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Pajaro Sunny Mesa Community Services District

Final Preliminary Engineering Report - Springfield Water System Improvements

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Pajaro/Sunny Mesa Community Services District

Final Preliminary Engineering Repot:
Springfield Water System Improvements

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ACRONYMS

AACE	American Association of Cost Engineers
ACOE	United States Army Corps of Engineers
ACP	Asbestos cement pipe
ADD	Average daily demand
APN	Assessor's Parcel Number
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
bgs	Below ground surface
Caltrans	California Department of Transportation
CART	Color alternatives review table
CCC	California Coastal Commission
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
County	Monterey County
DDW	California Department of Drinking Water
District	Pajaro/Sunny Mesa Community Services District
ENR	Engineering News-Record
ESHA	Environmentally Sensitive Habitat Area
GPD	Gallons per day
GPM	Gallons per minute
HDD	Horizontal directional drilling
HDPE	High density polyethylene
kW	Kilowatt(s)
LAFCO	Local Agency Formation Commission
m	Meter
MCL	Maximum contaminant level
MH	Mobile home
mg/l	Milligrams per liter
MDD	Maximum daily demand
MLWS	Moss Landing Water System
MS4	Municipal Separate Storm Sewer System
MSL	Mean sea level
OSHA	Occupational Safety and Health Administration
PHD	Peak hourly demand
ppm	Parts per million
PSI	Pounds per square inch
PSMCSD	Pajaro/Sunny Mesa Community Services District
PVC	Polyvinyl chloride
ROW	Right-of-way
RWQCB	Regional Water Quality Control Board
SFR	Single family residence
SMWC	Springfield Mutual Water Company
Springfield	Springfield Mutual Water Company
SUG	Seismic Use Group
SW-1	Springfield Well No. 1
SW-2	Proposed Springfield Well No. 2
SW-3	Proposed Springfield Well No. 3
SWRCB	California State Water Resources Control Board
SWS	Springfield Water System
TDH	Total dynamic head
TDS	Total dissolved solids
U.S.	United States
VFD	Variable frequency drive

Section 1. Executive Summary

1.1. District Background and Existing System

The Pajaro/Sunny Mesa Community Services District (PSMCSD or District) acquired the Springfield Mutual Water Company in 2005. The water system, now called the Springfield Water System (SWS), currently serves approximately 34 residences along Struve Road. The existing Springfield Water System is fed by a single shallow well, designated as Springfield Well No. 1 (SW-1). SW-1 has documented water quality problems for several contaminants, including nitrates exceeding up to five times the maximum contaminant level established by the State of California. Since the acquisition, the District has been working to improve the water quality delivered to residents.

1.2. Project Overview and Goals

The goal of the Springfield Water System Improvements project (Project) is to plan for, design, and implement upgrades to the SWS to provide a high-quality water source for long-term water supply reliability for the community.

The work to achieve this goal will be completed in multiple phases. The first phase is the Project ("Project") includes a new single source of supply to serve the entire system at completion of all phases, and distribution system infrastructure to serve existing SWS customers, approximately 10 residences on Springfield Road, and the MH Park.

Future phases, which are not included in the Project, are anticipated to include a second well to provide an additional source of supply and additional distribution system infrastructure to serve additional customers on Struve and Giberson Roads. When all phases are complete, the new potable water system is anticipated to serve approximately 34 residences on Struve Road currently served by the existing SWS, 24 additional residences on Springfield and Giberson Roads not currently served by the existing SWS, and the Moss Landing Mobile Home Park (MH Park) which includes 105 mobile home sites currently served by a private well.

1.3. System Demands

The average daily demand (ADD) and maximum daily demand (MDD) for the three communities to be served by the system are summarized in Table 1-1. Housing unit types include single family residences (SFR) and mobile homes (MH). While not all of these customers will be served the Project, demand for all future customers is considered for sizing of production, distribution, and storage facilities.

Table 1-1: Combined Water System Average Daily Demand

Community	Unit Type	Units	ADD (GPM)	MDD (GPM)
Springfield Water System	SFR	34	13	31
Moss Landing Mobile Home Park	MH	105	15	22
Springfield and Giberson Roads	SFR	24	9	22
Total			**37**	**87**

Peak hourly demand (PHD) is assumed to be 1.5 times the MDD, or 130 GPM.

1.4. Water Sources

The system will be supplied by at least one source of water, with a goal of two separate sources. Three potential sources are considered as part of this Preliminary Engineering Report (Report), including:

Alternative A: Drill a new well at the Moss Landing Middle School site (SW-2).

Alternative B: Connect to the existing Moss Landing water system.

Alternative C: Drill a new well at the existing well site (SW-3).

Alternative A is recommended as the primary water source for the SWS, since the test well has been completed and demonstrated the ability to provide sufficient water to the system. Alternative C is recommended as the secondary source of supply for the system as a result of input from the County of Monterey and State of California; in addition, the hydrogeologic evaluation conducted as part of this study indicates a new well at the existing well site would likely produce good quality water.

1.5. Project Description

The recommended Project will be Alternative A, which will develop an independent water supply system for the Springfield area, consisting of a new well, water storage tanks, booster pump station, and other improvements at the Moss Landing Middle School site; new distribution piping along Springfield Road, Struve Road, easements, and within the MH Park; and installation of new individual service laterals and meters.

Future Phases of work include a new well at the existing SW-1 site (Alternative C), additional distribution piping along Struve Road and Giberson Road, and installation of additional individual service laterals and meters.

1.6. Permitting

A variety of permits from various agencies are anticipated to be required for the Project. In addition to compliance with the California Environmental Quality Act (CEQA), anticipated permits for the Project construction include:

- Caltrans Encroachment Permit
- County of Monterey Encroachment Permit
- California Coastal Commission Coastal Development Permit
- Monterey Bay Air Resources District Permit to Construct and Permit to Operate
- U.S. Fish and Wildlife Service Section 7 or 10 Incidental Take Permit
- State Water Resources Control Board Permit Amendment

Permits Required for Future Phases include:

- County of Monterey Encroachment Permit
- California Coastal Commission Coastal Development Permit
- U.S. Army Corps of Engineers and RWQCB Section 401 and 404 permits
- U.S. Army Corps of Engineers and RWQCB Section 401 and 404 permits
- California Department of Fish and Wildlife Lake and Streambed Alteration Agreement
- U.S. Fish and Wildlife Service Section 7 or 10 Incidental Take Permit
- State Water Resources Control Board Permit Amendment

1.7. Project Costs

An estimate of total project costs has been developed. In addition to construction costs, various additional expenses anticipated to be incurred as part of the Project have been estimated based on an assumed percentage of construction costs, summarized in Table 1-2.

Table 1-2: Estimated Project Construction and Construction Management Costs

Project Element	Estimated Percentage of Construction Costs	Estimated Construction Cost	
		Project	Future Phases
Construction Costs	-	$6,980,000	$4,170,000
Construction Survey	1%	$69,800	$41,700
Utility Relocation	2%	$139,600	$83,400
Engineering Design	10%	$698,000	$417,000
Design Survey	1%	$69,800	$41,700
Geotechnical Engineering and Hydrogeology	2%	$139,600	$83,400
Construction Management and Inspection	12%	$837,600	$500,400
Environmental and Project Permitting	3%	$209,400	$125,100
Right-of-Way Engineering	1%	$69,800	$41,700
Right-of-Way Acquisition	3%	$209,400	$125,100
District Administration	5%	$349,000	$208,500
Total		**$9,772,000**	**$5,838,000**

1.8. Project Recommendations and Next Steps

The District has confirmed State funding will be acquired for all phases of the improvements, but the current available funding will not accommodate all proposed improvements. Therefore, it is recommended the Project be divided into multiple phases. It is anticipated that the Project will be covered by the State funding and will include the new well SW-2, storage tanks, booster pump station, and other associated improvements at the Moss Landing Middle School site, as well as new distribution piping, service laterals, and meters throughout the Springfield Road, Struve Road, and MH Park areas.

Future Phases will complete the SWS loop around McClusky Slough and the Springfield Road/Giberson Road/Struve Road area. Future Phases will not be covered by the initial State funding and will be constructed on a separate timeline. Only the Project will be included in the subsequent detailed design stage. All components of the Project will be designed and constructed to accommodate the water demand of the completed SWS, including Future Phases.

Dividing the Project into multiple phases will incur a greater final cost for the complete SWS whereas keeping the Project together as a single set of contract documents would be less expensive due to economy of scale. However, with funding available for the Project, it is recommended the District advance the Project forward as quickly as feasible to improve water quality in the Springfield area. If the Project moves forward in an efficient manner, it is anticipated construction could be complete by the end of 2021.

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Section 2. Project Overview

2.1. District Background

The Pajaro/Sunny Mesa Community Services District (PSMCSD or District) has been in operation since 1986. The District was created by the Monterey County Local Agency Formation Commission (LAFCO) with the consolidation of the Pajaro Community Services District, the Sunny Mesa Water District, and Monterey County Service Area No. 73. The District is a public agency governed by a five (5) member Board of Directors.

The District provides potable water service, fire protection, parks, streetlights, and sanitary sewer services to thousands of residents in northern Monterey County (County). The District provides these services from the Pajaro River in the north to Moss Landing in the west and to the Highway 101 corridor in the south. It is the only public agency which provides public potable water services in the Pajaro, Elkhorn, and Prunedale areas.

The PSMCSD water system is regulated by State Wate Resources Control Board Department of Drinking Water regulations and the Monterey County Environmental Health Department.

2.2. Existing Supply System

The District acquired the Springfield Mutual Water Company in 2005. Since the acquisition, the District has been working with the residents of Struve Road to improve the potable water system. The water system, now called the Springfield Water System (SWS), currently serves approximately 34 single family residential parcels along Struve Road.

The existing SWS is fed by a single shallow well, designated as Springfield Well No. 1 (SW-1), located in an active agricultural field to the north of Struve Road. A photo of the existing well site is provided in Figure 2-1. Existing SWS infrastructure, including SW-1, is shown on Figure 2-2.

Figure 2-1: Existing Springfield Well Site

SW-1 has documented water quality problems for a number of contaminants. Table 2-1 shows the maximum contaminant level (MCL) established by the State of California and typical levels of contaminants exceeding these levels recorded at SW-1, recorded between 2012 and 2019.

Table 2-1: Existing Springfield Well (SW-1) Water Quality Issues

Contaminant	MCL	Springfield Water System
Nitrate (NO_3)	45 mg/l	58-293 mg/l
Chloride	250 mg/l	639 mg/l
Total Dissolved Solids (TDS)	500 mg/l	2,170 - 2,900 mg/l
Specific Conductance	900 µS/m	4,146 µS/m
Sulfate	250 mg/l	349 mg/l
1,2,3-Trichloropropane	0.005 µg/l	0.025 - 0.039 µg/l

It is believed the high levels of nitrates in SW-1 are a result of non-point source pollution from agricultural operations. High levels of total dissolved solids (TDS) and specific conductance are a result of seawater intrusion into the shallow aquifer SW-1 draws water from. Sulfate contamination is likely from naturally occurring sources.

The existing water supply system does not disinfect water prior to distribution. Due to the low-quality water produced by the existing system, the District currently provides bottled water to residences served by the SWS for potable uses. Residences in the SWS are allowed 170 5-gallon bottles of potable water per week. On average, the District provides 437 5-gallon bottles of potable water per month. The District also recently began providing bottled water to the residences in the Moss Landing Mobile Home Park (MH Park).

The building housing the existing SW-1 facilities is dilapidated and should be demolished to protect the health and safety of District operation staff and the public. New facilities at this site should include security improvements to exclude the public.

2.3. Existing Distribution System

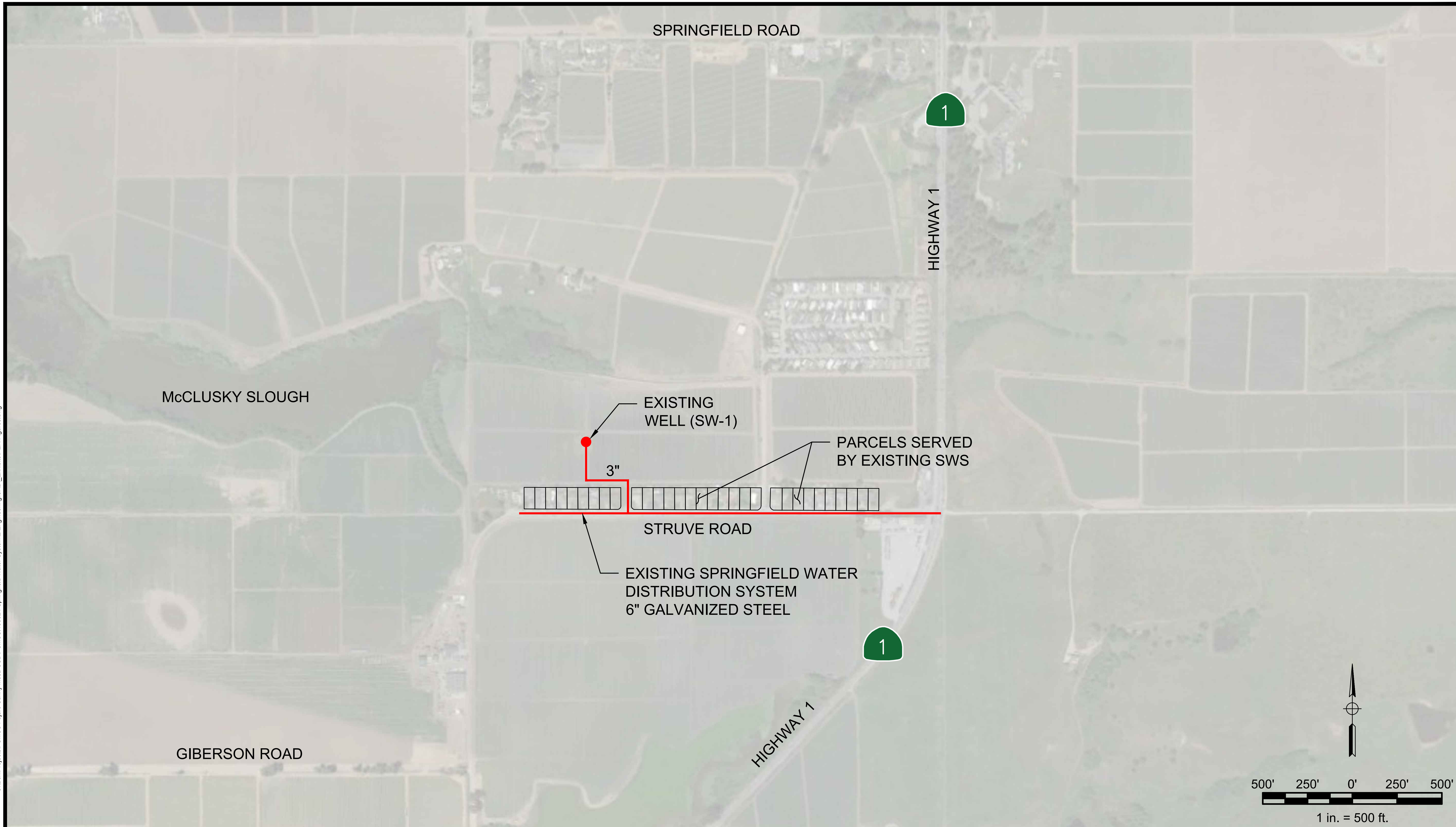
SW-1 discharges into the SWS which conveys water to the residences on Struve Road. There are currently 34 parcels being served by this system. The number of residences per parcel is unknown, but it is believed to be significantly higher than national average of approximately 3.14 persons in a family household (per the U.S. Census Bureau). The pipeline between SW-1 and the distribution main is believed to be constructed of 3-inch piping. The existing distribution main is 6-inch asbestos cement pipe (ACP). Existing service laterals are believed to be galvanized steel. Approximate locations of the existing distribution system piping are shown in Figure 2-2.

There are no individual water meters on the existing distribution system. The only water meter on the system is a total production meter at SW-1. Historic system demands are discussed in Section 2.5.

2.4. Project Goals

The goal of the Springfield Water System Improvements is to construct improvements to the SWS to deliver a reliable and potable water supply to the community. This Preliminary Engineering Report (Report) explores several alternative methods of supplying potable water to the area.

Initially, the project was intended to serve only the residences on Struve Road, currently served by the SWS, and potentially the MH Park. Since Project initiation, service to the MH Park has been confirmed, as well as additional residences along the proposed pipeline alignments.



