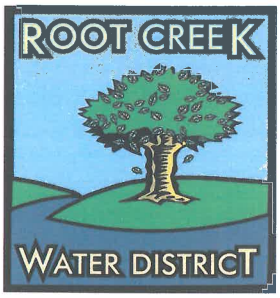
GROUNDWATER MANAGEMENT PLAN

ROOT CREEK WATER DISTRICT



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REVISED:
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PREPARED BY:

EST. 1968
PROVOST& PRITCHARD
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List of Abbreviations

AB	Assembly Bill
ACWA	Association of California Water Agencies
AF	acre-feet
bgs	below ground surface
BMO	Basin Management Objective
CASGEM	California State Groundwater Elevation Monitoring Network
CFU	colony forming unit
CVP	Central Valley Project
DBCP	dibromochloropropane
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EDB	ethylene dibromide
EPA	Environmental Protection Agency
GAC	Groundwater Advisory Committee
GMP	Groundwater Management Plan
HPC	heterotrophic plate count
HSA	Hydrologic Study Area
ID	Irrigation District
IRWMP	Integrated Regional Water Management Plan
KDSA	Kenneth D. Schmidt and Associates
MCL	Maximum contaminant level
MID	Madera Irrigation District
msl	mean sea level
P&P	Provost & Pritchard Engineering Group
RCWD	Root Creek Water District
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
TDS	total dissolved solids
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
WHPA	wellhead protection area

1 – INTRODUCTION

The Root Creek Water District (RCWD or District) was formed on October 14, 1996 under the California Government Code. The District covers approximately 9,217 acres wholly within Madera County north of the San Joaquin River and west of Highway 41 (**Figures 1** and **2**). In 1997, the District's board of directors adopted a Ground Water Management Plan (GMP or Plan), pursuant to California Assembly Bill No. 3030 (AB 3030) and California Water Code Sections 10750 et seq.

This GMP is an update to the 1997 Plan, and satisfies the new requirements for GMPs created by the September 2002 California State Senate Bill No. 1938, which amended Sections 10753 and 10795 of the California Water Code. This Plan also addresses recommended components for a Groundwater Management Plan described in Appendix C of Department of Water Resources Bulletin 118 (2003 Update). **Table 1.1** in Section 1.4 shows the required and recommended components for GMPs.

The primary motives for updating this GMP include:

1. Satisfy new State requirements for GMPs.
2. Update and document the District's goals and objectives for groundwater management.
3. Update local groundwater information so the GMP is a useful reference document.
4. Maintain the District's eligibility for certain State grants, loans and special drought assistance that require an updated GMP.
5. Continue the District's authority to responsibly manage local groundwater to ensure it can sustainably meet local water needs.

This plan outlines the framework for RCWD's groundwater management efforts. General categories that are addressed include a description of the District's geology and hydrogeology, basin management objectives, stakeholder involvement, groundwater monitoring, groundwater resources protection, groundwater sustainability, groundwater operations, and groundwater planning and management. Within these categories, specific groundwater management elements are described including existing activities and planned actions to improve groundwater management. This GMP covers the entire area within the boundary of RCWD.

1.1 - Background Information on Root Creek Water District

Location

The Root Creek Water District is situated on the eastern edge of the San Joaquin Valley of California approximately 10 miles north of downtown Fresno, in Madera County (**Figure 1**). The District lies just west of Highway 41 on the north side of the San Joaquin River. The District encompasses 9,217 acres (14.4 square miles). Nearby

water agencies include Fresno Irrigation District to the south, Madera Irrigation District to the north and west, and Garfield Water District to the east (**Figure 2**). Most of the area immediately surrounding RCWD is unincorporated County land and is not part of an organized water or irrigation district.

Topography

Land in the District generally slopes downward to the southwest at 8 to 10 feet per mile. However, slopes are much steeper in the northern portion of the District where the land is cut by several branches of Root Creek, a localized watershed, and in the southwest portion where the District extends below the San Joaquin River bluffs. Elevations range from about 385 feet above mean sea-level in the northeast corner of the District to around 230 feet in the southwest, below the river bluffs.

Climate

The climate of RCWD is characterized by cool, mild winters and hot, dry summers. Temperatures in the summer often exceed 100 degrees Fahrenheit. Fog is experienced for long periods in the winter, with low temperatures typically in the mid-30's. Winter temperatures occasionally drop into the 20's. Average annual precipitation is about 10 inches, with 80 percent of the rainfall occurring in the winter months. The frost-free growing season averages around 250 days per year.

Surface Water Supplies

Some lands in the southern portion of the District have the right, by virtue of being riparian or by USBR water holding contracts, to divert San Joaquin River water. About 1,077 acres can be served with this river water. It is estimated that these diversions are less than 4,000 AF/year.

RCWD also has an agreement with Westside Mutual Water Company to purchase a firm supply of 7,000 AF/year. RCWD also has an agreement with Madera Irrigation District (MID) for the purchase of surplus and flood water. The long-term water availability for this contract is estimated to be 7,335 AF/year, although water availability will be high in some years and zero in other years. In 2011, RCWD acquired a contract with the United States Bureau of Reclamation (USBR) to purchase San Joaquin River floodwater (also known as Section 215 water), which will provide a water supply during flood releases. RCWD's ability to use these water supplies is limited by distribution facilities. RCWD has an agreement with MID to deliver water to RCWD through the MID Lateral 6.2. Planned distribution facilities within RCWD, which should be completed in 2012 or 2013, will be able to deliver on average 6,100 AF/year.

Geology

The District is located in the Madera Groundwater Sub-basin (**Figure 3**). The basin is designated as being critically overdrafted by the California Department of Water Resources. Groundwater levels in the District have gradually declined over time. No major confining layers are found in the area, but the stratigraphy includes interfingered

layers of relatively impermeable materials. Refer to Section 2 for more details on the geology in RCWD.

Groundwater Supplies
The District lies on the eastern fringe of the enormous San Joaquin Valley-wide aquifer. Growers own and operate private wells to meet their water demands. Groundwater supplies have been adequate to meet crop requirements, even after extended drought. Groundwater quality in the District is generally adequate for agricultural use. Quality tends to worsen in the deeper portions of the aquifer, but water is usable within the zones usually tapped by wells in the District.

Land Use
RCWD was formed in 1996 after agricultural development of the District was essentially complete. Nearly the entire District is, and has been for many years, planted in orchards, with almonds, citrus, pistachios and olives being the major crops.

Water Demands
Water demand in the District area slowly increased over the years as land was brought into production. Since nearly full agricultural development has now occurred, and the District is planted largely to permanent crops, demands are fairly stable from year to year.

RCWD does not keep records on water use, crop acreage, or groundwater pumping. Therefore, no good information exists to develop a precise estimate of crop water demand. However, based upon the District area of 9,217 acres, and an assumed average annual consumptive-use demand of about 2.5 AF/acre, water demand in the District is on the order of 20,000 to 25,000 AF/year.

District Facilities
As of December 31, 2011, Root Creek Water District does not own or operate any water distribution facilities. Water needs in the District have been served solely by private wells and San Joaquin River water rights on lands bordering the river. However, the District has planned, approved, and obtained funding for a distribution system to begin delivering surface water to a portion of the District.

The RCWD 'In-Lieu Groundwater Recharge Project' includes the acquisition of the surface water supplies discussed above, and construction of distribution facilities to deliver surface water to an initial 3,200 acres of lands that currently rely exclusively on groundwater. The project will deliver surface water 'in-lieu' of groundwater pumping and thus preserve groundwater resources. The project area currently has an annual groundwater level decline of 3 to 5 feet.

Water will be diverted into RCWD through a new turnout on MID's Lateral 6.2. Additional facilities will include 2.7 miles of 48-inch diameter concrete pipe, 4.2 miles of

lateral pipes ranging in diameter from 4 to 24 inches, and twelve connections to existing irrigation pump stations owned by individual property owners. The current project is the first phase in a potentially larger project that could deliver water to most of RCWD.

1.2 - Goals and Objectives of Groundwater Management Plan

The purpose of this GMP is to develop a coordinated and comprehensive approach to the evaluation and management of groundwater resources within RCWD. The goal of this Plan is to implement effective groundwater management which moves to restore, where possible, and maintain a high quality and dependable groundwater resource. The goals and proposed actions in this plan will likely evolve as other concerns and issues arise.

This Plan documents the existing groundwater management efforts in RCWD and planned efforts to improve groundwater management. The objective the GMP is to help RCWD meet the following goals:

1. By use of new surface water supply, bring the groundwater within the District to a balance based upon a five-year moving average.
2. Stabilize groundwater levels in order to minimize pumping costs and energy use, and to provide groundwater reserves for use in droughts.
3. Maximize the use of surface water, including available flood water, for beneficial use, and thus reduce stress on groundwater resources.
4. Prevent groundwater degradation by protecting groundwater quality, importing clean surface water, and preventing intrusion of poor quality groundwater from neighboring areas.
5. Preserve, and, where feasible, enhance the existing quality of the area's groundwater.
6. Address potential changes in local hydrology brought about by surface water losses in the region (i.e. San Joaquin River Restoration), urban development, and drought.
7. Prevent surface water or groundwater exports that would reduce the long-term reliability of groundwater.
8. Coordinate groundwater management efforts between regional water users.
9. Responsibly manage the local groundwater resources so adjudication is unnecessary.
10. Maintain a groundwater-monitoring program to provide an "early warning" system to future problems.
11. Increase knowledge of the local geology and hydrogeology to better understand threats to groundwater quality and quantity.
12. Minimize possible "land subsidence" caused by groundwater pumping through in-lieu groundwater recharge, and wise and conservative use of pumped groundwater.

1.3 - Statutory Authority for Groundwater Management

California Assembly Bill No. 3030 (AB 3030), which became law on January 1, 1993, authorized local agencies that are within groundwater basins as defined in California Department of Water Resources (DWR) Bulletin 118-80, and that meet certain other criteria, to prepare and adopt Groundwater Management Plans. RCWD qualifies under the law. The District encompasses a portion of the Madera Groundwater Sub-basin as defined in Bulletin 118-80, which lies within the San Joaquin Basin Hydrologic Study Area (**Figure 3**).

AB 3030 remained unchanged with the amendments to the law provided by 2002 California Senate Bill 1938 (SB 1938), which also identified new requirements for GMPs. This GMP represents an updated version, and includes the additional components listed in California SB 1938.

The powers granted to an agency adopting a GMP include:

1. The District may take any actions needed to replenish the groundwater within the District, including buying and selling water, delivering water in-lieu of groundwater pumping, and spreading water for recharge.

2. The District may take actions needed to protect or prevent interference with water, water quality, or water rights within the District.

3. Using water quality goals, the District may take any action needed to preserve the water within the District for beneficial uses. These actions include preventing contaminants from entering District groundwater supplies, removing contaminants, locating and characterizing contaminants within the District, identifying parties responsible for contamination of groundwater, and performing studies relative to the listed water quality goals.

4. The District may enter into agreements with other local agencies or private parties to manage mutual groundwater supplies, including those existing in overlapping areas.

5. The District may levy and collect general groundwater replenishment assessments, as well as water extraction fees based on the amount of groundwater extracted from the aquifer. However, these fees must be "ratified" by a majority vote in an election, according to the election rules applicable to the District.

6. The District may sue to recover the amount of District expenditures for protection of groundwater quality protection from parties responsible for the contamination.

7. The District is granted additional powers of a Replenishment District, which

allows it to:

a) Acquire and operate facilities, waters and rights needed to replenish the groundwater supplies;
b) Store water in groundwater basins, acquire water rights, import water into the District, and conserve water;
c) Participate in legal proceedings as required to defend water rights, and water supplies, and to prevent unlawful exportation of water from the District;
d) Under certain conditions, to exercise the right of eminent domain;
e) Act jointly with other entities in order to economically perform required activities;
f) Carry out investigations required to implement programs;
g) Fix rates for water for replenishment purposes;
h) Recapture and reclaim water as provided for in Water Code section 60221; and
i) Fix the terms and conditions of contracts for use of surface water in-lieu of groundwater.

The District's overall strategy in using these powers is to perform grower education, water conservation efforts, and surface water imports, to reduce the rate of groundwater level decline, and eliminate groundwater overdraft, based upon a five year moving average, to help ensure that groundwater resources are sustainable. The District believes that this strategy will achieve its goals without requiring the District to exert significant control over private groundwater facilities.

1.4 - Groundwater Management Plan Components

This GMP includes the required and voluntary components for a GMP as identified in California Water Code Section 10753, et. seq. This Plan is also consistent with the recommended elements for a GMP as identified in DWR Bulletin 118 (2003), Appendix C. **Table 1.1** identifies the appropriate section of the GMP where each component is addressed.

Table 1.1 - Location of Groundwater Management Plan Components

	Description	Plan Section(s)
	California Water Code Mandatory Requirements (10750 et seq.)	
1.	Documentation of public involvement	1.5, Appendix A
2.	Groundwater basin management objectives	1.2, 3
3.	Monitoring and management of groundwater elevations, groundwater quality, land subsidence, and surface water	5.1 – 5.5
4.	Plan to involve other agencies located in the groundwater basin	4.3
5.	Monitoring protocols	5.3
6.	Map of groundwater basin and agencies overlying the basin	**Figures 1, 2, and 3**
	California Water Code Voluntary Components (10750 et seq.)	
7.	Control of saline water intrusion	6.3
8.	Identification and management of wellhead protection areas and recharge areas	6.2, 7.2, 7.3
9.	Regulation of the migration of contaminated groundwater	6.3, 6.4
10.	Administration of well abandonment and well destruction program	6.1
11.	Mitigation of overdraft conditions	7.2, 7.3
12.	Replenishment of groundwater extracted by water users	7.3
13.	Monitoring of groundwater levels and storage	5.1, 9.2
14.	Facilitating conjunctive use operations	7.4
15.	Identification of well construction policies	8.1
16.	Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects	8.2
17.	Development of relationships with state and federal regulatory agencies	4.2, 4.3
18.	Review of land use plans and coordination with land use planning agencies	9.1
	Additional Components Recommended by DWR (App. C of Bulletin 118)	
19.	Advisory committee of stakeholders	4.1
20.	Description of the area to be managed under the Plan	1.1, 2
21.	Descriptions of actions to meet management objectives and how they will improve water reliability	4 - 9
22.	Periodic groundwater reports	9.2
23.	Periodic re-evaluation of Groundwater Management Plan	9.4

1.5 - Adoption of Plan

Refer to **Appendix A** for documentation on the adoption of the GMP and the public process that was followed.

Groundwater Advisory Committee

A Groundwater Advisory Committee (GAC) was formed to assist with updating the GMP. The GAC includes the District Manager, District legal counsel, District engineer, and RCWD Board of Directors. The RCWD Board of Directors is comprised of local farmers and represents the local community. They are familiar with the local and regional water issues and are best suited to serve as the primary voice on the GAC.

Plan adoption

The original RCWD GMP was adopted through a formal public noticing process in 1997. Two duly noticed public meeting were held with relevant materials made available to the public. No adverse comments on the GMP were received. A copy of the resolution adopting the GMP in 1997 is provided in **Appendix A**.

A draft copy of the GMP update was sent to the following local agencies for their comments: Madera County, Madera Irrigation District, Chowchilla Water District and Gravelly Ford Water District. No comments were received from the agencies.

As required by the California Water Code Section 10753.2 (a), RCWD published a series of public notices, held public meetings, and adopted resolutions required for preparing and adopting this GMP. The public was provided a 45-day period to review the draft GMP. No comments were received from the public. These public outreach efforts are summarized in **Table 1.2** below.

Table 1.2 – Public Participation in Groundwater Management Plan Update

Phase of Public Noticing	Description	Date
Intent to update GMP	Notice of hearing published	11-1-2011 11-7-2011
	Hearing held. Resolution adopted.	11-10-2011
Public Review	Notice of hearing published	11-12-2011 11-18-2011
	Hearing held. Announcement that Draft GMP was available for public review.	11-22-2011 12-1-2011
GMP Adoption	Final GMP adopted by Board of Directors	1-6-2012

2 - GEOLOGY AND HYDROGEOLOGY

This section discusses the geology and hydrogeology of Root Creek Water District and immediate surrounding areas. The purpose of this section is to provide general background information on the local hydrogeology that will aid in selecting and implementing groundwater management programs. Most of the information on the District's geology was derived from Bertoldi et al. (1970), and Kenneth D. Schmidt and Associates (KDSA) and Provost & Pritchard Engineering Group (P&P) (2001).

The following sections include technical discussions on the District's groundwater. These are intended to provide geologists, engineers, and water managers a greater understanding of the area's stratigraphy, groundwater conditions, and hydrogeologic parameters. The content of this chapter requires a basic understanding of some geologic principles and terminology. Less technical discussions on groundwater management programs can be found in Sections 3-9.

2.1 - Groundwater Basin Description

Root Creek Water District is located in the Madera groundwater sub-basin (Madera Basin). The DWR considers the boundaries of the Madera sub-basin appropriate for groundwater management purposes (DWR Bulletin 118-80). These boundaries were identified on the basis of geological and hydrological conditions, as well as political boundary lines.

The Madera Basin lies within the San Joaquin Basin Hydrologic Study Area (HSA). RCWD lies in the southeastern portion of the Madera Basin (**Figure 3**). The individual basins within the San Joaquin Basin HSA were defined primarily upon political boundaries due to the continuous aquifer system within the HSA. The Madera Basin was determined in Bulletin 118-80 to be a "critically overdrafted" basin, according to the following definition:

> "*A basin is subject to critical conditions of overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social or economic impacts*."

This definition implies a more dire circumstance than mere "groundwater overdraft", which is generally defined as that condition where extractions exceed groundwater replenishment over some specified time period.

The Madera Basin extends from the Sierra Nevada foothills on the east to the eastern boundary of the Columbia Canal Company Service Area on the west, and from the San Joaquin River on the south to the southern boundary of the Chowchilla Groundwater Basin on the north.

2.2 - Geology and Geomorphology

Several reports include information on the soils, subsurface geology, hydrogeology and water quality in vicinity of RCWD. The descriptions provided below are mainly summarized from a USGS report entitled "*Geology, Hydrogeology and Quality of Water in the Madera Area, San Joaquin Valley California*" (Bertoldi et al., 1970). Other reports consulted include "*Hydrogeologic Investigation of Southeastern Madera County*" (P&P and KDSA, 2001) and "*AB 303 Project Summary Report*" (P&P and KDSA, 2003).

Geomorphology and Soils

The District lies entirely within the alluvial fan of the San Joaquin River, one of the largest geomorphic features in the Madera area. The alluvial fan of the San Joaquin River extends from the foothills of the Sierra Nevada near Friant California to the distal portions of the valley where it coalesces with the alluvial fan of the Fresno River about 20 miles west of Highway 99. East of Highway 99 in the area of the District, the San Joaquin River alluvial fan is well dissected and well drained, slopes from 13 to 15 feet per miles southwestward, and generally has local relief from 10 to 100 feet created by small ephemeral streams. Local ephemeral streams in RCWD include Root Creek and its tributaries.

The parent material of the District's soils are derived from mixed granitic and sedimentary rocks from the Sierra Nevada Mountains. These materials were deposited by the San Joaquin River during flood periods. The soils and underlying material are considered part of the "older alluvium" as mapped by Bertoldi et al. (1970). Soils formed under these conditions typically have large amounts of clay or hardpan at or close to the surface. Soils in the District are predominantly loams, ranging from sandy loams to clays. Soils throughout the region are stratified, with interspersed sandy and clayey layers. The sandy layers are not typically continuous across large areas. The soils map (**Figure 4**) shows sandier soils exist along Root Creek and its tributaries, and near the San Joaquin River.

Subsurface Geology

The District is underlain from the top down by older alluvium, Continental deposits of Tertiary and Quaternary age, and the granitic basement complex. The geologic descriptions provided below are primarily from Bertoldi et al. (1970).

Older Alluvium. The older alluvium is about 200 feet thick across the District. It dips southwestward and overlaps the Ione Formation and basement complex east of the District. It consists of intercalated lenses of clay, silt, sand, and some gravel. Near the surface of the older alluvium cemented sediment hardpan occurs throughout the area (Bertoldi et al. 1970). The breakdown of the dominantly granitic parent material (micaceous arkosic sediment from the Sierra Nevada and smaller amounts of volcanic ash) into red or brown clays leads researchers to assume the older alluvium is mostly oxidized. At depth this unit becomes finer and grades into the underlying fine–grained continental deposits of Tertiary and Quaternary age.

Continental Deposits. The continental deposits of Tertiary and Quaternary age (Continental Deposits) underlie the District starting at depths around 200 feet below the ground surface (bgs). Like the older alluvium the Continental Deposits dip southwestward across the District and extend down to the basement complex. The deposits consist of interbedded poorly-sorted sand, silt, clay and conglomerate with layers of hardpan and smaller amounts of volcanic glass and andesitic tuff. Electric and geologist logs indicate that these deposits become finer with depth and distance from the foothills. Of note is the presence of reduced blue-green clay deposits in the lower portions of the deposits that have been interpreted as having water of poor water quality for drinking water purposes and production of slime producing organisms. Near the eastern side of the District these reduced deposits were found from about 350 to 550 feet deep. Better quality water can be found by sealing of these depth and installing wells at greater depths (P&P and KDSA, 2001). Bertoldi et al. (1970) states that few wells were constructed within the Continental Deposits, so little is known about its water bearing qualities. However, most wells below depths of about 200 feet do tap these deposits and wells yields in the area can be as high as 2,000 gpm.

