, NAVD88
Aquifer Zone: Unknown



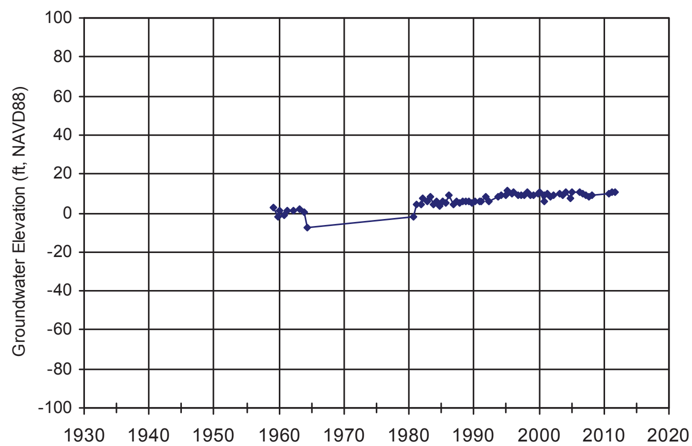
WellID: **04N02W09H001M** Source: DWR RPE: 7.19 ft, NAVD88
Aquifer Zone: Unknown



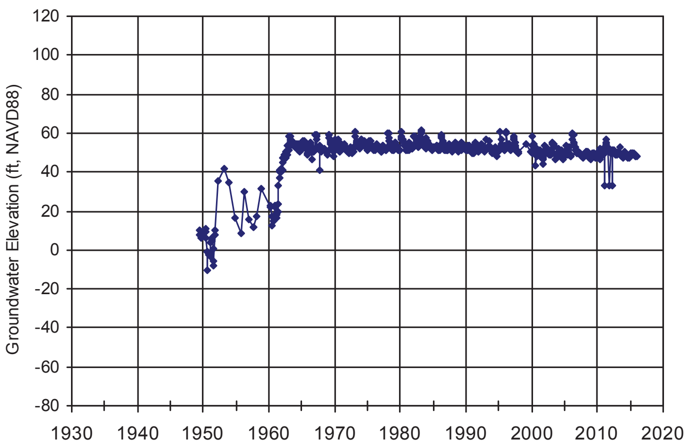
WellID: **04N03W12G001M** Source: DWR RPE: 46.39 ft, NAVD88
Aquifer Zone: Unknown



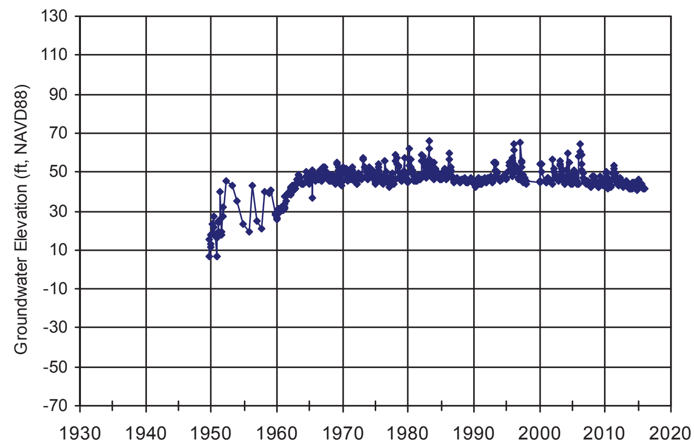
WellID: **05N02E07R002M** Source: DWR RPE: 18.5 ft, NAVD88
Aquifer Zone: Unknown



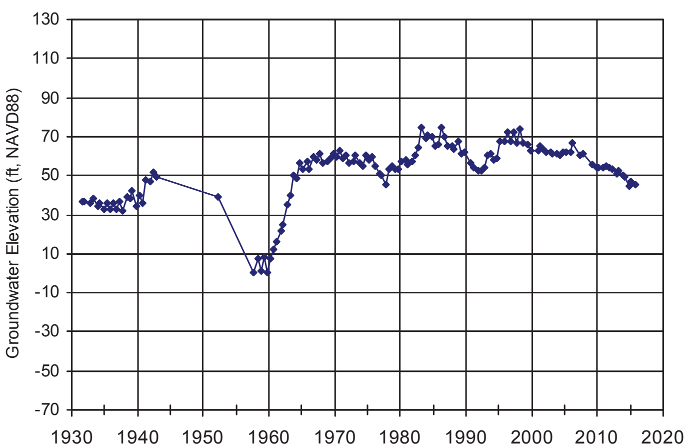
WellID: **05N02W21P003M** Source: DWR RPE: 63.32 ft, NAVD88
Aquifer Zone: Unknown



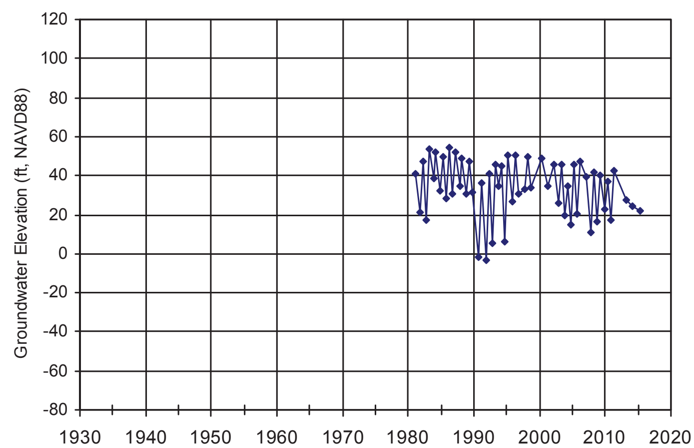
WellID: **05N02W30J001M** Source: DWR RPE: 68.02 ft, NAVD88
Aquifer Zone: Unknown



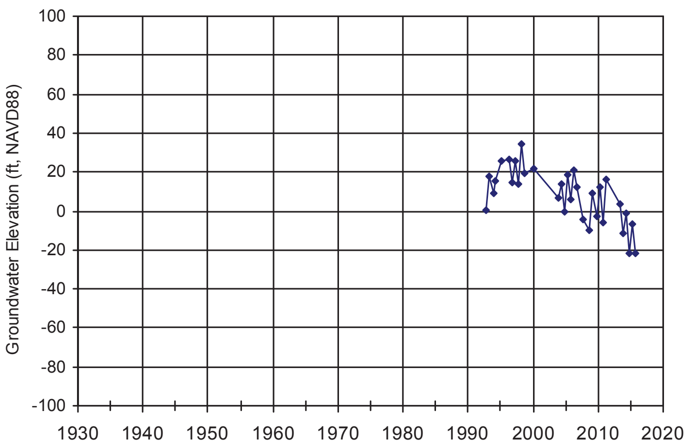
WellID: **07N01E10E001M** Source: DWR RPE: 81.58 ft, NAVD88
Aquifer Zone: Unknown



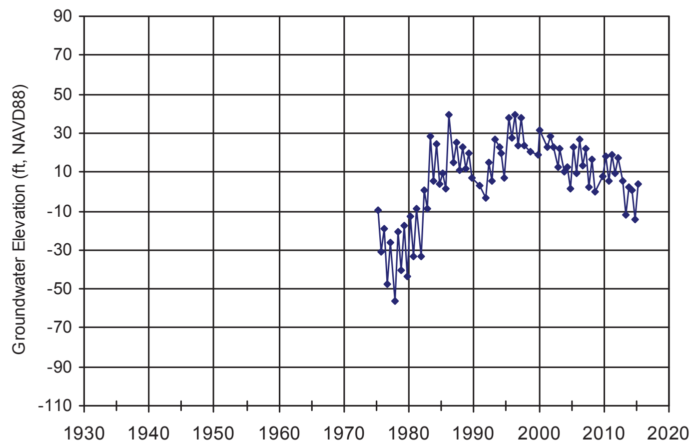
WellID: **07N01E27M004M** Source: DWR RPE: 68.6 ft, NAVD88
Aquifer Zone: Unknown



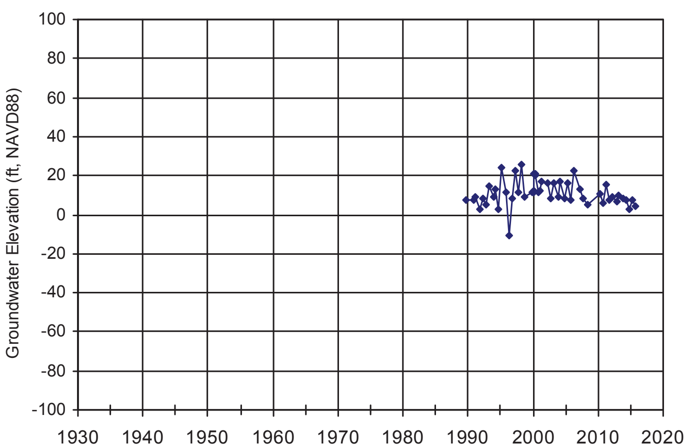
WellID: **07N02E04M004M** Source: DWR RPE: 53.5 ft, NAVD88
Aquifer Zone: Unknown



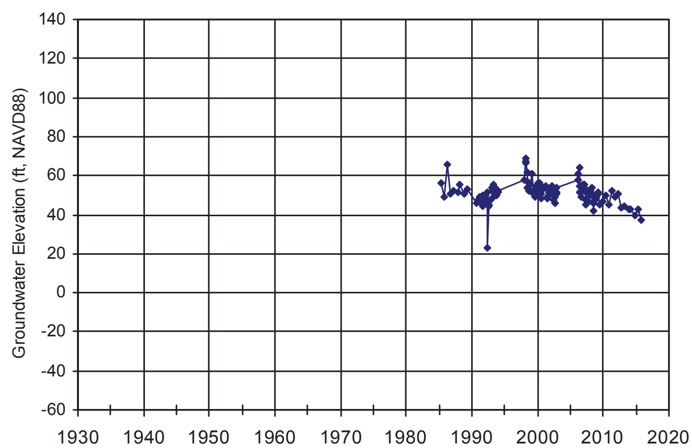
WellID: **07N02E21F003M** Source: DWR RPE: 48.64 ft, NAVD88
Aquifer Zone: Unknown



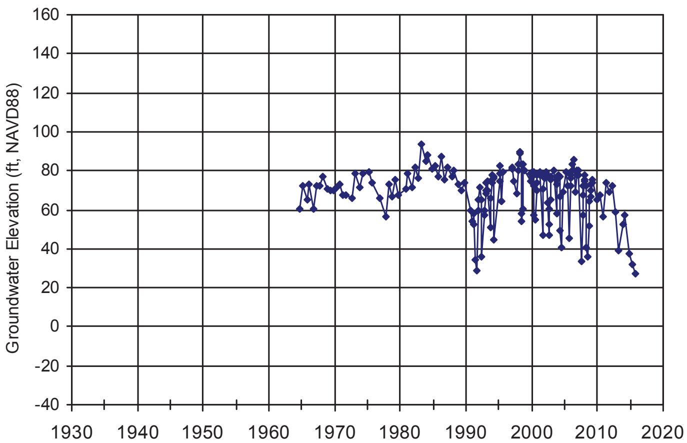
WellID: **07N02E26Q003M** Source: DWR RPE: 31.32 ft, NAVD88
Aquifer Zone: Unknown



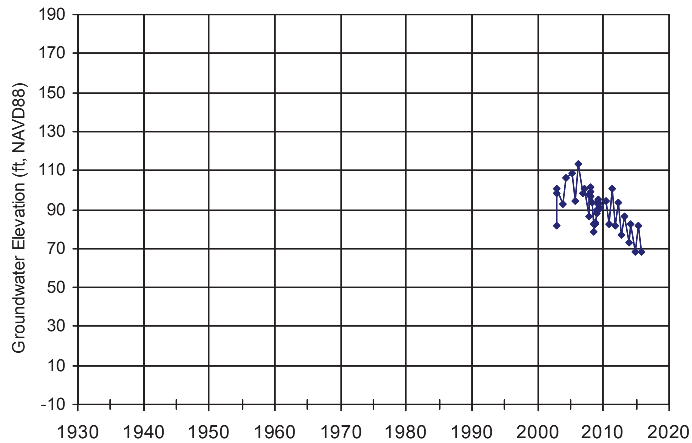
WellID: **08N01E15P002M** Source: DWR RPE: 89.57 ft, NAVD88
Aquifer Zone: Unknown



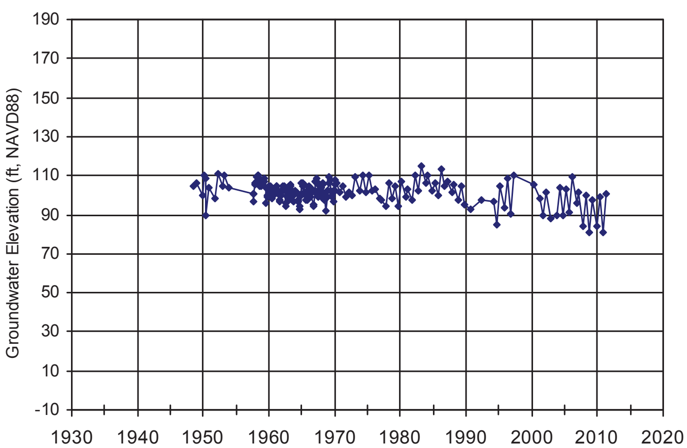
WellID: **08N01W25A002M** Source: DWR RPE: 117.08 ft, NAVD88
Aquifer Zone: Unknown



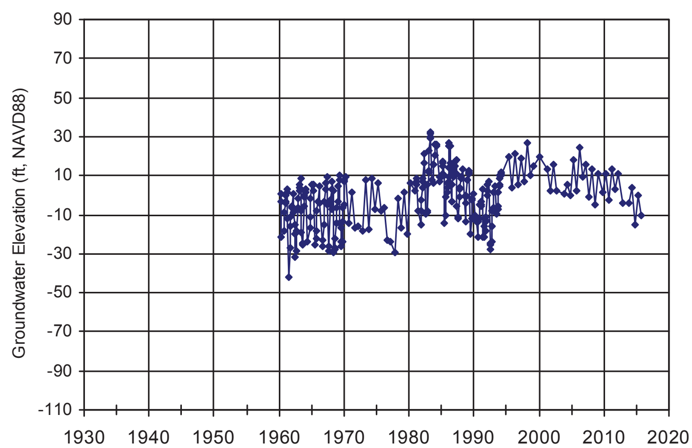
WellID: **08N01W32E002M** Source: DWR RPE: 150.1 ft, NAVD88
Aquifer Zone: Unknown



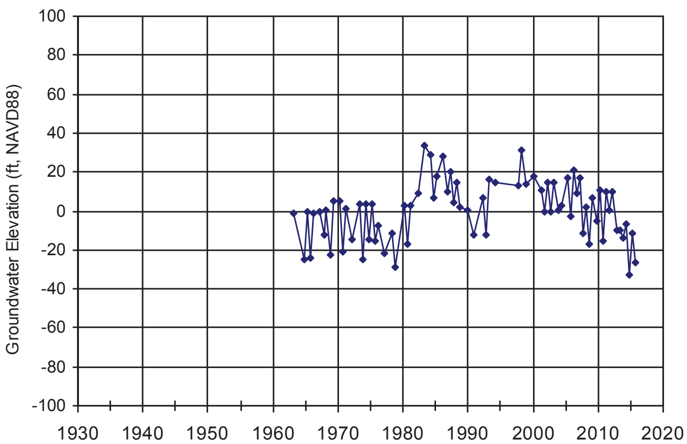
WellID: **08N01W32H001M** Source: DWR RPE: 144.1 ft, NAVD88
Aquifer Zone: Unknown