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EXISTING SPRINGFIELD WATER SYSTEM

SPRINGFIELD WATER SYSTEM IMPROVEMENTS PROJECT

PAJARO / SUNNY MESA COMMUNITY SERVICES DISTRICT

FIGURE 2-2

FEBRUARY 2020

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When all phases are complete, the expanded SWS is anticipated to serve approximately 34 residences on Struve Road, 24 residences on Springfield and Giberson Roads, and the MH Park which includes 105 mobile home sites. The proposed composite service area and distribution piping to serve these customers is shown on Figure 2-3. Service to all customers will be achieved over multiple phases as discussed in Section 11.

The system will be supplied by at least one source of water, with a goal of two separate sources. Three potential sources are considered as part of this Report, including:

Alternative A: Drill a new well at the Moss Landing Middle School site.

Alternative B: Install a new connection between the existing Moss Landing Water System and the SWS.

Alternative C: Drill a new well at the existing SW-1 well site.

New individual service laterals and meters will be installed for each customer.

2.5. System Demands

This section documents the demand requirements for the customers who will be served by the Project.

2.5.1. Existing Springfield Water System Residential Demands

Existing system demands were reviewed for the period from the start of 2011 through April 2018. Usage data is collected from a single water meter measuring total well production from SW-1. A summary of the monthly water use for the system is show in Table 2-2.

Table 2-2: Springfield Water System Historical Monthly Total Water Demand (Gallons)

	2011	2012	2013	2014	2015	2016	2017	2018
January	573,716	471,988	454,784	569,976	531,828	552,099	563,992	617,848
February	513,876	381,480	418,132	471,240	487,696	433,990	429,726	449,548
March	509,388	372,504	463,012	534,820	584,936	620,092	685,168	628,320
April	554,268	397,188	454,784	536,316	557,260	504,152	476,326	570,724
May	639,540	467,500	673,948	605,132	523,600	514,624	706,112	-
June	559,504	546,788	552,024	682,924	604,384	676,416	774,928	-
July	597,652	588,676	667,964	657,492	534,072	606,852	721,072	-
August	602,888	586,432	634,304	594,660	585,684	670,806	620,765	-
September	548,284	523,600	699,380	513,876	634,304	699,305	878,975	-
October	499,664	628,320	540,056	559,504	526,667	560,925	734,536	-
November	454,036	442,068	537,812	550,378	412,597	624,580	640,288	-
December	428,604	485,452	609,620	520,758	455,532	526,966	576,708	-
Average Daily Use	17,757	16,098	18,372	18,622	17,640	19,153	21,393	18,887

During the evaluation period, the SWS pumped an average of 18,491 gallons per day (GPD) from SW-1. For the 34 parcels served, this equates to 544 gallons per parcel per day. The highest monthly demand during this period occurred during September of 2017. During this month, the system provided an average of 29,299 GPD, or 862 gallons per parcel per day. To estimate the maximum daily demand (MDD) for the system, the maximum month demand was multiplied by a factor of 1.5 in accordance with the California Code of Regulations (CCR) Title 22 §64554.

The existing SWS provides non-potable water to the parcels served. The new system will provide a potable source of water, which is anticipated to increase water use, as water provided by the system will also be utilized for potable uses. Meters will be installed on the system as part of this Project, which will enable the District to bill customers based on actual water use rather than the flat monthly rate currently in effect. Billing customers using this strategy will place downward pressure on water use.

Since the impact of these considerations cannot be accurately established, future demands for existing customers are assumed to remain equal to existing demands. The average daily demands (ADD) and MDD for the SWS are summarized in Table 2-3. The ADD and MDD are described in units of GPD and gallons per minute (GPM).

Table 2-3: Springfield Water System Maximum Daily Demand Summary

Community	Parcels	Max Month ADD per Unit (GPD)	Max Month ADD (GPD)	MDD Peaking Factor	MDD (GPD)	MDD (GPM)
Existing Springfield Water System	34	862	29,299	1.5	43,949	31

2.5.2. Springfield Road and Giberson Road Demands

Twenty-four (24) potential water system customers have been identified on Springfield Road and Giberson Road which would potentially be served by the expanded SWS. For the purposes of estimating system demands, we have assumed each potential additional customer has an equal demand to the customers served by the existing system. The MDD for the Springfield Road and Giberson Road customers are summarized in Table 2-4. Service to all customers will be achieved over multiple phases as discussed in Section 11.

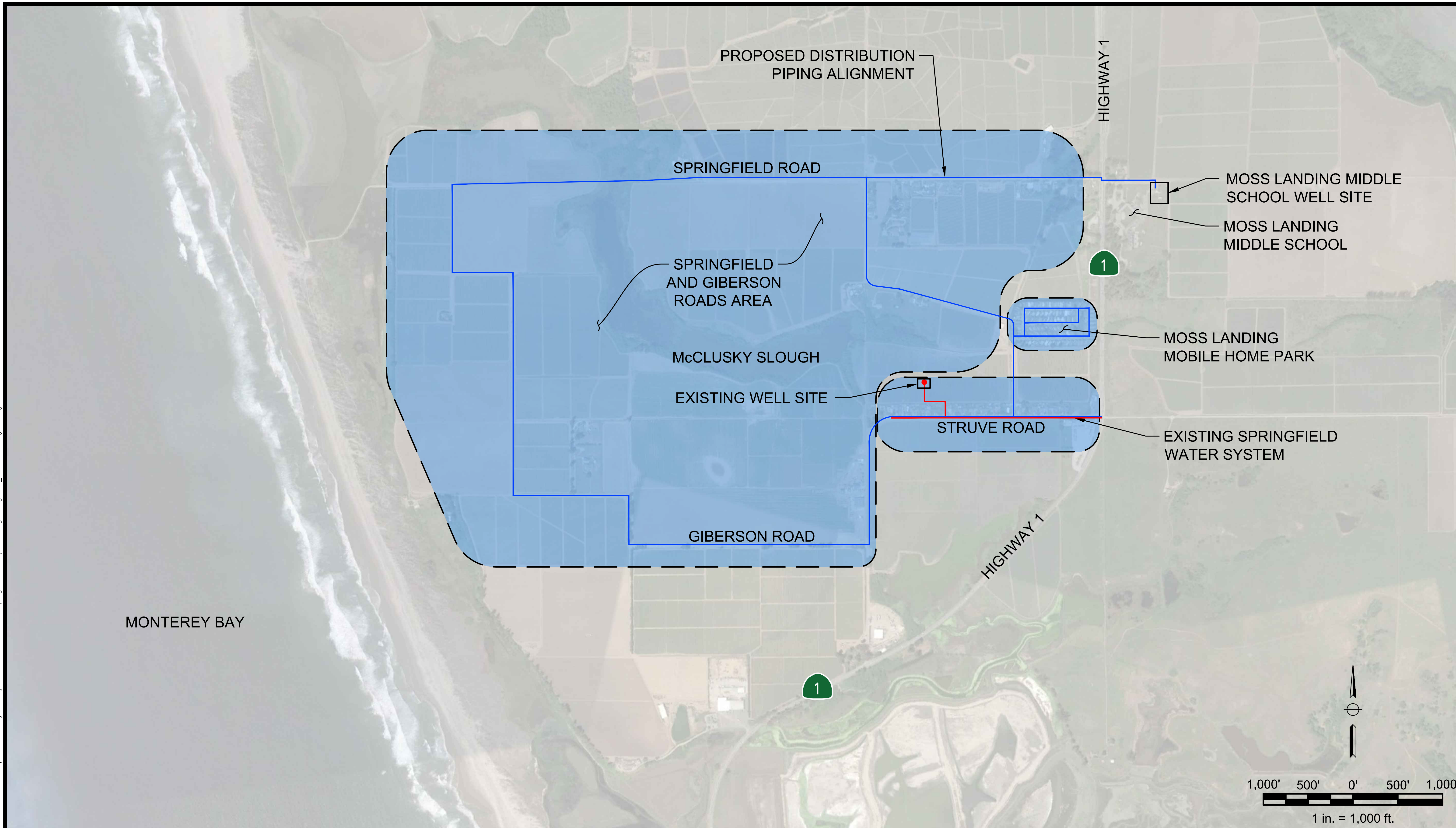
Table 2-4: Springfield Road and Giberson Road Customers Maximum Daily Demand Summary

Community	Parcels	Max Month ADD per Unit (GPD)	Max Month ADD (GPD)	MDD Peaking Factor	MDD (GPD)	MDD (GPM)
Springfield & Giberson Roads	24	862	20,682	1.5	31,023	22

2.5.3. Moss Landing Mobile Home Park

The MH Park has 105 individual units. The MH Park is currently provided bottled water by the District, but water usage data for the MH Park was not available for the preparation of this Report. As a basis for estimating demands, a search of publicly available documentation was conducted to identify typical mobile home water demands. A demand per mobile home unit was estimated based on a study of 2003 to 2006 average water use for four (4) mobile home parks in the Santa Clara Valley Water District. The ADD for each mobile home was calculated based on the 2003 to 2006 average yearly demand. Using the Santa Clara Valley Water District study, an ADD of 211 gallons per day per mobile home unit was estimated based on a connection weighted average of the four parks. The ADD of 211 gallons per day per mobile home unit was adopted to estimate demands for the MH Park

Average daily demands have been multiplied by 1.5 to estimate maximum monthly demands (MMD), and further multiplied by 1.5 to estimate MDD in accordance with CCR Title 22 §64554. The MDD for the MH Park customers are summarized in Table 2-5.



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PROPOSED COMPOSITE SERVICE AREA
SPRINGFIELD WATER SYSTEM IMPROVEMENTS PROJECT
PAJARO / SUNNY MESA COMMUNITY SERVICES DISTRICT

FIGURE 2-3

FEBRUARY 2020

Table 2-5: Moss Landing Mobile Home Park Maximum Daily Demand Summary

Community	Units	Average Daily Demand per Unit (GPD)	Average Daily Demand ADD (GPD)	MDD Peaking Factor	MDD (GPD)	MDD (GPM)
Moss Landing Mobile Home Park	105	211	22,155	2.25	49,849	35

2.5.4. Demand Summary

The ADD for the three communities proposed to be served by the SWS at buildout of all phases is summarized in Table 2-6. Housing unit types include single family residences (SFR) and mobile homes (MH).

Table 2-6: Expanded SWS Average Daily Demand

Community	Unit Type	Units	ADD per Unit (GPD)	ADD (GPD)	ADD (GPM)
Existing SWS	SFR	34	544	18,491	13
Moss Landing Mobile Home Park	MH	105	211	22,155	15
Springfield & Giberson Roads	SFR	24	544	13,052	9
Total				53,698	**37**

The MDD for the three communities proposed to be served by the system are summarized in Table 2-7.

Table 2-7: Expanded SWS Maximum Daily Demand

Community	MDD (GPM)
Existing SWS	31
Springfield & Giberson Roads	22
Moss Landing Mobile Home Park	35
Total	**87**

Peak hourly demand (PHD) is assumed to be 1.5 times the MDD, or 130 GPM.

2.5.5. Fire Flow

In accordance with the 2016 California Fire Code Appendix B, a minimum fire flow rate of 1,000 GPM for a period of one hour is required for one- and two-family residential dwellings, not equipped with automatic sprinkler systems, with a building area of up to 3,600 square feet. The District has confirmed 1,000 GPM is an acceptable fire flow rate but has requested a two-hour supply be provided. Section 4 describes the design requirements to meet these fire protection criteria.

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Section 3. Water Source Alternatives

3.1. Water Source Requirements

The County of Monterey Health Department has indicated a preference for the SWS to include a minimum of two sources of supply. The water source alternatives discussed in Section 3.2 were evaluated for use as primary and secondary sources of supply.

3.2. Water Source Alternatives

Three water supply alternatives were analyzed as part of this Report to provide a primary water supply for the SWS. This section provides an overview of the alternatives considered.

3.2.1. Alternative A – New Well at the Moss Landing Middle School Site

Alternative 1 would supply water to the SWS by constructing a new well and other improvements at a site on the property of the now-defunct Moss Landing Middle School. An easement on this site was acquired by the District in 2005. The easement on the school parcel (Assessor's Parcel Number (APN) 413-014-001), is 105 feet wide by 130 feet long and has an area of 0.31 acres surrounded by a four-foot-high chain link fence. The school parcel has a total area of 20.50 acres. An existing AT&T utility installation is located on the northeast corner of the parcel. According to data obtained from Google Earth, the site has an elevation of approximately 142 feet above mean sea level (MSL).

A test hole was drilled at the site in July 2008 to a depth of 630 feet below ground surface (bgs). Testing results and a geophysical electric log indicated good quality water is available at the site. These findings resulted in the decision to drill a test well at the site. The test well at the site was drilled from November 6 to 8, 2017. Subsequent casing, well development, and testing has shown this well is a suitable source of potable water for the SWS and has been completed as a production well. This well has been designated as the Springfield Well No. 2 (SW-2).

Additional information on the hydrogeology of the area, water quality information within the new well, and the recommendations for use of the well at the Moss Landing Middle School site is discussed in Section 5. A production rate of 100 GPM for this well is recommended.

3.2.2. Alternative B – Consolidate with Moss Landing Water System

Alternative 2 would serve the SWS with water provided from the existing Moss Landing Water System (MLWS). Three options for establishing this connection were evaluated. Each option would require construction of a transmission pipeline from the MLWS to a new water storage tank in the Springfield area. The transmission pipeline would connect to the MLWS at 2370 Highway 1 in front of the Whisper Charters and Monterey Bay Kayaks businesses.

Connecting to the existing MLWS will create additional demands on an already developed water system, which will reduce regional water supply reliability. In addition, this will expose the Springfield area to the risk of losing water supplies due to a water main break or other issue with the MLWS.

3.2.2.1. Moss Landing Water System Background

The existing MLWS is owned and operated by the District and serves the community of Moss Landing, located to the south of the Springfield area. The system consists of a single pressure zone supplied by two wells located east of Moss Landing on Dolan Road. The system also includes three water storage tanks and a booster pump station located adjacent to the Moss Landing Marine Laboratories located at 8272 Moss Landing Road.

Well pump operation is controlled based on the water level in the water storage tanks, each of which has a capacity of 59,000 gallons. The wells pump directly into the distribution system and provide system pressure for the distribution system when operating. Only one well may operate at a time. A backpressure sustaining valve regulates flow into the storage tanks; when the system pressure is above the set level, the valve opens to allow water to flow into the tanks until full; when the system pressure drops, the valve closes and stops flow to the tanks. The booster pump station draws water from the storage tanks and discharges into the distribution system.

Booster pump station operation is controlled based on system pressure. When one of the wells activates, system pressure increases, and the booster pump station shuts down. When a well pump turns off, pressure in the system drops, and the booster pump station activates. When operating, the booster pump station regulates output to maintain system pressure by regulating pump speeds using variable frequency drives (VFDs). Three small hydropneumatic tanks at the booster pump station site allow the booster pump station to shut down entirely during low flow periods.

Minimum static operating pressure in the MLWS varies between 38 and 68 pounds per square inch (PSI), depending on the location and elevation in the system. According to District records, the designated connection point with the SWS transmission pipeline has a minimum static system pressure of 62 PSI and is at an elevation of18 feet above MSL.