Basement Complex. The basement complex underlies the continental deposits of Tertiary and Quaternary age. The basement complex is composed mainly of granitic and metamorphic schistose rocks. These rocks crop out east of the older alluvium (east of the District) and dip below the older alluvium and continental deposits beneath the area. Structure contours and cross sections in Bertoldi et al. (1970) indicate that these rocks dip southwesterly across the District from about 800 feet near Highway 41 to nearly 2,000 feet on the west side of the District. In the eastern part of RCWD it slopes about 1 degree southwest forming a shelf evident in cross section. About midway across the district to the west the slope dramatically increases and it is known to be as deep as 10,000 feet near the center of the valley. No wells within District boundaries penetrate the basement complex and it does not yield water freely to wells.

2.3 - Aquifer Characteristics

The Root Creek Water District overlies a portion of a continuous aquifer system that occupies the Central Valley of California. The aquifer below the Root Creek Water District extends to depths ranging from about 800 feet to greater than 2,000 feet before basement rock is encountered, but the practical limit of the aquifer is typically considered to be at the base of the fresh water (defined as water containing less than 2,000 parts per million dissolved solids). The zone of fresh water may extend to the basement rock in the northeast corner of the District, (at a depth of around 800 feet) and ranges to a depth of about 1,200 feet in the southwest corner. Data is sparse on the periphery of the valley, and the hydrogeologic boundaries in the vicinity of the District are imprecise.

RCWD does not overlie any of the major confining clay layers that have been identified in the valley. However, the older alluvium and continental deposits underlying the

District are liable to include interfingered layers of relatively impermeable materials. KDSA and P&P (2001) state that fine-grained deposits dominate the subsurface in the northeast portion of the District to depths of about 400 feet, and the relative amount of coarser-grained deposits increase in the upper 300 feet near the San Joaquin River.

Well Yields

Well yields within RCWD typically range from 500 to 1,000 gallons per minute, though there are exceptions to both ends of this range. The best producing wells in the District yield in excess of 2,000 gpm.

Storage Capacity

The aquifer currently used by agricultural wells in RCWD is about 600 feet deep. Some wells tap strata in excess of 1,000 feet deep, but these are exceptions. Very few water bearing sands exist below about 600 feet. Assuming it is desirable for the water table to come no closer than ten feet from the ground surface, and applying an average specific yield of 0.075 to the aquifer, total storage capacity of the aquifer can be estimated at 410,000 AF. Specific yield is the ratio of the volume of water which will drain freely from a material to the total volume of the formation.

Transmissivity and Specific Capacity

Transmissivity and specific capacity are aquifer parameters used as indicators of the potential yield of an aquifer. Transmissivity is the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic head. Specific capacity is the rate of discharge of a well per unit drawdown.

Regional transmissivity data is available from Davis et al., (1964), who summarizes numerous specific capacity values from Pacific Gas & Electric pump tests performed across the San Joaquin Valley. Using data from 106 field tests in and around RCWD (T12S, R19E and T12S, R20E), they calculated specific capacities ranging from 41 to 61 gpm per foot of drawdown. These values are based on early time drawdown data, and probably over estimate long-term specific capacities. Thomasson et al. (1960) developed an empirical relationship between specific capacity and transmissivity, which is also discussed by Driscoll (1986, Appendix 16.D). Using this method, transmissivity values for RCWD range from about 60,000 to 90,000 gpd/ft based on early time drawdown data. Bertoldi et al. (1970) calculated transmissivity in the Madera area in the older alluvium, which are the deposits comprising the upper 200 feet of the District's aquifer. While none of the wells used by Bertoldi are inside RCWD, their values of transmissivity range from 18,000 to 99,000 gpd/ft; a broader range than the values calculated with the Thomasson method. Below depths of about 200 feet, the aquifer is comprised of continental deposits of Tertiary and Quaternary age, which are finer-grained than the overlying older alluvium and thus the transmissivity values provided by Bertoldi et al. (1970) are probably high. Several recent pumping tests for wells outside of but near the eastside of the District had estimated transmissivity values of 14,000 to 20,000 gpd/ft. For these reasons, a more realistic and conservative estimate of the

range of transmissivities would probably be about 20,000 to 60,000 gpd/ft. This range of transmissivity values is considered low compared to the broader San Joaquin Valley.

2.4 - Ground Water Levels and Flow Direction

Prior to development of groundwater resources in the Root Creek area, groundwater was typically around 100 feet below the ground surface. The direction of groundwater flow was to the southwest. In the fall of 1936, the first period for which a groundwater map is available, well water-levels ranged in elevation from around 270 feet above mean sea-level (msl) in the northeast corner of the District to 240 feet in the southwest. As development began in the region, groundwater levels started to decline. By the spring of 1960 ground water elevations ranged from around 230 to 255 feet above msl, and the direction of flow was more westerly with a slight southerly component. By 1993 a large pumping depression had formed north/northwest of the District and water elevations had dropped to 150 feet msl in the northern part of the area and were about 210 feet msl near the San Joaquin River. This large pumping depression effectively changed the direction of flow across the District to the north. By 2001, water elevations had dropped to about 120 feet msl in the northern part of the District and were about 210 to 220 feet msl near the San Joaquin River.

Recent groundwater elevation and contour maps are shown in **Figures 6** to **9**. **Appendix B** contains seven hydrographs representative of wells across the District. These maps indicate that the direction of flow across the District is still northerly and water elevations continue to decline. Groundwater elevations in the northern part of the District are about 20 feet lower than in 2001, and while the data is sparse near the San Joaquin River, it appears that constant river recharge has stabilized water elevations in this area. From 1936 to 2011, groundwater levels have declined about 140 feet in the north part of the District and have dropped 10 to 20 feet near the San Joaquin River. In addition, Boyle Engineering Corporation (2008) states that groundwater levels have declined from 1 to 4 feet per year across RCWD during 1970 to 2006.

Most of the hydrographs indicate that water levels continue to fall across the District but the rate of water level decline appears to have slowed since the mid 1990's. In contrast, the hydrograph for Well 130 shows an increase in water level of about 10 feet since 1996, while the hydrograph of Well 182 shows an increase in the rate of water level decline since 2001. Several hydrographs at the northern end of RCWD show groundwater levels stabilizing in the last 10 to 15 years. This may be attributed to the delivery of surface water to subordinate MID lands, just north of RCWD, which began around the mid 1990's.

Under the new development plans the District will import an average of 6,100 AF of water annually. The current overdraft is estimated to be 3,400 AF/year. The importation of the new surface water supply should have a positive impact on declining groundwater levels. Due to the strong groundwater gradient to the north, groundwater

will likely continue to flow out of the district, however the recent decline in groundwater levels in the northern portions of the District should be somewhat attenuated. It is possible that the surface water imports will allow groundwater levels in the southern part of the District to recover and be maintained near historic (i.e. pre-development) levels.

2.5 - Groundwater Recharge

Seepage of San Joaquin River flow is predominate source of recharge to RCWD (KDSA and P&P, 2001). P&P and KDSA also identify several areas where direct surface water recharge is viable. These locations are near the San Joaquin River in the southern part of the District, in the southern part of the District south of Avenue 9 and west of Road 39, along Root Creek central to the District, and north of avenue 12 adjacent to Madera Irrigation District (**Figure 10**). These sites were identified due to the relative abundance of coarse-grained materials above the water table, existence of relatively thin clay hardpan or restrictive layers, location up gradient of potential water supply areas, and beneficial impact to the District. The report does indicate that up to 20 feet of material would need removal to expose sands with recharge benefits. Bertoldi et al. (1970) identified a wide area in central RCWD as favorable for recharge, which is also shown on **Figure 10**. Currently the District does not actively recharge surface water. The District is open to the development of direct recharge facilities in the future, and projects to develop direct recharge facilities will be considered after the completion of the in-lieu pipeline.

2.6 - Groundwater Quality

Historically, groundwater has had adequate quality for agricultural use in the District. The best source of general information on historical water quality is provided by Bertoldi et al. (1970). A review of the maps indicates that wells were typically less than 300 feet deep, although the information on well depths was sparse. Most of the District's groundwater was calcium-sodium bicarbonate to sodium calcium bicarbonate. The groundwater typically had low salinity and sodium hazards, and variable nitrate concentrations from 1 to >20 mg/L. Chloride was less than 20 mg/L in groundwater with a small pocket of higher chloride water from 20-40 mg/L in the central part of the District. Soft groundwater (0-60 mg/L as $CaCo_3$) was found in the northeast part of the District, and a transitional zone of hardness (60-120 mg/L as CaCo3) extended northwest to southeast across the central part of the District with a zone of harder water (121-180 mg/L as CaCo3) evident near the San Joaquin River. Total Dissolved Solids ranged from 96 to 424 mg/L.

The most current and complete discussion on recent groundwater quality in the District is presented by KDSA and P&P (2003), who document sampling from 15 deep and shallow wells throughout the District. This information represents a more complete horizontal and vertical water quality data set, thus allowing for a more detailed understanding of water quality, especially the deeper groundwater. Results from that study include the following:

- Total dissolved solids (TDS) ranged from 130 to 500 mg/L
- The lowest TDS values were from wells less than 500 feet deep
- Groundwater above 500 feet was of calcium-sodium bicarbonate type
- Deep groundwater was of sodium bicarbonate or sodium chloride type
- Nitrate concentrations ranged from 1 to 26 mg/L, and generally were higher in shallower wells
- Boron concentration were less then 0.05 mg/L
- Iron concentrations were less than 0.05 mg/L, except for one well with a reported concentration of 0.1 mg/L
- Manganese concentrations exceeded the MCL in four wells (from 0.16 to 0.63 mg/L). Water from the remaining wells was below the detection limit for reporting.
- Elevated arsenic concentrations were reported in five wells and ranged from 13 to 109 ppb. Wells less than 650 feet deep usually had arsenic concentrations less than 2 ppb.
- Water from three deep wells had elevated heterotrophic plate count (hpc) above 15 cfu/ml (colony forming units). Water from other wells ranged from 2 to 12 CFU/ml.
- DBCP and EDB were not detected in the sampled wells.
- Gross alpha activities were reported at 6 picocuries or less.

For drinking water purposes, water quality concerns in RCWD include elevated levels of manganese, arsenic and HPC; mostly in wells about 800 feet deep. Groundwater above a depth of 650 feet appears to be largely suitable for drinking water supply, except for manganese in some shallower wells. A review of the groundwater quality concludes that, with a few exceptions, groundwater is adequate for agricultural use. The most notable exceptions includes elevated chloride in water from two wells and especially a deep well near Avenue 10 and Road 39 (severe at 172 mg/L), and several wells with water that have moderate micro-irrigation system plugging hazards due to alkalinity, pH, and manganese. Sodium is also indicated to be a problem for agricultural use, but only in two wells sampled for the study. Ground water quality in the District is generally better in the upper 600 feet of the aquifer.

2.7 - Land Subsidence

The United States Geological Survey, in cooperation with the California Department of Water Resources, published a report entitled '*Land Subsidence in the San Joaquin Valley as of 1983*' (USGS, 1986), which was updated in 1995 (Swanson, 1998). These reports are the most recent in a series of publications studying land subsidence in the San Joaquin Valley. The reports identify areas in the San Joaquin Valley experiencing more than 1-foot of subsidence (caused by groundwater pumping). RCWD is about 18 to 20 miles outside of the mapped subsidence area. Subsidence in the San Joaquin Valley has generally been correlated to groundwater withdrawals from confined aquifers, but no major confining layers are present in RCWD. In addition, RCWD staff have not noticed any visible signs of land subsidence such as raised well foundations.

2.8 - Saline Water Intrusion

Page (1973) mapped the base of fresh groundwater in the San Joaquin Valley, which he defined as water having less than 3,000 micromhos electrical conductivity. RCWD does not lie within an area having saline water according to Page. However, Bertoldi et al. (1970) states that highly saline connate water is present west of the District. Connate water is ancient water, often of marine origin, trapped in the interstices of a sedimentary rock when the rock was deposited. It is often found at great depths and not used as a regular water supply. KDSA and P&P (2001) indicate that connate water is not an important water supply for RCWD because of the District's easterly location. However, KDSA and P&P (2001) do discuss high chloride water below depths of 600 feet, and approximately 2 miles west of RCWD. They indicate that this may reflect some connate water influence due to upward movement of deeper groundwater. Additionally, KDSA and P&P (2003) report that an 800 foot deep well in the central portion of the District had chloride concentrations of 172 mg/L and total dissolved solids 500 mg/L. This could indicate that groundwater from deeper wells in that area might be affected by deeper connate groundwater. KDSA and P&P 2003 sampled 15 wells throughout the District and found that the highest TDS values were from wells perforated more than 700 feet deep. However, due to the proximity of the San Joaquin River, most wells in the District are constructed shallower and do not have problems with upconing of saline water.

3 - BASIN MANAGEMENT OBJECTIVES

Basin Management Objectives (BMOs) are broad goals for improving the management of a local groundwater basin. The following BMO's were developed by the RCWD to address its specific groundwater needs and challenges:

1. **Stabilize Groundwater Levels.** Stabilize groundwater levels by importing surface water and reducing consumptive use.

2. **Import New Surface Water Supplies.** Import an average of 6,100 AF/year of surface water for delivery to irrigators, which is projected to correct the current estimated groundwater overdraft of 3,400 AF/year within the District.

3. **Prevent Land Subsidence.** Prevent the potential for land subsidence by importing surface water and reducing groundwater pumping.

4. **Prevent Groundwater Degradation.** Prevent groundwater degradation by protecting groundwater through proper well construction and abandonment, proper use of agricultural amendments, and importing clean high-quality surface water.

5. **Maintain Good Groundwater Quality for Agricultural Irrigation.** Maintain suitable groundwater quality at values less than 700 ppm total dissolved solids for agricultural irrigation.

6. **Increase Knowledge of Local Geology and Hydrogeology.** Increase knowledge of the local geology and hydrogeology through technical studies, subsurface investigations, water quality testing, and water level monitoring. Gain a better understanding of regional groundwater quality, groundwater overdraft, and groundwater flow conditions. Seek funding for these investigations through State and Federal grant programs.

7. **Maintain/Strengthen the District's Authority for Local Groundwater Management.** Solidify the District's position and authority as the manager of local groundwater resources, provide better representation for the District growers on groundwater issues, and responsibly manage the groundwater so that adjudication of the groundwater basin is unnecessary.

4 - STAKEHOLDER INVOLVEMENT

4.1 - Groundwater Advisory Committee

A Groundwater Advisory Committee (GAC or Committee) was formed in 2011 to assist with updating this GMP. The GAC is comprised of the District Manager, District legal counsel, District engineer and RCWD Board of Directors. The RCWD Board of Directors is comprised of local farmers and represents the local community. They are familiar with the local and regional water issues and are best suited to serve as the primary voice on the GAC. The GAC offered several useful and insightful comments that were incorporated into this GMP. The GAC will also monitor and evaluate the technical progress made in achieving the goals of this GMP.

Existing Activities

Assisted with the development of this GMP.

Planned Actions

The Committee will hold special groundwater sessions during regular Board meetings, or more frequently if deemed appropriate, and will have the following responsibilities:

- Participate, as needed, in the Madera Region Regional Water Management Group and Madera-Chowchilla Basin Groundwater Monitoring Group;
- Review trends in groundwater levels and available information on groundwater quality;
- Evaluate the effectiveness of current groundwater management policies and facilities;
- Evaluate and respond to claims from landowners that their wells are being impacted by District operations;
- Discuss the need for new groundwater supply/enhancement facilities;
- Educate landowners on groundwater management issues;
- Assess the overall progress in implementing the programs outlined in the GMP;
- Recommend updates or amendments to the GMP;
- Identify regional and multi-party groundwater projects;
- Review and comment on the Annual Groundwater Report; and
- If needed, form special committees or task forces to undertake special groundwater management tasks.

4.2 - Relationships with Other Agencies

The development of relationships between RCWD, various regulatory agencies, and other local water agencies is an important part of an effective groundwater management plan. The District is located in the Madera groundwater sub-basins, which extends beyond many political boundaries and includes other municipalities, irrigation districts, water districts, private water companies, and private water users (see **Figures 1, 2 and 3**). This emphasizes the importance of inter-agency cooperation, and the District has historically made efforts to work conjunctively with many other water management

agencies. Below is a list of some organizations that the District has worked with in managing the local groundwater**:**

- Madera Region Regional Water Management Group
- Association of California Water Agencies
- Madera County Water Advisory Commission
- Madera-Chowchilla Basin Regional Groundwater Monitoring Group
- Madera County Service Area 19 (Rolling Hills)

A description of each organization and its role in managing groundwater in RCWD is provided below.

Madera Region Regional Water Management Group
RCWD is a member agency in the Madera Region Regional Water Management Group. RCWD regularly attends its meetings, has participated in development of the Integrated Regional Water Management Plan (IRWMP) and grant applications for implementation projects.

Association of California Water Agencies
RCWD is an active member of the Association of California Water Agencies (ACWA). ACWA fosters cooperation among all interest groups concerned with stewardship of the State's water resources. RCWD attends the ACWA annual meetings, has a representative on the Region 6 Board, and benefits from the educational and informational services that ACWA offers.

Madera County Water Advisory Commission
The president of the RCWD Board of Directors has been actively involved with the Madera County Water Advisory Committee, and has been a member of the Water Resource and Groundwater Committees since their inception.

Madera-Chowchilla Basin Regional Groundwater Monitoring Group
The Madera-Chowchilla Basin Groundwater Monitoring Group (Monitoring Group) was formed in 2010 to monitor groundwater levels in the Madera Groundwater sub-basin and Chowchilla Groundwater sub-basin in compliance with California Statewide Groundwater Elevation Monitoring program, which is described in Section 5.1. The group consists of MID, Chowchilla Water District, Madera County, Madera Water District, RCWD, and Gravelly Ford Water District. The monitoring area covers 789 square miles. The group has worked cooperatively to establish a regional groundwater level monitoring network.

Madera County Service Area 19 (Rolling Hills)
RCWD has facilitated efforts to help the neighboring Madera County Service Area 19 secure property for a well site and access a private well as a backup water supply.

Existing Activities

- On-going agreements, cooperative agreements and projects with other agencies mentioned above.

Planned Actions

- None

4.3 - Plan to Involve the Public and Other Agencies

The District is already involved with many neighboring and regional agencies on groundwater management projects. Nevertheless, RCWD is always interested in building new relationships with other agencies that share the same groundwater basin. RCWD will also strive to involve the public in groundwater management decisions. Additional cooperative relationships can be achieved through data sharing, inter-agency committees, interagency meetings, memorandums of understandings, formal agreements, and collaborations on groundwater projects.

Existing Activities

- Public outreach efforts described in sections 1.5 and 4.2.

Planned Actions

- Hold regular Groundwater Advisory Committee meetings that are open to the public.
- Provide copies of the annual groundwater reports to the public and interested public agencies at their request.
- Develop further relationships with regional agencies including members of the Madera Region Regional Water Management Group.

5 - MONITORING PROGRAM

This section discusses monitoring of groundwater levels, groundwater quality, land surface subsidence, and surface water. Monitoring is considered critical to future management decisions, and the District's monitoring program is intended to:

1. Provide warning of potential future problems;
2. Use data gathered to generate information for water resources evaluations;
3. Develop meaningful long-term trends in groundwater characteristics; and
4. Provide data comparable from place to place in the District

5.1 - Groundwater Level Monitoring

Groundwater level monitoring efforts in RCWD include district wide monitoring and participation in a regional monitoring program.

District-wide Groundwater Level Monitoring

RCWD has monitored spring and fall groundwater levels since 1998. Currently, these measurements are taken in about 23 wells. The data obtained in the spring reflects the "seasonal high" water table, as the measurements are made prior to pumping for pre-irrigation. The fall measurements are taken after a full season of crop irrigation pumping. RCWD also collects some groundwater level data just outside the district, to better understand groundwater conditions on its borders. The District uses this data to generate semi-annual groundwater contour maps (elevation and depth to water). Refer to **Figure 5** for a map of the monitoring wells and **Figures 6 to 9** for the most recent groundwater contour maps. **Appendix B** includes hydrographs for seven wells in RCWD. **Appendix C** includes a list of attributes for all wells used in the District as of 2003, including those used in the monitoring network. Future efforts will include estimating change in groundwater storage to evaluate the benefits of future surface water imports.

CASGEM

The California State Groundwater Elevation Monitoring (CASGEM) program was created by SBx7 6, Groundwater Monitoring, a part of the 2009 Comprehensive Water Package. By passing the bill, the Legislature established for the first time a statewide program to collect groundwater elevations, facilitate collaboration between local monitoring entities and the DWR, and report this information to the public.

In 2010, DWR approved the Madera-Chowchilla Basin Groundwater Monitoring Group as the local monitoring entity. As part of this group, RCWD helped to establish a regional monitoring network, and will submit groundwater level data each spring and fall to the DWR. The total monitoring area covers 789 square miles and includes all of the Madera sub-basin and most of the Chowchilla sub-basin. The wells RCWD will monitor for CASGEM are already part of the local network monitored for district uses.