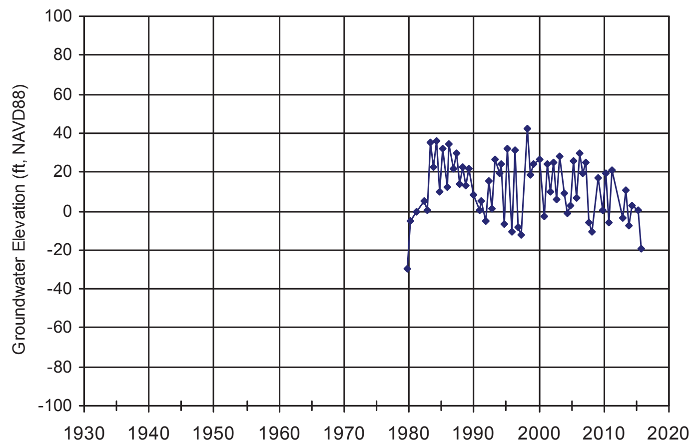
WellID: **08N02E24N001M** Source: DWR RPE: 41 ft, NAVD88
Aquifer Zone: Unknown



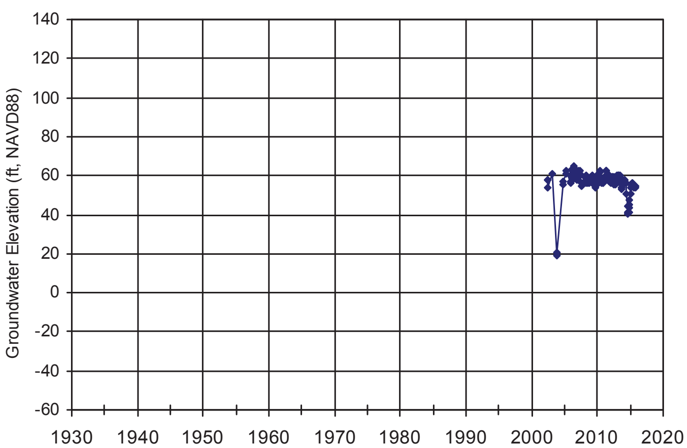
WellID: **08N02E27Q002M** Source: DWR RPE: 48.5 ft, NAVD88
Aquifer Zone: Unknown



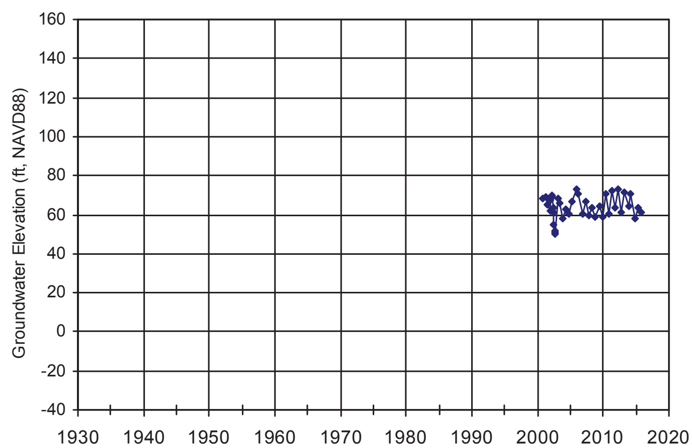
WellID: **08N02E32R001M** Source: DWR RPE: 59.5 ft, NAVD88
Aquifer Zone: Unknown



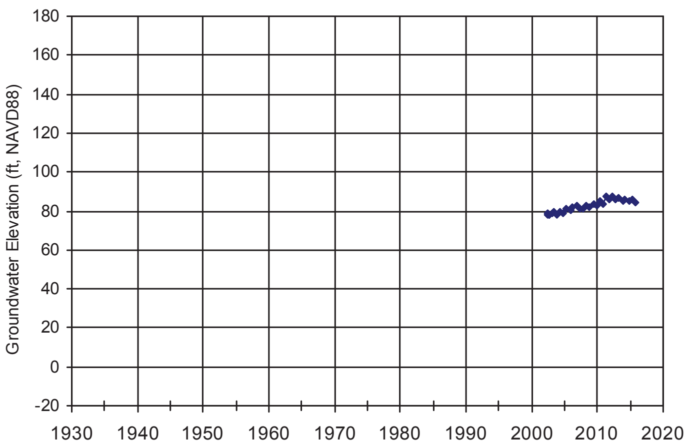
WellID: **DeMello** Source: CofV RPE: 82.45 ft, NAVD88
Aquifer Zone: Upper Tehama



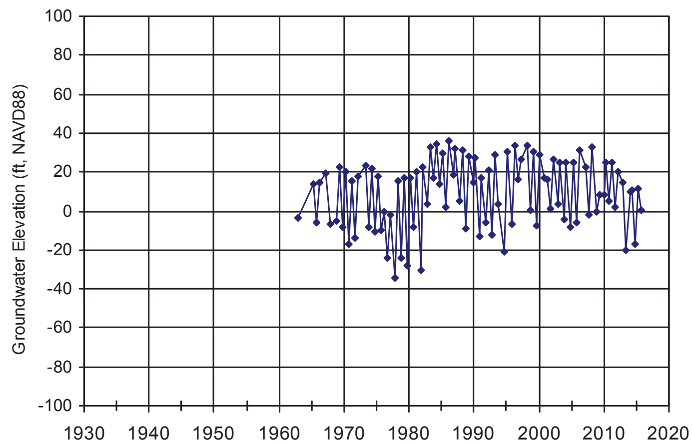
WellID: **MW-15-508ft** Source: CofV RPE: 95.39 ft, NAVD88
Aquifer Zone: Upper Tehama



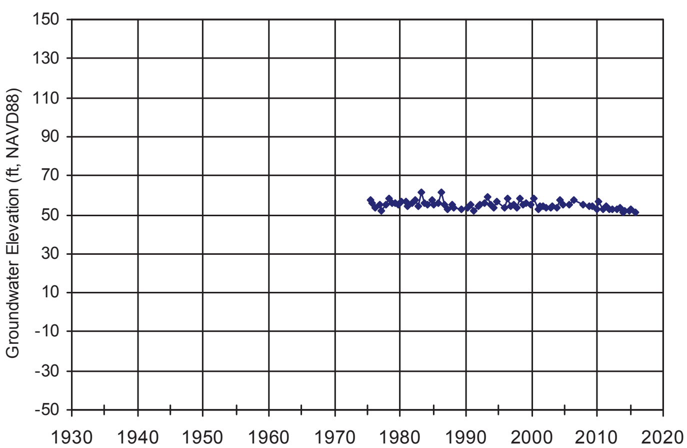
WellID: **MW-16-117ft** Source: CofV RPE: 103.3 ft, NAVD88
Aquifer Zone: Upper Tehama



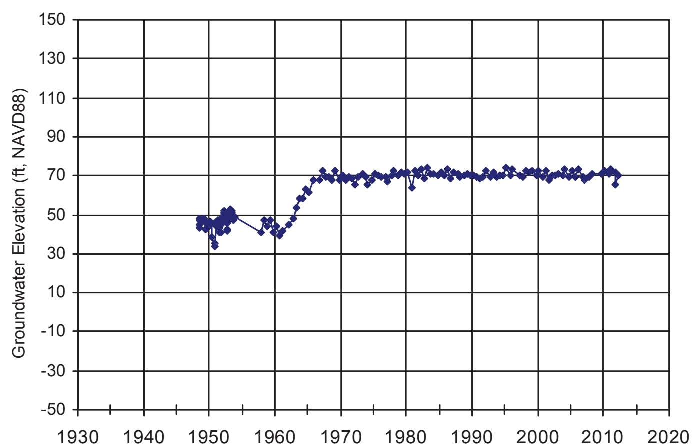
WellID: **06N01E02B001M** Source: DWR RPE: 49.57 ft, NAVD88
Aquifer Zone: Upper Tehama



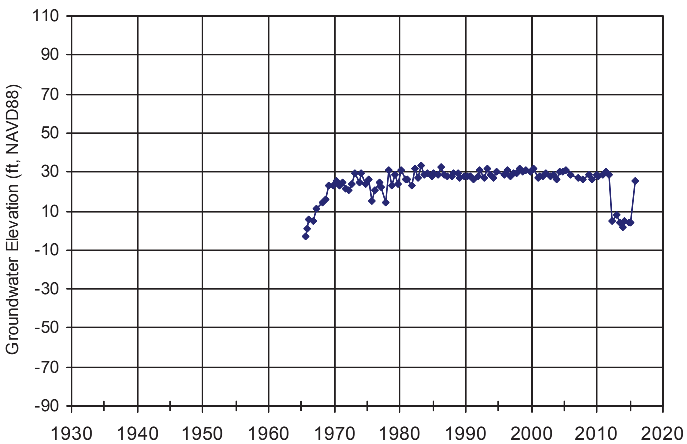
WellID: **06N01E05A001M** Source: DWR RPE: 65.18 ft, NAVD88
Aquifer Zone: Upper Tehama



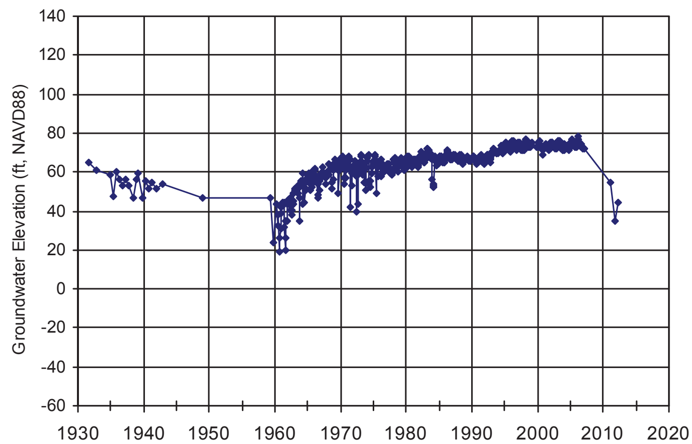
WellID: **06N01E18N001M** Source: DWR RPE: 75.57 ft, NAVD88
Aquifer Zone: Upper Tehama



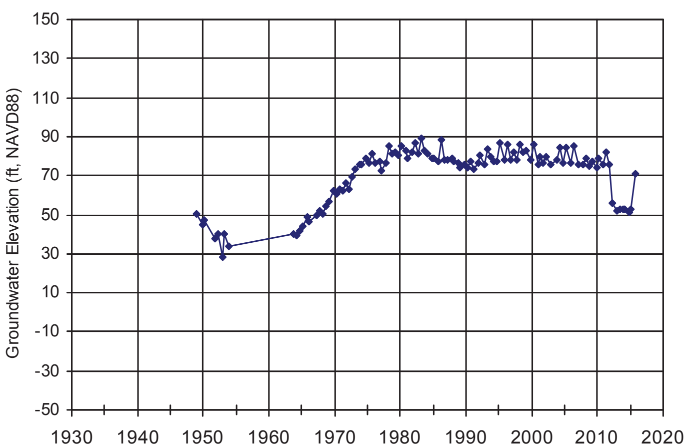
WellID: **06N01E24L003M** Source: DWR RPE: 35.04 ft, NAVD88
Aquifer Zone: Upper Tehama



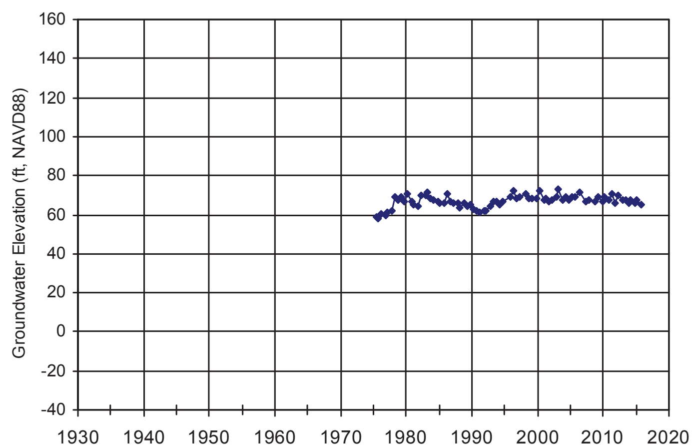
WellID: **06N01W01B001M** Source: DWR RPE: 84.59 ft, NAVD88
Aquifer Zone: Upper Tehama



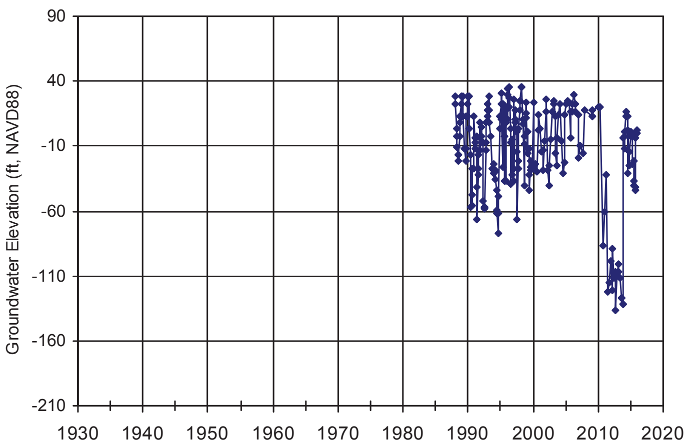
WellID: **06N01W24N001M** Source: DWR RPE: 91.07 ft, NAVD88
Aquifer Zone: Upper Tehama



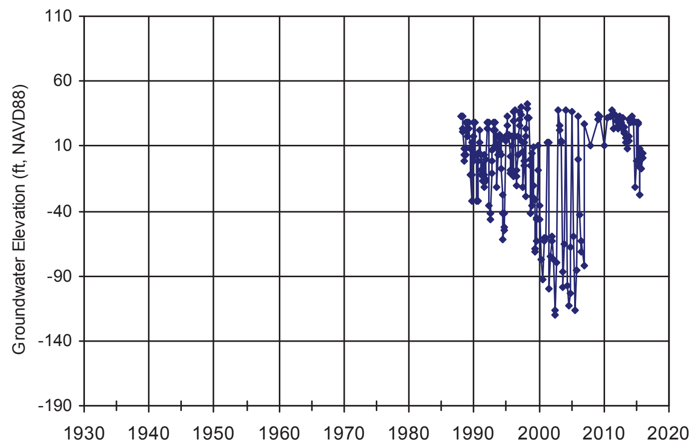
WellID: **06N01W36C004M** Source: DWR RPE: 82.86 ft, NAVD88
Aquifer Zone: Upper Tehama



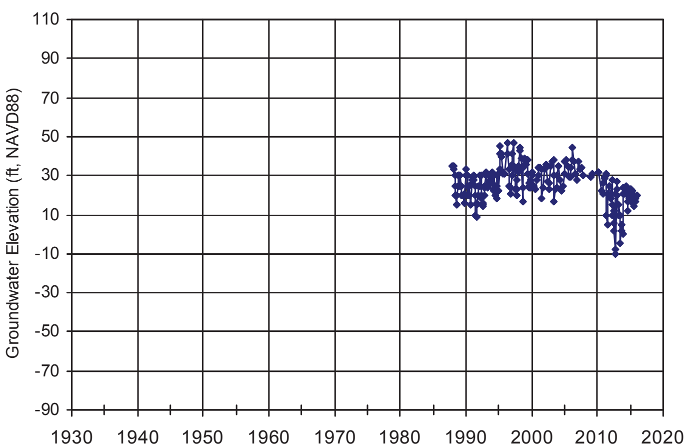
WellID: **07N01E13M001M** Source: CalWater RPE: 58 ft, NAVD88
Aquifer Zone: Upper Tehama



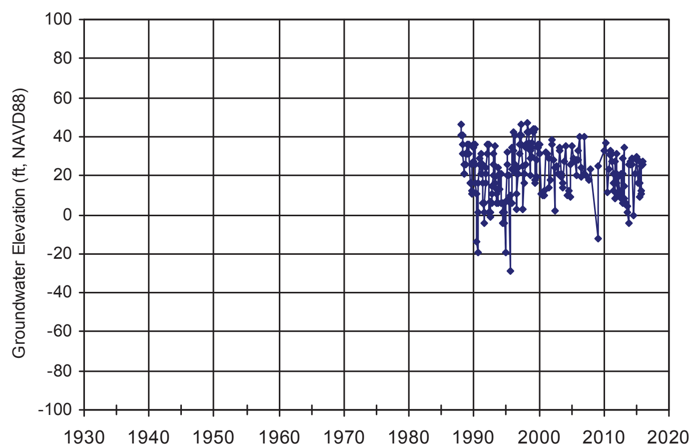
WellID: **07N01E14G002M** Source: CalWater RPE: 63 ft, NAVD88
Aquifer Zone: Upper Tehama