3.2.2.2. Moss Landing Water System Supply Capacity

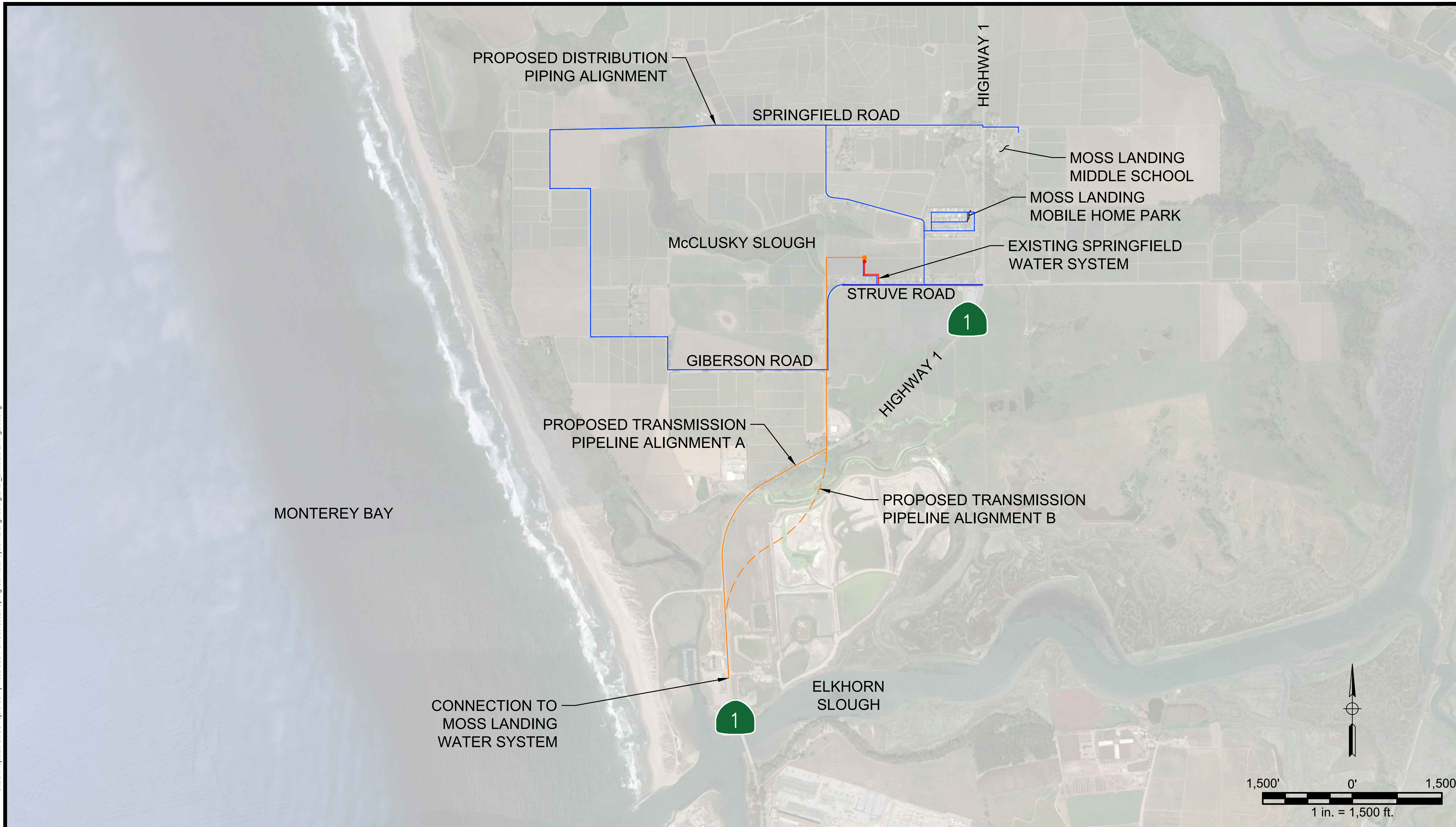
The primary MLWS well has a capacity of 450 GPM. The MLWS MDD is documented as 155,610 GPD, which equates to 108 GPM. This indicates excess capacity exists in the primary well, which could be used to serve the SWS. A hydrogeologic analysis on the potential impact of increased pumping at the MLWS wells has not been completed and is unknown.

Hydraulic modeling indicates there is insufficient capacity in the MLWS to directly serve the SWS fire flow demand. Meeting the fire flow demand requires water storage be provided in the SWS.

3.2.2.3. Moss Landing Connection Option 1

This option includes the construction of a new water storage tank for the SWS at either the existing SW-1 site or another nearby site at a similar elevation. A dedicated transmission pipeline would be extended from the MLWS to the new tank. The alignment of the transmission pipeline is assumed to be within Highway 1, which is a California Department of Transportation (Caltrans) right-of-way (ROW) from the point of connection to the MLWS to Struve Road, then within Struve Road and private property to the site of the new water storage tank. A combination altitude and backpressure sustaining valve would regulate flow into the storage tank. A new booster pump station would be provided adjacent to the new tank, which would pump water into the SWS distribution system. An emergency connection would be provided from the discharge side of the booster pump station to the MLWS side of the combination altitude and backpressure sustaining valve to allow the SWS to transfer water back into the MLWS. A back-up generator at the booster pump station would be required to provide back-up power in the event of a power outage.

This alternative is shown schematically on Figure 3-1. A conceptual level construction cost opinion has been developed and is included in Appendix A. Construction costs opinions for this alternative were developed in October 2016. The estimates were escalated for 2019 costs by utilizing the Engineering News-Record (ENR) Construction Cost Index.



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MOSS LANDING CONNECTION OPTION 1

SPRINGFIELD WATER SYSTEM IMPROVEMENTS PROJECT

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FIGURE 3-1

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3.2.2.4. Moss Landing Connection Option 2

This option includes the construction of a new water storage tank for the SWS at the Moss Landing Middle School site. There is currently insufficient system pressure in the Moss Landing Water System to reliably convey water to this new tank. A small booster pump station would be provided to transfer water through a dedicated transmission line to the new tank at the school site. A back-up generator at the booster pump station site would be required to provide back-up power in the event of a power outage. A pump station and back-up generator are also required to discharge water into the distribution system. The alignment of the transmission main is assumed to be in Highway 1 from the point of connection to the MLWS to the south side of Struve Road, then within Struve Road back to the intersection of Highway 1 in the east, continue within Highway 1 to Springfield Road, and follow Springfield Road to the Moss Landing Middle School site. This alignment was selected to minimize the length of piping installed within Caltrans ROW, installation costs, and challenges associated with future maintenance. A location for the booster pump station has not been established but would require acquisition of a site, or additional piping at the existing well site.

Bypass lines around both booster pump stations would also be provided to allow water stored in the tank at the Moss Landing Middle School site to serve the MLWS at a slightly reduced pressure in the event of an emergency.

This alternative is shown schematically on Figure 3-2. A conceptual level construction cost opinion has been developed and is included in Appendix A. Construction costs opinions for this alternative were developed in October 2016. The estimates were escalated for 2019 costs by utilizing the Engineering News-Record (ENR) Construction Cost Index.

3.2.2.5. Moss Landing Connection Option 3

This option is the same as Moss Landing Connection Option 2, except the booster pump station would be eliminated by increasing system pressure of the Moss Landing Water System by 10 to 15 PSI. This would provide sufficient pressure to reliably convey water to a tank at the Moss Landing Middle School site. A combination altitude and backpressure sustaining valve would regulate flow into the storage tank. A bypass line around the combination altitude and backpressure sustaining valve would also be provided to allow water stored in the tank at the Moss Landing Middle School site to serve the MLWS in the event of an emergency.

Modifications to the MLWS to increase system pressure would include reprogramming the booster pump station to modify pump set points and modifying settings on the backpressure sustaining valves which allow water to flow to the MLWS storage tanks. Increasing the pressure is anticipated to reduce the output of the primary MLWS well from 450 GPM to 430 GPM.

This alternative is shown schematically on Figure 3-3. A conceptual level construction cost opinion has been developed and is included in Appendix A. Construction costs opinions for this alternative were developed in October 2016. The estimates were escalated for 2019 costs by utilizing the Engineering News-Record (ENR) Construction Cost Index.

3.2.2.6. Moss Landing Connection Alternative B, Option Selection 1, 2, or 3

As a basis for comparing the Moss Landing Connection Options, a Color Alternatives Review Table (CART) was developed to provide a visual assessment of the alternatives, provided as Table 3-1.

Table 3-1: Moss Landing Connection Options CART

Option			Good →		Poor
	Estimated Construction Cost	Booster Pump Stations and Back-up Generators Required	Relative Energy Costs	Ability to Back Serve Moss Landing	Additional Challenges
Option 1: Tank Located at Existing Well Site	$6,500,000	Two	$$$	Yes	Permanent Access Easement Required
Option 2: Tank Located at Moss Landing Middle School Site with Booster	$6,900,000	Two	$$	Yes - At Reduced Pressure	Land Acquisition or Additional Piping and Permanent Access Easement Required
Option 3: Tank Located at Moss Landing Middle School Site with Increased Pressure	$5,500,000	One	$	Yes	-

Based on the criteria presented in Table 3-1, Option 3 is the preferred alternative for a connection with the MLWS.

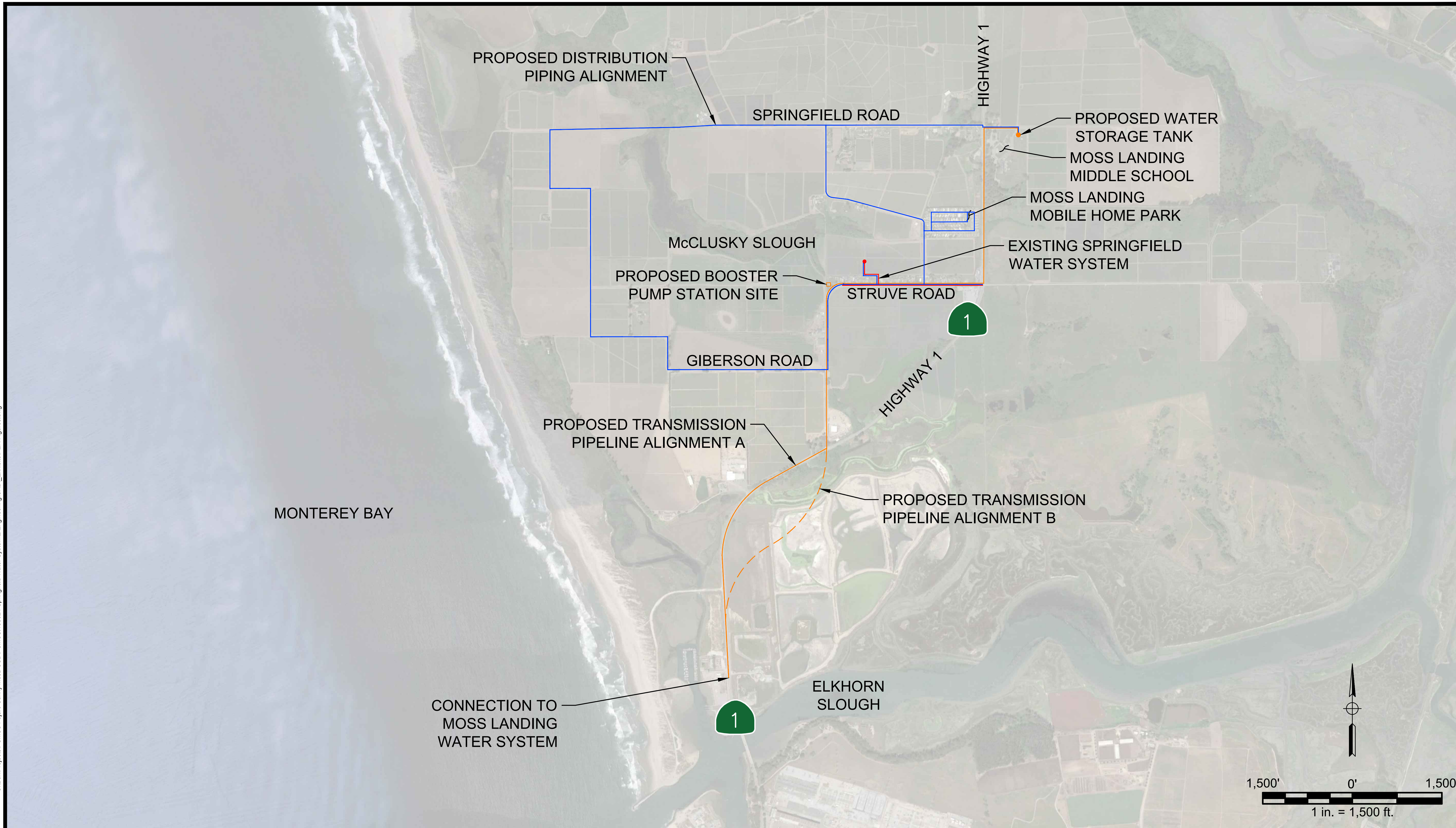
3.2.2.7. Pipeline Alignments and Installation Methods

Two pipeline alignments have been considered to connect the MLWS and SWS. Alignment A includes a transmission pipeline approximately 7,100 feet in length to be constructed primarily within the public ROW on Struve Road and Caltrans ROW along Highway 1. Alignment B would include a transmission pipeline approximately 6,900 feet in length which would be constructed primarily within the public ROW of Struve Road and within the Moss Landing State Wildlife Area. For either alternative, it is assumed the transmission pipeline would have a nominal diameter of eight inches to match the existing pipe diameter at the MLWS connection point. These alternative alignments are shown in Figures 3-1 through 3-3.

A technical memorandum assessing the feasibility of trenchless pipeline installation to connect to the MLWS was prepared by Aldea Services LLC, dated November 15, 2015. This technical memorandum is included as Appendix B of this report.

Based on the preliminary HDD feasibility evaluation for installing a pipeline from the SWS to the MLWS, using the HDD method is considered a viable construction alternative for installation of the water transmission pipeline. The proposed HDD bore alignments (assuming high density polyethylene (HDPE) pipe) are long (3,000 to 4,500 feet) to extremely long (greater than 4,500 feet). Shorter lengths can be performed in a single bore, while longer lengths are considered extremely long for a single bore and may need to be split into two separate bores or a single bore using the HDD intersect method.

While connecting the SWS to the MLWS using HDD piping installation methods is a viable alternative, utilizing the MLWS to supply the SWS is not recommended, as discussed in Section 3.3.



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MOSS LANDING CONNECTION OPTION 2

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FIGURE 3-2

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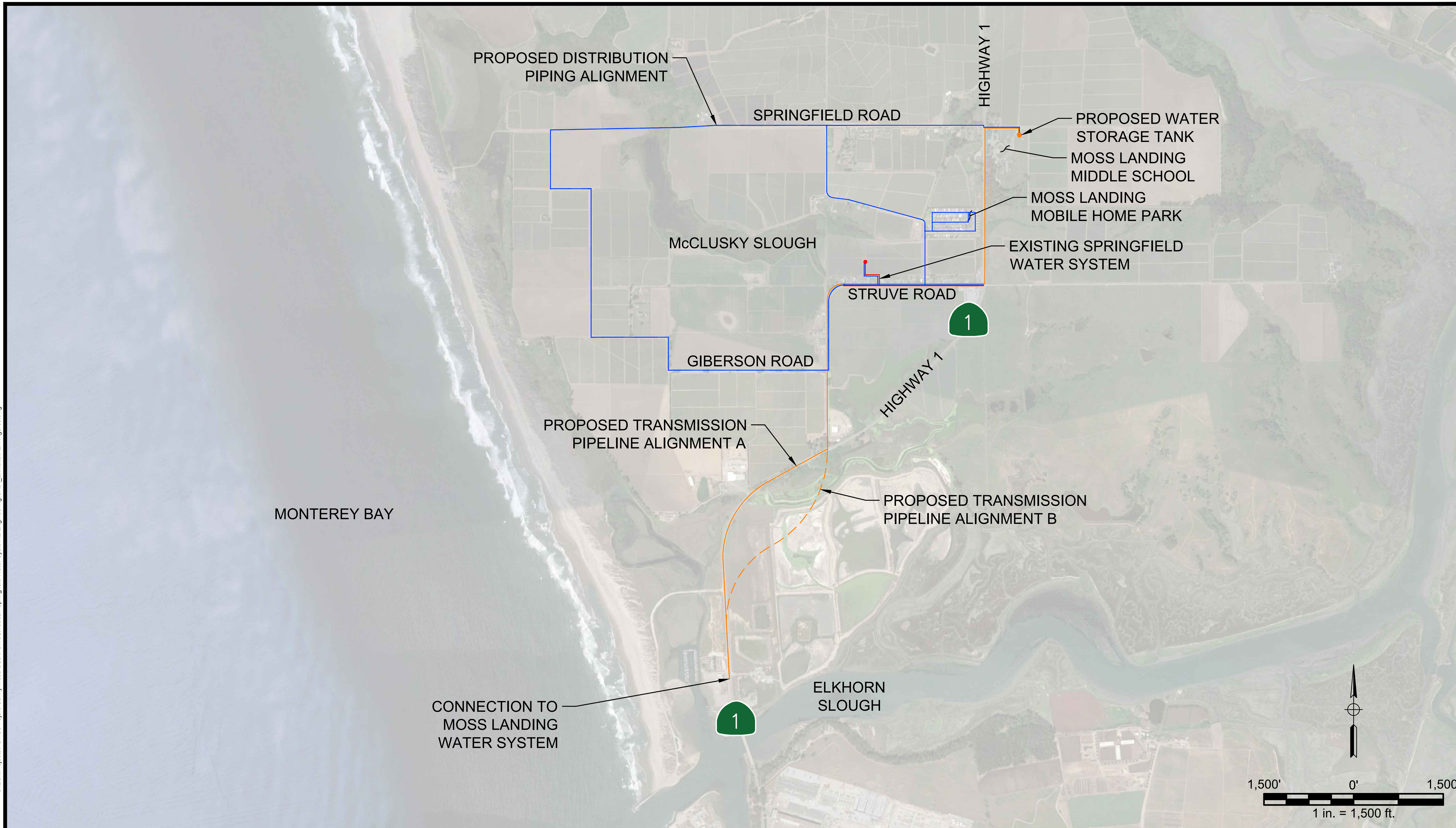

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MOSS LANDING CONNECTION OPTION 3
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FIGURE 3-3

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3.2.3. Alternative C – New Well at Existing Well Site

Alternative 3 would supply water to the SWS utilizing a new well at the existing Springfield well site. Based on the hydrogeologic evaluation conducted as part of this Report, and discussed in more detail in Section 5, it is likely a deeper well at this site would provide a high-quality water source for the SWS. For the purposes of this Report, a new well at the existing well site has been designated as the future Springfield Well No. 3 (SW-3). This well will be designed with a target production rate of 100 GPM.