Existing Activities

- Measure groundwater levels each spring and fall.
- Create groundwater contour maps (elevation and depth) each spring and fall

Planned Actions

- Estimate the annual change in groundwater storage from groundwater contour maps, and compare it to reductions in groundwater pumping and the volume of surface water imported. This will require landowners to meter groundwater pumpage, or estimate groundwater pumpage based on energy usage.
- Provide MID and Chowchilla Water District copies of annual groundwater balance calculations.
- Periodically review the monitoring network to determine if it provides sufficient areal coverage to evaluate groundwater levels.
- Maintain at least the same number of wells in the monitoring network by constructing monitoring wells, or adding new private wells to the network when existing wells are taken out of the monitoring network.
- Protect wells in monitoring program from being abandoned.
- Encourage landowners and developers to convert unused wells to monitoring wells. Inform them through the District educational outreach programs that their abandoned well(s) could be useful to RCWD.
- Seek grant funds to install dedicated monitoring wells.

5.2 - Groundwater Quality Monitoring

Groundwater quality monitoring is an important aspect of groundwater management in RCWD. Monitoring groundwater quality serves the following purposes:

1. Spatially characterize water quality according to soil types, soil salinity, geology, surface water quality, and land use;
2. Establish a baseline for future monitoring;
3. Compare constituent levels at a specific well over time (i.e. years and decades);
4. Determine the extent of groundwater quality problems in specific areas;
5. Identify groundwater quality protection and enhancement needs;
6. Determine water treatment needs;
7. Identify impacts of recharge and surface water use on water quality;
8. Identify suitable crop types that are compatible with the water characteristics; and
9. Monitor the migration of contaminant plumes.

District Monitoring

The District performed extensive groundwater quality testing in 2003 as part of a Local Groundwater Assistance Grant from DWR. The testing concluded that the water quality is acceptable for agriculture, with a few exceptions in limited areas. Refer to Section 2.6 for more information on the 2003 water sampling program. The District will begin

measuring electrical conductivity in monitoring wells each year, and will periodically perform detailed testing to verify that the water quality is not degrading. If the District begins delivering groundwater for urban uses in the future, then this Plan component will be modified to include more frequent testing, and testing for constituents important to drinking water quality.

Landowner Monitoring

Many landowners test the water quality of their domestic and irrigation wells on a regular basis. Some landowners may provide the test results to RCWD, however, the results are proprietary, and the landowners may ask that RCWD use the data for its information only and not release it to the general public.

Other Agency Monitoring

Numerous other agencies play important roles in the monitoring and mitigation of groundwater quality. These agencies include the Regional Water Quality Control Board, Environmental Protection Agency, Department of Toxic Substances Control, Madera County, USGS, and State Water Resources Control Board. RCWD makes an effort to collect and review pertinent water quality data published by these agencies.

Existing Activities

- Regularly collect new water quality information from other agencies and review it to identify any impending groundwater quality problems.

Planned Actions

- Protect wells in monitoring program from being abandoned.
- Measure electrical conductivity at monitoring wells every year to characterize changes in groundwater quality, and evaluate water quality impacts from surface water importation.

5.3 - Groundwater Monitoring Protocols

Monitoring protocols are necessary to ensure consistency in monitoring efforts and are required for monitoring evaluations to be valid. Consistency should be reflected in factors such as location of sample points, sampling procedures, testing procedures, and the time of year when the samples were taken. Without such common ground, comparisons between reports must be carefully considered. Consequently, uniform data gathering procedures are practiced by the District. The District has recently developed water level and water quality monitoring protocols, which can be found in **Appendix D**.

Existing Activities

None

Planned Actions

- Use the District's protocols when performing groundwater level and groundwater quality monitoring.
- Review the adequacy of the monitoring protocols annually and revise them when necessary.

5.4 - Surface Water Monitoring

Surface water sources in RCWD include Root Creek, the San Joaquin River, and surface water deliveries through facilities owned by MID. These are described below:

Root Creek. Root Creek is a small intermittent stream that flows east to west through the northern portion of RCWD (**Figure 5**). No flow data is available on the creek. Flows tend to come in the winter over short time periods when irrigation water demands are low. As a result, the creek waters are not used as a water supply and therefore RCWD does not monitor creek flows or water quality.

San Joaquin River. San Joaquin River Water is stored in Millerton Lake and impounded by Friant Dam. The USBR operates Friant Dam and monitors water releases, reservoir levels, and water quality. Some lands in RCWD have various appurtenant water rights in the San Joaquin River. These lands can take as much San Joaquin river water as they can beneficially use on the property with appurtenant rights. Most of these landowners measure their diversions, but none provide the data to RCWD.

Imported Surface Water. RCWD plans to import surface water purchased from Madera Irrigation District and Westside Mutual Water Company. The water will be conveyed through MID Lateral 6.2, where a propeller meter will measure diversions into a new pipeline. Flows will also be measured at each farmer turnout.

Water Quality Coalition. The RCWD landowners participate in the East San Joaquin Water Quality Coalition (Coalition). The Coalition is a group of agricultural interests and growers formed to represent all "dischargers" who own or operate irrigated lands east of the San Joaquin River within Madera, Merced, Stanislaus, Tuolumne and Mariposa Counties and portions of Calaveras County. The goals of the coalition include: 1) File required reports with the Central Valley Regional Water Quality Control Board (Regional Board) to provide conditional waiver coverage for members of the coalition; 2) Develop and implement an economical and scientifically valid water monitoring program for area rivers and agricultural drains (as required by the waiver); 3) Spread costs equitably among farm land owners/operators who are coalition members; and 4) Communicate to landowners where water monitoring indicates problems and work to solve those problems.

Existing Activities

- Regularly review hydrologic and water quality data for the San Joaquin River and surface water delivered directly to RCWD.

- Cooperate with the East San Joaquin Valley Water Quality Coalition in monitoring surface water quality in the region.

Planned Actions

- Monitor changes to surface water quality that could directly affect groundwater quality.

5.5 - Land Surface Subsidence Monitoring

High groundwater pumping can contribute to land subsidence across a broad area, resulting in aquifer compaction, loss of storage capacity, and adverse effects to surface features such as canals, flood control systems, and water supply pipelines which rely on gravity flow. Land subsidence has not historically been a problem in RCWD. RCWD staff and landowners have not observed any obvious signs of subsidence to irrigation facilities. Nevertheless, lands within the District will be observed for land subsidence, and, if land subsidence is observed and becomes a problem, RCWD will attempt to determine the cause of the subsidence. If necessary, this Plan will be amended to include preventative and mitigative measures. For now, a practical and sensible approach includes importing as much surface water as possible to minimize groundwater pumping, which is consistent with the District's current plans.

Existing Activities

- Periodically look for visual signs of land subsidence, such as collapsed wellheads.

Planned Actions

- Participate in any regional efforts to monitor and evaluate land subsidence.
- Educate local growers on the potential for land subsidence and visual indicators of possible subsidence.
- Review newly published land subsidence reports and information prepared by the USGS, DWR, USBR, CalTrans and other organizations.

6 - GROUNDWATER RESOURCES PROTECTION

6.1 - Well Abandonment

Existing State and Madera County law requires that owners or lessees properly destroy their abandoned wells. Proper destruction of abandoned wells is necessary to protect groundwater resources since abandoned or improperly destroyed wells can result in contaminated surface water entering the well, and water of different chemical qualities from different strata mixing. In both cases, groundwater can be degraded. The responsibility for administration and enforcement of the well ordinance will be left with Madera County.

The District will encourage landowners and developers to properly abandon their wells, or preferably, convert unusable wells to monitor wells so that they can become a part of the District's groundwater monitoring program. Before abandoned wells are converted to monitoring wells they will be evaluated for suitability, which will consider their condition, total depth, perorated interval, location, and other criteria.

Existing Activities

- Encourage landowners to abandon wells according to State and County standards.

Planned Actions

- Educate landowners through public outreach programs about well abandonment standards, and possible conversion of abandoned wells to RCWD monitoring wells.
- When possible, convert unusable production wells to monitoring wells.

6.2 - Wellhead Protection

The Federal Wellhead Protection Program was established by Section 1428 of the Safe Drinking Water Act Amendments of 1986. The purpose of the program is to protect groundwater sources of public drinking water supplies from contamination, thereby eliminating the need for costly treatment to meet drinking water standards. The program is based on the concept that the development and application of land use controls, usually applied at the local level in California, and other preventative measures can protect ground water.

A Wellhead Protection Area (WHPA), as defined by the 1986 Amendments, is "*the surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield*." The WHPA may also be the recharge area that provides the water to a well or wellfield. Unlike surface watersheds that can be easily determined from topography, WHPA's can vary in size and shape depending on subsurface geologic conditions, the direction of groundwater flow, pumping rates and

aquifer characteristics. There are several different methods typically used to delineate the lateral boundaries of a WHPA.

Under the Act, States are required to develop an EPA-approved Wellhead Protection Program. To date, California has no state-mandated program, but instead relies on local agencies to plan and implement programs. This is one of the factors that prompted the State Legislature to enact AB 3030. Wellhead Protection Programs are not regulatory in nature, nor do they address specific sources. They are designed to focus on the management of the resource rather than control a limited set of activities or contaminant sources.

As RCWD does not provide public drinking water, Wellhead Protection Areas are not currently applicable to this plan.

Existing Activities
None

Planned Actions

- Through landowner education efforts, encourage local growers to incorporate proper wellhead protection into all new wells, and retrofit old wells with proper wellhead protection.

6.3 - Saline Water Intrusion

Saline water intrusion occurs when a plume of saline groundwater migrates into an aquifer of higher quality water. This commonly occurs in coastal areas, in areas with large perched saline aquifers, or in areas were deep wells pump saline connate water from below fresh water.

Saline water intrusion is not currently a concern for RCWD. No saline plumes are located in or near the District. While the ground water may tend to be more saline in deeper portions of the regional aquifer, this appears to be a natural condition inherent in the geology, and does not threaten the District's groundwater supply**.** Upconing of saline water from deep groundwater pumping is unlikely, because saline groundwater is deeper than most wells in the area. The District will review available water quality data on a periodic basis. Should saline intrusion become a problem in the future, a GMP amendment will be prepared to address the issue.

Currently, the District strives to prevent the importation of saline surface waters that could ultimately degrade the groundwater. When alternative water sources are available for importation, the District will consider not only the cost but also the quality, including salinity, of the water. The District's current surface water supply is from the San Joaquin River, which has low salinity levels.

Existing Activities

- Review new water quality data to identify areas with the potential for saline water intrusion.
- Import surface waters with low salinity, when feasible and economical.

Planned Actions

None

6.4 - Migration of Contaminated Groundwater

Groundwater contamination can originate from many sources or activities. Groundwater contamination can be human induced or caused by naturally occurring processes and chemicals. Human induced sources of groundwater contamination can include irrigation, confined animal facilities, improper application of agricultural chemicals, septic tanks, industrial sources, stormwater runoff, and disposal sites.

The management and remediation of contaminant plumes generally falls under the responsibility of other agencies. Cleanup of contaminated groundwater is a complex and expensive task generally involving a number of organizations. Agencies with roles to play in mitigating groundwater contamination include the California Regional Water Quality Control Board (RWQCB), the California Department of Toxic Substances Control (DTSC) and the U.S. Environmental Protection Agency (EPA). Each agency has its own set of regulatory authorities and expertise to contribute, and the degree to which they participate depends on the nature and magnitude of the problem. The role of the RCWD will be to report any contamination that the District may discover to the appropriate agency. Currently, the District is not aware of any contaminant plumes in the area. The District will regularly review groundwater quality data from other sources and remain alert to the possibility of contaminated groundwater migration into RCWD.

Existing Activities

None

Planned Actions

- When possible, deliver surface water or strategically locate new recharge basins with respect to known areas of water quality problems to blend water supplies and/or create a hydraulic barrier to impede movement of contaminant plumes.
- Collect and consolidate maps from other agencies identifying contaminant plumes in or near the District.

6.5 - Groundwater Quality Protection

The District's surface water supplies cannot fully support the crop demand within the District, and therefore some groundwater will always be necessary. The groundwater, however, will have limited or no use if it has poor quality. Therefore, protecting the quality of the groundwater is a cardinal component of this GMP. Groundwater quality

can be protected through proper use of pesticides, herbicides and fertilizers, stormwater quality management, septic system management, and water vulnerability planning and management. Some of these tasks are the responsibility of cities and communities, but RCWD will support their efforts whenever possible.

Existing Activities

- None

Planned Actions

- Educate growers on the proper use of pesticides, herbicides and fertilizers.
- Import and recharge high-quality surface water.
- Seek funding to improve security at RCWD facilities and reduce the potential for contamination from acts of vandalism or terrorism.
- Follow State and County well construction standards for wellhead protection to protect groundwater quality.
- Construct, abandon and destroy wells according to State and County standards.

7 - GROUNDWATER SUSTAINABILITY

Groundwater has historically provided at least 80% of the District's water demands, with only small quantities of San Joaquin River surface water rights used on District lands. This situation will improve with the importation of an average of 6,100 AF/year of surface water beginning in 2012 or 2013. However, during years with low surface water allocations, groundwater is essential to prevent the loss of permanent crops and agricultural businesses. Groundwater is the most dependable water supply for the District's growers and local domestic water users. A decline in groundwater levels would reduce groundwater reserves, increase pumping lifts, and could require deepening or abandonment of wells. Therefore, preserving the sustainability of groundwater is essential for the economic well being of the District and its growers.

7.1 - Issues Impacting Groundwater Sustainability

Issues of concern for groundwater sustainability in RCWD are discussed below:

Groundwater Level Declines. Groundwater levels in RCWD have historically declined since the 1930's. Records indicate that groundwater levels have dropped about 140 feet in the northern portion of RCWD and about 10 to 20 feet near the San Joaquin River since 1936. These declines will likely continue without some mitigation measures. RCWD plans to begin importing 6,100 AF/year in 2012 or 2013, which will help to correct the current District overdraft of 3,400 AF/year, and help to stabilize current groundwater levels. Refer to Section 2.4 and **Appendix B** for more details on historic groundwater level declines in RCWD.

Regional Water Supply Issues. Impacts to regional water supplies can affect RCWD through increased overall demand and prices for surface water, and increased groundwater pumping in the groundwater basin. Some regional water supply issues include the San Joaquin River Restoration and pumping restrictions in the Sacramento-Bay Delta to protect sensitive species.

Cropping Patterns. Permanent plantings now cover most of the district. These increase winter water demands and reduce the ability of growers to fallow land and reduce demand in droughts.

7.2 - Overdraft Mitigation

Groundwater overdraft occurs when well pumping exceeds both natural and artificial groundwater replenishment (recharge, seepage, groundwater inflow, etc.). Overdraft of the groundwater supply can lead to a variety of problems, including land subsidence and increased pumping costs. Additionally, if overdraft continues unchecked, the groundwater supply may become unreliable when surface water is scarce, as in a time of extended drought.

Groundwater overdraft is due to an imbalance in the rates of extractions and replenishment. There are several methods to correct this imbalance. The first is to decrease the extraction to match the rate of replenishment. The second is to increase groundwater replenishment to match the extraction rate. The third method is a combination of the first two, to balance replenishment and extraction. Each of the methods are applied over an extended period, making use of the storage capacity of the aquifer. Extractions can exceed replenishment in drought periods as long as replenishment equally exceeds extractions in wetter periods.

Overdraft is a significant concern in the District. If it continues unchecked at the current pace it could ultimately affect the reliability and even availability of the District's water supply. Water demands in the District are fairly constant, due to the high level of agricultural development, predominance of permanent plantings, and wide use of high efficiency irrigation methods. However, continued decline of water levels to the north and west of RCWD could increase the subsurface outflow of groundwater. Periodic analyses of the District's groundwater levels are needed to monitor the overdraft situation.

Overdraft Mitigation Goal

RCWD has established a goal of eliminating groundwater overdraft (currently estimated at 3,400 AF/year) based on a 5-year moving average of recharge. This goal was established assuming that future hydrologic conditions were consistent with the period 1975 through 1995. Eliminating groundwater overdraft will be achieved by a combination of consumptive-use water reductions, in-lieu recharge from supplying surface water to areas that historically used groundwater, and in the future possibly direct groundwater recharge. The analysis will assume that 100% of in-lieu recharge and 90% of direct recharge contributes to overdraft mitigation. Water delivered from the San Joaquin River holding contracts will not be considered a contribution. The groundwater levels within RCWD will not necessarily stabilize if the District's overdraft is fully mitigated, since overdraft in surrounding areas may cause recharged water to flow out of the District.

In-Lieu Groundwater Recharge Project

The most significant effort to reduce groundwater overdraft will be the In-Lieu Groundwater Recharge Project, which will be operational in 2012 or 2013. The In-Lieu Groundwater Recharge Project includes the acquisition of surface water supplies and construction of distribution facilities to deliver surface water that would be used 'in-lieu' of groundwater. The project will import new surface water supplies into Madera County. Every acre-foot of surface water delivered by the project will offset an acre-foot of groundwater pumping and reduce overdraft in the local area and surrounding communities. The project will help to reverse the net overdraft in Southeastern Madera County that has been estimated at 22,000 AF/year in a report

by Kenneth D. Schmidt Associates entitled '*Hydrogeologic Investigation – Southeastern Madera County*', prepared in 2001. The estimated overdraft within RCWD is 3,400 AF, which is referenced in the same study. The project yield of 6,100 AF will not only mitigate for this local overdraft, but also deliver a net positive balance of 2,700 AF/year (6,100-3,400) within RCWD. The surface water delivery will also help to improve local water quality and improve water reliability.

Other policies that could help reduce overdraft are described below:

Limitations on Pumping
The California Water Code gives water and irrigation districts the power to limit or suspend groundwater extractions. These limits can only be implemented if the District determines through study and investigation that groundwater replenishment programs, or other alternative sources of water supply, have proved insufficient or infeasible to lessen impacts to groundwater. RCWD has no intention of limiting groundwater pumping or interfering with private landowner's rights to pump groundwater. If groundwater overdraft becomes severe, the District may pursue a voluntary program for reducing groundwater pumping, which would include incentives to compensate users for reducing their groundwater use.

Limitations on the Exportation of Water Supplies
RCWD does not generally support groundwater or surface water exports unless there is a benefit to the District. One example is a transaction involving an exchange that improves the timing of water delivery, provides drought protection or other benefits. Another likely example is sale of some RCWD surface water supplies for direct or in-lieu recharge in neighboring areas. By reducing the neighboring groundwater overdraft those exports would assist RCWD's water supply while also reimbursing RCWD for a portion of the importation costs.

Existing Activities

- Restrict water exports from the District.

Planned Actions

- Document recharge efforts to determine if the overdraft has been mitigated with direct or in-lieu recharge projects on a rolling 5-year average. Send copies of the documentation to MID and Chowchilla Water District.
- Evaluate annual groundwater contour maps for evidence of pumping well interference from neighboring agencies, or development of pumping depressions within the District.
- Educate growers on water conservation and conditions of overdraft.

7.3 - Groundwater Replenishment

Replenishment of groundwater is an important technique in management of a

groundwater supply to mitigate a condition of overdraft. Replenishment of groundwater underlying the District occurs both naturally and through intentional means. The various forms of groundwater replenishment in RCWD are listed below:

- Groundwater inflow to the District
- Deep percolation from precipitation
- In-lieu recharge from surface water deliveries
- Deep percolation from irrigation
- Streambed infiltration

Existing Activities
None

Planned Actions
- Perform a detailed water balance for the entire District, and prepare a user-friendly water balance model that can be used to estimate parameter values on a yearly basis.
- Perform studies, subsurface exploration, and infiltration tests to determine areas suitable for recharge.
- Seek grant funding for performing groundwater recharge studies and developing groundwater recharge basins.
- Perform in-lieu groundwater recharge by importing 6,100 AF/year of surface water.

7.4 - Conjunctive Use of Water Resources

Conjunctive operation of a groundwater basin is defined in DWR Bulletin 118-80 as:

> "*Operation of a groundwater basin in coordination with a surface water reservoir system. The basin is intentionally recharged in years of above average precipitation so groundwater can be extracted in years of below average precipitation when surface water supplies are below normal*."

Such management results in the groundwater storage being reduced in dry periods and increased in wetter periods. To avoid a condition of overdraft, replenishment and subsurface inflow must balance extraction and groundwater outflow over the long-term.

A conjunctive use program generally requires:

- A source of surface water in years of plentiful surface water supply.
- Recharge facilities.
- Conveyance facilities to import and export water to and from the groundwater storage area.
- Available storage capacity in the aquifer.
- Extraction facilities.

- Distribution facilities for surface and groundwater.

RCWD will need to develop some of these facilities before they can implement a conjunctive use program. Some previous studies have identified areas that may have potential as groundwater recharge sites (see **Figure 10**). Some additional studies would still be needed before a project could be developed. RCWD will consider developing groundwater recharge facilities in the future, but is presently focused on developing an in-lieu recharge system. Because of the strong natural recharge, however, the in-lieu recharge program will utilize the aquifer conjunctively by retaining groundwater for use in dry years.

Existing Activities
None

Planned Actions
- Construct distribution facilities to import surface water and reserve groundwater for dry periods.

7.5 - Water Conservation and Education

Water conservation is considered important in RCWD, and most District growers use water in a responsible and efficient manner. Most District growers use highly efficient sprinkler and drip irrigation systems. In addition, all surface water deliveries will be metered and billed based on the volume used. The surface water delivery system will be piped and experience low seepage losses.

Existing Activities
None

Planned Actions
- Bill surface water on a volumetric basis to encourage conservation.
- Educate growers on historical groundwater level trends.