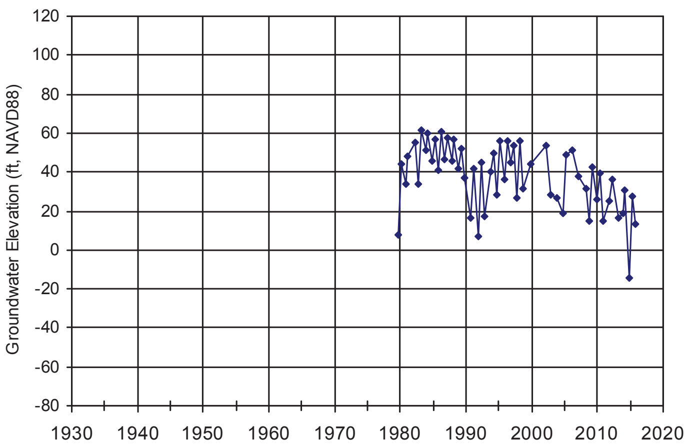
WellID: **07N01E14J001M** Source: CalWater RPE: 60 ft, NAVD88
Aquifer Zone: Upper Tehama



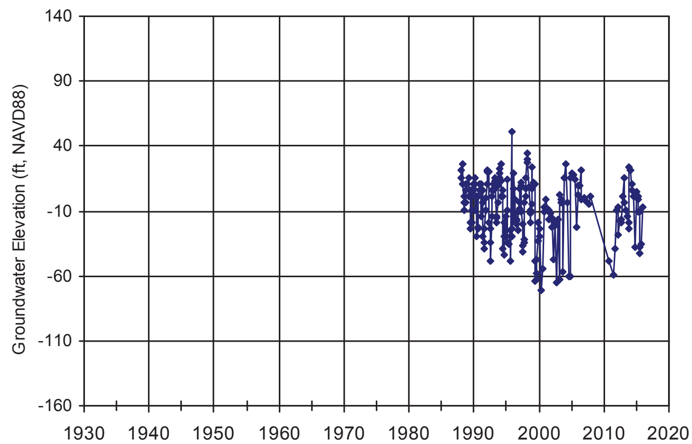
WellID: **07N01E14N003M** Source: CalWater RPE: 66 ft, NAVD88
Aquifer Zone: Upper Tehama



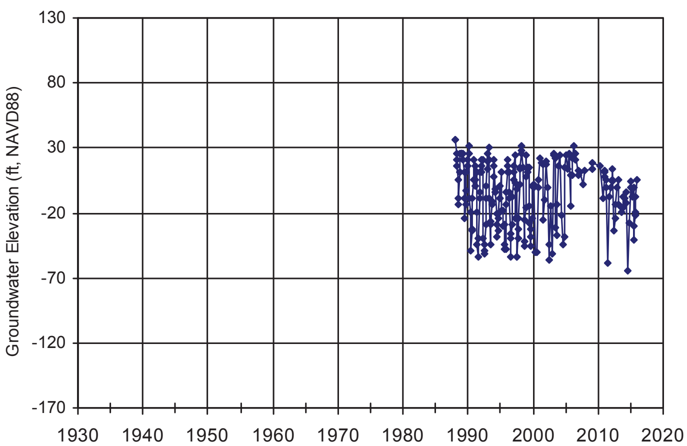
WellID: **07N01E21H003M** Source: DWR RPE: 73.58 ft, NAVD88
Aquifer Zone: Upper Tehama



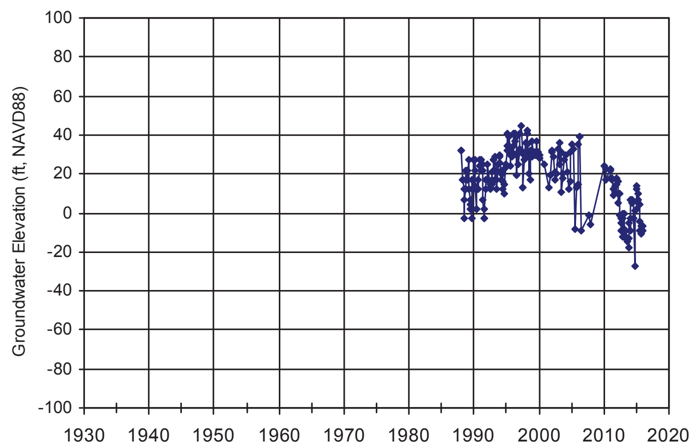
WellID: **07N01E23A004M** Source: CalWater RPE: 61 ft, NAVD88
Aquifer Zone: Upper Tehama



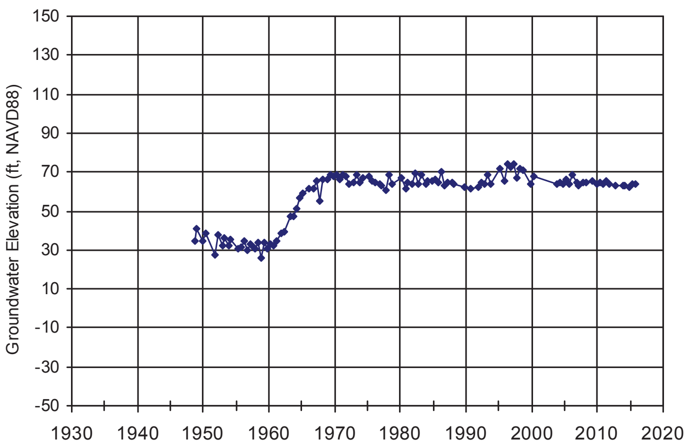
WellID: **07N01E23D002M** Source: CalWater RPE: 66 ft, NAVD88
Aquifer Zone: Upper Tehama



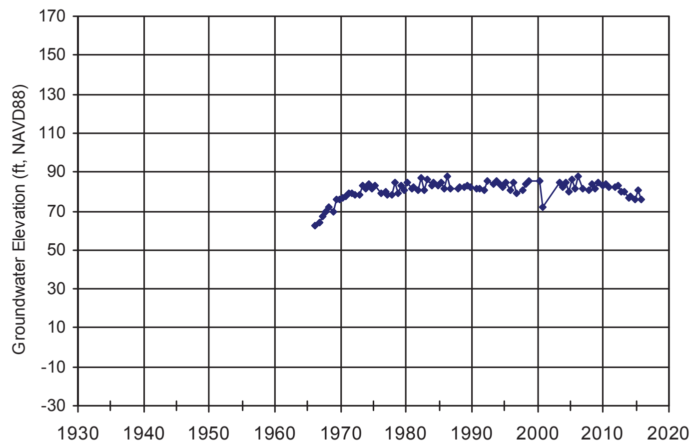
WellID: **07N01E24C002M** Source: CalWater RPE: 57 ft, NAVD88
Aquifer Zone: Upper Tehama



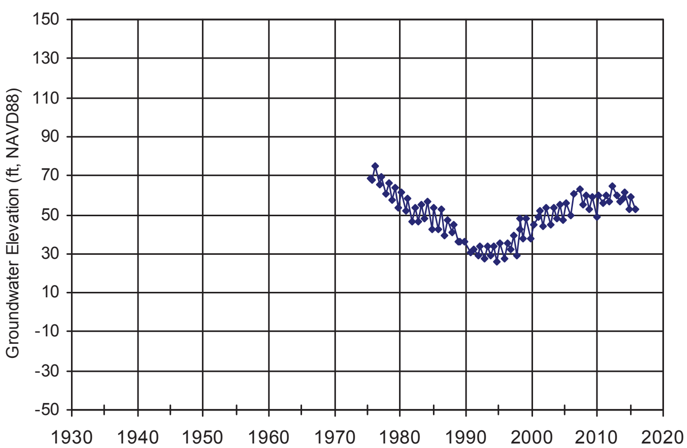
WellID: **07N01E29P001M** Source: DWR RPE: 76.59 ft, NAVD88
Aquifer Zone: Upper Tehama



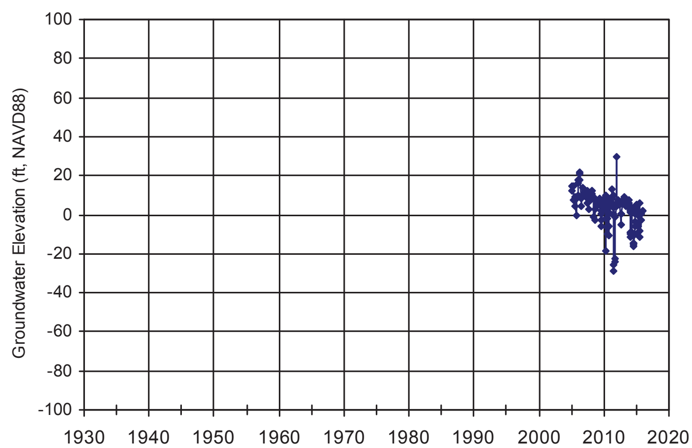
WellID: **07N01E30M001M** Source: DWR RPE: 90.59 ft, NAVD88
Aquifer Zone: Upper Tehama



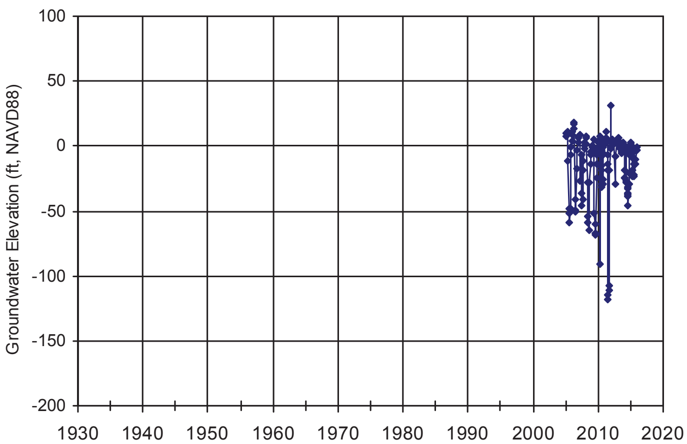
WellID: **07N01W33J002M** Source: DWR RPE: 133.12 ft, NAVD88
Aquifer Zone: Upper Tehama



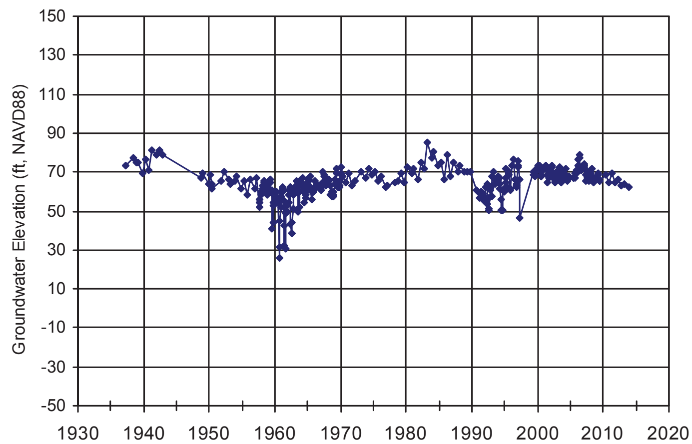
WellID: **07N02E35D002M** Source: DWR RPE: 34.29 ft, NAVD88
Aquifer Zone: Upper Tehama



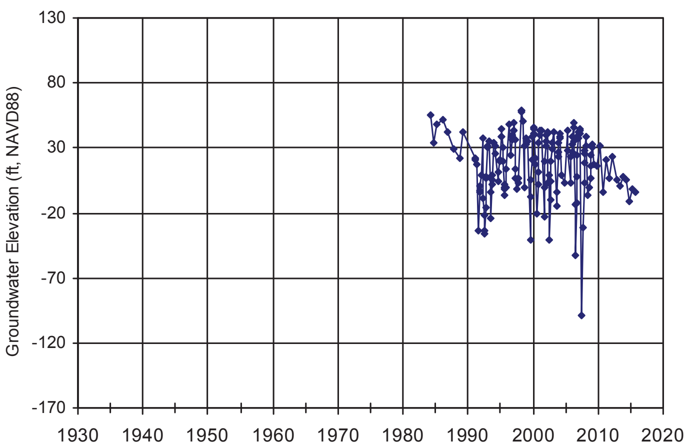
WellID: **07N02E35D003M** Source: DWR RPE: 35.15 ft, NAVD88
Aquifer Zone: Upper Tehama



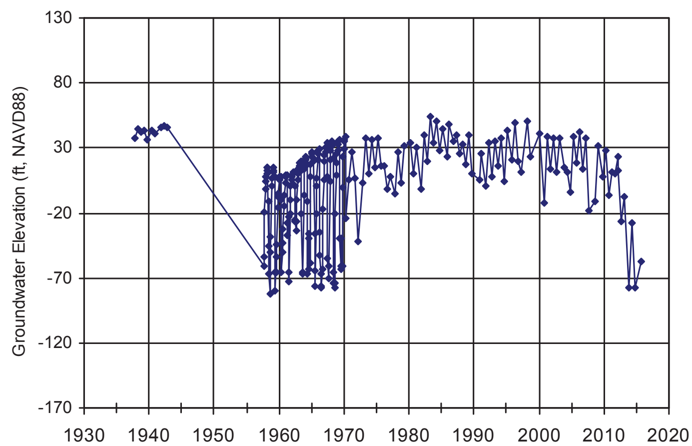
WellID: **08N01E19K001M** Source: DWR RPE: 107.08 ft, NAVD88
Aquifer Zone: Upper Tehama



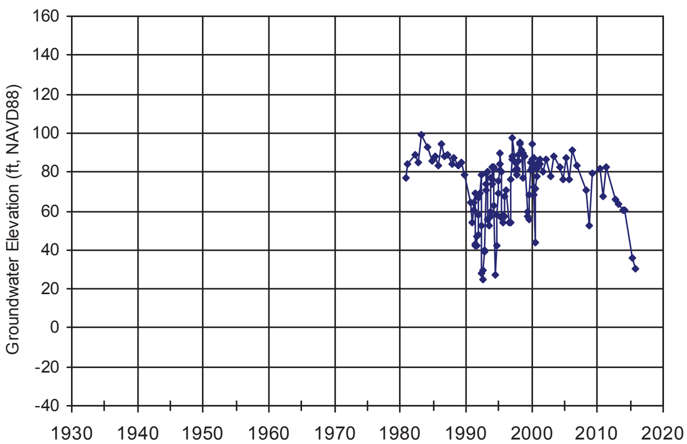
WellID: **08N01E25N001M** Source: DWR RPE: 75.55 ft, NAVD88
Aquifer Zone: Upper Tehama



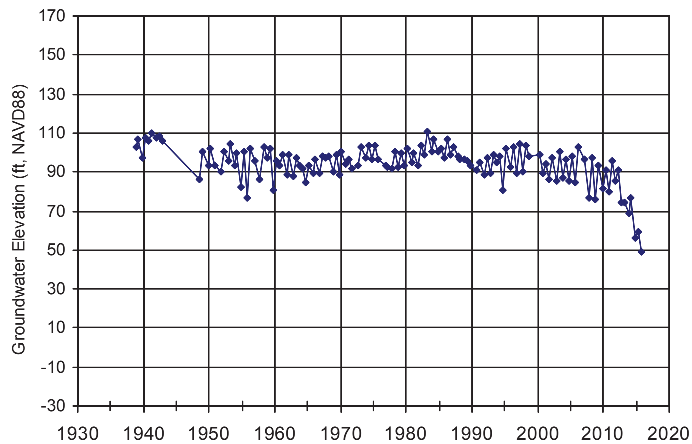
WellID: **08N01E35K001M** Source: DWR RPE: 72.3 ft, NAVD88
Aquifer Zone: Upper Tehama