3.3. Recommended Water Supply Sources

Alternative A is recommended as the primary water source for the SWS since the well has been completed and has a demonstrated ability to provide water to the system. Alternative C is recommended as the secondary source of supply for the system as a result of input from the County of Monterey and State of California; in addition, the hydrogeologic evaluation conducted as part of this study indicates a new well at the existing well site would produce water of good quality.

Connecting to the MLWS is not recommended due to the high construction cost associated with the interconnection, the resultant decrease in local water supply reliability, and anticipated environmental and encroachment permitting challenges.

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Section 4. Project Requirements

This section addresses the technical requirements for the proposed water system.

4.1. General Project Requirements

It is the intent of this Project to develop a reliable, independent water supply system for the Springfield area. To achieve this goal, infrastructure elements required as part of this Project include:

- Water Supply
- Water Treatment
- Water Storage
- Booster Pump Station
- Back-up Generator
- Water Transmission Mains and Upgrade of Service Laterals
- Municipal Site Development

Additional information on the requirements for each of these elements are included in the following sections. A figure showing the overall system is included as Figure 4-1. Various equipment cut sheets for proposed equipment is included in Appendix C.

4.2. Water Supply

Water for the SWS will be primarily provided from the recently constructed SW-2 located at the Moss Landing Middle School site, with future SW-3 located at the existing SW-1 site to provide a secondary source of supply. For the purposes of preliminary sizing of equipment, each well pump will be sized to provide 100 GPM of supply.

The SW-2 well pump has been sized based in an assumed static depth to ground water of 143 feet, with a drawdown of 12 feet (8.8 GPM per foot of drawdown) as recommended by the hydrogeologic report discussed in Section 5. The pump will discharge to onsite storage at an elevation of approximately 17 feet above grade.

The SW-3 well pump has been sized based in an assumed static depth to ground water of 20 feet, as documented in the well driller's report for SW-1, with a drawdown equal to SW-2. The SW-3 site is at an elevation of approximately 20 feet above MSL. The pump will discharge to the distribution system, which will be at a pressure of 80.7 to 90.7 PSI at the existing well site, depending on the pressure in the hydropneumatic tank at the Moss Landing Middle School site, as discussed is Section 4.5. The well pump is sized for the midpoint of the operating range.

For equipment consistency, the District has requested both wells be equipped with Goulds submersible vertical turbine well pumps. A summary of the well pumps is provided in Table 4-1.

Table 4-1: Recommended Well Pumps

Well	Primary Operating Point	Recommended Pump	Horsepower
SW-2	100 GPM @172' TDH	Goulds 95L07	7.5
SW-3	100 GPM @ 230' TDH	Goulds 95L10	10

4.3. Water Treatment

Water tests completed during development and testing of SW-2 indicate water quality in the well is satisfactory, with all tested parameters below State and Federal regulatory limits. Since these quality tests were completed, regulatory requirements for additional contaminants have been enacted. Additional testing will need to be completed for these contaminants to verify acceptable water quality. Detailed information on water quality is discussed in Section 5.

Based on the water quality testing results, treatment to remove specific contaminants is not required, unless additional contaminants are identified. In the future, water quality may degrade as a result of contamination from seawater, the upper aquifer, or another source. The site layout, discussed in Section 4.9, includes sufficient area for potential future water treatment facilities.

It is recommended water produced by SW-2 be chlorinated prior to entering on-site storage tanks and subsequently to the distribution system. Similar to the District's other systems, 1-gallon containers of sodium hypochlorite will be diluted on-site in a storage vessel to a concentration of 12.5%. To achieve a target chlorine residual of 1 part per million (ppm), 0.054 gallons of 12.5% sodium hypochlorite solution will need to be added each hour the system is operating. During ADD conditions, SW-2 is anticipated to operate for 10 hours per day, and 21 hours per day during MDD conditions; during these conditions, 0.54 and 1.134 gallons of 12.5% sodium hypochlorite solution will need to be added per day, respectively. A 20-gallon dual containment sodium hypochlorite storage tank is recommended to store sodium hypochlorite at the site.

An on-line continuous chlorine residual analyzer will be provided to verify chlorine residuals are being maintained. If the chlorine residual drops below a concentration of 0.5 ppm, an alarm will sound. A Hach CL17 chlorine analyzer is recommended.

The District may also desire to have an on-line turbidimeter included in the system design to provide data on water clarity. A turbidimeter can transmit an alarm if turbidity rises above a designated set point. A Hach TU5300 turbidimeter with an SC200 controller is recommended.

Both the chlorine analyzer and turbidimeter will discharge to waste.

The proposed SW-3 well has not yet been constructed. As a result, water quality parameters are unknown, but are anticipated to be substantially similar to the water quality observed at SW-2. As a result, considerations for water treatment are identical to those for SW-2.

4.4. Water Storage

Various criteria are considered for water storage, including storage volume, water quality, and storage tank appurtenances. These criteria are detailed in the following sections.

4.4.1. Water Storage Volume

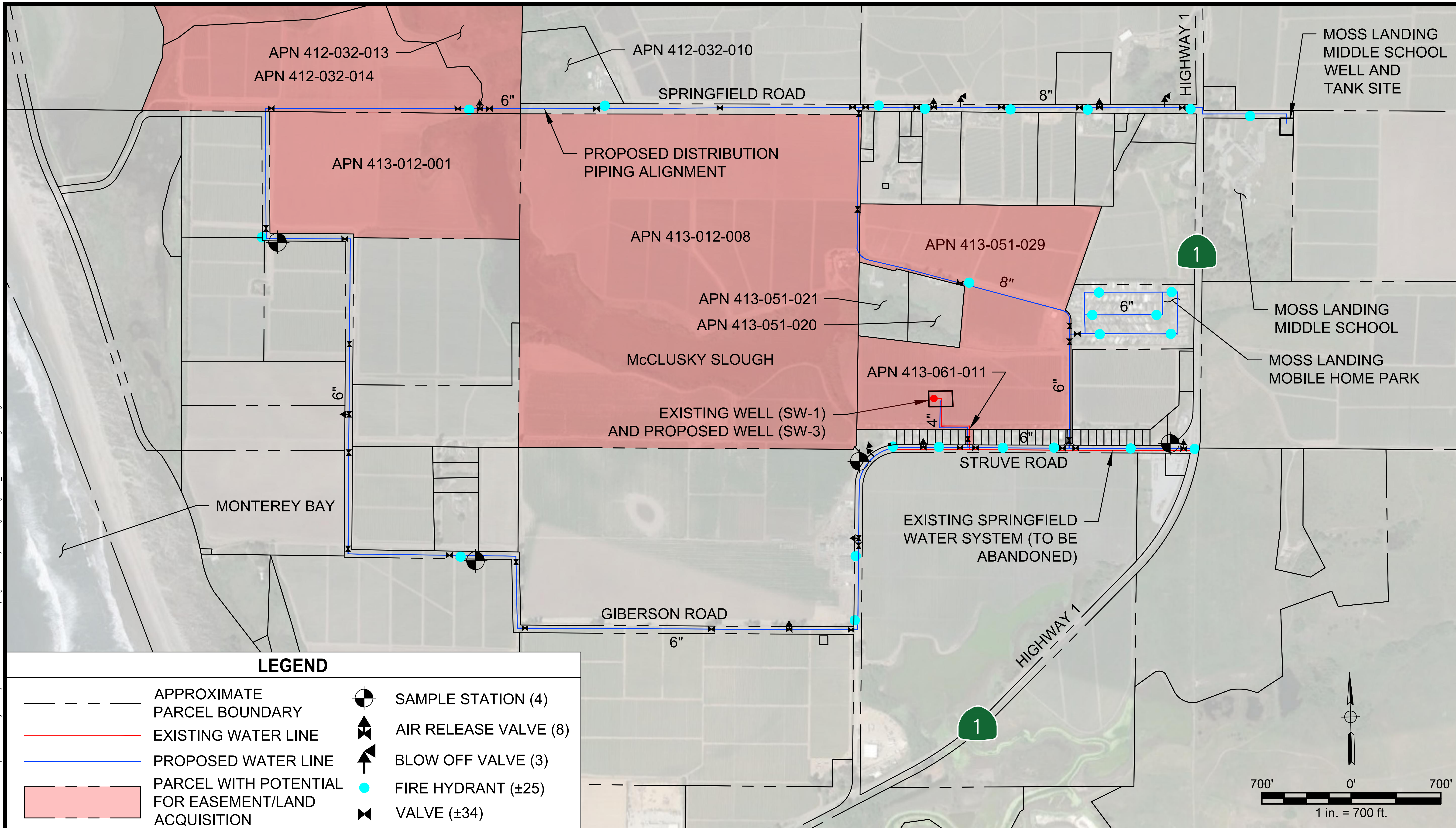
Determining the volume of water storage is a balance between multiple factors. Industry standards and fire protection requirements dictate the minimum water storage volume required for a potable water system.

The minimum storage required is determined by the following equation:

$$SSR = NFF + MDC - PC$$

Where:

SSR =Storage Supply Required (gallons)
NFF = Needed Fire Flow (120,000 gallons)
MDC = Maximum Daily Consumption (124,820 gallons)
PC = Production Capacity (24,000 gallons = 200 GPM for 2 hours, two wells pumping at 100 GPM)



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PROPOSED WATER DISTRIBUTION SYSTEM

SPRINGFIELD WATER SYSTEM IMPROVEMENTS PROJECT

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FIGURE 4-1

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Based on this calculation, a minimum storage volume of 220,820 gallons is required.

As water resides in a storage tank, chlorine residuals decay. If chlorine residuals drop sufficiently, water quality issues can develop. It is the District's goal to maintain three days' average daily demand in storage for the SWS.

4.4.2. Stored Water Quality

Based on the anticipated ADD for the SWS of 53,698 gallons per day, the residence time in a tank with a capacity of 220,820 gallons would be approximately 4.1 days, which could increase significantly during periods of lower demand. This exceeds the District's target of three days of storage capacity.

The existing SWS is not chlorinated. Assuming chlorination will be required for the new system, the primary water quality concern for water in the SWS is to maintain the water stored in a well-mixed state and maintain a consistent chlorine residual.

To achieve these goals, it is recommended permanent active storage mixing be installed to mix the chlorinated water. A variety of active mixing systems are available, including air bubbler systems and pumped mixing systems. A pumped mixing system, such as the GridBee Potable Tank Mixer, manufactured by the Medora Corporation, is recommended for this application.

4.4.3. Water Storage Design

Dividing the recommended storage volume of 220,820 gallons between two equal volume storage tanks will provide additional operating redundancy and allow for future repair of the tanks without necessitating temporary storage. Each tank will have a volume of 110,410 gallons or greater.

The water storage tanks for this project will be epoxy coated bolted steel tanks as described by American Water Works Association (AWWA) D103-09. Each tank will have a diameter of approximately 34 feet, with a liquid depth of approximately 17 feet. Each tank will be provided with the following appurtenances:

- Interior ladder
- Exterior ladder with Occupational Safety and Health Administration (OSHA) compliant cage, designed to limit access to District staff only
- Roof hatch
- Roof handrails, extending eight feet on either side of the exterior ladder
- Center roof vent
- Shell manway at ground level
- Exterior overflow
- Combined inlet/outlet connection
- Overflow outlet connection to drain
- Flexible connections for tank inlets and outlets
- Isolation valves (required on all inlets and outlets within 100 feet of new tank)
- Sample taps (2)
- Level sensor
- Gauge board
- Fall protection tie-off points

Since the storage tanks are not required to provide disinfection contact time, and are equipped with permanent mixing systems, separate inlet and outlet connections are not required.

The tanks will be provided with a factory-applied fusion-bonded epoxy coating to maximize the longevity of the tanks. A cathodic protection system is not recommended for bolted steel tanks with this type of coating.

Due to seismic design requirements, freeboard, or airspace, above the maximum water surface level is required to reduce the risk of tank damage in the event of an earthquake. This results in a taller tank than it would be to only store the required volume of water. The tank's Seismic Use Group (SUG) is the key determinant driving the design of tank freeboard and overall height.

The SUG assigned to a specific structure is a classification based on its intended use and expected performance under a variety of loading conditions, including earthquakes. The SUG has a significant impact on several factors involved in the structural design of facilities. SUG classifications range between I and IV; for potable water storage tanks, however, AWWA standards only include calculations for I, II and III. SUG IV is intended for structures of national strategic military importance and is not considered. Descriptions of these classifications according to AWWA standards are:

> *Seismic Use Group III:* SUG III shall be used for tanks that provide direct service to facilities deemed essential for post-earthquake recovery and essential to the life, health, and safety of the public, including post-earthquake fire suppression.
>
> *Seismic Use Group II:* SUG II shall be used for tanks that provide direct service to facilities deemed important to the welfare of the public
>
> *Seismic Use Group I:* SUG I shall be used for tanks not assigned to SUG II or III.

A SUG III is recommended for the proposed new tanks, as they provide supplies for fire protection, and there is no other storage in the system.

4.5. Pump Station

A pump station will be required to transfer water from the water storage tanks into the distribution system and maintain system pressure. The pump station is recommended to be sized based on maintaining a minimum system pressure of 40 PSI at the water meter for each customer. The customer with the highest elevation is the residence at the intersection of Springfield Road and Highway 1, which is at an elevation of approximately 114 feet above MSL. The Moss Landing Middle School site has an elevation of approximately 143 feet above MSL. Based on these elevations, the pump station needs to provide a minimum of 63.3 feet of head, or 27.4 PSI. The customers at the lowest elevation are those located on Struve Road, with a minimum elevation of approximately 20 feet above MSL. The pressure to these customers will be a minimum of 80.7 PSI.

Struve Road customers could be served without a pump station; however, due to the additional customers at higher elevations, a pump station is required.

Four pumps are recommended for the booster pump station. Two duty pumps would be provided, each sized for anticipated peak hourly system demand; this provides full redundancy for normal operating conditions. In addition, two fire pumps, each sized for peak fire flow, will also be provided; this provides full redundancy for emergency operating conditions. Each pump will be supplied with a soft starter to minimize peak electrical demands and transient pressures in the system. VFDs are not anticipated to be necessary. Both sets of pumps will be designed to operate in an alternating lead-lag set-up to operational frequency. Regular testing of the fire pumps will be required to verify and maintain operational conditions.

The duty pumps are recommended to be designed to transfer 200 GPM into the system, sufficient to meet the anticipated PHD for the system with a safety factor of 1.4. The fire pumps are recommended to be sized for 1,150 GPM each to meet PHD conditions and fire demands. Submersible canned vertical turbine pumps have been included in the preliminary design. This pump selection was made to protect the pumps from corrosion due to the coastal exposure of the site. Pumps and associated horsepower and make/model numbers are provided in Table 4-2.

Table 4-2: Recommended Booster Pumps

Pump	Primary Operating Point	Recommended Pump	Horsepower
Duty Pump #1	200 GPM @ 80' TDH	Xylem VIS-WFTM 7CHC	7.5
Duty Pump #2	200 GPM @ 80' TDH	Xylem VIS-WFTM 7CHC	7.5
Fire Pump #1	1150 GPM @ 73' TDH	Xylem VIS-WFTM 13CMC	30
Fire Pump #2	1150 GPM @ 73' TDH	Xylem VIS-WFTM 13CMC	30

The booster pump station will incorporate a hydropneumatic tank to allow pumps to provide consistent pressure and supply to the distribution system while cycling pumps on and off. The hydropneumatic tank has been sized based on the following equation:

$$Vt = [(P1 + 14.7)] / [P1 - P2]\ 15 * Qp * MF / Nc$$

Where:

Vt = Total hydropneumatic tank volume (gallons)

P1, P2 = Pressures selected for water system operation (psig, not absolute pressures). P1 corresponds to the pump-off pressure and P2 to the pump-on pressure (37.4, 27.4)

Nc = Number of pump operating cycles per hour. This number is either the current Department of Health (DOH) recommendation of six cycles per hour or a larger value that can be justified and documented by pump or motor manufacturers' warranties (6 cycles per hour)

Qp = Pump delivery capacity (GPM) at the midpoint of the selected pressure range. Determined based on pump curves. If this value is not used, the Qp occurring at P2 (pump-on) must be used (200 GPM).