7.6 - Water Recycling

RCWD does not currently use recycled water. No municipalities or industrial water users are located in or near the District that could provide a recycled water supply. In addition, due to high irrigation efficiencies, local growers produce little to no tailwater that could be re-used. However, the District supports the use of recycled water that meets crop water quality requirements, and will consider any new opportunities to use recycled water.

Existing Activities
None

Planned Actions

- Remain cognizant of opportunities to purchase recycled water from other local industrial facilities and municipalities.
- Evaluate the merits of purchasing recycled water from any new developments constructed in the District.

8 - GROUNDWATER OPERATIONS

8.1 - Well Construction Policies

Improperly constructed wells may result in contaminated groundwater by establishing a pathway for pollutants entering a well through drainage from the surface, allowing mixing between aquifers of varying water quality, or the unauthorized disposal of waste into the well. Madera County has enacted and is responsible for enforcing a County Well Ordinance that regulates well construction. The California DWR also has well construction standards documented in DWR Bulletins 74-81 and 74-90. RCWD does not have its own well construction policies, but rather follows State and County standards.

Existing Activities

None

Planned Actions

- Educate landowners on the existing Madera County well ordinance and State standards.
- Follow State and County standards if the District constructs wells in the future.

8.2 - Operation of Facilities

RCWD does not currently own any facilities, but plans to construct facilities that will allow for delivery of surface water and reduce stress on groundwater pumping. The facilities will include a 48-inch diameter pipeline and lateral pipelines that will allow for delivery of about 6,100 AF/year, which will directly replace groundwater pumping.

Existing Activities

None

Planned Actions

- Construct distribution facilities to allow for surface water deliveries.

9 - GROUNDWATER PLANNING AND MANAGEMENT

9.1 - Land Use Planning

Land use planning activities in unincorporated areas of Madera County are performed by the County of Madera's Planning Department, and overseen by the Madera County Planning Commission. RCWD does not have land use planning authority, therefore regional and local land use planning activities will remain with the appropriate agencies. However, when appropriate, RCWD will comment on proposed land use plans that may impact the local groundwater quantity or quality.

Some specific land-use planning goals that RCWD supports include: (1) preserving areas with high groundwater recharge potential for recharge activities; (2) protecting areas sensitive to groundwater contamination; (3) requiring hydrogeologic investigations, water master plans, and proven and sustainable water supplies for all new developments; and (4) requiring appropriate mitigation for any adverse impacts that land use changes have on groundwater resources.

Existing Activities

- When appropriate, comment on environmental documents and land-use plans that have the potential to impact groundwater.

Planned Actions

None.

9.2 - Groundwater Reports

The District has a goal to prepare groundwater reports every year to document groundwater levels, groundwater level trends, 5-year rolling overdraft mitigation analysis, changes in groundwater storage, direction of groundwater flow, groundwater quality, and other important groundwater related topics. This information will primarily be used to evaluate the impact from importing surface water (expected to begin in 2012 or 2013), forecast future problems, plan future groundwater projects, and develop new groundwater policies. The annual report will cover the prior calendar year and will be completed each year by April 30th. An outline for the annual groundwater report is included as **Figure 11**.

Existing Activities

- Prepare groundwater contour maps (elevation and depth to water) each spring and fall.

Planned Actions

- Prepare an annual groundwater report, as described above and in Figure 11.

9.3 - Plan Implementation

Implementation of this updated GMP is expected to result in significant amounts of new knowledge and an achievable improvement in groundwater management in RCWD. **Figure 12** includes an implementation schedule for this GMP from 2012-2017. The schedule does not include existing activities that will be continued. RCWD will maintain all existing programs unless stated otherwise in this GMP. Rather, the schedule includes new tasks and projects that are considered a high priority for the District. The highest priority task is completing a distribution system to allow for in-lieu groundwater recharge.

9.4 - Plan Re-evaluation

The GAC will be responsible for monitoring the progress in implementing the GMP objectives. Refer to Section 4.1 for more information on the membership, policies, and procedures of the Committee. The Committee will attempt to meet at each regularly scheduled Board meeting to review and evaluate groundwater conditions as well as evaluate the effectiveness of the GMP. As new policies, practices, and ordinances become necessary or desirable to enhance the management of the District's groundwater supply, this Plan will be amended as necessary.

Existing Activities

None.

Planned Actions

- Update the GMP at least every five years through a formal public process, or more frequently if a sufficient quantity of revisions, updates and additions have been identified.
- Evaluate the effectiveness of the GMP and need for an update at least once a year.
- Document recommendations for improving or updating the GMP in each annual Groundwater Report.

9.5 - Dispute Resolution

The District's dispute resolution policy is provided below:

> *"When landowners or water users within Root Creek Water District (the "District") cannot resolve differences or controversies with the District's employees, they are expected to discuss the problem with the District Manager prior to asking the Board of Directors for final determination. The Board of Directors reserves the authority to act as the final level of appeal on differences and controversies between landowners and water users within Root Creek Water District and District employees."*

Groundwater disputes between landowners are not the responsibility of RCWD, however, when asked to, RCWD may choose to help resolve disputes as an impartial mediator. Such efforts are intended to maintain amicable relationships among landowners, educate landowners on groundwater management goals and policies, and avoid an adjudication of the local groundwater basin.

Existing Activities

- Resolve disputes through the District's formal dispute resolution policy.

Planned Actions

- Discuss groundwater issues of concern at the regular Board of Director meetings in an effort to prevent future disputes.

9.6 - Program Funding and Fees

Several alternatives are available to RCWD for funding the existing and planned actions described in this plan, and are described below:

Water Replenishment Fees

Under AB 3030, local agencies have the authority to limit groundwater extractions and implement water replenishment fees based upon the amount of water extracted (extraction based fees must first be approved by majority vote of impacted landowners). These are considered measures of last resort and RCWD will strive to ensure the private unrestricted use of groundwater by the local growers. However, if at some point the State begins to regulate groundwater extractions, or if a legal adjudication of the basin occurs, then these fees may be unavoidable.

Capital Improvement Fees

The District has the authority to finance capital improvement projects and collect repayment charges from the benefited parties. This process would require a favorable vote from the constituency or a contract with the benefitted parties. This is considered a realistic alternative for large capital projects.

Grants and Loans

The District will pursue available grants and low-interest loans from the DWR as well as other State and Federal agencies such as the Bureau of Reclamation. The District realizes that funding from State and Federal agencies for groundwater projects will be partially based on its progress in implementing this GMP.

Other Revenue Sources

Groundwater projects can also be financed through water user fees and assessments. Assessments are currently collected from all landowners, and water user fees will be collected from those receiving surface water.

Exiting Activities

- Regularly research grant and loan opportunities from the State and Federal governments and apply for these opportunities when they appear advantageous to the District.

Planned Actions

- Identify beneficial groundwater projects that become economically feasible when costs are shared among two or more participants.
- Share information on funding opportunities with other agencies that may be potential partners in multi-agency groundwater projects.

10 - REFERENCES

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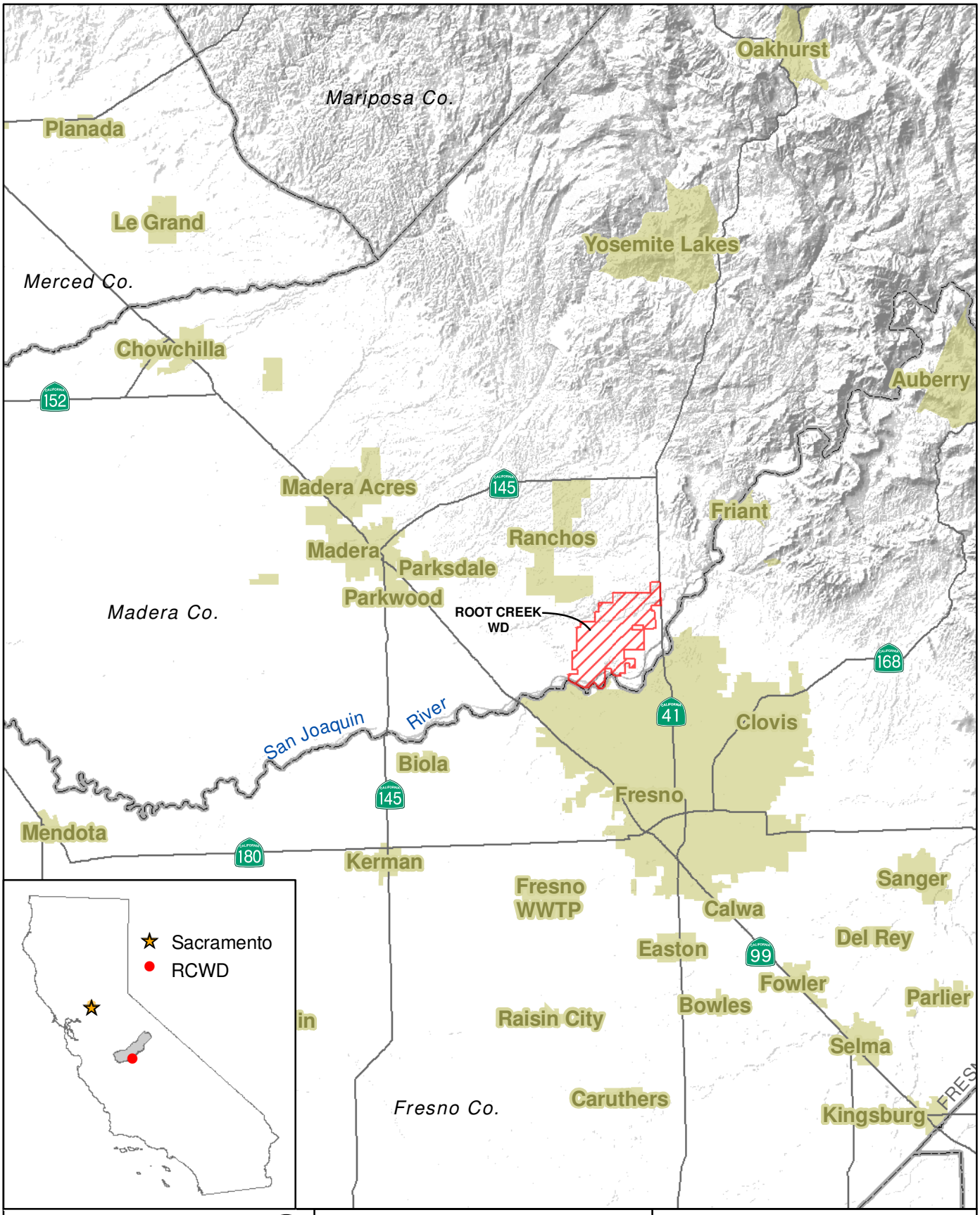

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Root Creek Water District

Vicinity Map

Figure 1

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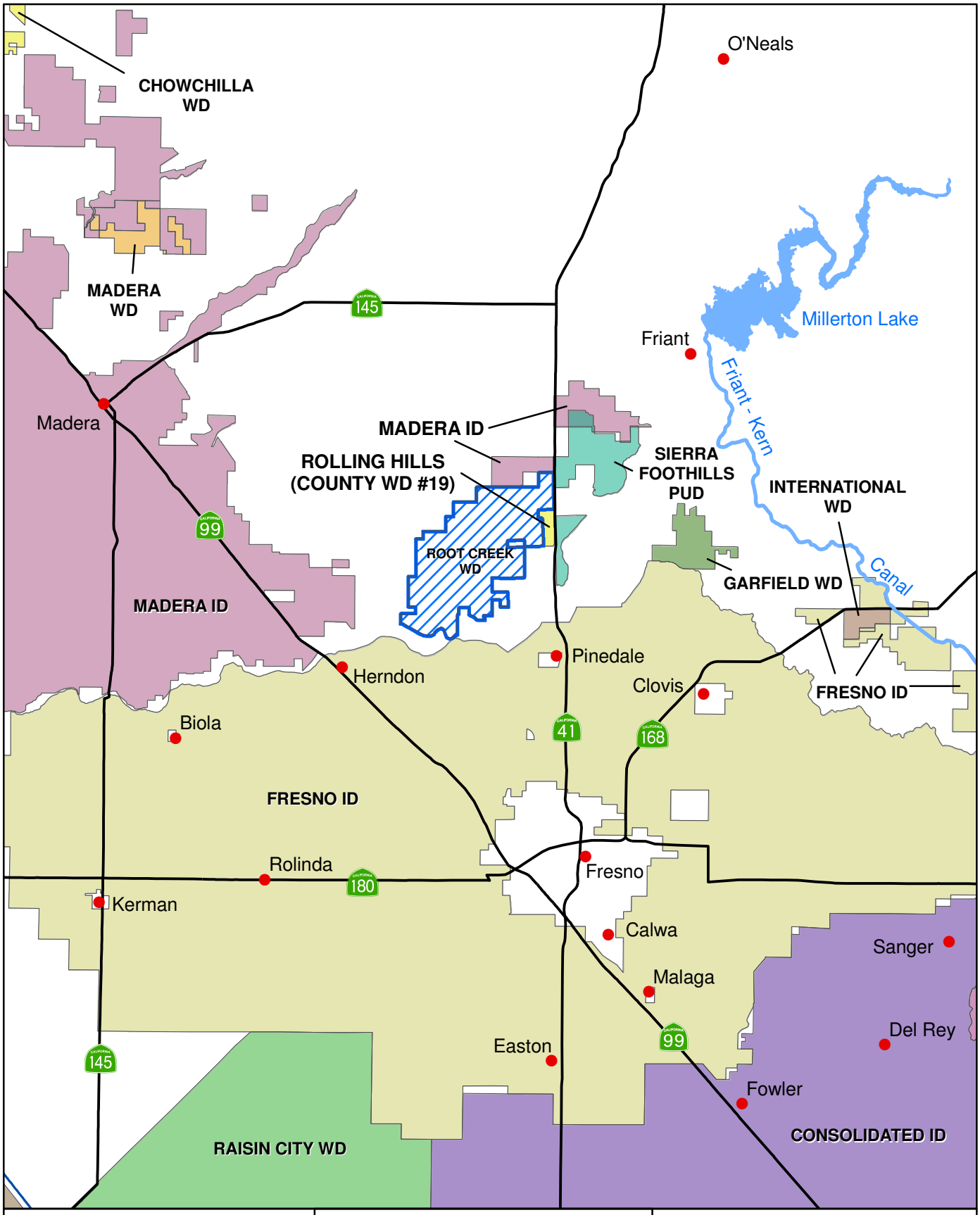

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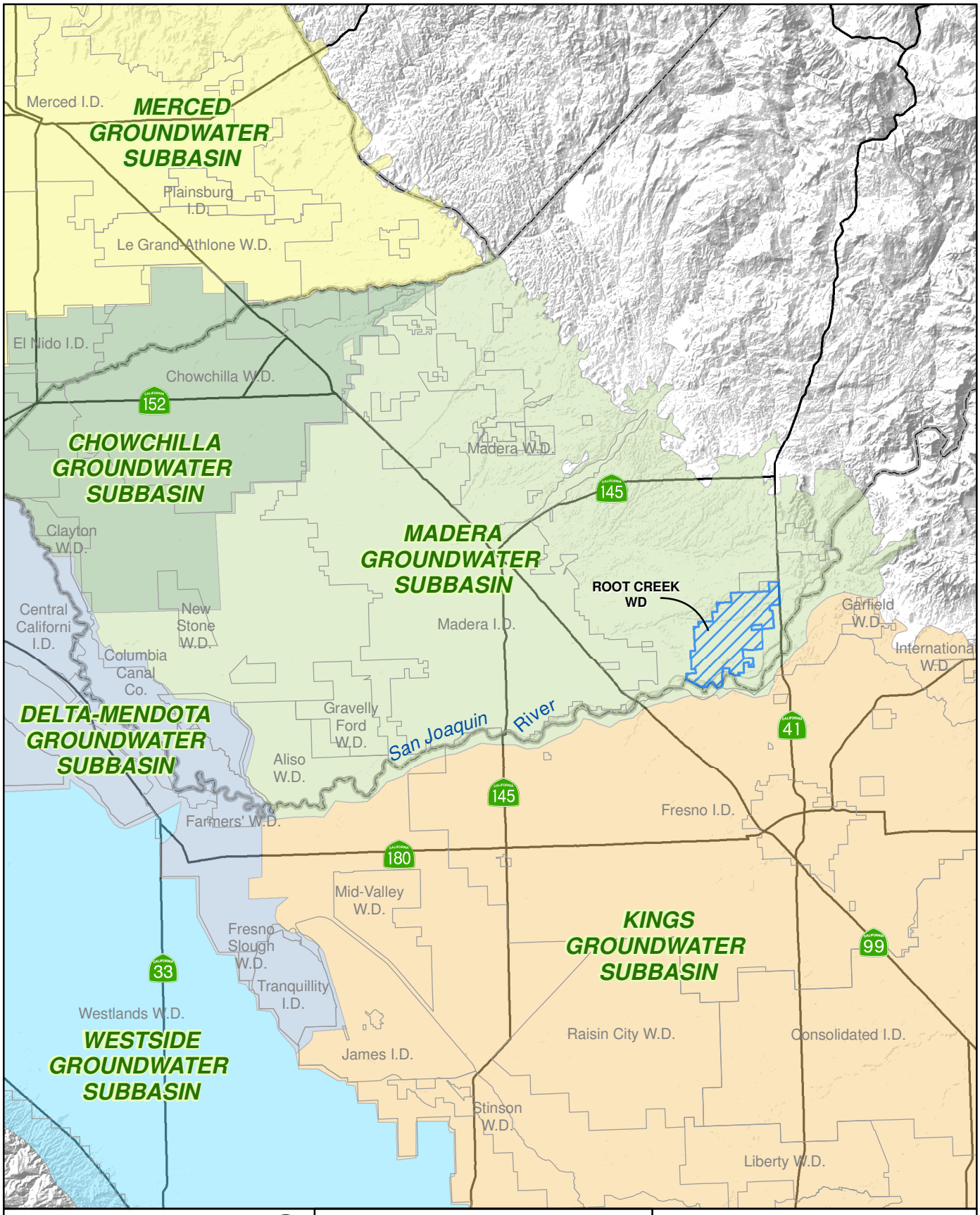

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Root Creek Water District

Groundwater Sub Basins

Figure 3

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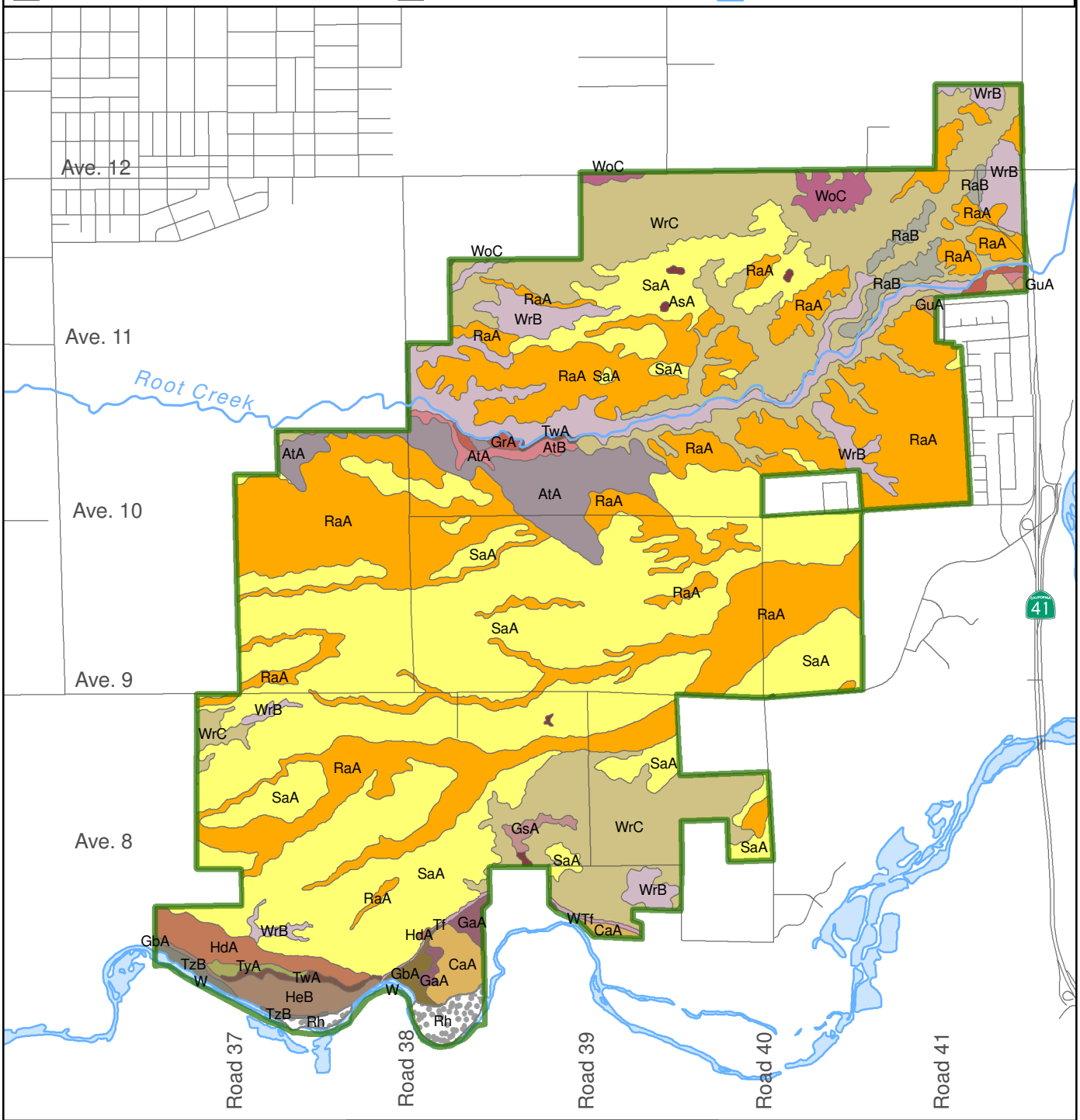