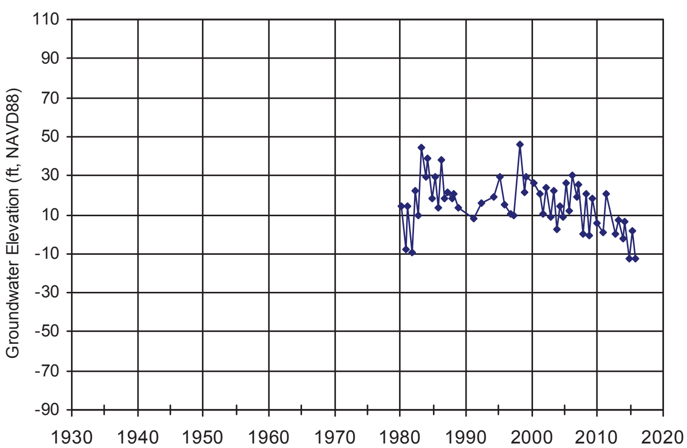
WellID: **08N01W24D001M** Source: DWR RPE: 120.6 ft, NAVD88
Aquifer Zone: Upper Tehama



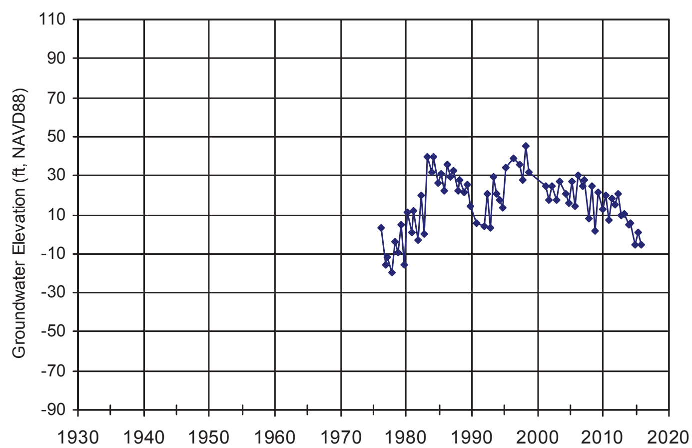
WellID: **08N01W33B002M** Source: DWR RPE: 139.1 ft, NAVD88
Aquifer Zone: Upper Tehama



WellID: **08N02E21L001M** Source: DWR RPE: 62.4 ft, NAVD88
Aquifer Zone: Upper Tehama

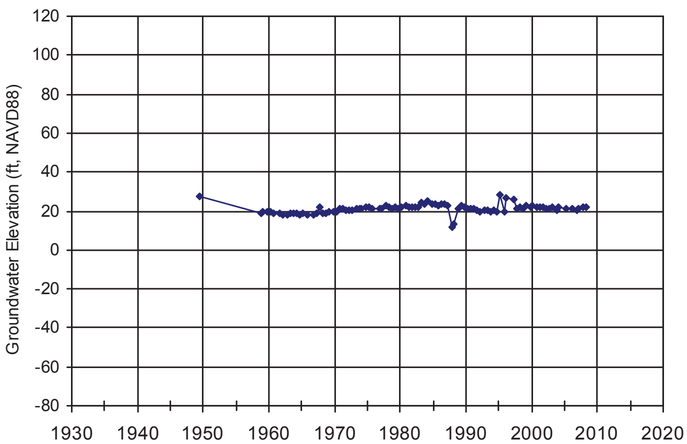


WellID: **08N02E32N001M** Source: DWR RPE: 60.55 ft, NAVD88
Aquifer Zone: Upper Tehama



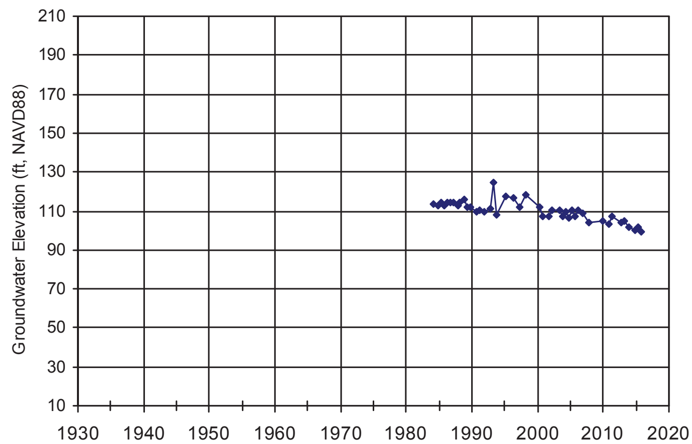
WellID: **04N02E09A001M** Source: DWR RPE: 41.67 ft, NAVD88

Aquifer Zone: Upper Tehama (possible)



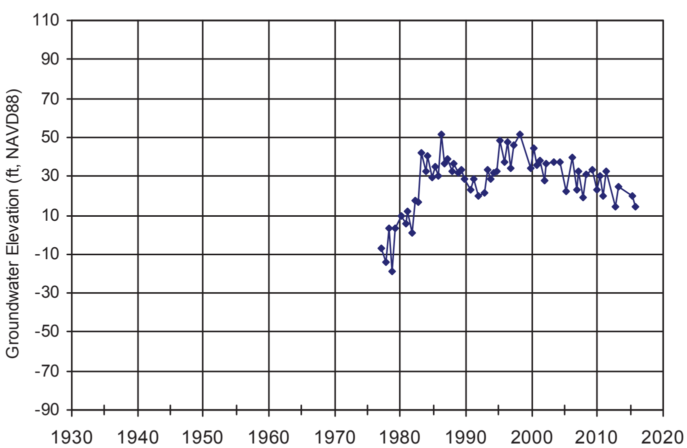
WellID: **07N01W15L001M** Source: DWR RPE: 133.1 ft, NAVD88

Aquifer Zone: Upper Tehama (possible)



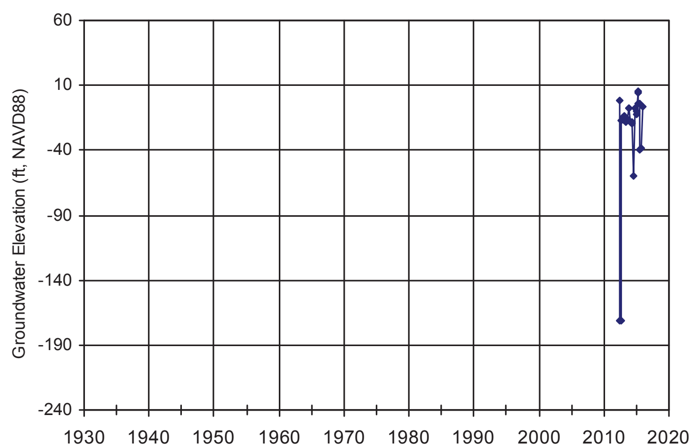
WellID: **07N02E17E002M** Source: DWR RPE: 54.6 ft, NAVD88

Aquifer Zone: Upper Tehama (possible)



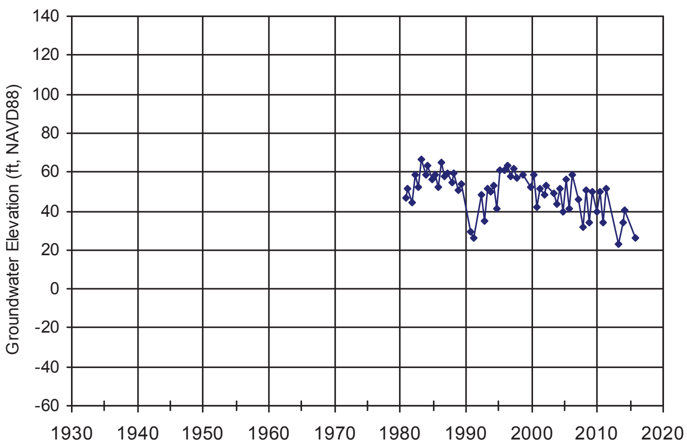
WellID: **07N01E14J002M** Source: CalWater RPE: 62 ft, NAVD88

Aquifer Zone: Upper Tehama (primary) & Middle Tehama



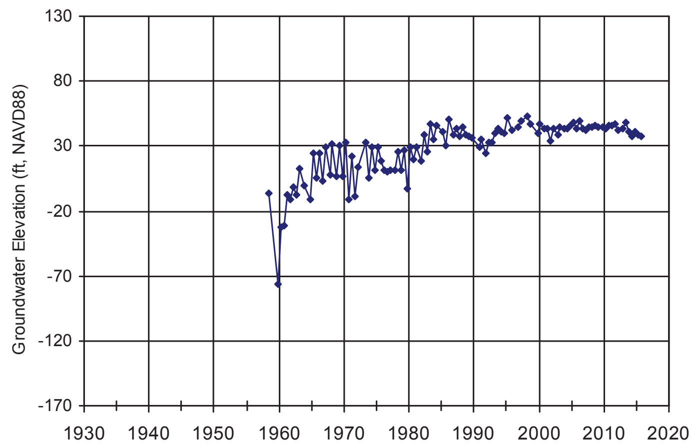
WellID: **07N01E16B002M** Source: DWR RPE: 77.6 ft, NAVD88

Aquifer Zone: Upper Tehama (primary) & Quaternary Alluvium



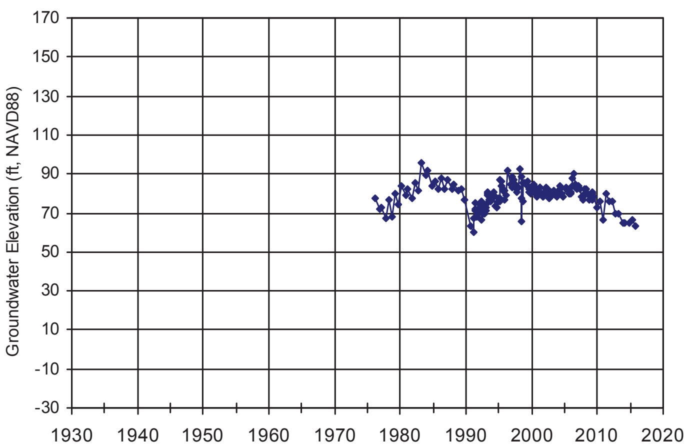
WellID: **07N01E26Q002M** Source: DWR RPE: 58.07 ft, NAVD88

Aquifer Zone: Upper Tehama (primary) & Quaternary Alluvium



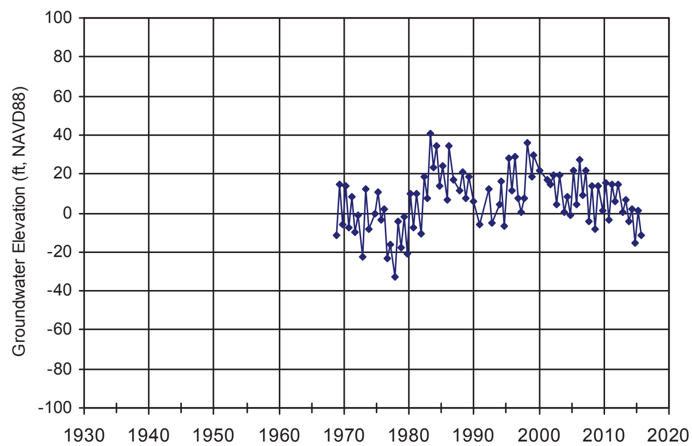
WellID: **08N01W26A002M** Source: DWR RPE: 124.59 ft, NAVD88

Aquifer Zone: Upper Tehama (primary) & Quaternary Alluvium



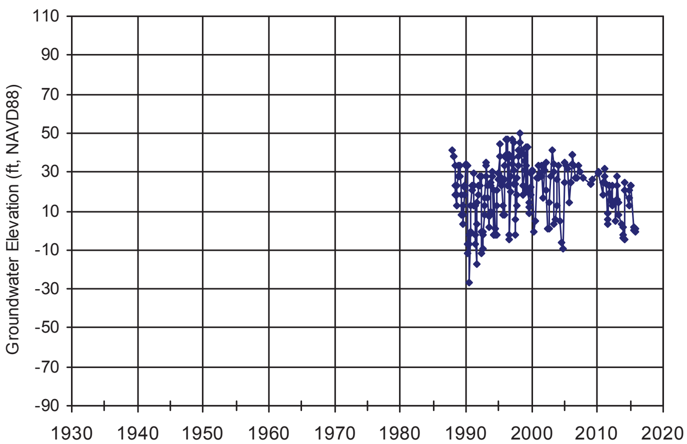
WellID: **08N02E27C002M** Source: DWR RPE: 54.5 ft, NAVD88

Aquifer Zone: Upper Tehama (primary) & Quaternary Alluvium



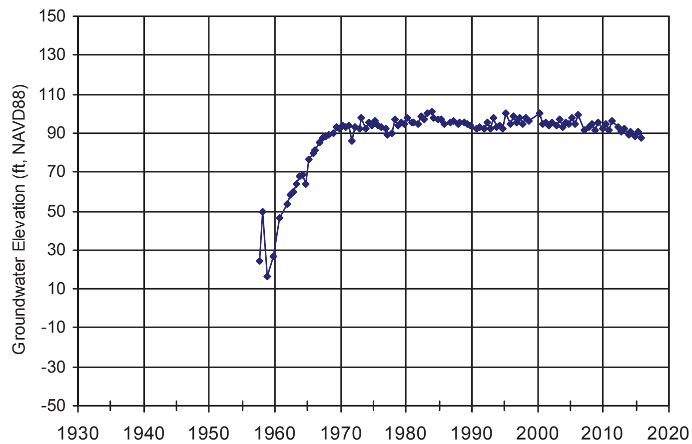
WellID: **07N01E23G002M** Source: CalWater RPE: 63 ft, NAVD88

Aquifer Zone: Upper Tehama (primary) & Quaternary Alluvium (possible)



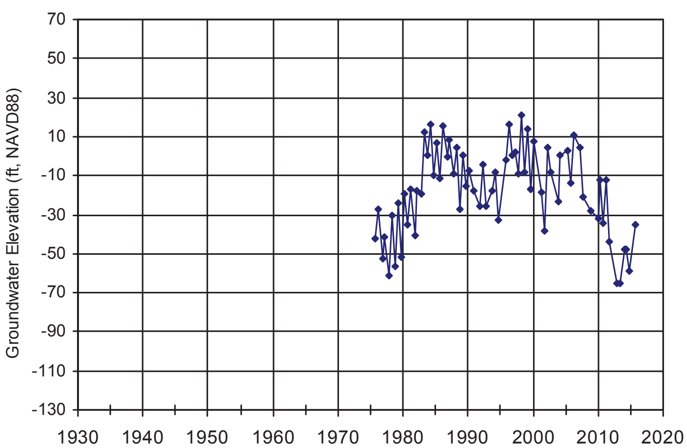
WellID: **07N01W13H001M** Source: DWR RPE: 108.6 ft, NAVD88

Aquifer Zone: Upper Tehama (primary) & Quaternary Alluvium (possible)



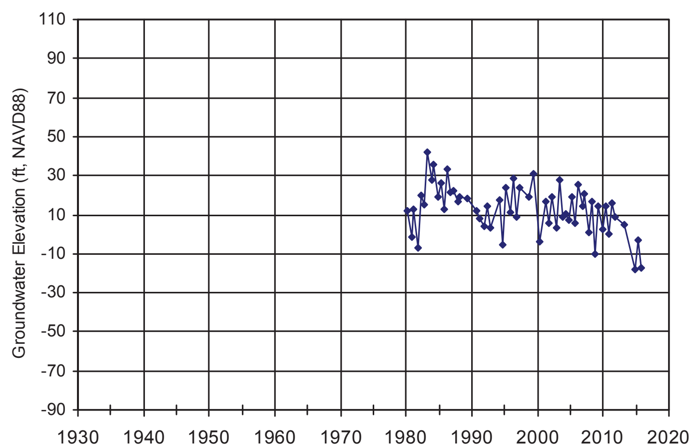
WellID: **07N02E02F002M** Source: DWR RPE: 36.04 ft, NAVD88