D = Tank diameter (72 inches)

MF = A multiplying factor related to tank diameter for horizontal tanks to ensure a six-inch water seal at the bottom of the tank. (1.06)

Based on this calculation, a minimum hydropneumatic tank volume of 2,761.3 gallons is calculated. A 3,000-gallon tank is included in the preliminary design. The booster pumps will be located outdoors at the site.

4.6. Back-up Electrical Generator

A back-up electrical generator will be required at the site. The generator will be sufficiently sized to handle the maximum anticipated load at the site. This maximum load is anticipated when starting a fire pump during operation of SW-2 as well as other minor on-site loads.

The back-up electrical generator has preliminarily been sized with a minimum generation capacity of 50 kilowatts (kW). The District has expressed an interest in a Caterpillar brand diesel generator with an integral double wall fuel tank for consistency with other sites. A Caterpillar C4.4 generator has been used as a basis for the preliminary design.

4.7. Water Transmission and Distribution Mains and Appurtenances

Water transmission mains will be required to transfer water from the booster pump station at the Moss Landing Middle School site and SW-3 to the distribution system. Mains have been preliminarily sized to provide sufficient water supplies without exceeding allowable pressure drops through the system during peak flows. New water mains will be constructed of polyvinyl chloride (PVC) C-900 pipe, pressure class 165 (DR25), sufficient to handle maximum system pressures. For portions of the project installed by horizontal directional drilling (HDD), fusible PVC pipe will be used for material consistency.

The existing SWS will be expanded to serve the additional customers. The existing 3-inch pipeline between SW-1 and Struve Road has a history of breaks and repairs and has reached the end of its service life; a new 4-inch water main will be installed between the SW-3 site and the distribution system. Replacement of the existing ACP within Struve Road is also recommended to be included in the project, as the planned increase in system pressure may cause catastrophic pipe failure. Approximately 12,700 linear feet of new 4-, 6-, and 8-inch water mains will be constructed in the Springfield, Giberson, and Struve Roads areas as shown on Figure 4-1.

New water mains will be installed throughout the MH Park, with metered laterals installed for each individual mobile home; all MH Park residents will become customers of the District. New fire hydrants will also be installed within the MH Park.

New distribution system piping will include valves, fire hydrants, air release valves, blow-offs, sampling stations, and other appurtenances as appropriate. The District has requested a minimum of four water quality sampling points throughout the distribution system. Fire hydrants, shown on Figure 4-1, are located approximately every 500 linear feet in residential areas, at dead ends of the distribution system, and in other strategic locations throughout the system. Existing wharf style hydrants will be removed. Fire hydrants will not be provided in areas where there are no existing residences or structures. Main line valves will be provided at selected fire hydrants, at intersections in the distribution system, and approximately every 1,000 linear feet throughout the distribution system.

4.8. Water Service Laterals

Water service laterals will be installed from the new main to new water meters at the property line for each customer. For customers with an existing water service, the new meter will be connected to the existing service lateral at the property line on the private (downstream) side of the meter. For customers without an existing water service, the service lateral will end at the new water meter at the property line, but the property owner will be required to extend the service line from the meter to the location of use at the owner’s expense. New services will be installed in accordance with District standards; separate water meters will be provided for each individual service connection.

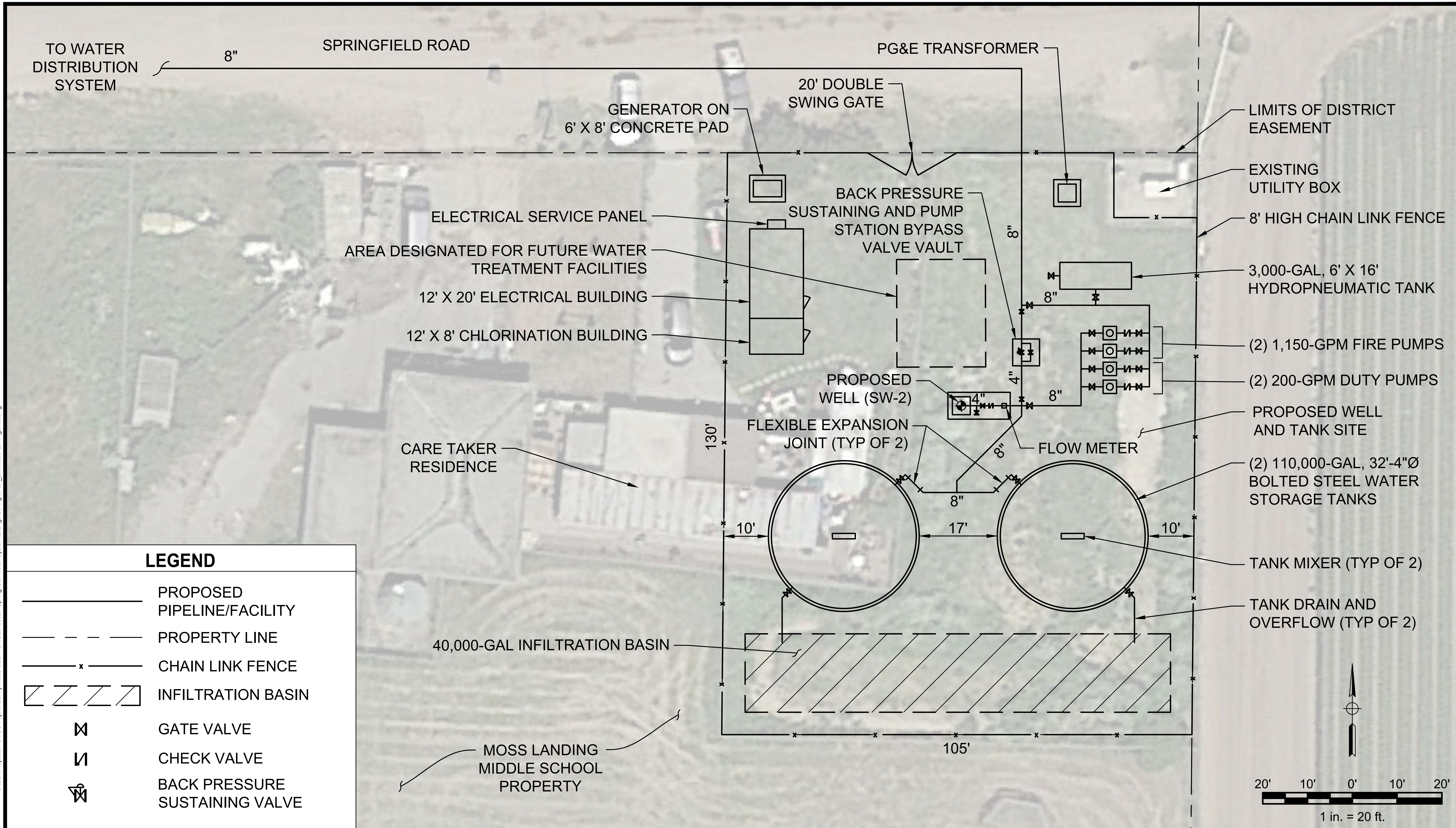
4.9. Moss Landing Middle School Site Development

The Moss Landing Middle School site will be developed as a fully functional municipal site. In addition to the permanent water supply infrastructure at the site, an area will be designated for a future treatment system to manage issues associated with potential future degradation of water quality. Other improvements at the site will include:

- Above-grade, below-grade, and interconnecting piping, valves, and accessories
- Chlorination facilities
- Electrical and lighting improvements
- Communications equipment
- A gravel surface suitable for driving vehicles and equipment
- A fiberglass reinforced plastic (FRP) building to house electrical equipment, chemical dosing equipment, chlorine analyzer, and turbidimeter (if provided)
- An eight-foot-high chain link fence with a locking gate to provide access to the site
- Communications equipment

A proposed layout of the Moss Landing Middle School site is included as Figure 4-2.

The existing roadway adjacent to the projected tank site, Springfield Road, is public ROW and has a paved surface.



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MOSS LANDING MIDDLE SCHOOL SITE PLAN
SPRINGFIELD WATER SYSTEM IMPROVEMENTS PROJECT
PAJARO / SUNNY MESA COMMUNITY SERVICES DISTRICT

FIGURE 4-2

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4.10. Existing Well Site Development

The existing SW-1 site will be redeveloped to provide a fully functioning municipal site. Improvements at the site will include:

- A new well, SW-3
- Above- and below-grade piping, valves, and accessories
- Chlorination facilities
- Electrical and lighting improvements
- A gravel surface suitable for driving vehicles and equipment
- FRP building to house electrical equipment, chemical dosing equipment, and chemicals
- An eight-foot-high chain link fence with a locking gate to provide access to the site
- Communications equipment
- Abandonment and demolition of the existing well
- Demolition of the existing building

In addition, a new access road will be required to provide all-weather access to the site from Struve Road. A conceptual design for the proposed roadway section includes of over-excavation to remove organic material and poor soils in the top 24 inches, fill as required, followed by a layer of geotextile fabric, and a 12-inch layer of graded and compacted base rock. A proposed layout of the existing SW-1 site and access road is included as Figure 4-3.

4.11. System Operation, Control, and Communication

A schematic drawing of the proposed SWS is provided as Figure 4-4. Additional information on operation of each of the components is provided in the following sections.

4.11.1. Well Pump Operation

Well pump operation will be controlled based on level in the water storage tanks. When the water level in the tanks drop below an adjustable set point, a well pump will activate. When the water storage tanks are full, the well pump will turn off.

SW-2 will act as the primary source of water for the system. SW-3 will only activate if manually activated by District staff if SW-2 is out of service or water levels in the water storage tanks drop below an adjustable set point.

SW-2 will discharge directly into the water storage tanks. SW-3 will discharge directly into the distribution system. Water produced by SW-3 in excess of system demand will be discharged to the water storage tanks; this discharge will be regulated by a backpressure sustaining valve.

4.11.2. Chlorination Operation

Sodium hypochlorite dosing pump operation will be controlled based on well pump operation. For each well, the dosing pump will operate whenever the well pump is operating, unless manually overridden by an operator. Dosing rates will be manually adjustable by operations staff based on observed well discharge rates and desired chlorine residual concentrations in the water storage tanks.

4.11.3. Booster Pump Station Operation

The booster pump station will maintain SWS water pressure at all times. Only one pump will operate at a time. Pumps will be controlled based on pressure in the hydropneumatic tank. When pressure in the hydropneumatic tank drops below a set point, the lead duty pump will activate. When pressure in the hydropneumatic tank reaches a high set point, the duty pump will turn off. If the pressure in the hydropneumatic tank drops below a low-low level set point, the duty pump will turn off, and a fire pump will activate. The fire pump will remain on until the high pressure set point is achieved, at which point it will turn off and return to normal duty operation.

Both pairs of duty and fire pumps will alternate lead/lag operation each pumping cycle. If a lead pump fails to activate, an alarm will sound, and the lag pump will activate. An on-site air compressor will automatically activate and add air to the hydropneumatic tank if a combination of tank level and pressure indicate additional air is required.

4.11.4. Back-up Generator Operation

The electrical system will be equipped with an automatic transfer switch. If a power outage is detected, the back-up generator will start automatically and provide power to the SWS. When electrical service resumes, the generator will turn off automatically and the SWS will return to grid-supplied power. The District will need to operate the back-up generator regularly as part of normal operation and maintenance procedures.

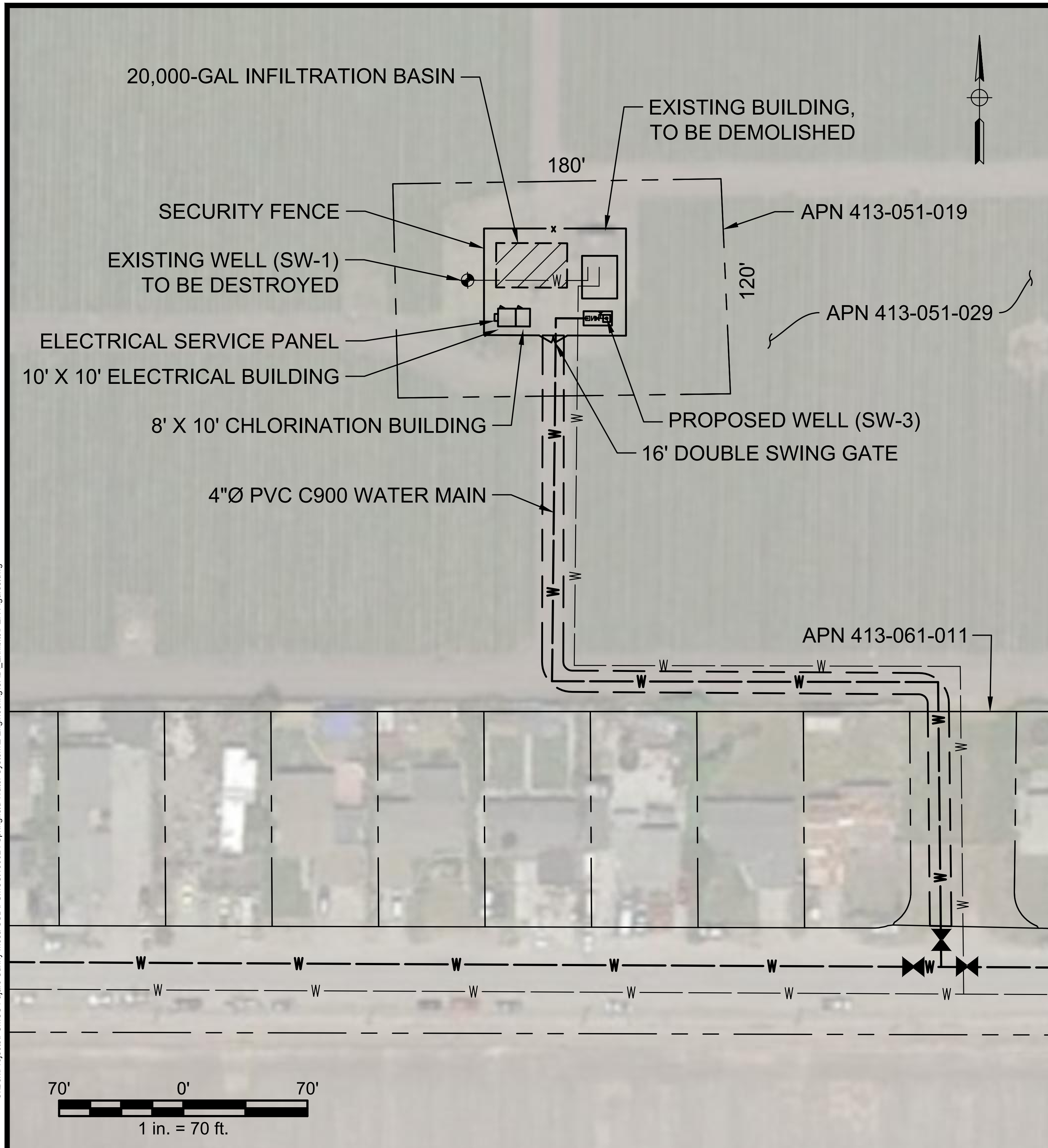
4.11.5. Alarms

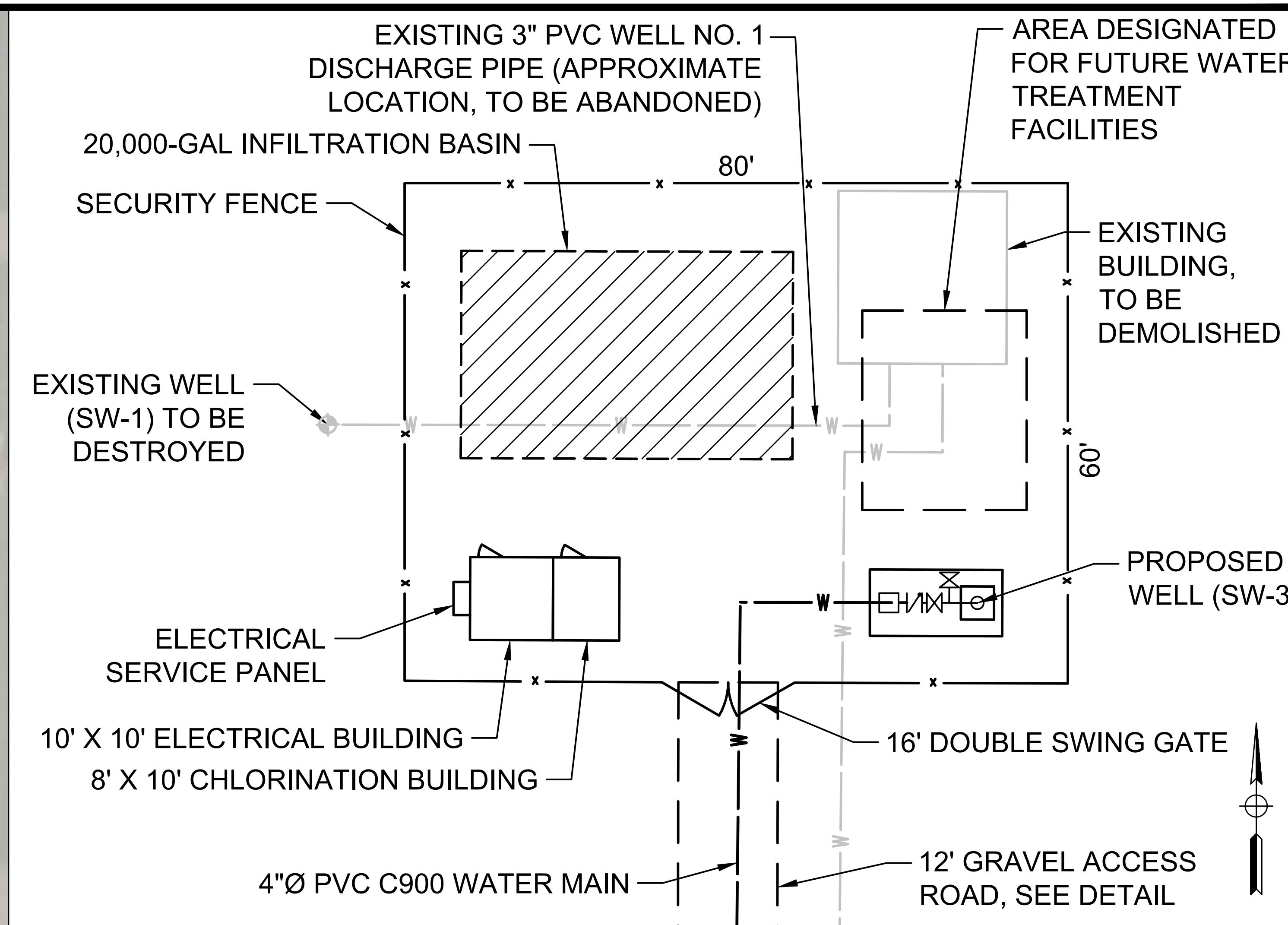
The SWS will incorporate various alarms to notify District staff of operation failures. An auto-dialer will contact operators when alarm conditions occur. A list of alarm conditions is provided as follows:

- Fire pump activated
- Tank high level
- Tank low level
- Duty pump No. 1 failure
- Duty pump No. 2 failure
- Fire pump No. 1 failure
- Fire pump No. 2 failure
- SW-2 pump failure
- SW-3 pump failure
- Hydropneumatic tank low pressure
- Hydropneumatic high pressure
- Sodium hypochlorite dosing pump failure (SW-2)
- Sodium hypochlorite dosing pump failure (SW-3)

4.11.6. Communication and Controls

Control of the SWS will primarily be from the Moss Landing Middle School site. Control systems will be located within the electrical building. A radio communications system will provide a signal between the two well sites. A radio survey will need to be conducted to verify a line-of-sight system will be functional.

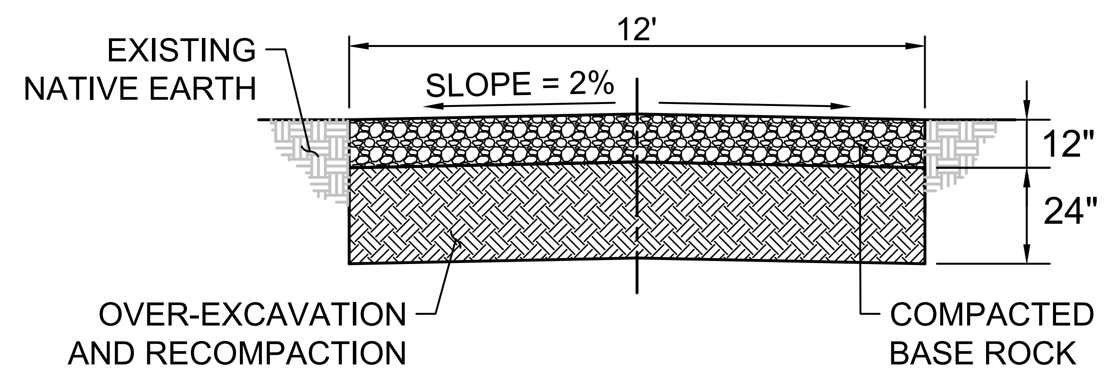




SITE PLAN

20' 10' 0' 10' 20'

1 in. = 20 ft.



ACCESS ROADWAY CROSS-SECTION DETAIL

4' 0' 4'

1 in. = 4 ft.

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EXISTING WELL SITE PLAN

SPRINGFIELD WATER SYSTEM IMPROVEMENTS PROJECT
PAJARO / SUNNY MESA COMMUNITY SERVICES DISTRICT

FIGURE 4-3

FEBRUARY 2020

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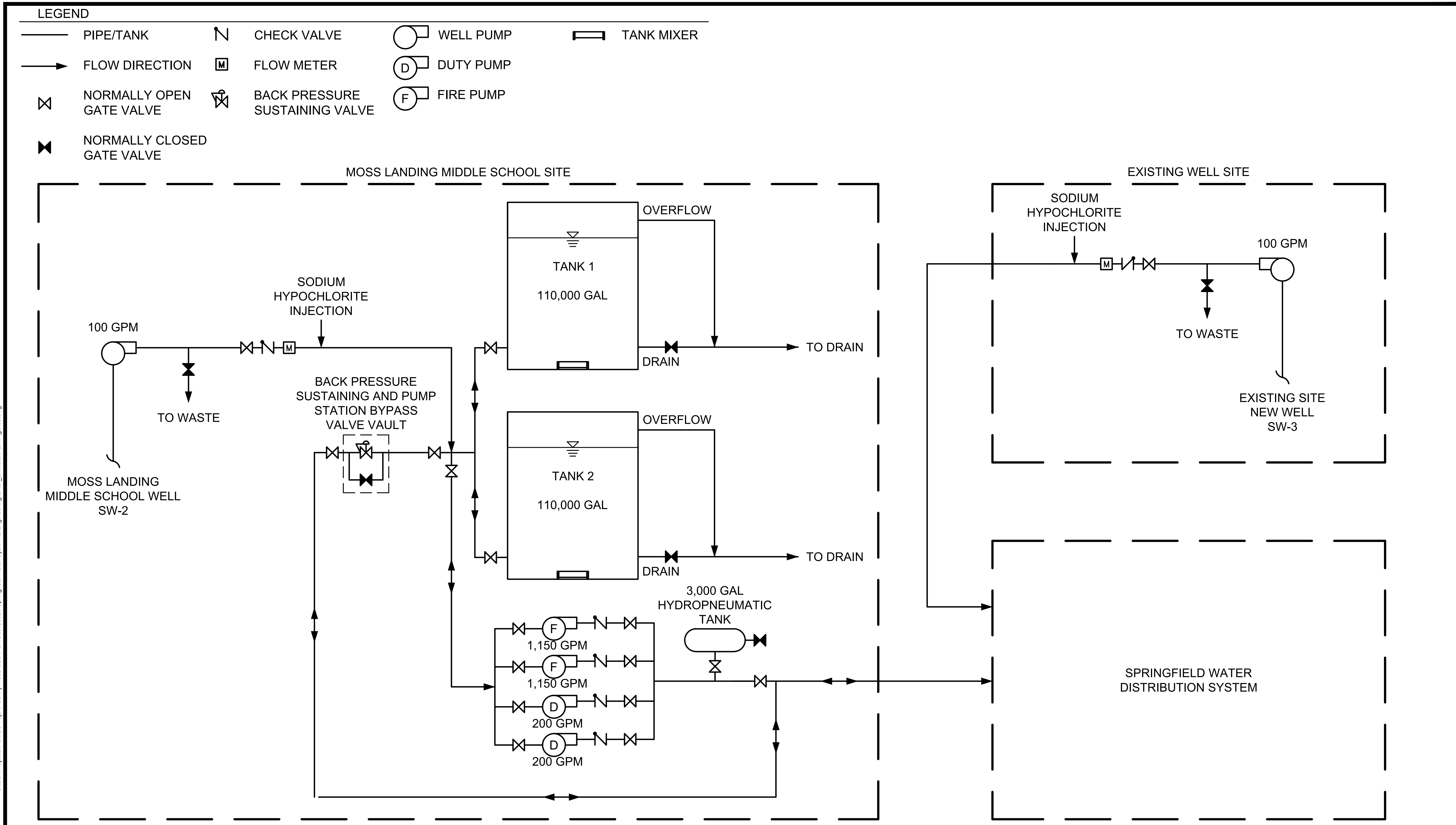

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SYSTEM FLOW SCHEMATIC

SPRINGFIELD WATER SYSTEM IMPROVEMENTS PROJECT

PAJARO / SUNNY MESA COMMUNITY SERVICES DISTRICT

FIGURE 4-4

FEBRUARY 2020

Section 5. Hydrogeologic Findings

5.1. Hydrogeologic Report Summary

A hydrogeologic report titled *Drilling, Water Quality, and Yield Results, Springfield Well No. 2, Pajaro / Sunny Mesa Community Services District, Monterey California*, dated May 2018, was prepared for the project by Balance Hydrologics, Inc. This study is included as Appendix D of this report. A summary of the report findings are as follows.

The existing Springfield well SW-1 is located a little over one mile from the coast and from the Elkhorn Slough at an elevation of 19 feet above MSL. It draws groundwater from a depth of 122 to 172 feet bgs from a zone demonstrated to be intruded with seawater across the area. The SW-1 site is surrounded by agricultural fields in sandy soils within a gently sloping shallow swale draining to McClusky Slough, subject to flooding from agricultural drainage. Both seawater and agricultural drainage are likely sources of contamination to the existing well. Seawater intrusion across the Springfield subarea is fundamentally related to a chronic storage depletion from groundwater pumping drawing water levels below minimum levels required to stop seawater intrusion.

Two alternatives for a new potable water supply well were explored as part of the study. The first and preferred alternative well site is located at the Moss Landing Middle School site located approximately 3,500 feet northeast from the existing well. The second alternative is to install a new deeper well at the existing well site. The two project sites are located within the southern portion of the Springfield subarea of the Pajaro Valley Groundwater Basin. The primary aquifers within the basin are found in the Aromas Sands and overlying alluvial deposits.

The Moss Landing Middle School site is further from the ocean but closer to Elkhorn Slough than the existing well and sits at an elevation of 142 feet above MSL, rather than 19 feet above MSL. A test well hole was drilled at the Moss Landing Middle School site on July 28, 2008 to a depth of 630 feet bgs, and water-quality testing results and geophysical logging showed favorable conditions for a new source well at the site. The Moss Landing Middle School site appears to be a favorable location for a new water supply well based on the results of lithologic and geophysical logging, and water-quality sampling indicates fresh water quality. The site is not prone to flooding, and water storage at the site would be at a higher elevation, potentially providing head to the distribution system.

Based on the finding of the hydrogeologic report, SW- 2 was completed at the Moss Landing Middle School site, as discussed in Section 5.2. Following completion of SW-2, the hydrogeologic report was updated to incorporate the results of well construction, completion, development and water quality testing.

Minimal water quality information is available specifically at depth for the SW-1 site. However, based on information assembled in the hydrogeologic report, evaluating groundwater conditions by drilling and conducting e-log testing in a pilot hole and completing and testing a deeper well at the SW-1 site would be a reasonable approach to determining if SW-3 would be a suitable secondary source of supply.

5.2. Test Well Results

The SW-2 was completed to a depth of 600 feet with an 8-inch diameter PVC casing, 100 feet of screen casing from 490 to 590 feet bgs, and a 470-foot cement seal from the surface. Subsequent yield testing and water quality sampling confirmed SW-2 is suitable for use as a new municipal water supply source well. Preliminary area-of-influence calculations suggest the well may continue to be suitable for many decades, and possibly longer, if pumped at the proposed average day demand. The lifespan of the well is dependent on many factors, including location and pumping rates of other existing and future wells in the area, locations and movement of high salinity and/or contaminant plumes, and pumping intensity of SW-2. Minimizing well discharge rates and increasing pumping times will help to extend the well lifespan.

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Section 6. Pipeline Installation

This section discusses considerations for installing new water transmission and distribution mains.

6.1. Existing Utilities

Agencies which have below-grade utilities within the Project area were contacted to obtain utility atlas maps. Utilities with existing facilities in the area include:

- Castroville Community Services District (wastewater collection pipelines)
- Pajaro Valley Water Management Agency (recycled water pipelines)
- AT&T (communications infrastructure)
- PG&E (gas and electric)

Record or atlas information documenting the locations of existing utilities in the area have been collected. During the detailed design phase of the Project, in any location where new water transmission pipelines cross existing utilities, separation requirements and hydraulics will be considered and appropriate measures included in the design.

6.2. Separation Requirements

The separation requirements between wastewater facilities and potable water pipelines are provided by the Waterworks Standards (California Code of Regulations, Title 22, Division 4, Chapter 16, §64572). In general, these guidelines require ten feet of horizontal separation between parallel potable water pipelines and non-potable pipelines, including recycled water pipelines. In addition, vertical separation requirements are also designated when the conveyance facilities cross.

6.3. Pipeline Alignments

The initial project concept included a transmission pipeline from the Moss Landing Middle School site to Struve Road, with the alignment primarily traveling longitudinally within Highway 1. As the project developed and the scope of the SWS expanded to serve additional customers, an alternative alignment was identified to serve these additional customers.

Additionally, the revised project pipeline alignments are preferred to the original concept as the encroachment within Caltrans ROW is limited to a single crossing rather than a longitudinal encroachment. This is preferred by Caltrans and reduces safety risks to District staff.

The revised pipeline alignments will require ROW acquisition, as discussed in Section 8.

6.4. Pipeline Installation Methodology

Open trench pipeline installation and various trenchless pipeline installation methods were considered for construction of the Project.

6.4.1. Open Trench Pipeline Installation

Open trench installation is the traditional and most common method of water main pipeline construction. Open trench excavation consists of excavating down to the pipeline depth, installing the pipe, then backfilling the trench. This method is typically less expensive than trenchless installation if the pipe is constructed in an unpaved area.

Recommendations for open trench backfill materials will be developed during detailed design in conjunction with the Project geotechnical evaluation and standards for the jurisdictions owning the ROW where pipeline segments are to be installed.

Costs associated with open trench installation are dependent on the location where the pipeline is installed. Excavation in some areas is likely to encounter groundwater. Groundwater present in trench excavations will need to be dewatered, which will increase construction costs. Estimated depths to groundwater will be determined as part of the Project geotechnical evaluation.

6.4.2. Highway 1 Crossing

A new 8-inch pipeline will be required to cross Highway 1 at the intersection with Springfield Road. This pipeline installation will need to conform to Caltrans standards which require the pipeline to be installed within a steel casing pipe, anticipated to be 14 inches in diameter with a minimum wall thickness of 1/4 inch. The casing pipe will be installed using the bore and jack method.

6.4.3. McClusky Slough Crossing

Installation of the water main crossing McClusky Slough is anticipated to be completed by horizontal directional drilling (HDD). Fusible PVC pipe is proposed for the crossing in order to maintain material consistency throughout the system.

Section 7. Electrical Requirements

This section provides a summary of the electrical requirements for the project.

7.1. Electric Service

The existing SW-1 site is currently served by an existing 480-volt service. A new transformer will be provided to serve low voltage demands, which will include a chlorine dosing pump, turbidimeter, chlorine analyzer, and communications equipment.

The Moss Landing Middle School site will require a new 480-volt service. A new transformer will be provided to step down the 480-volt to serve low voltage demands, which will also include a chlorine dosing pump, turbidimeter, chlorine analyzer, air compressor, and communications equipment.

7.2. Demand Summary

A summary of the anticipated electric demands is provided in Table 7-1. Only demands of 0.5 horsepower and greater are documented.

Table 7-1: Electrical Demand Summary

Load	Voltage	Horsepower
SW-2 Well Pump	480	7.5
SW-3 Well Pump	480	10
Duty Pump #1	480	7.5
Duty Pump #2	480	7.5
Fire Pump #1	480	30
Fire Pump #2	480	30
Tank #1 Mixing System	120	0.5
Tank #2 Mixing System	120	0.5
Hydropneumatic Tank Air Compressor	120	1

7.3. Back-up Generator Sizing

An emergency back-up generator will be provided at the Moss Landing Middle School site. The back-up generator will need to be able to supply power to the SW-2 well pump, one fire pump, both tank mixing systems, and other miscellaneous minor demands at the site. If a fire pump is operating, a duty pump will not be operating.