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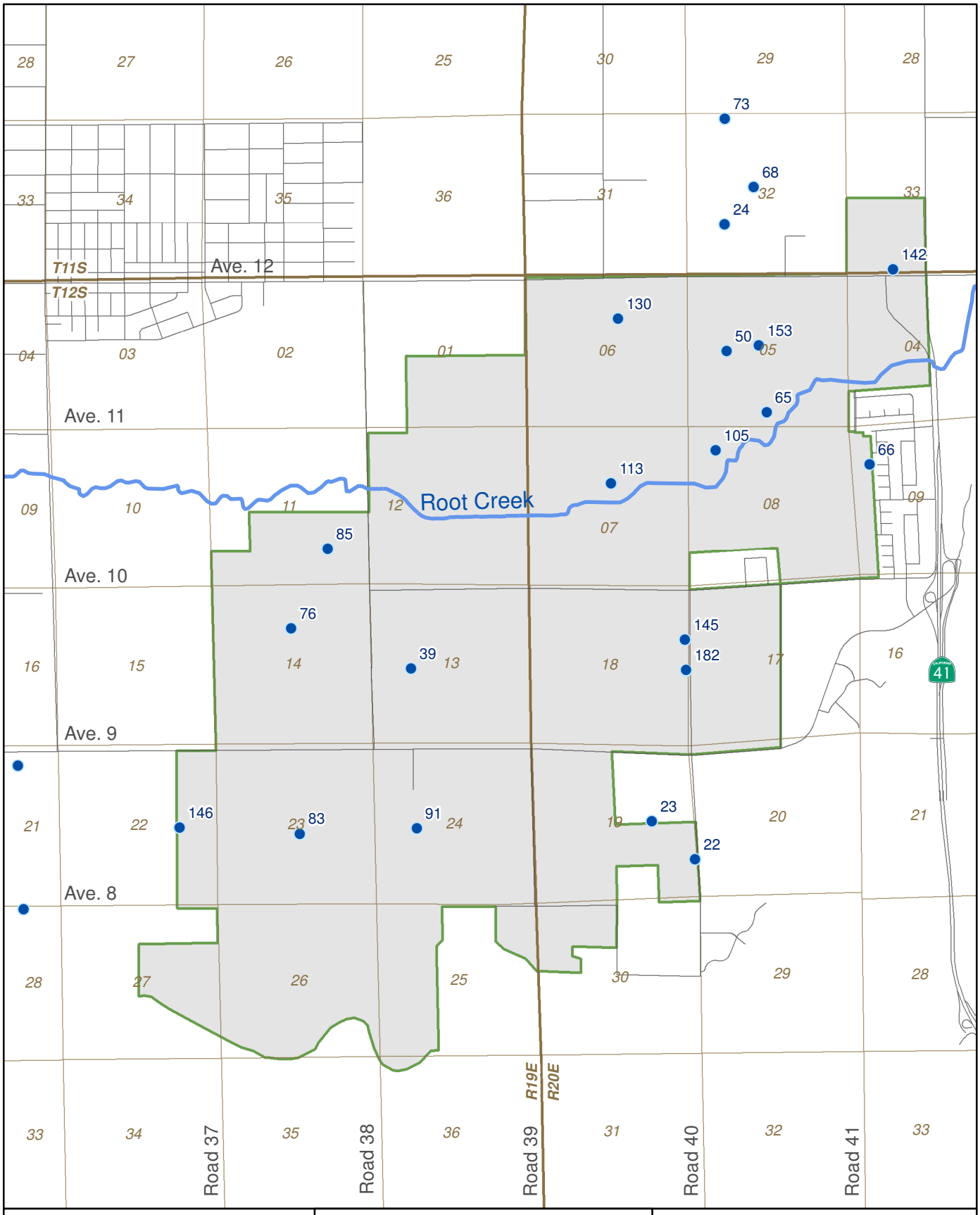
Root Creek Water District

Soil Survey Map

Figure 4



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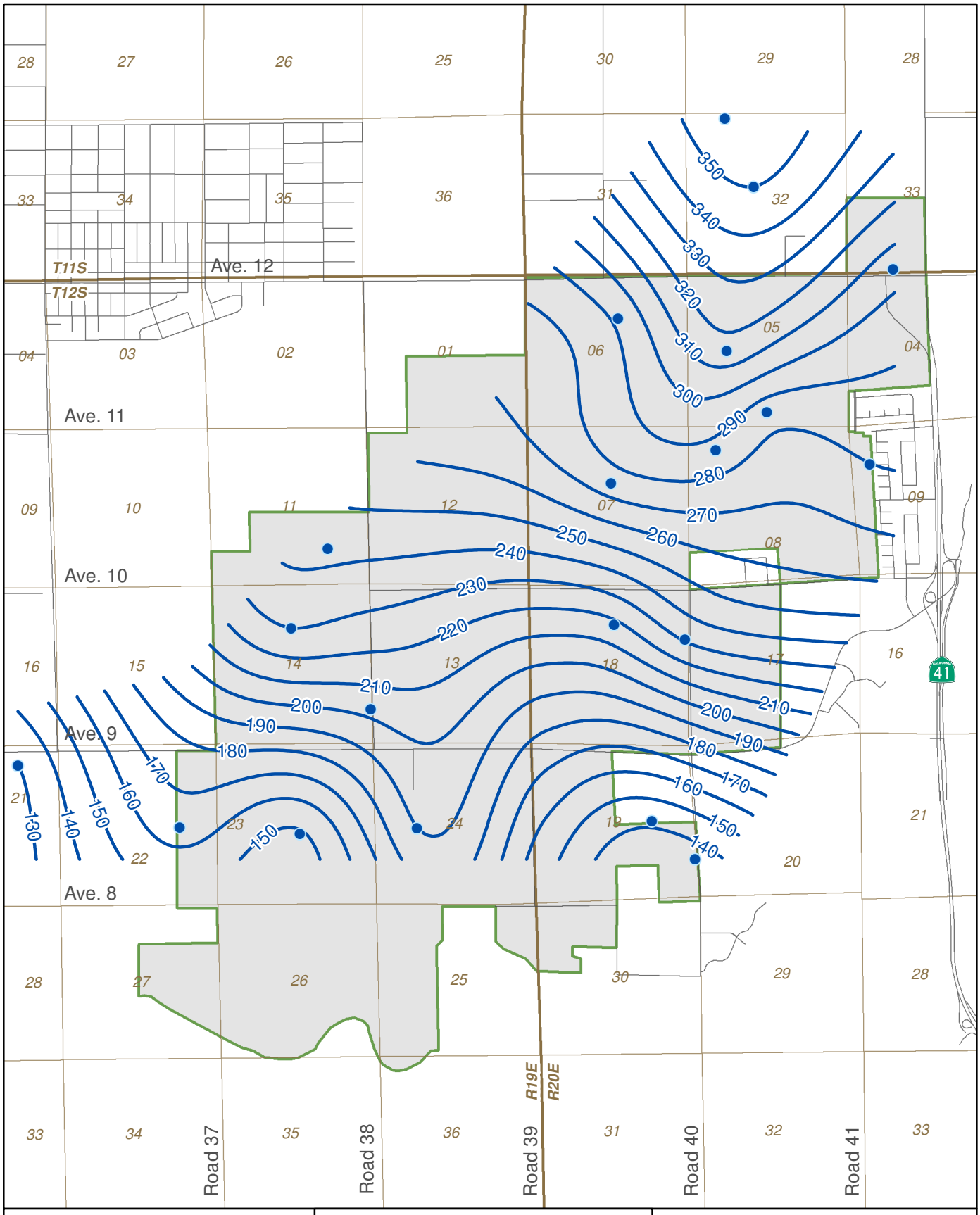

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Legend

- Root Creek WD
- Well Used In Analysis

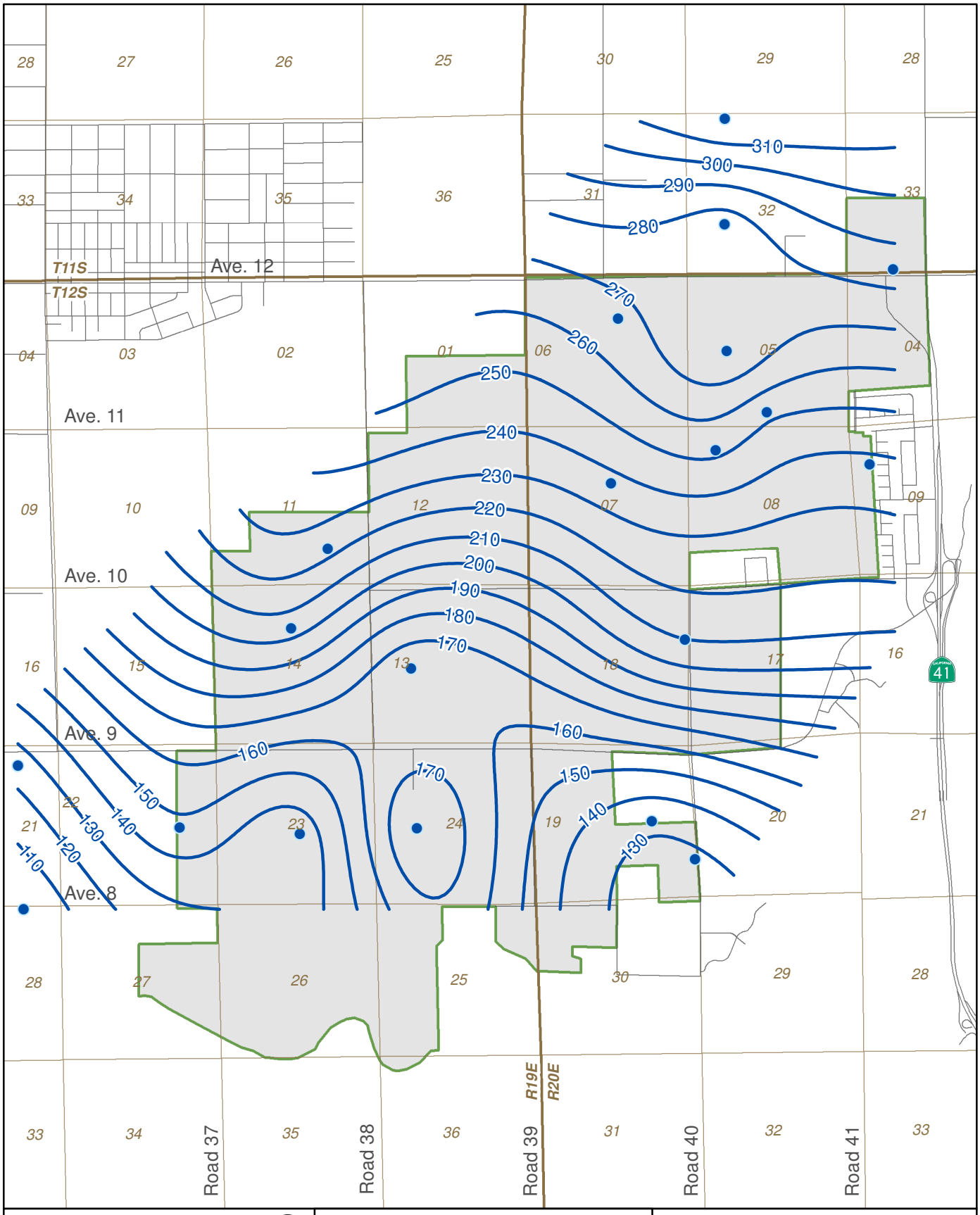
Depth To Water in Wells (depth below natural ground)

- Line of Equal Depth (10 ft interval)

Root Creek Water District

Depth to Water in Wells
Fall 2010

Figure 6



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Legend

Root Creek WD

Well Used In Analysis

Depth to Water in Wells (depth below natural ground)

Line of Equal Depth (10 ft interval)

Root Creek Water District

Depth to Water in Wells
Spring 2011

Figure 7

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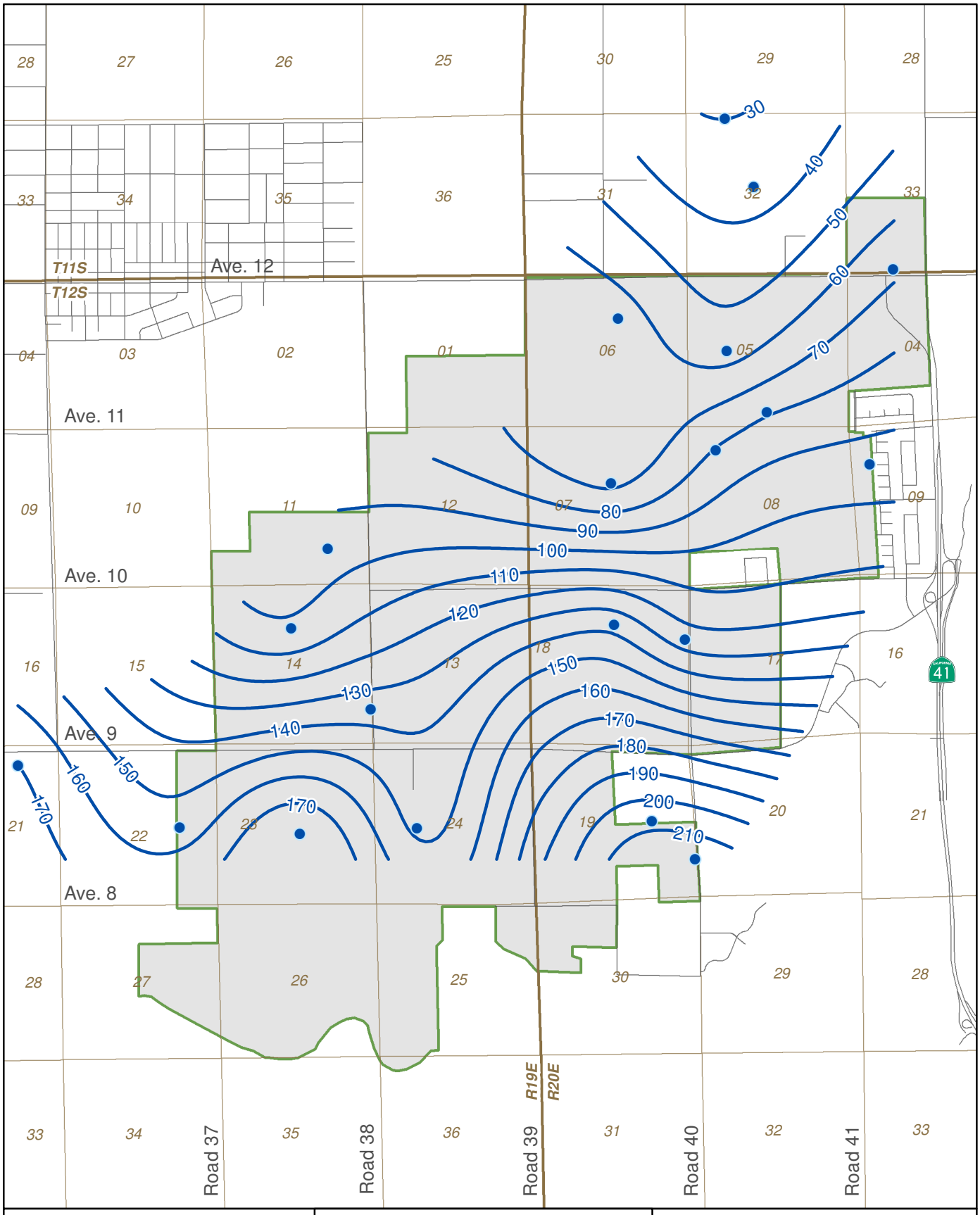

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Root Creek WD

Well Used In Analysis

Elevation of Water in Wells (feet above sea level)

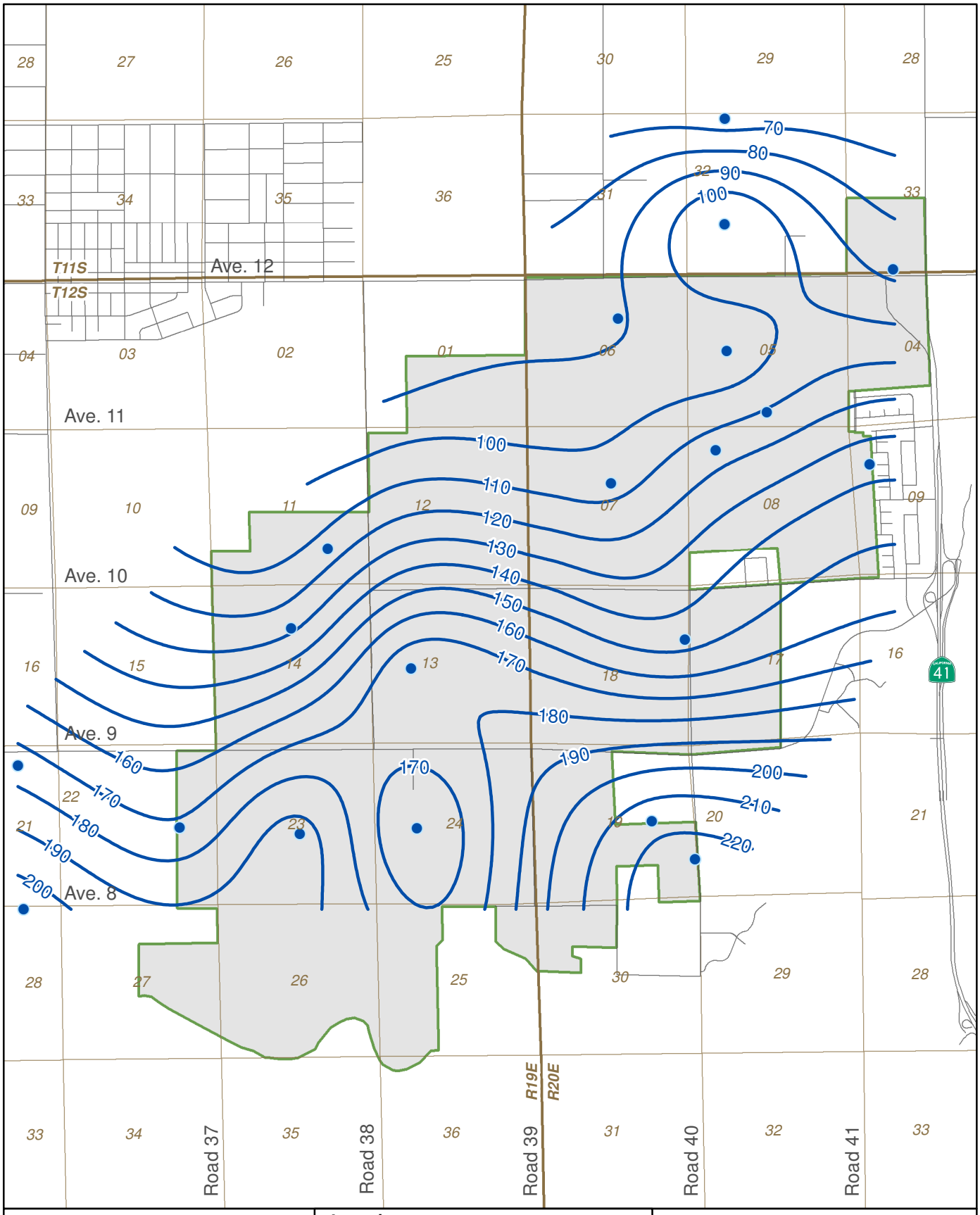
Line of Equal Elevation (10 ft interval)

Root Creek Water District

Elevation of Water in Wells
Fall 2010

Figure 8

12/13/2011 \\pineflat\dwg_dgn\Clients\Root Creek WD-1249\GIS\124911C4-GMP\GIS\Map\Fall10_WSE.mxd