Aquifer Zone: Upper Tehama (primary) & Quaternary Alluvium (possible)



WellID: **08N02E20G001M** Source: DWR RPE: 62.05 ft, NAVD88

Aquifer Zone: Upper Tehama (primary) & Quaternary Alluvium (possible)



APPENDIX D

Appendix D Summary Table of Solano County Groundwater Quality-Select Constituents

			Total Dissolved Solids				Nitrate (as Nitrogen)				Arsenic				Chromium VI			
	Well ID	Zone[1]	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)
ALAMO BUNGALOWS	WELL 01	unknown	12/5/1994	1	660	660	12/05/1994	1	0.4	0	12/05/1994	1	<2	<2				
ALDEA INC	ALDEA WELL - INACTIVE	unknown	7/6/1989 - 8/9/2000	4	300 - 540	463	07/06/1989 - 02/05/2001	10	4.1 - 20	13	12/21/1995 - 08/09/2000	2	ND - 2	2				
BIRDS LANDING HUNTING PRESERVE	WELL 01	unknown	11/3/1999	1	640	640	05/12/1999 - 10/28/2015	15	ND - 18	3								
BUTTON TRANSPORTATION	WELL 01	unknown					04/13/1999 - 02/24/2012	28	2.9 - 68	9								
CADENASSO WINERY	WELL 01 - INACATIVE	unknown					09/22/1999	1	ND	ND								
CAL YEE FARMS	WELL 01	unknown	12/21/1995	1	490	490	12/21/1995 - 04/10/2002	7	5.4 - 14	8	12/21/1995	1	<2	<2				
CALIFORNIA WATER SERVICE CO. - DIXON	WELL 01-02 - INACTIVE	unknown	4/21/1987 - 8/5/1990	2	506 - 705	606	04/21/1987 - 08/05/1990	2	7.9 - 14	11	04/21/1987 - 08/05/1990	2	<5 - <10	<10				
	WELL 01-03	unknown	3/3/1994 - 2/11/2015	8	360 - 475	406	03/03/1994 - 11/03/2015	86	3.2 - 8.8	5	01/28/2002 - 02/09/2009	13	ND - 3	1.9	01/23/2001 - 11/03/2015	21	13 - 20	16
	WELL 02-01	unknown	4/20/1987 - 5/20/2014	11	462 - 613	519	04/20/1987 - 03/31/2015	300	3.4 - 12	8	11/12/2001 - 05/06/2008	15	ND - 3	2.2	07/15/2002 - 01/01/2015	9	22 - 25	23.6
	WELL 03-01	unknown	6/20/1988 - 12/26/2012	9	443 - 551	498	06/20/1988 - 12/16/2015	211	1.6 - 15	8	04/30/1991 - 04/07/2009	13	ND - 18	4	01/23/2001 - 12/30/2014	5	22 - 24	23
	WELL 04-01	unknown	6/20/1988 - 5/11/2015	10	410 - 1200	525	06/20/1988 - 05/11/2015	75	ND - 9.9	7	04/18/2000 - 08/19/2014	15	ND - 5.2	2.1	01/23/2001 - 06/11/2015	9	17 - 20	18.8
	WELL 05-01	unknown	6/20/1988 - 2/11/2015	10	333 - 460	369	06/20/1988 - 05/19/2015	308	2.1 - 11	6	06/06/2000 - 06/20/2006	14	ND - 2.3	2	01/23/2001 - 01/01/2015	11	14 - 23	19.5
	WELL 06-01	unknown	3/6/1989 - 11/20/2013	9	379 - 446	410	03/06/1989 - 06/08/2015	68	1.4 - 8.9	6	12/01/1998 - 06/08/2015	56	ND - 3	1.6	01/24/2001 - 06/11/2015	10	17 - 18	17.1
	WELL 07-01	unknown	3/6/1989 - 3/18/2013	9	248 - 349	311	03/06/1989 - 05/11/2015	54	1.4 - 5.5	3	03/03/1998 - 03/04/2010	14	ND - 3	2.6	01/24/2001 - 06/11/2015	12	16 - 20	17.7
	WELL 08-01	unknown	3/6/1989 - 3/20/2013	9	319 - 459	385	03/06/1989 - 03/31/2015	51	1.1 - 6.6	3	03/03/1998 - 03/20/2013	13	ND - 4	2.9	01/24/2001 - 04/07/2015	8	11 - 18	14.9
	WELL 09	unknown	10/4/2010 - 9/11/2013	2	320 - 360	340	10/04/2010 - 11/03/2015	18	0.9 - 3.5	3	10/04/2010 - 10/04/2010	2	ND - 3.4	3.4	10/04/2010 - 11/09/2015	15	ND - 24	20.9
CAMPBELL RANCH	WELL 01	unknown	7/13/2006	1	460	460	10/07/1998 - 12/23/2014	25	ND - 3.4	1	07/13/2006	1	ND	ND				
CAMPBELL SOUP SUPPLY CO - DIXON CANNING	DOMESTIC WELL	unknown	11/6/2003 - 6/7/2012	6	360 - 480	420	12/20/1999 - 09/03/2015	38	1.2 - 8.1	5	10/28/2004 - 06/11/2015	6	2.2 - 3.6	2.6	12/01/2014 - 11/19/2015	6	17 - 31	23.5
CITY OF DIXON	WELL 37	unknown	7/16/1990 - 4/4/2012	15	340 - 380	359	07/12/1989 - 06/26/2015	47	2.1 - 5.2	4	07/29/1998 - 05/11/2006	6	1.8 - 2.6	2.1	05/22/2001 - 06/26/2015	8	7.8 - 20	15.2
	WELL 44	unknown	7/9/1990 - 4/4/2012	16	310 - 450	360	07/02/1989 - 06/26/2015	120	1.6 - 8.6	5	07/27/1995 - 05/11/2006	10	1.9 - 3	2.3	05/17/2001 - 06/26/2015	8	14 - 25.6	22.1
	WELL 48	unknown	7/30/1991 - 4/4/2012	16	260 - 353	306	07/30/1991 - 06/26/2015	38	0.8 - 4.1	2	07/27/1995 - 04/04/2012	13	2 - 3.2	2.5	05/17/2001 - 06/26/2015	8	11 - 19.5	16
	WELL 52	unknown	4/16/2003 - 4/5/2012	6	312 - 470	396	04/16/2003 - 06/26/2015	49	0.5 - 9.5	6	04/16/2003 - 05/11/2006	3	2.6 - 3.4	2.9	02/24/2004 - 06/26/2015	5	5 - 20	14
	WELL 54	unknown	12/12/2006 - 4/5/2012	3	302 - 360	334	12/12/2006 - 06/26/2015	12	0.6 - 1	1	12/12/2006 - 04/05/2012	3	2.2 - 2.8	2.4	12/18/2014 - 06/26/2015	4	14 - 27	21.3
CITY OF RIO VISTA	WELL 07	unknown	7/29/1987 - 10/5/2015	37	270 - 502	412	07/29/1987 - 12/02/2013	44	ND - 4.5	2	03/09/1993 - 11/03/2015	101	5 - 11	8.3	01/21/2014 - 06/16/2014	2	<0.05 - 1.1	1.1
	WELL 08	unknown	7/29/1987 - 10/6/2009	10	450 - 850	731	07/29/1987 - 09/08/2009	36	ND - 3.5	2	03/09/1993 - 11/02/2009	28	5.6 - 15	8.6	01/21/2014 - 06/16/2014	2	0.62 - 1.5	1.1
	WELL 09	unknown	7/29/1987 - 10/5/2015	29	360 - 450	412	07/29/1987 - 09/11/2006	28	ND - 7.4	2	03/09/1993 - 11/03/2015	89	5 - 14	8				
	WELL 10	unknown	11/28/1989 - 7/7/2014	22	360 - 450	417	11/28/1989 - 12/02/2013	42	ND - 3.2	2	11/28/1989 - 09/29/2015	78	8 - 22	16.3	06/16/2014	1	<0.05	<0.05
	WELL 11	unknown	9/11/1995 - 10/5/2015	30	390 - 510	445	09/11/1995 - 03/06/2015	46	ND - 3.2	2	09/11/1995 - 11/03/2015	27	5 - 13	7.2	01/21/2014 - 06/16/2014	2	1.36 - 2.21	1.8
	WELL 12	unknown	10/24/1995 - 1/4/2010	5	434 - 490	455	10/24/1995 - 12/08/2009	30	ND - 1.9	1	10/24/1995 - 02/25/2009	16	5 - 17	9.1				
	WELL 13	unknown	4/15/2004 - 10/5/2015	29	420 - 530	455	04/15/2004 - 10/05/2015	12	0.5 - 2.9	2	04/15/2004 - 11/03/2015	95	6 - 11	9.1	01/21/2014 - 06/16/2014	2	1.52 - 2.99	2.3
	WELL 14	unknown					03/06/2015	1	1.7	2	01/30/2015 - 11/03/2015	10	3 - 10	8.1				
	WELL 15	unknown					03/06/2015	1	0.5	1	01/30/2015 - 11/03/2015	10	7 - 9	8.2				
CITY OF VACAVILLE	DE MELLO WELL - STANDBY	UT	12/5/2002 - 1/12/2011	4	270 - 296	282	12/05/2002 - 01/31/2012	10	ND - 0.6	0	12/05/2002	1	2	2	12/05/2002	1	ND	ND
	WELL 01	MARK	2/18/1987 - 6/18/2014	8	500 - 546	532	02/18/1987 - 05/12/2015	16	2.5 - 3	3	04/29/1999 - 03/07/2002	2	2.1 - 2.6	2.3	05/17/2001 - 11/05/2014	3	1.5 - 1.7	1.6
	WELL 02	BT	2/18/1987 - 1/21/2014	9	310 - 460	377	02/18/1987 - 01/01/2015	18	1.8 - 5.2	3	06/03/1999 - 03/16/2005	3	1.9 - 3	2.3	05/17/2001 - 01/01/2015	3	4.2 - 4.7	4.4
	WELL 03	BT	3/30/1987 - 1/21/2014	9	300 - 390	338	03/30/1987 - 01/01/2015	19	ND - 3	2	01/26/1995 - 01/12/2011	6	2 - 3.1	2.5	05/17/2001 - 12/15/2015	6	14 - 16	15.1
	WELL 04 - DESTROYED	unk	3/25/1986 - 2/22/1989	2	330 - 332	331	02/25/1986 - 02/22/1989	2	0.4 - 1.6	1	02/25/1986 - 02/22/1989	2	<4	<4				
	WELL 05	BT	2/25/1986 - 1/21/2014	10	380 - 480	432	02/25/1986 - 01/01/2015	19	ND - 4.6	4	01/26/1995 - 03/07/2002	3	1.6 - 2	1.9	05/17/2001 - 01/01/2015	3	2.9 - 4.1	3.4
	WELL 06	BT	3/16/1988 - 1/21/2014	8	340 - 390	364	03/16/1988 - 05/12/2015	17	1.4 - 2.4	2	04/29/1999 - 02/16/2011	5	1.9 - 3	2.4	05/17/2001 - 10/20/2014	3	ND - 11.2	10.5
	WELL 07	BT	3/16/1988 - 1/30/2008	6	350 - 384	366	03/16/1988 - 01/30/2008	11	0.9 - 1.1	1	08/02/1994 - 01/30/2008	5	3.1 - 4.1	3.7	05/17/2001 - 03/14/2002	2	8.5 - 9.5	9
	WELL 08	BT	3/16/1988 - 1/21/2014	9	270 - 430	357	03/16/1988 - 01/12/2015	19	ND - 2.9	1	10/28/1999 - 01/12/2011	5	2.9 - 5.4	3.9	05/17/2001 - 01/01/2015	3	6.4 - 12.8	9.7
	WELL 09	BT	1/30/1989 - 1/21/2014	9	300 - 480	330	01/30/1989 - 01/01/2015	18	ND - 3.7	1	01/26/1995 - 01/12/2011	6	2 - 4.4	3	05/17/2001 - 12/15/2015	6	16 - 20.4	17.6
	WELL 13	BT	6/7/1990 - 1/21/2014	8	310 - 400	360	06/07/1990 - 05/12/2015	17	1.2 - 3.6	3	04/29/1999 - 03/16/2005	3	1.9 - 2	2	05/17/2001 - 11/05/2014	3	6.8 - 7.8	7.5
	WELL 14	BT	8/4/1997 - 1/21/2014	9	280 - 330	291	08/04/1997 - 01/01/2015	18	ND - 0.7	1	08/04/1997 - 01/21/2014	9	2.3 - 7	4.9	05/17/2001 - 12/15/2015	6	20 - 22.2	20.8
	WELL 15	BT	6/29/2004 - 1/21/2014	6	298 - 310	306	06/29/2004 - 01/01/2015	13	0.6 - 1	1	06/29/2004 - 01/21/2014	6	2.7 - 3.9	3.5	06/29/2004 - 12/15/2015	6	10.7 - 13.3	11.7
	WELL 16	BT	12/28/2004 - 1/21/2014	6	290 - 350	310	12/28/2004 - 01/01/2015	11	ND - 0.5	0	12/28/2004 - 12/15/2015	46	2.6 - 13	7.8	12/28/2004 - 12/15/2015	6	5.1 - 24	18.9
	DeMello MW-95ft	QA	7/16/2001 - 1/5/2011	2	380 - 500	440	07/16/2001 - 01/05/2011	2	3.2 - 6.1	4.7	07/16/2001 - 01/05/2011	2	2 - 3	2.5				
	MW-14	BT	3/25/1993	1	290	290	03/25/1993	1	0.5	0.5	03/25/1993	1	<10	<10				
	MW-15-188ft	QA_UT	8/18/2000 - 1/15/2011	3	200 - 250	225	01/06/1999	1	0.8	0.8	08/18/2000 - 01/15/2011	3	<2 - 1.9	1.6				
	MW-15-508ft	UT	8/18/2000 - 1/4/2011	2	291 - 320	306	08/18/2000 - 01/15/2011	3	0.72 - 0.98	0.9	08/18/2000 - 01/04/2011	2	<1 - <2	<2				
	MW-15-1815ft	BT	1/6/1999	1	277	277	08/18/2000 - 01/04/2011	2	1.1	1.1	01/06/1999	1	<2	<2				

Appendix D Summary Table of Solano County Groundwater Quality-Select Constituents