Based on these demands, a back-up generator has been preliminarily sized; a 50-kW generator is anticipated to provide sufficient capacity. This recommendation will be refined during detailed design.

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Section 8. Right-of-Way Requirements

This section discusses the ROW requirements for the Project. The Project includes acquisition of temporary construction access easements, as well as acquisition of permanent easements and/or real property acquisition in several areas. Parcel maps of the areas are included in Appendix E.

8.1. Moss Landing Middle School Site

The District has obtained a permanent easement at the northeast corner of the Moss Landing Middle School property, APN 413-014-001. The easement has dimensions of 105 feet by 130 feet, as shown on Figure 4-2. This easement is suitable and sufficient for development of the site.

8.2. Existing Well Site

The existing SW-1 site is owned by the District. The parcel, APN 413-051-019, has an area of approximately 0.5 acres, with dimensions of 180 feet by 120 feet and is shown on Figure 4-3. The District currently owns an access easement to access the property from Struve Road, but utilizes an alternative route across private property for accessing the site.

8.3. Distribution System

The majority of the distribution system will be constructed within the public ROW, owned by Monterey County. Pipelines installed outside the County ROW will require easements from private landowners.

To provide for distribution system pipeline construction and ongoing maintenance of the pipe segment between Springfield Road and Struve Road, a permanent easement or ROW acquisition and potentially a separate temporary construction access easement will be required on parcel APN 413-012-008 if the construction requires more area than included in the existing permanent ROW access easement. Assuming the new pipeline will be installed within existing 15-foot and 60-foot wide public ROWs on parcels APN 413-051-029, 413-051-021, and 413-051-020, temporary construction access easements may be required during construction on these properties to accommodate construction activities.

To provide for distribution system pipeline construction and ongoing maintenance of the pipe segment crossing McClusky Slough, permanent easements or ROW acquisitions and potentially a separate temporary construction access easement will be required. These acquisitions could occur on the east side, west side, or both sides of McClusky Slough, depending on the willingness of private landowners to cooperate with the District. Affected parcels include APNs 412-032-103, 412-032-014, and 413-012-001.

An easement from Caltrans will be required for the Highway 1 crossing at Springfield Road. Parcels where easement or land acquisition may be required are identified on Figure 4-1.

The distribution system infrastructure will be completed over multiple phases as discussed in Section 11.

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Section 9. Engineering Standards

9.1. Design Standards

The following design standards will be utilized, called-out, and specified throughout the Project plans, specifications, and other documentation:

- American Water Works Association (AWWA) Standards
- American Society for Testing and Materials (ASTM) Standards
- Caltrans Standard Specifications and Details
- Department of Drinking Water
- Monterey County Environmental Health Department
- Monterey County Standard Details

Construction and installation, materials, and methodologies shall comply with the design standards listed, as appropriate.

9.2. Geotechnical Engineering

A geotechnical engineering analysis will be required for the proposed Project. The geotechnical evaluation will include borings along the pipeline route and adjacent to McClusky Slough and the Highway 1 crossing at Springfield Road. Additional borings will be completed at both the Moss Landing Middle School site and the existing SW-1 site. The geotechnical analysis will provide input into the design for the proposed facilities.

9.3. District Reviews and Approvals

Plans, specifications, and estimate will be reviewed by the District at the 30%, 65%, and 100% Final Design stages. The District's comments from each submittal will be integrated prior to submittal of the next submittal package.

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Section 10. Regulatory Requirements

This section documents the anticipated project permitting requirements.

10.1. Permitting Requirements

Required permits from various agencies are documented in the following sections.

10.1.1. California Environmental Quality Act (CEQA)

This project will be required to comply with the CEQA. The District has retained a consultant to develop an environmental document in support of the project.

10.1.2. Caltrans Encroachment Permit

The water transmission main crosses Highway 1 at Springfield Road, which is Caltrans ROW. For this crossing, Caltrans requires an encroachment permit and easement be obtained prior to the start of construction. The design of the pipeline crossing will comply with Caltrans standards.

10.1.3. County of Monterey Encroachment Permit

For water mains constructed with the public ROW, an encroachment permit will be required from Monterey County. Traffic control and roadway reconstruction will comply with Monterey County standards.

10.1.4. Coastal Development Permit

The project is located within the Coastal Zone, regulated by the California Coastal Commission (CCC). A coastal development permit will be required to authorize construction of the proposed improvements.

Additionally, the banks of McClusky Slough may be considered coastal wetlands or Environmentally Sensitive Habitat Area (ESHA) by the CCC.

10.1.5. California Department of Fish and Wildlife

The crossing under McClusky Slough is anticipated to have potential impacts to riparian habitat, which is listed as sensitive habitat by the California Department of Fish and Wildlife (CDFW). A Lake and Streambed Alteration Agreement may be required.

10.1.6. U.S. Fish and Wildlife Service

The project has the potential to impact federally regulated endangered species. A Section 7 or 10 Incidental Take Permit may be required.

10.1.7. U.S. Army Corps of Engineers and RWQCB

McClusky Sough is anticipated to be considered jurisdictional waters of the U.S. and be regulated by the U.S Army Corps of Engineers (ACOE). As a result, Section 401 and 404 permits from the ACOE and Regional Water Quality Control Board (RWQCB) will be required.

10.1.8. Monterey Bay Air Resources District Permit to Construct and Permit to Operate

The proposed back-up generator at the Moss Landing Middle School site will require permitting as a new source of air pollution by the Monterey Bay Air Resources District. This requires two permits, a Permit to Construct and a Permit to Operate.

10.1.9. State Water Resources Control Board Permit Amendment

The State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) requires a permit amendment application be filed for the proposed water system improvements. This amendment application includes submittals prior to the start of construction and extensive technical reports. After the system is constructed, information on the completed system will need to be submitted. DDW staff will also likely require an in-person inspection of the new facilities prior to finalization of the permit amendment and placing the system into service.

10.2. Stormwater General Permit

As a linear underground project (LUP), with surface disturbance of less than one acre, this project is likely exempt from obtaining a stormwater compliance permit.

This Project is outside of the Monterey County Phase II Municipal Separate Storm Sewer System (MS4) permit area. This permit area delineates the urban boundary. As a result, this Project is not subject to compliance with Post-Construction Stormwater Requirements.

Section 11. Project Funding and Implementation Phasing

This section discusses anticipated funding for the Project and phased Project implementation.

11.1. Project Planning and Design Funding

Preparation of this Report, planning, design, and construction of the SW-2 well, and preparation of preliminary (30% complete) contract documents, including geotechnical investigations and topographic and boundary surveys, is being funded by a planning grant from the SWRCB DDW. Initially, this source of funding was intended to cover all costs associated with design and permitting of the Project. The expansion of the Project to include additional customers and realigning pipelines, permitting, and design cannot be completed with the available funds. Completion of these tasks to advance the Project to a bid-ready state will be partially funded with construction funds.

11.2. Construction Funding

The District does not have the capability to fund construction of the proposed improvements through internal sources. External funding will be required for construction and other activities associated with Project construction. A series of conference calls with various Project stakeholders, including the District, the design engineer, the County, the State of California finance department, the Division of Drinking Water, and the District's grant administrator, took place over the period of 2019 in which the scope of work was developed.

Due to the magnitude of the Project costs, the proposed improvements have been divided into primary and secondary elements, based on prioritization. It is the intent of the District to construct the Project's highest priority improvements during an initial project phase, with the remaining infrastructure to be designed and constructed during a future phase. These phases are discussed in Section 11.3.

Construction funding for the Project is anticipated to be obtained through a grant from the State of California. Funding for development of detailed design, permitting, construction, etc. for Future Phases of the Project will be obtained on a separate path. State of California staff indicated construction funding for the Project would likely be available upon completion of the 30 percent design package.

11.3. Implementation Phasing

The proposed SWS infrastructure has been divided into primary and secondary elements. Primary infrastructure elements will be completed during Project implementation. Primary infrastructure elements include:

- Site development and water improvement infrastructure at the Moss Landing Middle School site, including the electrical/chlorination building, fencing, storage tanks, booster pump station, disinfection, electrical and improvements, etc. Items not included at this site include communications equipment and facilities to fill the storage tanks at the site from SW-3;
- Pipeline from the Moss Landing Middle School site across Highway 1, approximately 0.15 miles;
- Pipeline to the west of Highway 1 along Springfield Road including service laterals, hydrants, etc., along the pipeline alignment, approximately 0.5 miles;
- Pipeline south from Springfield Road (at the corner of the agricultural field), approximately 0.25 miles;
- Pipeline to the southeast to the MH Park, including services, hydrants, etc., along the pipeline alignment, approximately 0.3 miles;
- MH Park distribution system, including service laterals, hydrants, etc., along the distribution system piping, approximately 0.6 miles;
- Pipeline from the MH Park to Struve Road, approximately 0.2 miles;

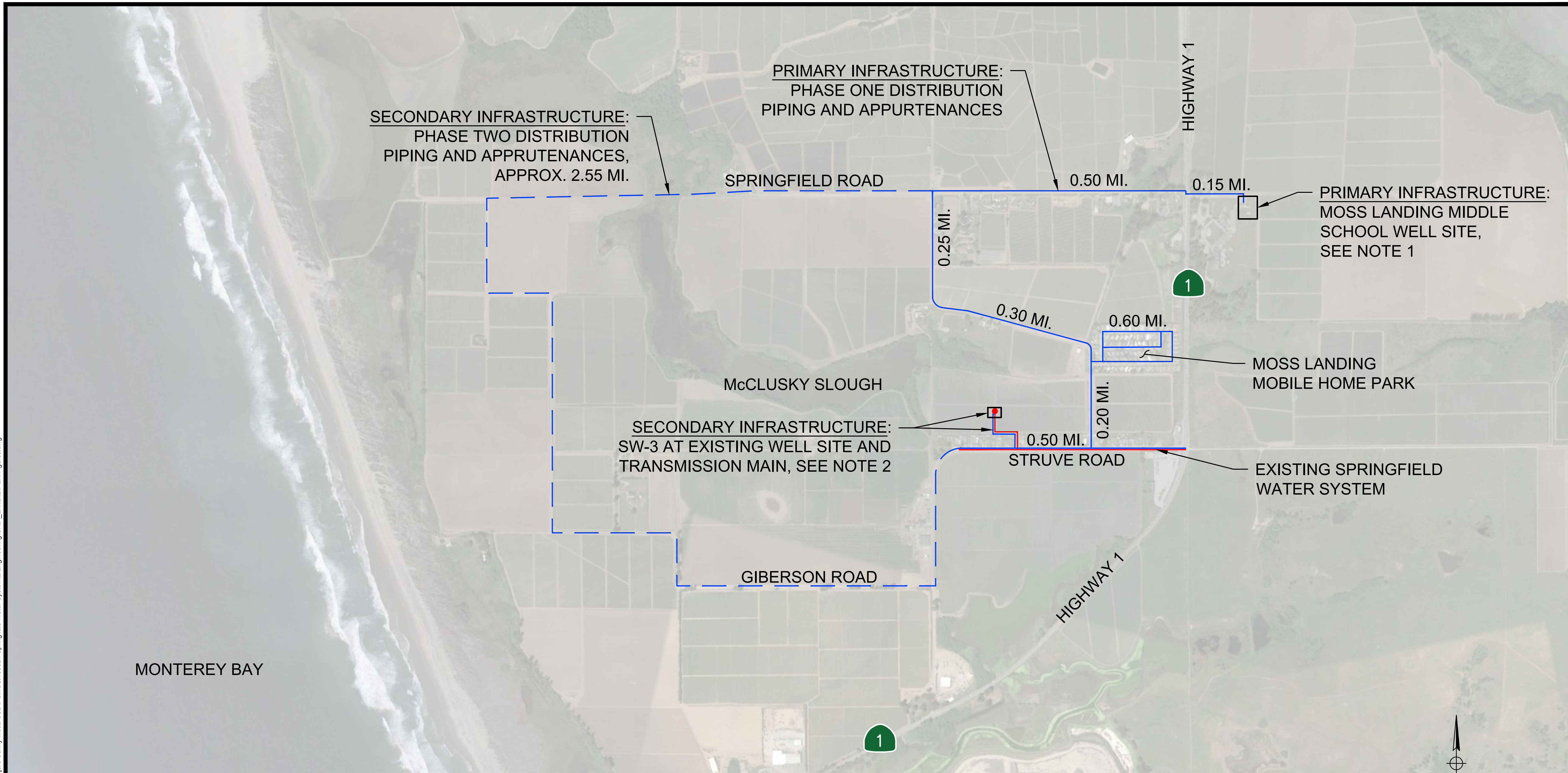
- Replacement of the SWS distribution piping on Struve Road to accommodate fire flow and increased system pressure, including service laterals, hydrants, etc., along the pipeline alignment, approximately 0.5 miles.

Secondary infrastructure elements will be completed during Future Phases of implementation. Secondary infrastructure elements include:

- Construction of a new well (SW-3) at the existing SWS well site;
- Site development and water improvement infrastructure at the existing SWS well site, including electrical/chlorination building, fencing, disinfection, electrical and communication improvements, etc.;
- Improvements at the Moss Landing Middle School site, including communications equipment and facilities to fill the storage tanks at the site from SW-3;
- A new transmission pipeline from SW-3 well to the SWS distribution system on Struve Road;
- Additional distribution system piping on Springfield Road, Giberson Road, and Struve Road, including service laterals, hydrants, etc., along the pipeline alignment, approximately 2.55 miles.

During implementation of the Project, the system will be tied-in to the existing SW-1 discharge on Struve Road. A segment of above ground wellhead piping at SW-1 will be removed and capped. This will allow the District to utilize SW-1 as a back-up source of supply to provide non-potable water in an emergency condition. During implementation of Future Phases of project implementation, SW-1 will be destroyed, and the SW-1 connection point on Struve Road will be used to connect SW-3 to the SWS distribution system.

The division of the primary and secondary infrastructure elements is provided as Figure 11-1.



NOTES:

1. COMMUNICATIONS IMPROVEMENTS AT THE MOSS LANDING MIDDLE SCHOOL SITE ARE SECONDARY INFRASTRUCTURE ELEMENTS TO BE INCLUDED IN FUTURE PHASES.
2. WELL SW-3 AND ASSOCIATED IMPROVEMNETS AT THE EXISTING WELL SITE ARE SECONDARY INFRASTRUCTURE ELEMENTS TO BE INCLUDED IN FUTURE PHASES.

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PRIMARY AND SECONDARY INFRASTRUCTURE

SPRINGFIELD WATER SYSTEM IMPROVEMENTS PROJECT

PAJARO / SUNNY MESA COMMUNITY SERVICES DISTRICT

FIGURE 11-1

FEBRUARY 2020

Section 12. Construction Cost Opinions

This section discusses the costs associated with construction of the proposed improvements.

12.1. Construction Cost Opinion

Preliminary construction cost opinions have been developed for the Project and Future Phases of the proposed improvements. The detailed cost opinions are included in Appendix F. A summary of the anticipated construction costs is provided in Tables 12-1 and 12-2.

Table 12-1: Project Construction Cost Opinion Summary

Project Element	Estimated Construction Cost
Moss Landing Middle School Site	$2,350,000
Distribution System	$4,630,000
Total	**$6,980,000**

Table 12-2: Future Phases Construction Cost Estimate Summary

Project Element	Estimated Construction Cost
Existing Well Site and Well Construction	$750,000
Distribution System	$3,320,000
Moss Landing Middle School Site	$100,000
Total	**$4,170,000**

These cost opinions should be considered accurate in accordance with the American Association of Cost Engineers (AACE) to a Class 4 cost estimate with an accuracy of -30% to +50%.

12.2. Total Project Costs

An estimate of total project costs has been developed. In addition to construction costs, various additional expenses anticipated to be incurred as part of the project have been estimated based on an assumed percentage of construction costs. The estimated total project costs are summarized in Table 12-3. District administration includes legal review, project management, permitting fees, and public outreach.

Table 12-3: Estimated Total Project Costs

Project Element	Estimated Percentage of Construction Costs	Estimated Construction Cost	
		Project	Future Phases
Construction Costs	-	$6,980,000	$4,170,000
Construction Survey	1%	$69,800	$41,700
Utility Relocation	2%	$139,600	$83,400
Engineering Design	10%	$698,000	$417,000
Design Survey	1%	$69,800	$41,700
Geotechnical Engineering and Hydrogeology	2%	$139,600	$83,400
Construction Management and Inspection	12%	$837,600	$500,400
Environmental and Project Permitting	3%	$209,400	$125,100
Right-of-Way Engineering	1%	$69,800	$41,700
Right-of-Way Acquisition	3%	$209,400	$125,100
District Administration	5%	$349,000	$208,500
Total		**$9,772,000**	**$5,838,000**

Both Project and Future Phases total project costs have been developed based on a Project timeline with the midpoint of construction occurring 36 months from completion of this Report. It is likely Future Phases of the Project will not be constructed on this timeline. Future Phase project costs should be revised as appropriate when a clear path to construction is developed.