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Legend

- Root Creek WD
- Well Used In Analysis

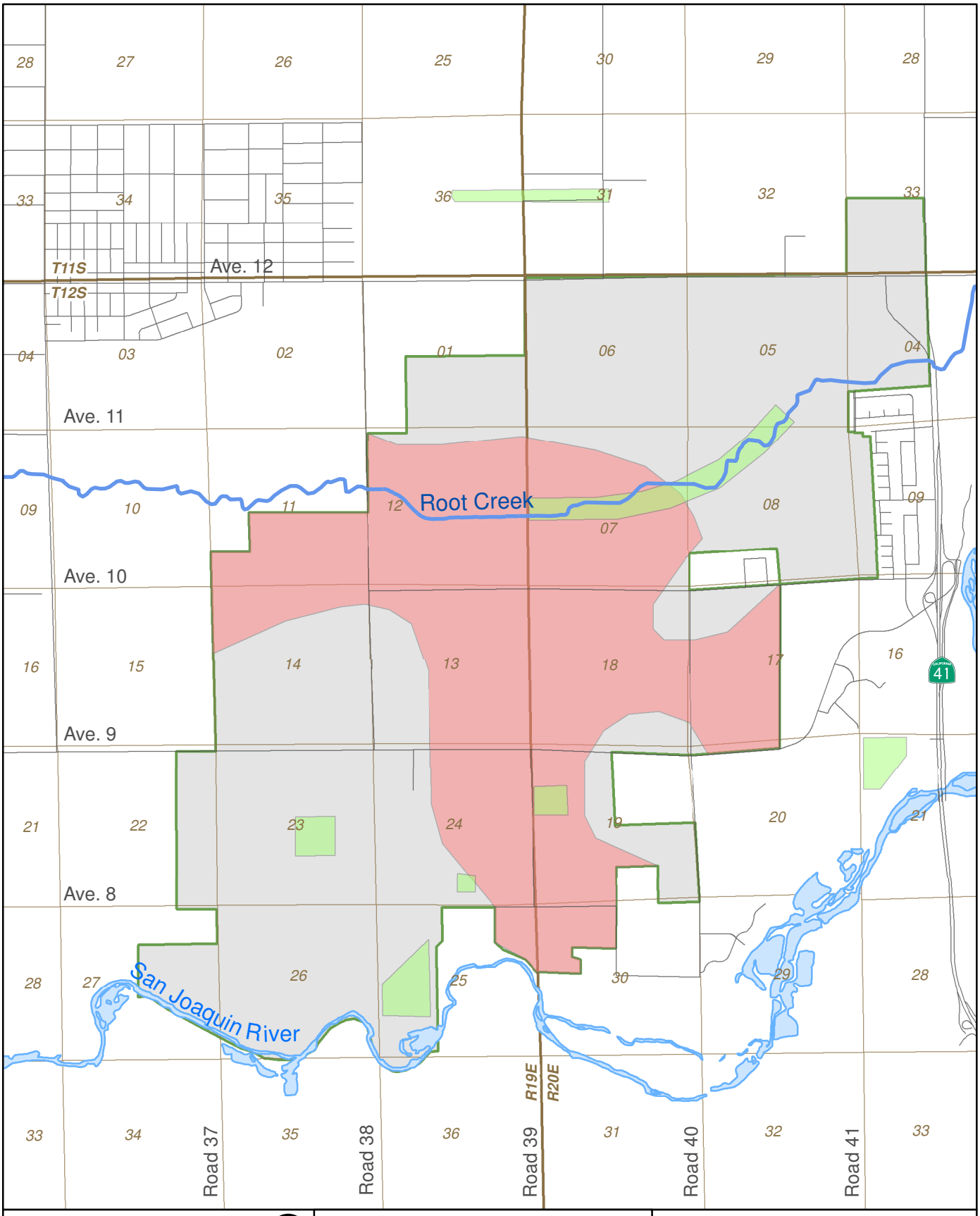
Elevation of Water in Wells (feet above sea level)

- Line of Equal Elevation (10 ft interval)

Root Creek Water District

Elevation of Water in Wells
Spring 2011

Figure 9



Root Creek Water District

Potential Groundwater Recharge Areas

Figure 10

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12/13/2011 \\pineflat\dwg_dgn\Clients\Root Creek WD-1249\GIS\124911C4-GMP\GIS\Map\possible_recharge.mxd

Table Of Contents

FIGURE 12

Root Creek Water District
Groundwater Management Plan
Implementation Schedule

Task No.	Task[1]	2012				2013				2014				2015				2016			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Design and construct 'in-lieu' groundwater recharge pipeline																				
2	Groundwater recharge studies																				
3	Install dedicated monitoring wells																				
4	Prepare water balance model																				
5	Measure electrical conductivity in monitoring wells																				
6	Prepare annual groundwater report																				

Notes:

1 - Only proposed new projects are shown in this schedule. Existing and on-going projects are not shown. Also, new policies and guidelines that will be implemented on a continuous basis are not shown.

2 - Implementation of some projects will depend on the results of feasibility studies and funding availability.

ROOT CREEK WATER DISTRICT

GROUNDWATER MANAGEMENT PLAN

APPENDIX A – PUBLIC PARTICIPATION IN PLAN ADOPTION

Proof of Publication

(2015.5 C.C.P.)

NOTICE OF PUBLIC HEARING

NOV. 22, 2011

RE: GROUNDWATER MANAGEMENT PLAN

RESOLUTION NO. 2011-10

ROOT CREEK WATER DISTRICT.

STATE OF CALIFORNIA)
) ss.
County of Madera)

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of the Madera Tribune, a newspaper of general circulation, published in the City of Madera, County of Madera, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Madera, State of California, under the date of November 9, 1966, Case Number 4875 that the notice, of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to wit:

NOVEMBER 18, 2011

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Ellen Beach

Signature

Date: November 18, 2011

Proof of Publication - The Madera Tribune, P.O. Box 269, Madera, CA 93639
Adjudged a newspaper of general circulation by court decree No. 4875 dated
The Madera Tribune

NOTICE

Root Creek Water District (RCWD) Board of Directors will hold a public hearing on Tuesday, November 22 nd at 9:00 a.m. to review and consider adopting a proposed Groundwater Management Plan (GWMP). The public hearing will be at Baker Manock & Jensen, 5260 N. Palm Ave., Ste 421, Fresno, CA. A copy of the proposed GWMP will be available at Baker Manock Jensen at the public hearing. If there is no majority protest by the public within 35 days of the public hearing, the RCWD Board of Directors will consider adopting the GWMP on January 6, 2012 at their special board meeting.

ROOT CREEK WATER DISTRICT
RESOLUTION NO. 2011-10

Whereas ROOT CREEK WATER DISTRICT ("RCWD" or the "District") previously adopted a Ground Water Management Plan prepared on October 13, 1997 ("1997 GWMP").

Whereas RCWD has taken all actions necessary to comply with the 1997 GWMP, including regularly collecting data.

Whereas the 1997 GWMP needs to be revised to incorporate all the information that the District has compiled since 1997 and to comply with the best management practices.

NOW, THEREFORE, BE IT RESOLVED that:

1. The above recitals are true and correct.

2. RCWD intends to draft a new Groundwater Management Plan.

3. RCWD authorizes Provost and Pritchard, Inc. to prepare a new Groundwater Management Plan for the District.

4. The Resolution shall take effect immediately.

ADOPTED this 10th day of November, 2011.

Vote	Yes	No
Philip Pierre	_X_	___
Jeffrey D. Coulthard	_X_	___
Rodger Jensen	_X_	___
Timothy Jones	_X_	___
Laura Whitaker	_X_	___
L. Dave Cobb (absent)	___	___

No. 18166 - Nov. 18, 2011

Proof of Publication

(2015.5 C.C.P.)

NOTICE OF PUBLIC HEARING

NOV. 22, 2011 RE:

GROUNDWATER MANAGEMENT PLAN

ROOT CREEK WATER DISTRICT

STATE OF CALIFORNIA)
) **ss.**
County of Madera)

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of the Madera Tribune, a newspaper of general circulation, published in the City of Madera, County of Madera, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Madera, State of California, under the date of November 9, 1966, Case Number 4875 that the notice, of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to wit:

NOVEMBER 12, 18, 2011

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Signature

Date: November 18, 2011

NOTICE

Root Creek Water District Board of Directors will hold a public hearing on Tuesday, November 22nd at 9:00 a.m. to review and consider adopting a proposed Groundwater Management Plan. The public hearing will be at Baker Manock & Jensen, 5260 N. Palm Ave., Ste 421, Fresno, CA.
No. 18132 - Nov. 12, 18, 2011

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Adjudged a newspaper of general circulation by court decree No. 4875 dated November 9, 1966
The Madera Tribune

Proof of Publication

(2015.5 C.C.P.)

NOTICE OF PUBLIC HEARING

NOV. 10, 2011

RE: GROUNDWATER MANAGEMENT PLAN

ROOT CREEK WATER DISTRICT

STATE OF CALIFORNIA)
) ss.
County of Madera)

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of the Madera Tribune, a newspaper of general circulation, published in the City of Madera, County of Madera, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Madera, State of California, under the date of November 9, 1966, Case Number 4875 that the notice, of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to wit:

NOVEMBER 1, 7, 2011

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Signature

Date: November 7, 2011

NOTICE

Root Creek Water District Board of Directors' will hold a public hearing on Thursday, November 10th at 9:00 a.m. to consider adopting a new Groundwater Management Plan. The public hearing will be at Baker Manock & Jensen, 5260 N. Palm Ave, Ste 421, Fresno, CA.
No. 18069 - Nov. 1, 7, 2011

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The Madera Tribune

RESOLUTION NO. 97-3

RESOLUTION OF
ROOT CREEK WATER DISTRICT
TO ADOPT A GROUND WATER MANAGEMENT PLAN

WHEREAS, Part 2.75 of Division 6 of the California Water Code permits the adoption and implementation of ground water management plans to encourage authorized local agencies to manage ground water resources within their service areas; and

WHEREAS, the Root Creek Water District (the "District") is an authorized local agency and may therefor adopt and implement such a ground water management plan; and

WHEREAS, a first public hearing was held on April 14, 1997 to discuss the adoption and implementation of a ground water management plan; and

WHEREAS, the District passed, and subsequently published, a Resolution of Intention to Draft a Ground Water Management Plan (RCWD Resolution 97-1); and

WHEREAS, the District's consultant prepared a Ground Water Management Plan at the direction of the District Board of Directors; and

WHEREAS, a second public hearing was held on October 13, 1997 in accordance with the California Water Code Section 10753.5, et seq. to consider adoption of the proposed Ground Water Management Plan; and

WHEREAS, no protests to the proposed Ground Water Management Plan were filed at the second public hearing; and

WHEREAS, the Board believes that the adoption of the proposed Ground Water Management Plan is in the best interests of the District's landowners and water users and can help meet the projected long-term water needs of the District;

BE IT RESOLVED, that it is the intention of the District adopts the Ground Water Management Plan in accordance with Part 2.75 of Division 6 of the California Water Code, as prepared by the District's consultant and dated June12, 1997;

RESOLVED, that the Board hereby authorizes each of the officers of the District to execute all documents and take any other action necessary or advisable to carry out the purpose of this resolution.

The foregoing Resolution was passed and adopted this 13th day of October, 1997.

ROOT CREEK WATER DISTRICT

By: _____
Rodger Jensen, President

CERTIFICATE OF SECRETARY

The undersigned certifies that he is the Secretary of the Root Creek Water District and that the foregoing resolution was adopted by the Board of Directors in said District at a meeting thereof, duly and regularly held on October 13, 1997 following a public hearing at which meeting a quorum of the Board of Directors was at all times present and acting.

IN WITNESS WHEREOF, I have set my hand this 13th day of October, 1997.

_____
Deborah Messer, Assistant Secretary
Root Creek Water District

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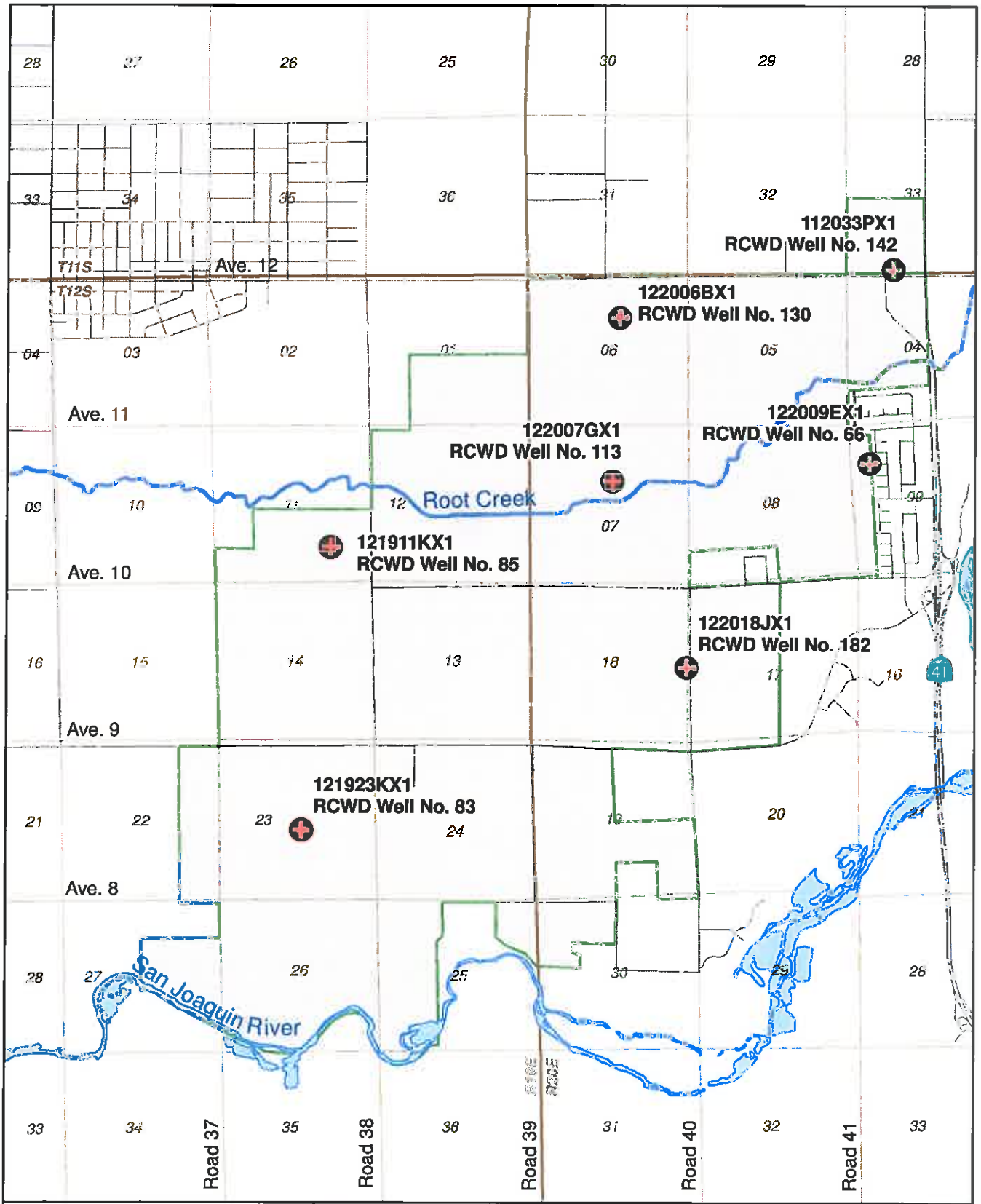
ROOT CREEK WATER DISTRICT

GROUNDWATER MANAGEMENT PLAN

APPENDIX B – WELL HYDROGRAPHS



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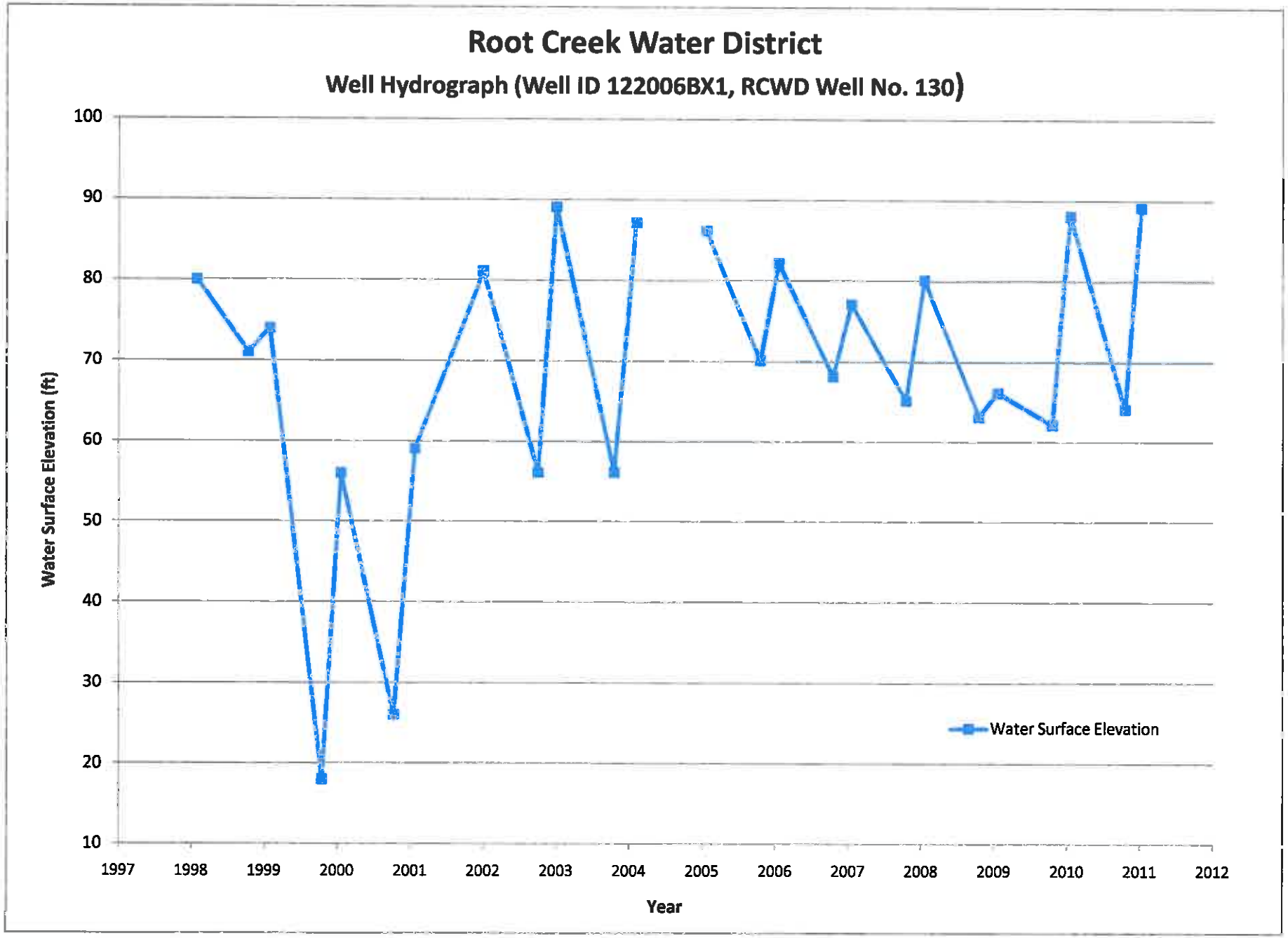