			Total Dissolved Solids				Nitrate (as Nitrogen)				Arsenic				Chromium VI			
	Well ID	Zone[1]	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)
CITY OF VACAVILLE	MW-16-117ft	UT	5/29/2002 - 1/4/2011	3	250 - 272	261	05/29/2002 - 12/16/2010	3	0.25 - 0.93	0.6	05/29/2002 - 01/04/2011	3	<2 - 1.6	1.4				
	MW-16-1166ft	BT	5/29/2002 - 12/16/2010	3	280 - 330	307	05/29/2002 - 01/04/2011	3	0.25 - 1.02	0.6	05/29/2002 - 12/16/2010	3	<2 - 5	4.8				
	MW-16-1430ft	BT	11/19/2002 - 1/18/2011	3	280 - 302	294	11/19/2002 - 01/18/2011	3	0.14 - 0.56	0.4	11/19/2002 - 01/18/2011	3	1.8 - 7.4	3.1				
	MW-16-1464-1604	BT	9/20/2002	1	330	330	09/20/2002	1	<0.23	<0.23	09/20/2002	1	11	11				
	MW-17-1280ft	BT	1/26/2011 - 3/31/2011	2	310 - 300	305	01/26/2011 - 01/26/2011	2	ND - ND	ND	01/26/2011 - 03/31/2011	2	2.6 - 2.8	2.7				
	MW-17-1360ft	BT	1/25/2011 - 3/30/2011	2	250 - 260	255	01/25/2011 - 01/25/2011	2	0.47 - 0.5	0.49	01/25/2011 - 03/30/2011	2	2.4 - 3	2.7				
	MW-17-1470ft	BT	1/24/2011 - 3/8/2011	2	310 - 290	300	01/24/2011 - 03/08/2011	2	ND - 0.47	0.47	01/24/2011 - 03/08/2011	2	2.3 - 2.9	2.6				
	MW-93C	UNK	12/22/1992	1	490	490	12/22/1992	1	0.7	0.7	12/22/1992 - <10	1	<10	<10				
	MW-98A	BT	11/16/1988 - 1/10/2011	3	271 - 296	282	11/16/1998 - 01/10/2011	3	0.5	0.5	11/16/1998 - 01/10/2011	2	<3 - 2.9	2.9				
	MW-98B	BT	1/13/1999	1	362	362	01/13/1999	1	<0.02	<0.02	01/13/1999 - 01/13/1999	1	4.7	4.7				
	MW-98C	BT	1/29/1999 - 1/12/2011	2	302 - 320	311	01/29/1999 - 01/26/2011	2	<0.2 - 0.07	0.07	01/29/1999 - 01/12/2011	2	<2 - 3.5	3.5				
COLLINSVILLE WATER WORKS	WELL 01	unknown	2/22/2000 - 5/12/2015	3	700 - 736	712	01/05/1996 - 05/12/2015	6	ND - ND	0	02/22/2000 - 05/12/2015	3	14 - 17	15.7	05/12/2015	1	ND	ND
CRESTA MESA PARQUE	WELL 01	unknown	11/10/2000 - 2/28/2013	3	169 - 180	173	11/10/2000 - 06/23/2015	11	ND - 1.8	1	02/28/2013	1	20	20				
DANA RANCH	WELL 01	unknown	8/26/1998 - 8/4/2014	6	670 - 800	742	05/04/1994 - 08/04/2015	19	ND - 6.6	2	05/04/1994 - 11/17/2015	12	6 - 17	12.1	08/04/2015	1	5	5
DELTA CONSERVATION CAMP	WELL 03	unknown	7/6/1993 - 10/9/2014	4	680 - 750	705	07/06/1993 - 10/02/2015	11	ND - 3.6	1	08/07/1997 - 10/09/2014	6	5.2 - 6.1	5.9	12/02/2014	1	<1	<1
DELTA INDUSTRIAL PROPERTIES	WELL 02	unknown	3/21/1999	1	560	560	03/21/1999 - 08/20/2006	7	ND - 3.4	3	03/21/1999	1	15	15				
DIXON 76	WELL 01	unknown	10/12/1999	1	760	760	04/13/1999 - 10/01/2015	56	ND - 18	13								
DIXON FRUIT MARKET	WELL 01 - RAW	unknown	4/22/2008	1	57.1	57	02/26/2003 - 04/02/2010	1	ND	ND								
DIXON HOUSING AUTHORITY	WELL 01	unknown	4/1/1999 - 10/2/2003	2	430 - 430	430	04/01/1999 - 11/13/2007	7	ND - 3.4	2	04/01/1999 - 10/02/2003	2	3 - 4	3.5				
DIXON MIGRANT CENTER	WELL 01	unknown					05/26/2009	1	0.9	1					04/06/2011 - 04/26/2011	2	21 - 29	25
	WELL 02	unknown					12/16/2008 - 06/29/2015	6	ND - 0.8	1	07/23/2012 - 06/29/2015	2	3.1 - 3.1	3.1	04/26/2011 - 06/29/2015	4	6.9 - 11	9.3
EB STONE	WELL 01	unknown	11/13/1995 - 2/15/2007	4	580 - 680	630	11/13/1995 - 06/26/2015	19	6.6 - 21	11	11/13/1995 - 02/15/2007	3	4.5 - 5.9	5.2				
EL TAPATIO CAFE	WELL 01	unknown	9/6/1996	1	740	740	09/06/1996 - 12/11/2015	16	1.6 - 6.1	4	09/06/1996	1	4	4				
FAITH BAPTIST CHURCH	WELL 01	unknown					04/02/2007 - 12/03/2008	2	4.7 - 5.4	5								
FRED FINCH YOUTH CENTER	WELL 01	unknown	12/9/1994 - 3/21/2003	3	360 - 480	420	12/09/1994 - 05/11/2010	43	ND - 15	9	12/09/1994 - 03/31/2003	3	1.7 - 2.6	2.1				
GEORGE S ORANGE/MR. TACO	WELL 01	unknown					12/29/2000 - 06/29/2005	9	2.4 - 11	6								
GILL SIDHU CHEVRON	WELL 01	unknown					04/05/2006 - 09/04/2015	48	1.3 - 15	9	04/05/2006	1	2.4	2.4				
GLASHOFF'S FRUIT STAND	WELL 01	unknown	10/13/1999	1	740	740	05/12/1999 - 10/09/2000	3	0.5 - 4.1	3								
HANSEN ROOFING TILE	WELL 01 - RAW	unknown	10/12/2005	1	300	300	01/11/1999 - 02/08/2007	6	1.8 - 18	7	10/12/2005	1	4	4				
HARRIS MORAN SEED COMPANY	WELL 01	unknown	12/19/2000 - 5/12/2009	3	279 - 532	444	12/19/2000 - 11/03/2015	32	ND - 12	6	12/19/2000 - 05/05/2015	2	4 - 4.2	4.1				
HASTINGS ISLAND HUNTING PRESERVE	WELL 01	unknown					05/12/1999 - 09/10/2013	10	ND - ND	ND	02/09/2005	1	ND	ND				
HICKORY PIT	WELL 01 - INACTIVE	unknown	11/2/1999	1	260 - 260	260	10/11/1995 - 11/13/2002	6	ND - 1.8	2								
HIDDEN ACRES TRAILER VILLA	MAIN WELL	unknown	10/11/1999 - 6/4/2014	5	420 - 540	478	07/24/1996 - 07/13/2015	13	ND - 2	1	10/11/1999	1	4	4	12/15/2014	1	ND	ND
	WELL 01	unknown	10/11/1999 - 6/4/2014	2	430 - 430	430	10/11/1999 - 07/13/2015	7	ND - 1.9	1	06/04/2014	1	ND	ND	12/15/2014	1	ND	ND
	WELL 02	unknown	10/11/1999	1	440	440	10/11/1999 - 03/03/2005	3	0.5 - 1.9	1								
HINES NURSERIES WINTERS NORTH	WINTERS NORTH DOMESTIC WELL	unknown	10/12/1999 - 8/22/2006	5	230 - 320	276	10/12/1999 - 09/29/2015	15	ND - 4.1	3	08/11/2003 - 09/04/2009	3	2.7 - 3.3	3.1	12/05/2000 - 06/23/2015	3	9.1 - 13	10.7
HINES NURSERY WINTERS SOUTH	WELL 01	unknown	6/23/2005 - 10/21/2008	2	220 - 220	220	06/23/2005 - 09/29/2015	11	2.1 - 6.8	4	06/23/2005 - 08/30/2012	3	ND - <2	<2	06/23/2015 - 09/29/2015	2	9.6 - 15	12.3
HUNTER HILL REST AREA	WELL 01	unknown	11/2/1999	1	530	530	12/15/1995 - 10/30/2014	19	1.1 - 4.3	2								
JT RANCH	WELL 01	unknown					11/14/2001 - 06/09/2014	13	ND - 2.7	1								
LAKE SOLANO PARK	CAMPGROUND WELL - INACTIVE	unknown					08/05/1997 - 09/30/2008	7	ND - 1.5	1								
	PICNIC AREA WELL	unknown					11/10/1999 - 09/26/2013	8	ND - 1	1								
	YOUTH AREA WELL	unknown					08/05/1997 - 02/24/2014	16	ND - 0.7	1								
LAKE SOLANO PICNIC AREA	WELL 01 - INACTIVE	unknown					07/26/1995 - 11/30/2000	3	0.8 - 1.2	1								
LEDGEWOOD CREEK WINERY	PEABODY WELL 05	unknown					08/04/2004 - 06/20/2014	9	ND - ND	ND								
MARIANI PACKING COMPANY, INC.	WELL 03 - ABANDONED	unknown					07/01/1997 - 09/14/2006	2	0.7 - 1.6	1								
	WELL 04 - INACTIVE	unknown					07/01/1997 - 12/13/2005	4	0.9 - 4.5	2								
	WELL 05	unknown	7/1/1997 - 6/22/2004	2	300 - 310	305	12/21/1994 - 09/29/2015	15	ND - 4.1	1	12/13/1995 - 08/12/2013	5	2.2 - 4	3.2	09/10/2014 - 09/25/2014	2	8.7 - 12	10.35
	WELL 06	unknown	38160	1	320	320	07/01/1997 - 09/29/2015	14	ND - 2.7	1	06/22/2004 - 06/03/2010	2	2.5 - 3	2.8	09/10/2014 - 09/25/2014	2	10 - 21	15.5
MARTIN'S METAL FABRICATION	WELL 01	unknown					11/13/2002 - 02/24/2014	13	3.8 - 12	6								

Appendix D Summary Table of Solano County Groundwater Quality-Select Constituents

			Total Dissolved Solids				Nitrate (as Nitrogen)				Arsenic				Chromium VI			
	Well ID	Zone[1]	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)
MIDWAY FOODS	WELL 01	unknown	6/8/1999	1	270	270	02/01/1996 - 05/06/2015	18	ND - 3.2	1	06/08/1999	1	ND	ND				
MIDWAY RV PARK	WELL 01	unknown					12/01/1998 - 05/06/2015	15	ND - 0.9	1								
NEIL'S SERVICE CENTER	WELL 01 - STANDBY	unknown	5/11/1999	1	440	440	04/05/1999 - 11/07/2015	25	ND - 14	6	05/11/1999 - 03/19/2012	2	2 - 3	2.5	08/12/2015	1	0.26	0.26
	WELL 02	unknown	2/4/2003 - 8/12/2015	3	180 - 480	308	02/04/2003 - 08/12/2015	13	0 - 4.7	3	08/03/2009 - 08/14/2012	2	3 - 4	3.5	02/04/2003 - 08/12/2015	2	ND - 0.15	0.15
NEIL'S SERVICE CENTER II	WELL 02	unknown	4/5/1999	1	210	210	04/05/1999 - 05/18/2015	15	ND - 1.6	2	04/05/1999	1	ND	ND				
NEW LIFE CHURCH	WELL 1	unknown					02/05/2015	1	ND	ND								
NORTH CAMPUS HIGH SCHOOL	WELL 01	unknown	4/26/1999	1	450	450	10/26/1994 - 10/01/2009	38	4.3 - 15	8	04/26/1999	1	ND	ND				
PEDRICK PRODUCE	WELL 01	unknown					01/06/1995 - 03/18/1999	6	ND - 16	6								
RANCHOTEL	WELL 01 - STANDBY	unknown					12/30/1996 - 07/25/2014	9	1.1 - 2.5	2								
	WELL 02	unknown					03/30/2009 - 10/26/2015	3	0.9 - 1.3	1								
RIVERBANK MOBILE HOME	WELL 01	unknown	8/23/1994 - 8/11/2004	3	487 - 680	565	08/23/1994 - 04/13/2005	4	ND - 0.4	0	08/23/1994 - 08/11/2004	3	6.5 - 14	10	08/11/2004	1	<1	<1
RURAL NORTH VACAVILLE WATER DISTRICT	WELL 01	BT	12/16/2004 - 11/7/2013	4	350 - 390	365	12/16/2004 - 11/12/2015	11	0.2 - 5	1	11/10/2003 - 11/12/2015	52	3.3 - 13	5.9	08/26/2004 - 08/30/2011	6	3.4 - 4.1	3.7
	WELL 02	BT	12/16/2004 - 1/29/2014	3	340 - 340	340	12/16/2004 - 01/29/2014	6	ND - 1.2	0	11/10/2003 - 08/20/2014	35	5 - 25	15.8	08/26/2004 - 02/23/2005	2	1.3	1.3
	RNVWD MW-446ft	MT	7/11/2005	1	360	360	07/11/2005	1	3.2	3.2	07/11/2005	1	<2	<2				
	RNVWD MW-594ft	MT	7/11/2005	1	400	400	07/11/2005	1	5.9	5.9	07/11/2005	1	<2	<2				
	RNVWD MW-862ft	BT	7/11/2005	1	380	380	07/11/2005	1	1	1	07/11/2005	1	13	13				
	RNVWD MW-1389ft	BT	9/9/1998 - 7/6/2005	2	344 - 380	362	09/09/1998 - 07/06/2005	2	1.3 - 1.4	1.4	09/09/1998 - 07/06/2005	2	3.3 - 6.3	4.8				
RUSH RANCH OPEN SPACE	NORTH WELL	unknown					10/02/2012 - 05/05/2015	5	0.6 - 14	10								
SAVE MART DISTRIBUTION CENTER 802	WELL 01	unknown	11/20/2002	1	320	320	01/28/1998 - 03/05/2015	7	1 - 1.4	1	03/05/2015	1	2	2	11/06/2014 - 11/06/2014	5	4.1 - 5.4	4.9
SCARLETT RANCH - FORCED TO PICME	WELL 01 - INACTIVE	unknown	11/2/1999	1	500	500	11/02/1999	1	ND	ND								
SCHOLL RANCH - FORCED TO PICME	WELL 01 - INACTIVE	unknown					10/09/2000	1	ND	ND								
SELF-SERVE PETROLEUM	WELL 01	unknown					04/01/1999 - 06/16/2015	6	ND - 10.4	8								
SID - ELMIRA	SID DEEP WELL 46	unknown	7/21/1994 - 4/16/2014	15	340 - 530	440	07/21/1994 - 04/16/2015	25	0.1 - 4.1	2	08/03/1998 - 08/09/2000	2	1 - 1.2	1.1	05/22/2001 - 02/12/2015	3	1.2 - 2.8	2
SID - QUAIL CANYON	SID DEEP WELL 47	unknown	9/23/1993 - 7/24/2014	15	260 - 380	312	09/23/1993 - 07/07/2015	26	ND - 0.9	1	07/27/1999 - 08/22/2000	2	2 - 2.1	2	11/15/2000 - 02/12/2015	5	ND - 3.1	2.3
SNUG HARBOR RESORT	WELL 01 - DESTROYED	unknown	5/22/2002	1	450	450	05/22/2002 - 05/10/2004	2	ND - ND	ND	05/22/2002	1	17	17				
	WELL 02	unknown	8/10/1998 - 9/14/2015	8	480 - 790	729	08/10/1998 - 11/09/2015	14	ND - 0.2	0	05/22/2002 - 11/09/2015	22	9 - 12	10.6	12/08/2014	1	<0.5	<0.5
	WELL DW-1R	unknown	11/5/1999 - 9/14/2015	7	400 - 477	441	11/05/1999 - 11/09/2015	11	ND - 0.2	0	11/05/1999 - 11/09/2015	22	10 - 19	17.4	12/08/2014	1	<0.5	<0.5
STOCKING RANCH DEEPWELL	STOCKING RANCH DEEPWELL 39 - SID	unknown	7/14/1993 - 5/15/2014	10	280 - 460	302	07/14/1993 - 05/07/2015	19	ND - ND	ND	07/14/1993 - 05/15/2014	10	5.1 - 8.4	6.8	05/23/2001 - 02/12/2015	3	ND	ND
SUISUN-SOLANO WATER AUTHORITY	WELL 06 - INACTIVE	unknown	7/10/1986 - 7/26/2001	12	350 - 490	443	07/10/1986 - 07/26/2001	15	0.7 - 2.9	2	07/10/1986 - 07/26/2001	12	ND - <4	<4	01/22/2001 - 07/26/2001	2	ND	ND
SUNRISE TRAILER PARK	WELL 01	unknown					12/19/1997	1	8.8	9	08/23/1995	1	5	5				
SUPERIOR PACKING CO.	WELL 01	unknown	2/20/2009 - 11/12/2009	3	370 - 410	393	01/18/1999 - 05/18/2015	59	ND - 9.9	6	01/18/1999 - 02/22/2006	4	ND - <2	<2				
	WELL 02	unknown	11/12/2009	1	620	620	01/18/1999 - 06/04/2015	44	ND - 14	9	01/18/1999 - 02/22/2006	2	1.8 - 3.6	2.7				
	WELL 03 - INACTIVE	unknown					01/18/1999 - 03/22/2000	2	5.2 - 12	9	01/18/1999	1	<2	<2				
TRAILER CITY	WELL 01	unknown	11/7/1995	1	750	750	11/07/1995 - 11/07/2002	7	ND - 11	5	11/07/1995	1	ND	ND				
TRAVIS AIR FORCE BASE - DISTRIBUTION	WELL 2006 - DESTROYED	unknown	1/14/1987 - 5/16/1990	2	397 - 422	410	01/14/1987 - 05/16/1990	2	0.4 - 0.5	1	01/14/1987 - 05/16/1990	2	<10	<10				
	WELL 2008 - DESTROYED	unknown	6/12/1987 - 1/17/1995	4	340 - 457	379	06/12/1987 - 01/17/1995	5	0.1 - 1.5	1	08/31/1992	1	15 - 15	15				
	WELL 2010 - DESTROYED	unknown	1/14/1987 - 1/17/1995	4	350 - 382	366	01/14/1987 - 01/17/1995	5	ND - 0.4	0	01/14/1987 - 01/17/1995	4	<5 - <10	<10				
	WELL 2014 - DESTROYED	unknown	1/14/1987 - 1/17/1995	4	420 - 505	461	01/14/1987 - 01/17/1995	5	0.3 - 9	3	08/31/1992	1	11	11				
	WELL 2029	unknown	11/2/1992 - 3/6/2003	4	390 - 430	403	08/31/1992 - 03/11/2011	14	0.2 - 6.6	2	06/12/2000 - 06/20/2000	2	2.4 - 2.5	2.5	07/18/2001 - 10/22/2002	2	1.7 - 2.2	1.95
	WELL 2037	unknown	6/12/2000 - 3/7/2006	3	370 - 380	373	07/27/1998 - 03/24/2015	13	0.5 - 3.4	2	06/12/2000 - 06/20/2000	2	1.1 - 1.4	1.3	07/18/2001 - 11/24/2014	3	1.4 - 2.1	1.8
	WELL 2038	unknown	6/12/2000 - 3/7/2006	3	370 - 390	377	07/27/1998 - 03/11/2011	11	ND - 1.6	1	06/12/2000 - 06/20/2000	2	1 - 1.2	1.1	07/18/2001 - 10/22/2002	2	1.8 - 2.1	1.95
	WELL 2040 - PENDING	unknown	11/3/2004 - 3/7/2006	6	300 - 330	320	11/03/2004 - 03/24/2015	7	1 - 1.9	1	02/13/2006	1	2	2	11/03/2004 - 04/19/2005	5	ND - 1.3	1.3
	WELL 2041 - PENDING	unknown	11/8/2004 - 3/7/2006	5	450 - 480	470	11/08/2004 - 03/07/2006	5	1.4 - 1.6	2	11/08/2004 - 03/29/2006	5	3.6 - 7	5.7	02/17/2005 - 09/06/2005	3	ND	ND
TRIPLE M GRADING STATION	WELL 01	unknown					05/04/1998 - 11/13/2001	6	ND - 17	12								
UPCO	WELL 01	unknown	10/26/1994 - 9/17/2014	7	369 - 430	404	10/26/1994 - 11/10/2015	15	ND - 5	1	10/26/1994 - 11/10/2015	7	6 - 35	12.2	09/02/2003 - 09/22/2014	2	ND - <1	<1