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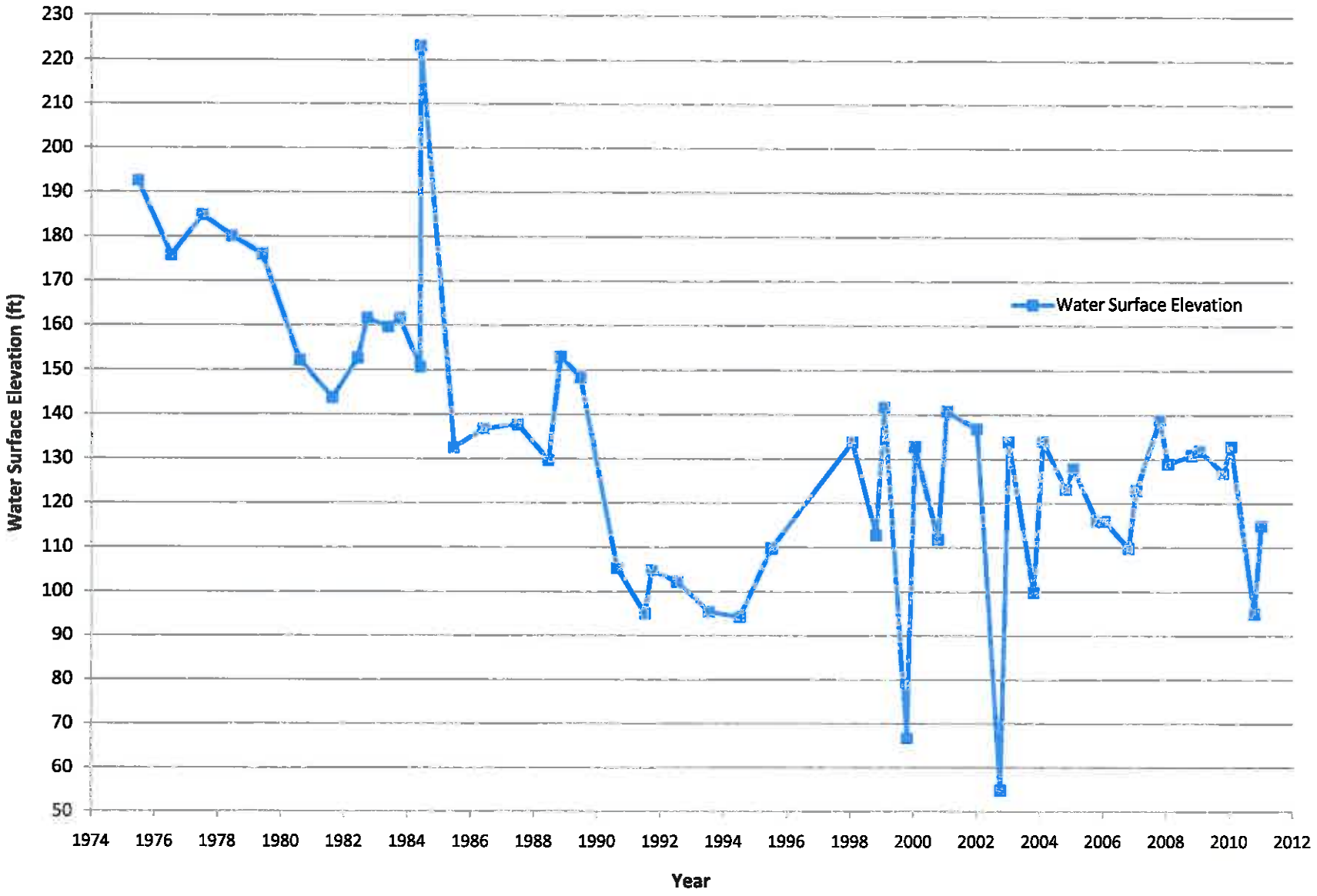
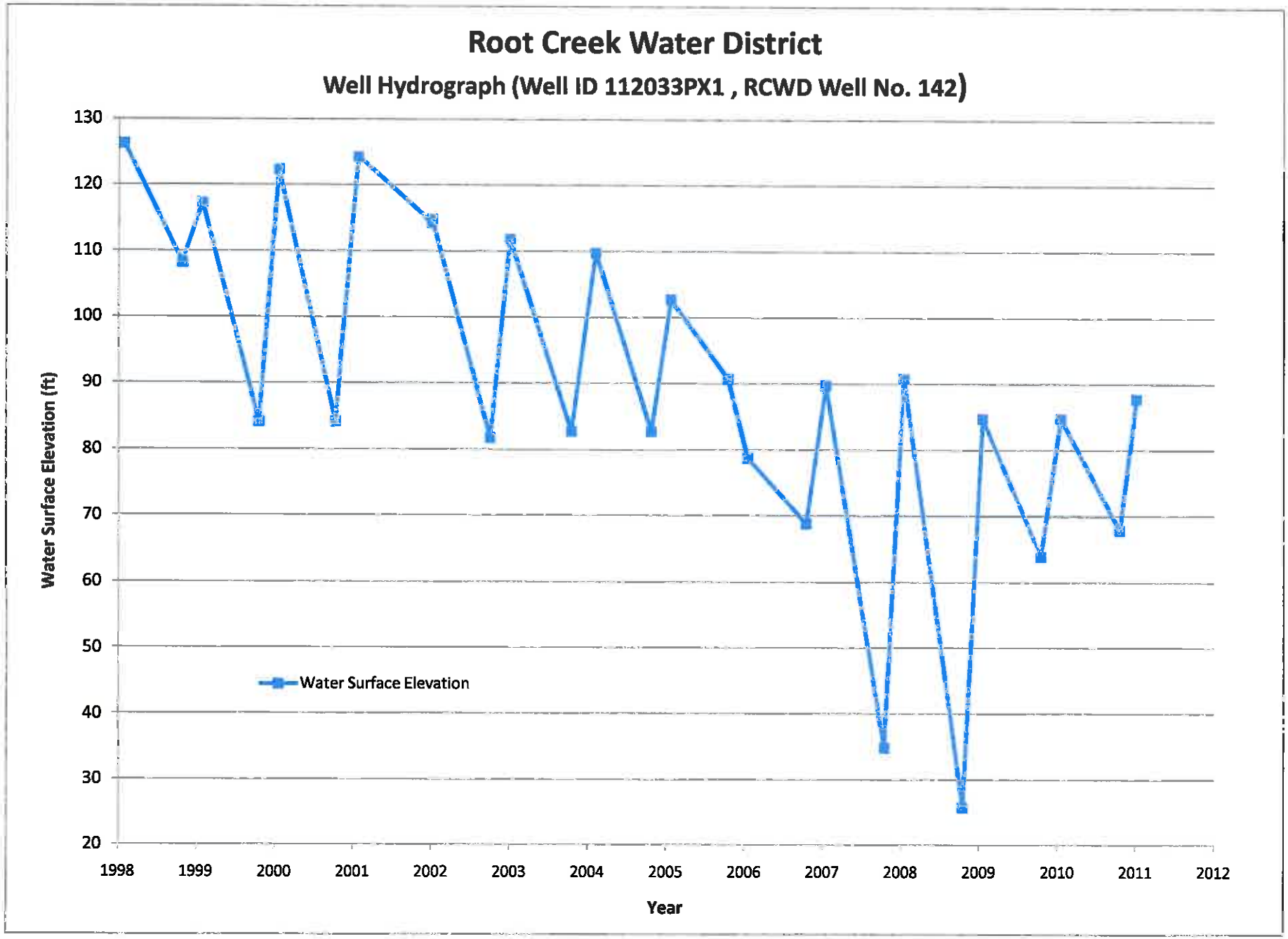
Root Creek Water District

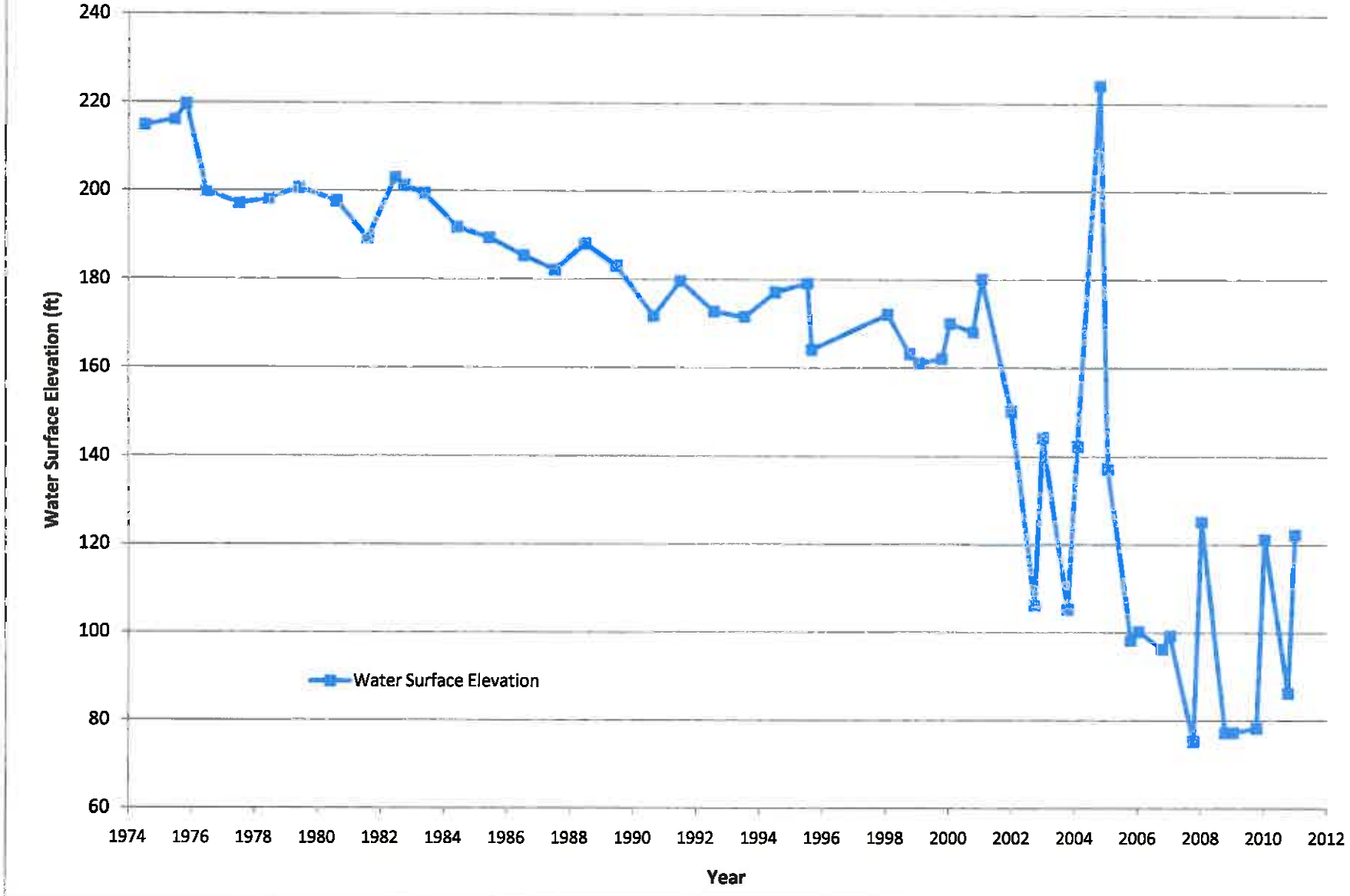
Well Hydrograph (Well ID 121911KX1 , RCWD Well No. 85)

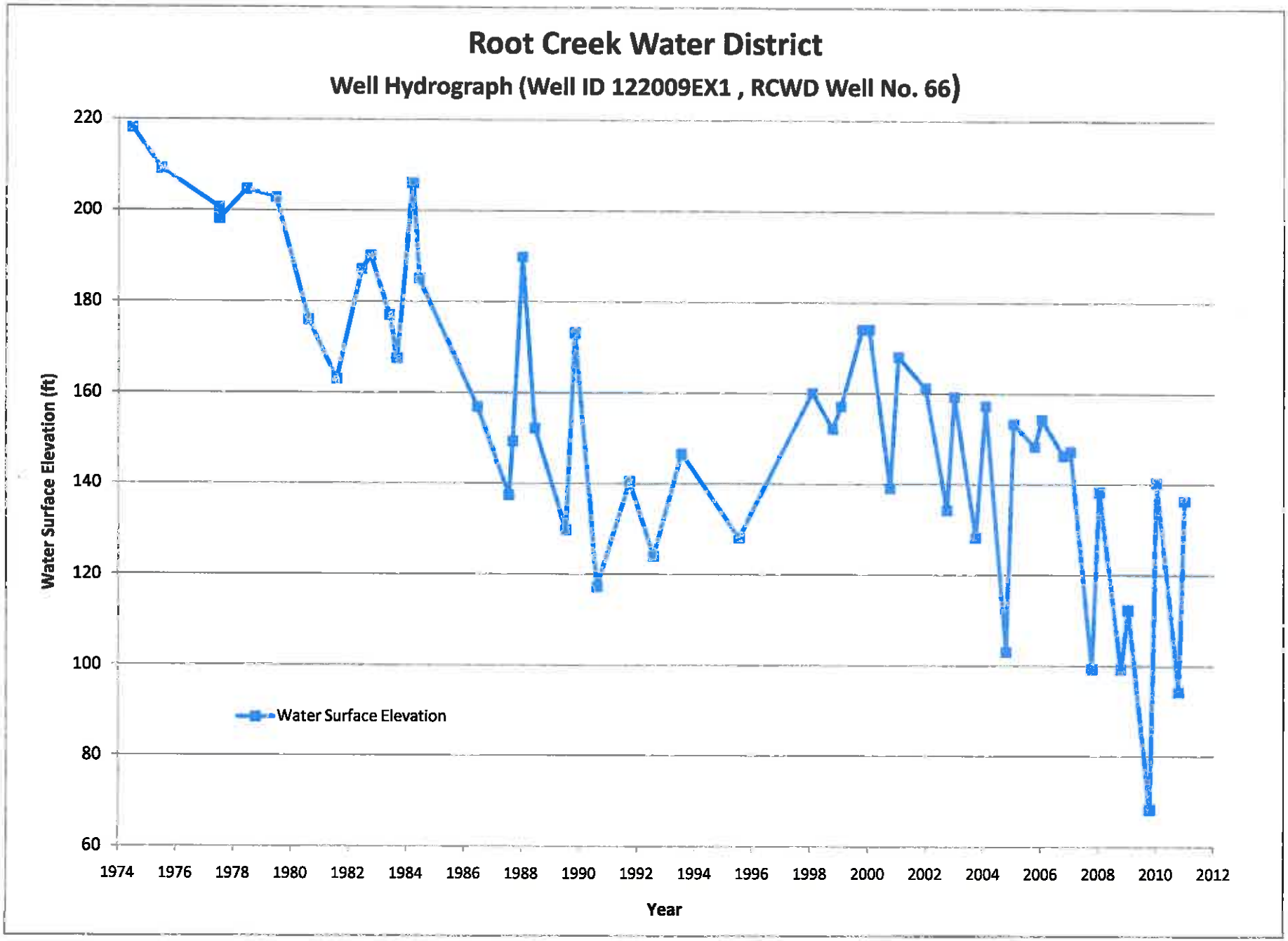


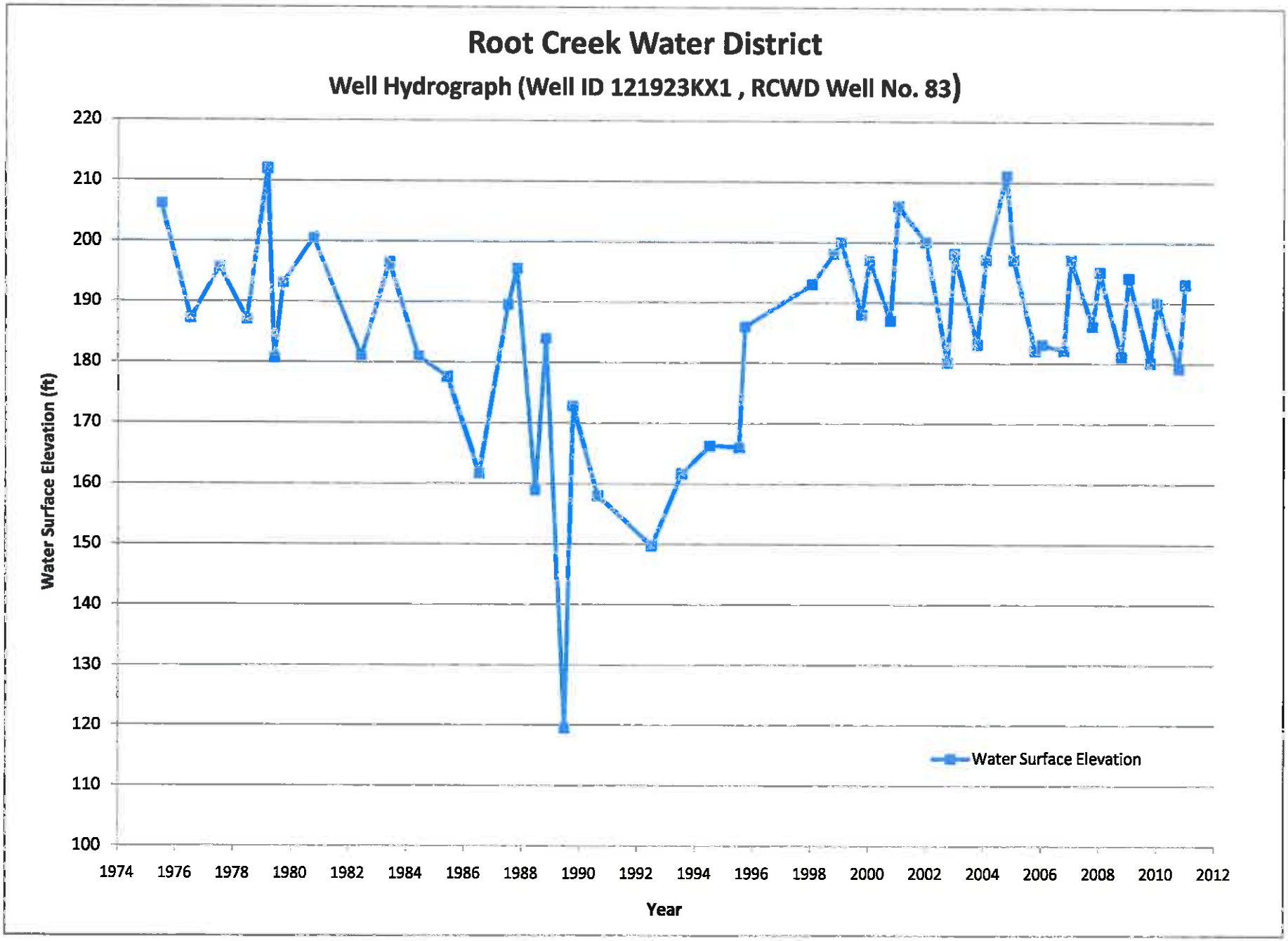

Root Creek Water District
Well Hydrograph (Well ID 112033PX1 , RCWD Well No. 142)
Water Surface Elevation (ft)
130
120
110
100
90
80
70
60
50
40
30
20
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
Water Surface Elevation

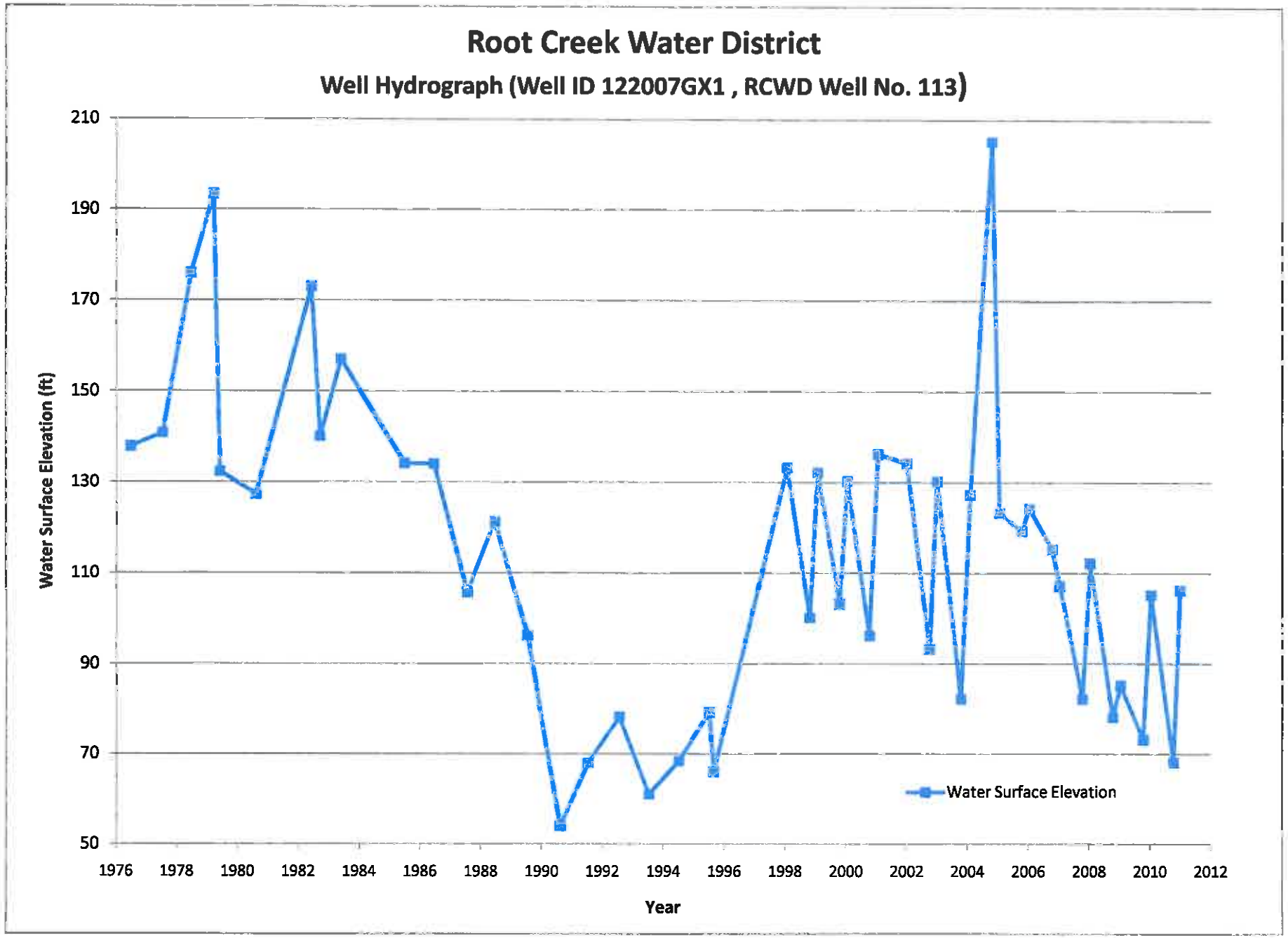
Root Creek Water District

Well Hydrograph (Well ID 122018JX1 , RCWD Well No. 182)




Root Creek Water District
Well Hydrograph (Well ID 122009EX1 , RCWD Well No. 66)
Water Surface Elevation (ft)
220
200
180
160
140
120
100
80
60
Water Surface Elevation
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
Year


Root Creek Water District
Well Hydrograph (Well ID 121923KX1 , RCWD Well No. 83)
Water Surface Elevation (ft)
220
210
200
190
180
170
160
150
140
130
120
110
100
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
Year
Water Surface Elevation