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			Total Dissolved Solids				Nitrate (as Nitrogen)				Arsenic				Chromium VI			
	Well ID	Zone[1]	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)
VACA VILLA APARTMENTS	WELL 01	unknown	10/28/1994 - 11/4/2014	6	480 - 820	640	12/28/1994 - 02/10/2015	20	ND - 2	1	12/28/1994 - 11/04/2014	6	ND - <2	<2				
VACA-DIXON SUBSTATION	WELL 01 - DESTROYED	unknown					07/07/2005 - 07/05/2006	2	2.9 - 4.5	4								
	WELL 03 - MAIN WELL - DESTROYED	unknown	2/4/2004	1	480	480	02/04/2004	1	3.8	4	02/04/2004	1	3.8	3.8	02/04/2004	1	ND	ND
	WELL 05	unknown	5/2/2007	1	520	520	05/02/2007 - 08/04/2014	7	1.5 - 4.1	3	05/02/2007 - 06/04/2013	3	ND - <2	<2	05/02/2007 - 09/10/2014	2	<1 - 1.1	1.1
VACAVILLE SEVENTH DAY ADVENTIST CHURCH	WELL	unknown	6/7/2000	1	182	182	06/07/2000 - 11/30/2012	7	1.9 - 4.3	3	06/17/2003	1	2	2				
VALLEY EVANGELICAL FREE CHURCH	WELL 01	unknown	11/2/1999	1	880	880	10/08/1997 - 12/07/2015	120	ND - 21	12	04/10/2012	1	ND	ND				
VINEYARD RV PARK	WELL 01	unknown	10/12/1999 - 5/7/2012	3	320 - 330	327	06/01/1998 - 05/06/2015	16	ND - 3.6	2	08/08/2001 - 05/07/2012	4	ND	ND	08/12/2015	1	0.04	0.04
	WELL 02	unknown	8/8/2001 - 5/6/2015	3	320 - 340	330	06/08/1999 - 05/06/2015	12	ND - 3.8	3	08/08/2001 - 08/03/2009	2	4	4	08/12/2015	1	0.29	0.29
WEST WIND WINERY	WELL 01	unknown	11/2/1999	1	480	480	06/08/1999 - 07/15/2015	29	1.1 - 7	3								
WESTERN RAILROAD MUSEUM	WELL 01	unknown	2/8/1995	1	500	500	02/08/1995 - 02/11/2015	13	2.9 - 9.5	6	02/08/1995	1	12	12				
	WELL 02	unknown	9/20/2005	1	410	410	09/20/2005 - 02/11/2015	8	4.7 - 6.6	5	09/20/2005	1	9.7	9.7				
WOODEN VALLEY WINERY	WELL 01	unknown	11/2/1999	1	430	430	02/27/1996 - 04/23/2015	32	ND - 6.6	2								
SCWA - Allendale	SCWA-Allendale MW-1235	BT	3/27/2008	1	300	300	03/27/2008	1	0.6	0.6	03/27/2008	1	2.5	2.5				
	SCWA-Allendale MW-1345	BT	3/25/2008	1	310	310	03/25/2008	1	0.5	0.5	03/25/2008	1	2.5	2.5				
	SCWA-Allendale MW-1925	BT	3/26/2008	1	360	360	03/26/2008	1	<0.45	<0.45	03/26/2008	1	2.6	2.6				
SCWA - Maine Prairie	SCWA-MainePrairie MW-2170	BT	4/29/2008	1	350	350	04/29/2008	1	<0.45	<0.45	04/29/2008	1	4.9	4.9				
	SCWA-MainePrairie MW-1960	BT	4/29/2008	1	380	380	04/29/2008	1	<0.45	<0.45	04/29/2008	1	5	5				
	SCWA-MainePrairie MW-840	TEH_GEN	4/30/2008	1	530	530	04/30/2008	1	2.1	2.1	04/30/2008	1	7.1	7.1				
SCWA - Meridian	SCWA-Meridian MW-1680	BT	6/4/2008	1	320	320	06/04/2008	1	0.8	0.8	06/04/2008	1	3.3	3.3				
	SCWA-Meridian MW-400	TEH_GEN	6/4/2008	1	350	350	06/04/2008	1	0.5	0.5	06/04/2008	1	<2	<2				
	SCWA-Meridian MW-825	TEH_GEN	6/3/2008	1	380	380	06/03/2008	1	0.56	0.56	06/03/2008	1	<2	<2				
SCWA - Dixon	SCWA-Dixon MW-1200	TEH_GEN	10/1/2009	1	350	350	10/01/2009	1	<0.45	<0.45	10/01/2009	1	3.1	3.1				
	SCWA-Dixon MW-2212	BT	10/1/2009	1	310	310	10/01/2009	1	<0.45	<0.45	10/01/2009	1	3.2	3.2				
	SCWA-Dixon MW-2370	BT	9/30/2009	1	330	330	09/30/2009	1	<0.45	<0.45	09/30/2009	1	8.6	8.6				
Department of Water Resources (DWR)	03N01E04B001M	unknown	07/18/1973 - 09/13/2013	15	595 - 763.8	675	05/15/1975 - 09/13/2013	8	<0.02 - 1.3	1.2	09/13/2013	1	11	11				
	03N01E09H001M		9/22/1980	1	1460	1460					09/22/1980	1	ND	ND				
	03N01E21D001M	unknown	08/02/1971 - 06/07/1976	3	1140 - 1701.8	1352	07/10/1974	1	0.1	0.1								
	03N01E22F002M	unknown	08/01/1972 - 07/20/2006	12	777 - 1427.1	1117	07/03/1979 - 07/20/2006	5	1.6 - 12.6	6.3								
	03N03W18G001M	unknown	08/05/1971 - 06/11/1976	3	657 - 770.5	728	07/24/1974	1	3.6	3.6								
	03N03W18G002M	unknown	07/31/1973 - 07/17/1981	3	829 - 904.5	859	05/29/1975	1	8.1	8.1								
	03N04W05M001M	unknown	07/31/1973 - 08/07/1986	7	938 - 1118.9	1065	11/16/1982	1	7.5	7.5								
	04N01E01J001M	unknown	07/29/1970 - 07/07/1987	9	953 - 1326.6	1145	07/29/1970 - 06/27/1980	2	5.4 - 7.9	6.7								
	04N01E03A001M		9/17/1980	1	750	750					09/17/1980	1	ND	ND				
	04N01E08F001M	unknown	07/09/1954 - 08/06/2014	33	604 - 1660	732	07/09/1954 - 08/06/2014	14	0.5 - 4.5	2	08/06/2014	1	24	24				

Appendix D Summary Table of Solano County Groundwater Quality-Select Constituents

			Total Dissolved Solids				Nitrate (as Nitrogen)				Arsenic				Chromium VI			
	Well ID	Zone[1]	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)
Department of Water Resources (DWR)	04N01E12B002M		9/17/1980	1	887	887												
	04N01E20F001M	UNK	07/12/1977 - 08/06/2014	12	460 - 663	543	07/12/1977 - 08/06/2014	7	2.5 - 20.1	11.7	08/06/2014	1	3	3				
	04N01E35R001M	UNK	9/22/1980	1	822	822												
	04N01W03R001M		07/11/1978 - 07/14/1988	7	313 - 458.28	408	07/11/1978 - 06/17/1980	3	0.4 - 2.2	1.3								
	04N01W32G001M	UNK	06/07/1976 - 07/26/1990	7	243.88 - 3497.4	2869	06/07/1976 - 07/24/1986	2	1.5 - 1.5	1.5								
	04N01W33A001M	unknown	07/19/1973 - 08/31/2005	10	178 - 3304	2608	08/19/1982 - 08/31/2005	4	<0.02 - 1.8	0.8								
	04N02E11R001M		9/17/1980	1	708	708					09/17/1980	1	ND	ND				
	04N02E16H001M		9/17/1980	1	403	403												
	04N02E18N001M		9/17/1980	1	573	573					09/17/1980	1	ND	ND				
	04N02E22P001M	QA_UT?	06/08/1976 - 10/29/2010	12	385 - 538.01	441	06/08/1976 - 10/29/2010	6	<0.02 - 1.3	1								
	04N02E25L001M		9/23/1980	1	391	391					09/23/1980	1	ND	ND				
	04N02E30M001M		9/17/1980	1	660	660												
	04N02W04D001M	unknown	08/03/1971 - 08/06/2014	12	695 - 971.5	836	07/09/1974 - 08/06/2014	6	0.1 - 5.6	2.2	08/06/2014	1	1	1				
	04N02W05L007M	UNK	06/07/1976 - 07/26/1999	9	544 - 777.2	699	06/07/1976 - 07/26/1999	3	<0.02 - 0.3	0.3								
	04N02W05Q002M	unknown	08/02/1972 - 08/06/2014	11	319 - 964.8	618	06/18/1980 - 08/06/2014	6	<0.02 - <0.02	<0.02	08/06/2014	1	7	7				
	04N02W09H001M	UNK	07/19/1973 - 08/06/2014	12	1960 - 2826	2321	05/20/1975 - 08/06/2014	5	<0.02 - 0.2	0.1	08/06/2014	1	75	75				
	04N02W18M001M	unknown	08/03/1971 - 08/28/2015	12	584 - 857.6	725	07/09/1974 - 08/28/2015	7	0.4 - 3.4	0.9	09/13/2013 - 08/28/2015	2	ND - 1	1				
	04N03E09D001M		9/23/1980	1	646	646					09/23/1980	1	ND	ND				
	04N03E11P002M		9/23/1980	1	650	650					09/23/1980	1	ND	ND				
	04N03E30C001M		9/23/1980	1	660	660												
	04N03E31F002M	unknown	05/18/1959 - 09/12/2007	25	422 - 585	531	05/18/1959 - 09/12/2007	10	1.4 - 5.6	2.2								
	04N03W12G001M	UNK	07/12/1977 - 08/06/2014	10	998 - 1490	1282	07/12/1977 - 08/06/2014	5	2.6 - 7	5.3	08/06/2014	1	2	2				
	04N03W13G002M		08/02/1972 - 07/09/1974	2	665.98 - 670	668												
	05N01E01N001M	UNK	09/04/1958 - 08/05/1965	8	1145.7 - 2330	1387	09/04/1958 - 05/21/1963	7	0.1 - 36	5.4								
	05N01E04G001M		9/11/1980	1	845	845					09/11/1980	1	ND	ND				
	05N01E14A001M		9/11/1980	1	566	566												
	05N01E23R001M	unknown	07/28/1969 - 07/11/1989	17	439 - 592.28	486	07/28/1969 - 06/23/1981	13	<0.02 - 0.2	0.2								
	05N01E25J001M		9/11/1980	1	706	706												
	05N01E28K001M	unknown	2/1/1980	1	3370	3370	02/01/1980	1	<0.02	<0.02								
	05N01E28Q006M	unknown	2/1/1980	1	265	265	02/01/1980	1	<0.02	<0.02								
	05N01E35B001M	unknown	08/12/1971 - 07/11/1989	14	876 - 1185.9	1007	08/12/1971 - 06/23/1981	11	10.4 - 15.8	13.6								
	05N01E36A001M	UNK	07/28/1969 - 07/20/1973	3	553 - 730.3	649	07/28/1969 - 07/22/1970	2	1.2 - 1.8	1.5								
	05N01W13D001M	QA_KU?	9/16/1980	1	418	418	06/07/1976 - 08/06/2014	6	1.7 - 19	5.9	09/16/1980	1	ND	ND				
	05N01W15B001M		7/19/1984	1	757.1	757												
	05N01W15D001M		06/07/1976 - 08/06/2014	11	451 - 958.1	702					08/06/2014	1	1	1				
	05N01W15P001M		9/16/1980	1	1650	1650												
	05N01W19K001M	UNK	8/2/1972	1	552	552	08/02/1972	1	4.3	4.3								
	05N01W19K002M	unknown	7/16/1974	1	564	564	07/16/1974	1	3.8	3.8								
	05N01W25R001M	UNK	08/02/1971 - 06/24/1981	9	1090 - 1470	1238	06/04/1976 - 06/24/1981	6	3.2 - 4.1	3.7								
	05N01W28P001M	UNK	07/19/1973 - 07/18/1985	9	395.3 - 543.37	466	07/08/1977 - 06/24/1981	5	0.3 - 2	1.2								
	05N01W29C001M	UNK	06/27/1974 - 05/15/1975	2	1190 - 1450	1320	06/27/1974 - 05/15/1975	2	3.8 - 4.1	4								
	05N01W30H001M	unknown	07/23/1971 - 07/08/1977	7	636 - 867	754	07/23/1971 - 07/08/1977	7	8.4 - 11.7	9.7								
	05N01W30J001M	unknown	7/23/1971	1	1190	1190	07/23/1971	1	1.8	1.8								
	05N01W30J002M	unknown	08/01/1972 - 07/18/1973	2	966 - 1160	1063	08/01/1972 - 07/18/1973	2	2.7 - 4.7	3.7								
	05N01W35E001M	QA_KU?	07/08/1977 - 09/11/2007	8	1140 - 1728.6	1429	07/08/1977 - 09/11/2007	6	2.9 - 11.6	7.7								
	05N02E15F001M	unknown	08/14/1972 - 08/21/2015	17	574 - 777.2	644	07/11/1974 - 08/21/2015	9	<0.02 - 0.05	0.05	11/01/2011 - 08/21/2015	3	5 - 7	6				
	05N02E25K001M	QA	08/27/1958 - 07/21/1970	14	884 - 1284	1031	08/27/1958 - 07/16/1969	7	<0.02 - 0.6	0.4								
	05N02E25P002M	unknown	06/08/1976 - 11/01/2011	12	663 - 844.2	740	06/08/1976 - 11/01/2011	6	<0.02 - 0.1	0.1	09/23/1980	1	ND	ND				
	05N02W08H007M	unknown	08/02/1972 - 08/28/2015	15	327 - 435.5	369	08/02/1972 - 08/28/2015	8	2.1 - 6.6	4.7	09/13/2013 - 08/28/2015	2	ND - 1	1				
	05N02W21P003M	UNK	08/03/1971 - 08/28/2015	15	489 - 659.95	585	07/05/1979 - 08/28/2015	7	2.5 - 8.1	4.1	08/28/2015	1	ND	ND				
	05N02W27L002M	UNK	07/09/1974 - 08/15/1988	8	556 - 1192.6	836	07/09/1974 - 07/19/1984	2	6.6 - 7.9	7.2								
	05N02W29L003M	unknown	07/09/1974 - 08/01/1986	6	334 - 395.97	361	07/09/1974 - 07/19/1984	2	1.5 - 3.6	2.6								
	05N02W34N001M	unknown	07/19/1973 - 07/17/1985	7	732 - 958.1	826	07/19/1973 - 06/15/1983	2	2 - 3.6	2.8								
	05N02W34P004M	unknown	07/09/1974 - 07/19/1984	5	817.4 - 1005	917	07/09/1974	1	14	14								
	05N03E03H001M		9/23/1980	1	304	304					09/23/1980	1	10	10				
	05N03E15M001M		9/23/1980	1	397	397												
	05N03E26H001M		9/23/1980	1	415	415												

Appendix D Summary Table of Solano County Groundwater Quality-Select Constituents

			Total Dissolved Solids				Nitrate (as Nitrogen)				Arsenic				Chromium VI			
	Well ID	Zone[1]	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)
Department of Water Resources (DWR)	06N01E03A002M		9/4/1980	1	385	385												
	06N01E05A001M	UT	06/08/1976 - 08/21/2015	16	317 - 632	522	06/08/1976 - 08/21/2015	10	0.7 - 12.5	8	11/01/2011 - 08/21/2015	3	3 - 5	4				
	06N01E06F002M		9/9/1980	1	370	370					09/09/1980	1	ND	ND				
	06N01E11H001M		9/3/1980	1	671	671												
	06N01E13J002M	unknown	08/03/1971 - 10/29/2010	14	334 - 600	394	08/03/1971 - 10/29/2010	6	0.1 - 8	1.5								
	06N01E18C002M		9/4/1980	1	1130	1130					09/04/1980	1	ND	ND				
	06N01E18L001M		9/4/1980	1	610	610					09/04/1980	1	ND	ND				
	06N01E19L001M	unknown	08/26/1958 - 05/18/1959	2	494 - 609.03	552	08/26/1958 - 05/18/1959	2	4.5 - 4.5	4.5								
	06N01E19L002M	unknown	09/28/1960 - 07/25/1990	20	344 - 696.8	542	09/28/1960 - 06/24/1980	5	2.5 - 12.2	6.1								
	06N01E19Q001M	unknown	05/19/1961 - 07/12/1989	19	356 - 623.77	510	05/19/1961 - 07/12/1989	6	0 - 3.2	2								
	06N01E21K001M		9/14/1980	1	534	534												
	06N01E23C002M		9/4/1980	1	550	550					09/04/1980	1	ND	ND				
	06N01E26G001M		9/4/1980	1	760	760												
	06N01E32M001M		9/4/1980	1	592	592					09/04/1980	1	ND	ND				
	06N01W01B004M	unknown	07/20/1973 - 07/12/1989	9	373.86 - 475.7	440	07/06/1979 - 07/12/1989	2	3.8 - 4.5	4.2								
	06N01W01E001M	unknown	08/23/1972 - 08/20/2015	16	278 - 735	510	08/23/1972 - 08/20/2015	8	0.4 - 5	3.4	11/02/2011 - 08/20/2015	3	4 - 8	6				
	06N01W04G001M		9/9/1980	1	268	268												
	06N01W12P001M		9/9/1980	1	581	581												
	06N01W20A001M		9/9/1980	1	539	539					09/09/1980	1	ND	ND				
	06N01W23L001M	unknown	04/14/1953 - 07/25/1990	23	274 - 470	373	04/14/1953 - 07/25/1990	9	0.2 - 1.6	0.9								
	06N01W23L004M	unknown	6/7/1990	1	340	340	06/07/1990	1	1.7	1.7								
	06N01W24E002M		9/3/1980	1	425	425												
	06N01W29C003M		9/12/1980	1	786	786												
	06N01W36C004M	UT	06/09/1976 - 08/20/2015	16	402 - 538.01	446	06/09/1976 - 08/20/2015	9	3.4 - 6.3	4.9	11/02/2011 - 08/20/2015	3	ND - 1	1				
	06N01W36E002M		9/16/1980	1	413	413					09/16/1980	1	ND	ND				
	06N02E01A001M		9/2/1980	1	515	515												
	06N02E06A001M		9/2/1980	1	383	383					09/02/1980	1	ND	ND				
	06N02E15P001M		9/2/1980	1	449	449					09/02/1980	1	ND	ND				
	06N02E19J001M	QA_UT	05/23/1975 - 07/25/1990	8	698 - 1152.4	906	05/23/1975 - 07/25/1990	3	5.9 - 11.3	7.9								
	06N02E23A001M		9/3/1980	1	1520 - 1520	1520					09/03/1980	1	ND	ND				
	06N02E30M002M		9/2/1980	1	414	414												
	06N02E32N002M	UNK	9/11/1980	1	2000	2000	08/23/1972 - 10/29/2010	6	<0.02 - 10.7	8								
	06N02W12R002M		9/22/1980	1	600	600					09/22/1980	1	ND	ND				
	06N02W25J001M		9/22/1980	1	526	526												
	07N01E08N002M		08/23/1972 - 10/29/2010	13	218 - 455	350												
	07N01E12H001M		8/26/1980	1	613	613					08/26/1980	1	ND	ND				
	07N01E13M001M	unknown	08/13/1979 - 06/17/1986	3	324.95 - 436.17	379	08/13/1979 - 06/17/1986	3	1.1 - 3.6	2.3								
	07N01E14D004M		9/3/1980	1	363	363												
	07N01E14G002M	unknown	09/03/1975 - 06/20/1988	10	333 - 408.7	369	09/03/1975 - 06/20/1988	10	1.8 - 4.7	3.1								
	07N01E14J001M	unknown	09/05/1974 - 06/20/1988	9	551 - 633.15	612	09/05/1974 - 06/20/1988	9	6.8 - 10.6	8.5								
	07N01E14N003M	unknown	05/17/1976 - 06/19/1985	6	397.98 - 496.47	462	05/17/1976 - 06/19/1985	6	2.5 - 5	3.9								
	07N01E18J001M		8/26/1980	1	319	319	05/10/1954	1	6.3	6.3	08/26/1980	1	ND	ND				
	07N01E23A001M	unknown	5/10/1954	1	645.21	645												
	07N01E23A002M	unknown	01/05/1950 - 04/20/1987	10	313.56 - 750.4	658	01/05/1950 - 04/20/1987	10	0.8 - 10.4	8.1								
	07N01E23A004M	unknown	05/10/1954 - 07/11/1986	9	382 - 492.45	415	05/10/1954 - 07/11/1986	9	1.8 - 4.5	3.2								
	07N01E23D002M	unknown	04/18/1979 - 06/19/1985	3	355.1 - 385.25	374	04/18/1979 - 06/19/1985	3	2.7 - 3.8	3.5								
	07N01E23G002M	unknown	07/30/1974 - 06/20/1988	9	437 - 603	515	07/30/1974 - 06/20/1988	9	4.1 - 8.6	6.1								
	07N01E24C002M	unknown	05/10/1954 - 04/20/1987	11	399.99 - 700.15	613	05/10/1954 - 04/20/1987	11	2.1 - 10.2	6.9								
	07N01E25J001M		8/28/1980	1	820	820												
	07N01E27N004M		9/3/1980	1	519	519					09/03/1980	1	ND	ND				
	07N01E30F001M		8/26/1980	1	234	234												
	07N01E36C001M	unknown	08/28/1958 - 08/01/1986	16	550 - 850.9	698	08/28/1958 - 06/24/1980	6	1.7 - 10.2	3.9								
	07N01W05F001M		9/10/1980	1	312	312					09/10/1980	1	ND	ND				
	07N01W11B001M		9/10/1980	1	246	246												
	07N01W14P003M	UT_QA?	08/03/1971 - 08/20/2015	16	233 - 257.95	248	08/03/1971 - 08/20/2015	8	1.9 - 2.6	2.4	11/02/2011 - 08/20/2015	3	ND - 1	1				
	07N01W22D001M		9/10/1980	1	279	279												
	07N01W25J001M		9/10/1980	1	623	623												

Appendix D Summary Table of Solano County Groundwater Quality-Select Constituents

			Total Dissolved Solids				Nitrate (as Nitrogen)				Arsenic				Chromium VI			
	Well ID	Zone[1]	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (mg/L)	Average Value (mg/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)	Range of Sample Dates	Number of Samples	Range of Values (ug/L)	Average Value (ug/L)
Department of Water Resources (DWR)	07N01W28N001M		9/10/1980	1	346	346					09/10/1980	1	ND	ND				
	07N01W28Q001M	unknown	08/14/1972 - 08/20/2015	16	240 - 351.08	290	08/14/1972 - 08/20/2015	8	1.7 - 3.8	3	11/02/2011 - 08/20/2015	3	ND - 1	1				
	07N01W34R001M		9/12/1980	1	270 - 270	270					09/12/1980	1	ND	ND				
	07N01W34R002M		9/12/1980	1	311 - 311	311					09/12/1980	1	ND	ND				
	07N02E02C001M		8/27/1980	1	731 - 731	731												
	07N02E02D001M	unknown	08/28/1958 - 10/28/2010	16	523.27 - 811	670	08/28/1958 - 10/28/2010	6	1.6 - 12.9	4.4								
	07N02E02F002M	UT_QA?	05/21/1975 - 10/28/2010	9	482 - 749	634	05/21/1975 - 10/28/2010	4	1.8 - 10.3	7.4								
	07N02E06N001M	UT	05/21/1975 - 08/21/2015	16	350 - 552.75	455	05/21/1975 - 08/21/2015	10	2.6 - 7.7	4.7	11/02/2011 - 08/21/2015	3	3	3				
	07N02E06N002M	UNK	06/09/1976 - 07/30/1980	3	376 - 525.95	461	06/09/1976	1	4.1	4.1								
	07N02E06N003M	TEH_GEN_QA?	08/01/1986 - 08/21/2015	3	294 - 306	300	08/01/1986 - 08/21/2015	3	1.1 - 2.5	2	11/01/2011 - 08/21/2015	2	4	4				
	07N02E07R003M		8/27/1980	1	598	598	08/03/1971 - 07/26/1984	2	10.2 - 12.9	11.5	08/27/1980	1	ND	ND				
	07N02E14C001M		8/27/1980	1	476	476	08/28/1958 - 10/29/2013	12	0.8 - 26.7	9.2								
	07N02E17F002M		8/28/1980	1	585	585					08/28/1980	1	ND	ND				
	07N02E18R002M	unknown	08/03/1971 - 07/17/1990	10	639.18 - 783.9	726												
	07N02E26K001M		8/27/1980	1	530	530					08/27/1980	1	ND	ND				
	07N02E30J002M		8/27/1980	1	547	547												
	07N02E34C002M	UNK	08/28/1958 - 10/29/2013	24	448 - 929	634					11/01/2011	1	3	3				
	07N02E35D001M	QA	11/15/2005	1	412	412	11/15/2005	1	2.8	2.8	11/15/2005	1	3	3				
	07N02E35D002M	UT	11/15/2005	1	409	409	11/15/2005	1	5.3	5.3	11/15/2005	1	4	4				
	07N02E35D003M	UT	11/15/2005	1	381	381	11/15/2005	1	0.5	0.5	11/15/2005	1	4	4				
	07N02E35Q001M		9/9/1980	1	659	659												
	08N01E20F003M		8/25/1980	1	651	651												
	08N01E22B001M		8/25/1980	1	288	288					08/25/1980	1	ND	ND				
	08N01E26F001M	unknown	08/01/1952 - 10/28/2010	21	420.09 - 763.8	604	08/01/1952 - 10/28/2010	7	1.3 - 9.7	3.6								
	08N01E32P001M		9/3/1980	1	308	308					09/03/1980	1	ND	ND				
	08N01E36J001M		8/25/1980	1	590	590					08/25/1980	1	ND	ND				
	08N01W23A001M	unknown	05/18/1959 - 06/14/1976	7	294 - 408.7	357	05/18/1959 - 07/29/1969	2	1 - 1.1	1.1								
	08N01W23A002M	unknown	08/21/1978 - 10/28/2010	4	278 - 441.53	392	08/21/1978 - 10/28/2010	1	1.2	1.2								
	08N01W26G002M		8/26/1980	1	626	626												
	08N01W28J001M	TEH_GEN_QA?	07/09/1979 - 08/21/2015	14	212 - 498.48	259	07/09/1979 - 08/21/2015	10	0 - 0.8	0.3	11/02/2011 - 08/21/2015	3	ND - 1	1				
	08N01W33E002M		8/26/1980	1	325	328					08/26/1980	1	ND	ND				
	08N02E15P001M		8/25/1980	1	785	785												
	08N02E21B002M		8/26/1981	1	323	323					08/26/1981	1	ND	ND				
	08N02E21K001M	unknown	11/11/1971 - 07/11/1988	9	319 - 568.16	379	11/11/1971 - 08/23/1982	2	0.1 - 0.2	0.2								
	08N02E24J003M		8/25/1980	1	613	613												
	08N02E29G001M		8/25/1980	1	637	637												
	08N02E35B001M		8/25/1980	1	417	417					08/25/1980	1	ND	ND				
	08N02W36L001M		8/26/1980	1	327	327												
	08N02W36L002M	unknown	9/2/1982	1	345	345	09/02/1982	1	0.4	0.4								

1. BT = Basal Tehama, BT_MT = Basal Tehama (primary) & Middle Tehama, MARK = Markley Formation, MT = Middle Tehama, QA = Quarternary Alluvium, QA? = Quaternary Alluvium (possible), QA_KU? = Quaternary Alluvium (primary) & undifferentiated Cretaceous Rock (possible), QA_UT = Quaternary Alluvium (primary) & Upper Tehama, QA_UT? = Quaternary Alluvium (primary) & Upper Tehama (possible), TEH_GEN = Tehama (general), TEH_GEN_QA = Tehama (general, primary) & Quaternary Alluvium, TEH_GEN_QA? = Tehama (general, primary) & Quaternary Alluvium (possible), UNK = unknown, UT = Upper Tehama, UT? = Upper Tehama (possible), UT_QA = Upper Tehama (primary) & Quaternary Alluvium, UT_QA? = Upper Tehama (primary) & Quaternary Alluvium (possible)

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