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ROOT CREEK WATER DISTRICT

GROUNDWATER MANAGEMENT PLAN

APPENDIX C – ATTRIBUTES OF WELLS MONITORED BY DISTRICT

ROOT CREEK WATER DISTRICT

MONITORING WELL ATTRIBUTES

PPENG ID	WELL TYPE	SURVEY	PGE TAG	POWER TYPE	CLIENT NO.	DISCHARGE PIPE (IN)	DISCHARGE PIPE DIRECTION	CA STATE PLANE COORD. NORTHING	CA STATE PLANE COORD. EASTING	HORSEPOWER	PUMP NO.	GROUND_ELEV	REF_ELEV
121928AX1												307	309.4
121921BX1												300	301
122018HX2	ABANDONED	NONE			1			0	0	0	0	0	0
122006DX1	AG	RTK	R29835	ELECTRIC	103	8	EAST	1793968.35	6754757.2	100	103	361.9959	362.1159
122004DX1	AG	RTK	094R30	ELECTRIC	104	10	SOUTH	1793922.929	6766044.311	100	0	381.5938	381.6138
122008DX1	AG	RTK	094R12	ELECTRIC	105	8	EAST	1789446.77	6761077.398	100	105	367.3753	367.4353
121912GX1	AG	RTK	7358R4	ELECTRIC	107	10	NORTH	1788713.659	6752157.694	150	107	342.1212	342.3812
122007AX1	DOMESTIC	RTK	3722T0	ELECTRIC	11	6	SOUTH	1789702.745	6759717.908	3	0	360.916	360.916
122018QX2	ABANDONED	NONE			112			0	0	0	0	0	0
122007GX1	AG	RTK	094R17	ELECTRIC	113	8	EAST	1788354.675	6757598.818	75	113	343.1531	343.1731
121914AX1	AG	RTK	40805R	ELECTRIC	120	8	WEST	1783478.118	6748287.101	100	120	335.7059	335.8259
122007JX1	AG	RTK	91832R	ELECTRIC	123	8	SOUTH	1787470.216	6759805.933	75	123	360.1044	360.1944
121912QX1	AG	RTK	91823R	ELECTRIC	129	8	EAST	1785202.718	6753570.904	100	0	352.022	352.182
122006BX1	AG	RTK	5838R5	ELECTRIC	130	8	WEST	1793824.927	6757832.963	75	130	356.0966	356.1966
122004NX1	AG	RTK	5833R7	ELECTRIC	136	8	SOUTH	1791441.742	6766289.095	75	0	359.343	359.843
122007GX2	AG	RTK	90519T	ELECTRIC	141	10	WEST	1788042.661	6757869.647	100	0	333.156	333.506
112033PX1	AG	RTK	57R744	ELECTRIC	142	10	NORTH	1795461.389	6766994.798	100	142	372.2815	372.8215
122018HX1	AG	RTK	066R91	ELECTRIC	145	10	NORTH	1783155.674	6760061.249	100	145	356.468	356.588
121922HX1	AG	RTK	402R07	ELECTRIC	148	10	SOUTH	1776909.762	6743227.75	100	146	319.4475	320.0175
122005FX1	AG	RTK	60R270	ELECTRIC	153	10	EAST	1792931.06	6762521.931	200	153	354.1799	354.3799
122008BX1	AG	RTK	616R02	ELECTRIC	156	10	NORTH	1789220.863	6764763.234	200	156	365.0859	365.2559
121912LX1	AG	RTK	6566R1	ELECTRIC	157	10	EAST	1787024.606	6752114.784	200	157	321.3675	321.3675
122008KX1	AG	RTK	41983T	ELECTRIC	16	8	NORTH	1787668.917	6763923.957	75	16	367.8016	367.9716
122005DX1	AG	RTK	6565R9	ELECTRIC	169	10	NORTH	1794461.444	6760188.673	200	169	373.017	373.017
122006QX1	AG	RTK	094R19	ELECTRIC	17	10	WEST	1791434.826	6757546.991	100	17	365.1042	365.3042
121901PX1	AG	RTK	4872R6	ELECTRIC	175	10	EAST	1790742.664	6752034.998	200	0	341.1482	341.8182
122018QX1	AG	RTK	03387R	ELECTRIC	180	8	EAST	1780869.851	6758762.43	75	180	355.029	355.029
122018JX1	AG	RTK	92151T	ELECTRIC	182	8	EAST	1782136.553	6760095.078	75	182	358.2471	358.2471
122018CX1	ABANDONED	NONE			2			0	0	0	0	0	0
121913CX1	AG	RTK	1589R6	ELECTRIC	20	8	NORTH	1783503.672	6750954.413	50	20	342.6993	342.6993
121911RX1	AG	RTK	1886R3	ELECTRIC	21	8	EAST	1786100.954	6749483.816	50	21	340.1177	340.1187
122019RX1	AG	RTK	61291T	ELECTRIC	22	8	EAST	1775841.831	6760394.821	40	22	352.3423	352.4023
122019KX1	AG	RTK	R70555	ELECTRIC	23	8	NORTH	1777116.984	6758957.719	30	23	349.1596	349.1596

ROOT CREEK WATER DISTRICT
MONITORING WELL ATTRIBUTES

PPENG ID	WELL TYPE	SURVEY	PGE TAG	POWER TYPE	CLIENT NO.	DISCHARGE PIPE (IN)	DISCHARGE PIPE DIRECTION	CA STATE PLANE COORD NORTHING	CA STATE PLANE COORD EASTING	HORSEPOWER	PUMP NO.	GROUND_ELEV	REF_ELEV
112032MX1	AG	RTK	0195R7	ELECTRIC	24	8	EAST	1796968.782	6761381.923	50	0	386.331	386.471
122018JX2	ABANDONED	NONE			25			0	0	0	0	0	0
112031AX1	AG	RTK	7078R2	ELECTRIC	29	8	EAST	1800461.97	6758789.577	60	0	383.55	383.61
122018BX1	AG	RTK	3649R5	ELECTRIC	3	10	SOUTH	1783641.858	6757700.937	100	0	354.3607	354.5907
121913DX1	AG	RTK	4259R9	ELECTRIC	30	8	NORTH	1784778.607	6750876.987	60	30	343.7436	343.9936
112031QX1	AG	RTK	R40644	ELECTRIC	32	8	NORTH	1796484.337	6758725.343	50	0	379.001	379.101
121913LX1	AG	RTK	R68959	ELECTRIC	34	8	NORTH	1782206.619	6752241.52	50	34	342.2452	342.3152
121911PX1	AG	RTK	43136R	ELECTRIC	36	8	NORTH	1786089.877	6746876.755	75	36	335.8514	336.0514
121913EX1	AG	RTK	408R65	ELECTRIC	38	8	EAST	1783487.691	6749685.784	40	38	340.8125	340.9625
121913MX1	AG	RTK	43193R	ELECTRIC	39	8	NORTH	1782189.89	6750943.179	60	39	339.7504	339.9504
122007PX2	ABANDONED	NONE			5			0	0	0	0	0	0
122007PX3	DOMESTIC	RTK	NONE	ELECTRIC	5	6	SOUTH	1784932.4	6756676.727	3	0	356.391	356.391
122005MX1	AG	RTK	93084R	ELECTRIC	50	8	WEST	1792741.61	6761445.038	75	50	371.9245	372.3245
122007PX1	AG	RTK	041R26	ELECTRIC	6	6	WEST	1785962.78	6757513.635	0	0	356.5746	356.9246
122007CX1	AG	RTK	R98583	ELECTRIC	63	8	EAST	1789256.561	6757490.922	75	63	356.1753	356.1753
122005PX1	AG	RTK	59R383	ELECTRIC	65	10	SOUTH	1790713.251	6762783.514	100	65	363.6155	363.8555
122009EX1	AG	RTK	R04571	ELECTRIC	66	10	WEST	1788971.73	6766211.113	75	0	374.1417	374.3117
112032FX1					68							386	386
121912RX1	ABANDONED	NONE			7			0	0	0	0	0	0
122006JX1	AG	RTK	7079R6	ELECTRIC	70	8	NORTH	1792748.619	6758829.455	75	70	369.7535	370.1235
112032DX1	AG	RTK	92141R	ELECTRIC	73	8	NORTH	1800473.09	6761384.195	75	0	385.72	385.92
121914CX1	AG	RTK	25080R	ELECTRIC	76	10	NORTH	1783521.048	6746948.995	100	76	332.3294	332.4294
121901QX1	AG	RTK	4207R6	ELECTRIC	77	8	WEST	1790696.466	6753060.8	100	77	347.225	347.675
122005BX1	AG	RTK	NO TAG	ELECTRIC	78	8	WEST	1794876.709	6762804.887	100	78	375.8235	376.2835
121912QX2	ABANDONED	NONE			8			0	0	0	0	0	0
121923KX1	AG	RTK	094R28	ELECTRIC	83	8	SOUTH	1776695.141	6747233.091	75	83	328.0383	328.1083
121911KX1	AG	RTK	89651R	ELECTRIC	85	8	EAST	1786163.989	6748162.978	100	85	337.7895	337.9195
121912EX1	AG	RTK	9983R3	ELECTRIC	86	10	EAST	1787468.794	6750754.165	75	86	343.9355	344.4555
121914RX1	AG	RTK	R68910	ELECTRIC	88	10	EAST	1780839.774	6749597.105	75	0	338.3559	338.6059
121924LX1	AG	RTK	42000T	ELECTRIC	91	8	SOUTH	1776880.146	6751131.837	100	91	338.5164	338.5864
121926CX1	AG	RTK	066R86	ELECTRIC	92	8	WEST	1773542.836	6747078.743	100	92	326.471	326.581
112031RX1	AG	RTK	40782R	ELECTRIC	NONE1	8	EAST	1796500.956	6760093.989	60	0	382.51	382.511
121925FX2	AG	RTK	NONE	DIESEL	NONE10	8	SOUTH	1772817.914	6751282.316	60		259.247	259.247

ROOT CREEK WATER DISTRICT

MONITORING WELL ATTRIBUTES

PPENG ID	WELL TYPE	SURVEY	PGE TAG	POWER TYPE	CLIENT NO.	DISCHARGE PIPE (IN)	DISCHARGE PIPE DIRECTION	CA STATE PLANE COORD NORTHING	CA STATE PLANE COORD EASTING	HORSEPOWER	PUMP NO.	GROUND_ELEV	REF_ELEV
121913QX1	AG	RTK	NO METER	DIESEL	NONE11	10	WEST	1780211.111	6753643.547	150	0	343.4008	343.7008
122018NX2	AG	RTK	NO METER	DIESEL	NONE13	10	WEST	1780917.312	6756245.86	150	0	351.7123	351.7123
121914NX1	AG	RTK	4419R5	ELECTRIC	NONE14	10	EAST	1780851.063	6745691.566	100	0	330.0062	330.5262
121925FX1	AG	RTK	8639R8	ELECTRIC	NONE15		SOUTH	1772819.566	6751295.987	15		258.9068	258.9068
121913HX1	AG	RTK	NO METER	DIESEL	NONE16	8	EAST	1783611.581	6754825.583	125	0	348.0329	348.0929
121913GX1	AG	RTK	R08521	ELECTRIC	NONE17	10	WEST	1783484.881	6753520.298	150	0	344.4553	344.7653
122019CX1	AG	RTK	R28438	ELECTRIC	NONE18	10	WEST	1778311.79	6757595.907	100	0	347.015	347.165
122017FX1	AG	RTK	NONE	ELECTRIC	NONE2	8	EAST	1783260.873	6761723.822	60	0	360.398	360.398
121914PX1	AG	RTK	7433R7	ELECTRIC	NONE3	8	EAST	1780859.882	6746991.617	100	0	331.2867	331.4167
121924EX1	AG	RTK	790R08	ELECTRIC	NONE4	8	EAST	1777520.361	6750999.153	75	0	336.6924	336.8124
122018NX1	AG	RTK	NO METER	DIESEL	NONE5	10	SOUTH	1779676.025	6756147	150		348.0334	348.0334
121925MX1	AG	RTK	NONE	DIESEL	NONE6	10	SOUTH	1771365.055	6750852.039	60		256.7736	256.7736
121913BX1	AG	RTK	5570R6	ELECTRIC	NONE7	8	EAST	1784630.091	6753501.854	75	0	349.7376	350.1376
122030EX1	AG	RTK	42927R	ELECTRIC	NONE8	8	NORTH	1772331.084	6756001.33	40		262.694	262.694
121923CX1	AG	RTK	NONE	DIESEL	NONE9	10	SOUTH	1778287.825	6745794.264	200	0	328.7315	329.0815

ROOT CREEK WATER DISTRICT

GROUNDWATER MANAGEMENT PLAN

APPENDIX D – GROUNDWATER MONITORING PROTOCOLS

GROUNDWATER MONITORING PROTOCOLS

This document outlines protocols for groundwater level and groundwater quality monitoring in root creek water district. Specific topics include water level measuring procedures, water quality sampling procedures, equipment requirements, monitoring forms, and recommended water quality constituents.

WATER LEVEL MONITORING

WATER LEVEL MEASUREMENT PROCEDURES

An electronic sounder, accurate to the nearest +/- 0.01-ft, shall be used to measure depth to water in wells. When using an electronic sounder, the probe is lowered down the casing to the top of the water column; the graduated markings on the probe wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of the well screen. Total well depths will be measured by lowering the weighted probe to the bottom of the well and recording the depth to the nearest 0.1-ft. Water levels will be measured in wells that have the least amount of known contamination first. Wells with known or suspected contamination will be measured last. Water levels shall be measured semi-annually and prior to collecting water quality samples.

GROUNDWATER QUALITY MONITORING

WATER QUALITY CONSTITUENTS

The water quality constituents tested should be based on the purpose of the testing and the constituents of concern in the area. In most cases, an agricultural suitability analysis will be adequate within District lands. The typical constituents in an agricultural suitability analysis are provided below:

- Calcium
- Magnesium
- Potassium
- Sodium
- Carbonate
- Bicarbonate
- Sulfate
- Chloride
- Nitrate
- Fluoride
- Boron
- Copper
- Iron
- Manganese
- Zinc
- TDS
- pH
- Electrical Conductivity
- Sodium Absorption Ratio

WELL PURGING FOR WATER QUALITY TESTING

All wells will be purged prior to sampling. If the well casing volume is known, a minimum of three casing volumes of water will be purged using the dedicated well pump, if present, or a bailer, hand pump, or submersible pump depending on the diameter and configuration of the well. When a submersible pump is used for purging, clean flexible Teflon tubes will be used for groundwater extraction. Pumps will be placed 2 to 3 ft from the bottom of the well to permit reasonable drawdown while preventing cascading conditions.

Water will be collected into a measured bucket to record the purge volume. Casing volumes will be calculated based on total well depth, standing water level, and casing diameter. One casing volume will be calculated as $\mathbf{V = \pi r^2 h\ 7.48}$ where **V** is the volume of one well casing of water in gallons ($1ft^3$ = 7.48 gallons); π = 3.14; **r** is the radius of the inner well casing (in ft); and **h** is the total height of the water column in the well (in ft).

It is most important to obtain a representative sample from the well. Stable parameter field measurements (temperature, pH, and specific conductivity) indicate representative sampling is obtainable. Water quality is considered stable if for three consecutive readings:

- Temperature range is no more than +1/C;
- pH varies by no more than 0.2 pH units; and
- EC readings are within 10% of the average.

All field meters will be calibrated according to manufacturer's guidelines and specifications before and after every day of field use.

If the well casing volume is known, measurements will be taken before the start of purging, in the middle of purging, and at the end of purging each casing volume. If the well casing volume is NOT known, measurements will be taken every 2.5 minutes after flow starts. If water quality parameters are not stable after 5 casing volumes or 30 minutes, purging will cease, which will be noted in the field notes, and groundwater samples will be taken. The depth to water, water quality field measurements, and purge volumes will be recorded on a Monitoring Well Purging and Sampling Record as presented at the end of this document.

If a well dewaters during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80% of the static water column and dewatered once more. After water levels have recharged to 80% of the static water column, groundwater samples will be collected.

Purged and excess groundwater collected for sample container filling may be disposed on site or in the sampling area by dispersing onto the ground, or at the owner's direction.

SAMPLE CONTAINERS AND PRESERVATIVES

Sample containers are generally available directly from the laboratory. All containers shall be one-liter polyethylene, pre-cleaned, and analyte specific. The remaining samples need not be preserved. If a preservative is present, the bottle will be capped and lightly shaken to mix in the preservative. Samples from each location that require the same preservative may be placed in the same bottle if being analyzed by the same laboratory. Samples to be analyzed for dissolved metals must be filtered prior to preservation and analysis.

WATER QUALITY SAMPLING PROCEDURES

Water samples shall be placed into laboratory prepared containers, sealed with tight fitting caps, labeled, and stored in a cool ice chest. Water used for field measurements of temperature, pH, and EC shall not be used as sample water. The following are the recommended sample collection procedures:

- Rinse the tubing with one liter of sample prior to sample collection;
- If no preservative is present, rinse sample bottles three times with a small amount of sample;
- Collect sample directly into the sample bottle;
- Allow sample containers to be open for the shortest time possible to prevent contamination;
- Do not touch the inside of bottles, lids, or tubes. Hold the bottle lid with the inside facing down to prevent contaminating the inside of the lid;
- Allow the sample water to flow into the bottle from above;
- Close bottle tightly;
- Samples will be chilled to 4 C^{o} immediately upon collection; and
- Transport samples to the lab as soon as possible.

At each sampling location, all bottles designated for a particular analysis will be filled sequentially before bottles designated for the next analysis are filled. If a duplicate sample is to be collected, all bottles designated for a particular analysis will be filled sequentially before bottles for another analysis are filled.

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. Every sample, including samples collected from a single location but going to separate laboratories, will be pre-assigned an identifiable, unique sample number. The following is an example sample label:

Sample #:	**Well ID:**
Analytes:	**Date:**
Collected by:	**Time:**

It will be possible to identify each unique sample by recording the following information on the Monitoring Well Purging and Sampling Record:

- Sample identification numbers and any explanatory codes;
- Sample date and time;
- Lot numbers of the sample containers;
- Chain-of-custody form numbers;
- Shipping arrangements (overnight air bill number); and
- Name(s) of recipient laboratory (ies).

WATER QUALITY SAMPLING FORM

During the collection of each sample, the following information will be recorded on a Monitoring Well Purging and Sampling Record as presented at the end of this document:

- Well identification;
- Sampler's name(s);
- Date and time of sample collection;
- Designation of sample as composite or grab, if applicable;
- Type of sampling equipment used;
- Field instrument readings and calibration;
- Field observations and details related to analysis or integrity of samples (e.g., conditions in nearby waterways, weather conditions, noticeable odors, colors, etc.);
- Preliminary sample descriptions (e.g., clear with strong ammonia-like odor);
- Time of arrival/entry on site and time of site departure; and
- Deviations from sampling plans.

EQUIPMENT DECONTAMINATION PROCEDURES

Water level sounding equipment and field meter probes (pH, dissolved oxygen, conductivity, temperature, and turbidity) will be thoroughly rinsed with deionized/distilled water before and after each reading.

All equipment that comes into contact with potentially contaminated water will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. The following, to be carried out in sequence, is the recommended procedure.

- Non-phosphate detergent and tap water wash, using a brush if necessary;
- Tap water rinse; and
- Deionized/distilled water rinse.

CHAIN-OF-CUSTODY

A chain-of-custody (COC) record will be completed and accompany all sample shipments for each laboratory and each shipment. If multiple coolers are sent to a single laboratory on a single day, COCs will be completed and sent with the samples for each cooler. Generally, the laboratory will supply blank COCs.

The COC will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. The sampling team leader or designee will sign the COC in the "relinquished by" box and note date, time, and air bill number.

SAMPLE HANDLING AND TRANSPORT

The following outlines the packaging procedures for sample delivery to a California Certified Environmental Laboratory Accreditation Program (ELAP) laboratory:

- Pack ice in zip-locked, double plastic bags. Seal the drain plug of the cooler with tape to prevent melting ice from leaking out;
- Line the bottom of the cooler with bubble wrap to prevent breakage during shipment;
- Check screw caps for tightness;
- Seal all container tops with tape;
- Secure sample labels onto the containers with clear tape;
- Wrap all glass sample containers in bubble wrap to prevent breakage;
- Seal all sample containers in heavy-duty plastic zip-lock bags with the sample numbers written on the outside of the bags with indelible ink;
- Place samples in a sturdy cooler(s) lined with a large plastic trash bag. Enclose the appropriate COC(s) in a zip-lock plastic bag affixed to the underside of the cooler lid;
- Fill empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment;
- Double seal ice in two ziplock plastic bags and place on top and around the samples;
- Secure each ice chest with strapping tape; and
- Secure address and shipping labels to cooler.

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Monitoring Well Purging and Sampling Record

Client: _____ Date: _____
Project Name: _____ County: _____
Project Address: _____
Project Manager: _____ Job No: _____ Phase(s): _____
Regulatory Contact: _____ Telephone: _____
Sample Containers: _____ Air Temp (F): _____
Preservatives: _____ Precipitation: _____
Instrumentation: _____ Wind (dir/speed): _____
Date Last Calibrated/By: _____ Sampler Signature: _____

Well Number						
Well Elevation (ft)						
Well Diameter (in)						
Slotted Interval (ft)						
DTW (ft)						
GW Elevation (ft)						
Sounding Depth (ft)						
Well Volumes (gal)						
Notes:						
Well Volume Purged (1st)						
Time						
Temp (C°)						
pH						
EC						
Volume Removed (gal)						
Well Volume Purged (2nd)						
Time						
Temp (C°)						
pH						
EC						
Volume Removed (gal)						
Well Volume Purged (3rd)						
Time						
Temp (C°)						
pH						
EC						
Volume Removed (gal)						
Sample Depth (ft)						
Sample Time						

Equipment used:

Remarks:

2" Well Volume = 0.163 x height of water column 4" Well Volume = 0.653 x height of water column