Section 13. Project Recommendations and Next Steps

This section presents the recommended project description and discusses anticipated steps and associated schedules for advancing the Project forward to construction.

13.1. Recommended Project

Due to funding limitations as described in Section 11, the Project has been divided into multiple phases. This section describes the first phase defined in this report as the Project.

Water for the Springfield Water System will be provided from a single source as part of the Project. This source is SW-2, a well drilled in 2018 at the Moss Landing Middle School site. SW-2 is located within an easement owned by the District on the northeast corner of the Moss Landing Middle School property. SW-2 has been tested for production capacity and water quality and is anticipated to be a suitable source of supply for a public water system.

The Moss Landing Middle School site will be developed as a new municipal site. The SW-2 well site improvements will include a new submersible well pump, piping, valves, and appurtenances; electrical and communication improvements; chlorination facilities; two new 110,000-gallon bolted steel water storage tanks; a permanent back-up generator; a new booster pump station including a hydropneumatic tank and four pumps to provide fully redundant domestic and fire service; and civil site improvements including fencing and security improvements, hardscape, a new building to house the new well and associated equipment, and miscellaneous other site improvements.

A physical separation between the existing SW-1 well and the improved water system will be created to prevent future supply of contaminated water to the system. SW-1 well will be mothballed, and only used in emergency situations.

The existing distribution system will be replaced, and new Phase One distribution system piping will be constructed to serve the additional customers and to connect to the Moss Landing Middle School well site. Approximately 12,500 linear feet of new 6- and 8-inch water mains will be constructed in Springfield Road, Struve Road, and across private property and unnamed roads through easements. New distribution system piping will include valves, fire hydrants, air release valves, blow-offs, sampling stations, and other appurtenances as appropriate. Water service laterals will be replaced from the existing distribution mains to each residence currently receiving water from the system, and individual water meters will be provided for each new service connection. Customers not served by the existing SWS or MH Park water systems will be provided with new service laterals and meters up to the property line. New distribution system piping will be installed primarily by the open trench method or horizontal directional drilling, at the contractor’s option; distribution piping crossing Highway 1 will be installed in a steel casing installed by the jack and bore method.

The Project includes acquisition of temporary construction access easements, as well as acquisition of permanent easements and/or real property acquisition in several areas.

To provide for distribution system pipeline construction and ongoing maintenance for the pipe segment between Springfield Road and Struve Road, a permanent easement or ROW acquisition will be required, and a separate temporary construction access easement will potentially be required on parcel APN 413-012-008 if the construction requires more area than included in the permanent access easement. Assuming the new pipeline will be installed within existing 15-foot and 60-foot wide existing public rights-of-way on parcels APN 413-051-029, 413-051-021, and 413-051-020, temporary construction access easements may be required during construction on these properties to accommodate construction activities.

13.2. Recommended Future Project Phases

Future Phases of the work are described in this section.

Future Phases will include development of an additional source of potable water supply, anticipated to be a new well, SW-3, to be constructed at the existing SW-1 well site. The capacity and water quality produced by a well at this site is expected to be similar to the completed SW-2 well at the Moss Landing Middle School site, but will need to be verified.

The existing SW-1 site will be enhanced to function as a municipal site. Improvements at the site will include a new potable water supply well, SW-3; a new submersible well pump, piping, valves, and appurtenances; electrical and communication improvements; chlorination facilities; and civil site improvements including fencing and security improvements, hardscape, a new building to house the new well and associated equipment, and miscellaneous other site improvements. The proposed SW-3 will discharge directly into the water distribution system installed in the Project. Roadway improvements within the existing access easement will also be provided. The existing SW-1 will be removed from service and destroyed as required by the County Health Department.

New distribution system piping will be constructed to serve the additional customers. Approximately 13,000 linear feet of new 4- and 6-inch water mains will be constructed in Springfield Road, Giberson Road, Struve Road, and across private property and unnamed roads. New distribution system piping will include valves, fire hydrants, air release valves, blow-offs, sampling stations, and other appurtenances as appropriate. Additional customers served by the expanded system will be provided with new service laterals and meters up to the property line. New distribution system piping will be installed primarily by the open trench method or horizontal directional drilling, at the contractor's option; approximately 400 feet of distribution piping crossing under McClusky Slough at the eastern end of Springfield Road will be installed by horizontal directional drilling.

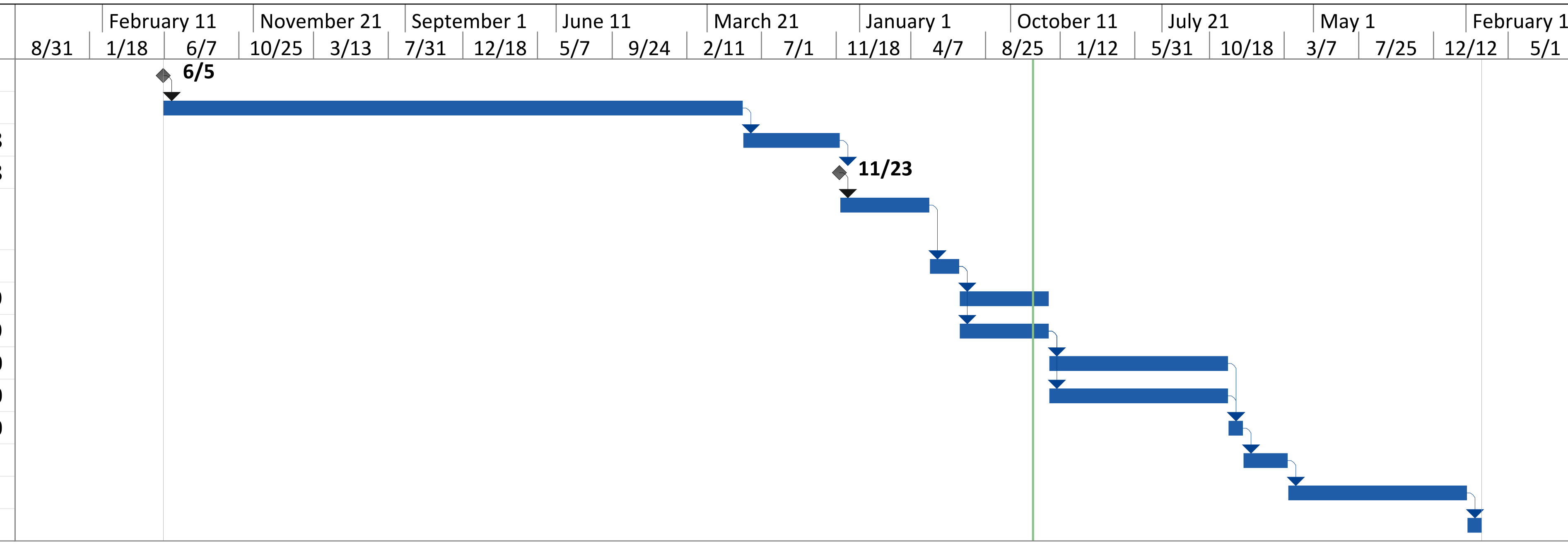
The project includes acquisition of temporary construction access easements, as well as acquisition of permanent easements and/or real property acquisition in several areas. To provide for distribution system pipeline construction and ongoing maintenance for the pipe segment crossing McClusky Slough, a permanent easement or ROW acquisition and potentially a separate temporary construction access easement will be required. These acquisitions could occur on the east side, west side, or both sides of McClusky Slough, depending on the willingness of private landowners to cooperate with the Project.

13.3. Project Schedule

An anticipated Project schedule has been prepared and is included as Figure 13-1. Based on the prepared schedule, the Project is anticipated to be complete by early 2023. Future Phases of the Project will be dependent on obtaining funding for preparation of detailed designs, permitting, construction, etc., and as a result has not been incorporated into the anticipate schedule.

Pajaro/Sunny Mesa Community Services District
Springfeild Water System Improvement Project
Implementation Schedule

ID	Task Name	Duration	Start	Finish
1	Project Initiation	0 days	Fri 6/5/15	Fri 6/5/15
2	SW-2 Planning, Construction, and Reporting	776 days	Fri 6/5/15	Fri 5/25/18
3	Springfield Water System Preliminary Design Repo	130 days	Mon 5/28/18	Fri 11/23/18
4	Submit Preliminary Design Report to State	0 days	Fri 11/23/18	Fri 11/23/18
5	State Review of Preliminary Design Report and Funding Authorization	6 mons	Mon 11/26/18	Fri 5/10/19
6	Topographic Survey, Geotechnical Engineering	2 mons	Mon 5/13/19	Fri 7/5/19
7	Right-of-Way Acquisition	6 mons	Mon 7/8/19	Fri 12/20/19
8	Draft Detailed Design (90%)	6 mons	Mon 7/8/19	Fri 12/20/19
9	Environmental Permitting	12 mons	Mon 12/23/1	Fri 11/20/20
10	Project Permitting	12 mons	Mon 12/23/1	Fri 11/20/20
11	Final Detailed Design	1 mon	Mon 11/23/2	Fri 12/18/20
12	Project Bidding, Bid Review and Contract Award	3 mons	Mon 12/21/2	Fri 3/12/21
13	Project Construction	12 mons	Mon 3/15/21	Fri 2/11/22
14	Project Testing, Start-up and Comissioning	1 mon	Mon 2/14/22	Fri 3/11/22



Project: Springfield Water System
Date: Fri 11/22/19

Task | Milestone | Manual Task | Deadline | Manual Progress

Appendices

Appendix A – Moss Landing Water System Connection Alternative Cost Estimates

OPINION OF PROBABLE CONSTRUCTION COST

MNS ENGINEERS INC.

Project: Springfield Water Supply Improvements, Pajaro Sunny Mesa Community Services District

Prepared By: NEP
Date Prepared: 10/3/2016
MNS Proj. No. PSMCS.150024

Building, Area: Alternative B - Option 1 - Storage Tank at Existing Well Site

Estimate Type:
- [x] Conceptual
- [ ] Preliminary (w/o plans)
- [ ] Design Development @
- [ ] Construction
- [ ] Change Order

_______ % complete

Current at ENR: 10435
Escalated to ENR: 11326
Months to Midpoint of Construction: 36

Item No.	Description	Qty.	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-Contractor $/Unit	Sub-Contractor Total	Total
1	8" PVC Transmision Main - Moss Landing Connection to Struve Road	4450	LF	$100.00	$445,000.00	$170.00	$756,500.00		$0.00	$1,201,500.00
2	8" PVC Transmission Main - Struve Road and Connection to Site	5350	LF	$90.00	$481,500.00	$80.00	$428,000.00		$0.00	$909,500.00
3	Access Road	550	LF	$100.00	$55,000.00	$100.00	$55,000.00		$0.00	$110,000.00
4	Existing Well Destruction	2	EA		$0.00		$0.00	$20,000.00	$40,000.00	$40,000.00
5	Existing Building and Chlorination Facility Demolition	1	LS	$5,000.00	$5,000.00	$10,000.00	$10,000.00		$0.00	$15,000.00
6	220,000-Gallon Bolted Steel Water Storage Tank	1	LS		$0.00		$0.00	$250,000.00	$250,000.00	$250,000.00
7	Tank Foundation	1	LS		$0.00		$0.00	$40,000.00	$40,000.00	$40,000.00
8	Back Pressure Sustaining Valve	1	LS	$10,000.00	$10,000.00	$1,500.00	$1,500.00		$0.00	$11,500.00
9	8" Flow Meter	1	LS	$2,500.00	$2,500.00	$500.00	$500.00		$0.00	$3,000.00
10	8" Gate Valve	7	EA	$3,000.00	$21,000.00	$650.00	$4,550.00		$0.00	$25,550.00
11	8" Flex Tend Expansion Joint	2	LS	$6,500.00	$13,000.00	$1,500.00	$3,000.00		$0.00	$16,000.00
12	Booster Pump Station, Building, and Controls	1	LS	$350,000.00	$350,000.00	$50,000.00	$50,000.00		$0.00	$400,000.00
13	3,000-Gallon Hydropneumatic Tank and Surge System	1	LS	$100,000.00	$100,000.00	$40,000.00	$40,000.00		$0.00	$140,000.00
14	Site Fencing	600	LF	$15.00	$9,000.00	$10.00	$6,000.00		$0.00	$15,000.00
15	20' Wide Double Swing Manual Gate	1	EA	$1,000.00	$1,000.00	$1,500.00	$1,500.00		$0.00	$2,500.00
16	Miscellaneous Site Improvements	1	LS	$20,000.00	$20,000.00	$20,000.00	$20,000.00		$0.00	$40,000.00
17	Site Piping	1	LS	$20,000.00	$20,000.00	$20,000.00	$20,000.00		$0.00	$40,000.00
18	Site Electrical Improvments and Lighting	1	LS		$0.00		$0.00	$50,000.00	$50,000.00	$50,000.00
19	Upgraded Electric Service	1	LS		$0.00		$0.00	$50,000.00	$50,000.00	$50,000.00
20	75 KW Back-up Generator	1	LS	$75,000.00	$75,000.00	$25,000.00	$25,000.00		$0.00	$100,000.00
	Subtotals				$1,608,000		$1,421,550		$430,000	$3,459,550
	Division 1 Costs	@	2.00%		$32,160		$28,431		$8,600	$69,191
	Subtotals				$1,640,160		$1,449,981		$438,600	$3,528,741
	Taxes - Materials Costs	@	7.75%		$127,112					$127,112
	Subtotals				$1,767,272		$1,449,981		$438,600	$3,655,853
	Contractor Markup for Sub	@	12.00%						$52,632	$52,632
	Subtotals				$1,767,272		$1,449,981		$491,232	$3,708,485
	Contractor OH&P	@	10.00%		$176,727		$144,998		$49,123	$370,849
	Subtotals				$1,944,000		$1,594,979		$540,355	$4,079,334
	Estimate Contingency	@	30.00%							$1,223,800
	Subtotals									$5,303,134
	Escalate to Midpoint of Construct	@	12.5%							$662,171
	Estimated Bid Cost									$5,965,305
	Total Estimate									$5,965,310
	Total Estimate	at ENR	10435							**$6,000,000**
	Total Estimate	at ENR	11326							**$6,500,000**

This cost estimate is for comparison of Moss Landing Water System connection options and does not include costs associated with the Distribution System and Existing Well Site

OPINION OF PROBABLE CONSTRUCTION COST

MNS ENGINEERS INC

Project: Springfield Water Supply Improvements, Pajaro Sunny Mesa Community Services District

Building, Area: Alternative B - Option 2 - Tank at Middle School Site with Offsite Booster Pump Station

Prepared By: NEP
Date Prepared: 10/3/2016
MNS Proj. No. PSMCS.150024

Estimate Type:

- ☑ Conceptual
- ☐ Preliminary (w/o plans)
- ☐ Design Development @
- ☐ Construction
- ☐ Change Order
- ______ % complete

Current at ENR: 10435
Escalated to ENR: 11326
Months to Midpoint of Construction: 36

				Materials		Installation		Sub-Contractor		
Item No.	Description	Qty.	Units	$/Unit	Total	$/Unit	Total	$/Unit	Total	Total
1	8" PVC Transmision Main - Moss Landing Connection to Struve Road & Struve to Springfield	7100	LF	$100.00	$710,000.00	$170.00	$1,207,000.00		$0.00	$1,917,000.00
2	8" PVC Transmission Main - Struve Road and Springfield Road	6100	LF	$90.00	$549,000.00	$80.00	$488,000.00		$0.00	$1,037,000.00
3	Existing Well Destruction	2	EA		$0.00		$0.00	$20,000.00	$40,000.00	$40,000.00
4	Existing Building and Chlorination Facility Demolition	1	LS	$1,000.00	$1,000.00	$5,000.00	$5,000.00		$0.00	$6,000.00
5	220,000-Gallon Bolted Steel Water Storage Tank	1	LS		$0.00		$0.00	$250,000.00	$250,000.00	$250,000.00
6	Tank Foundation	1	LS		$0.00		$0.00	$40,000.00	$40,000.00	$40,000.00
7	8" Flow Meter	1	LS	$2,500.00	$2,500.00	$500.00	$500.00		$0.00	$3,000.00
8	8" Gate Valve	6	EA	$3,000.00	$18,000.00	$650.00	$3,900.00		$0.00	$21,900.00
9	8" Flex Tend Expansion Joint	2	LS	$6,500.00	$13,000.00	$1,500.00	$3,000.00		$0.00	$16,000.00
10	Booster Pump Station, Building, and Controls	1	LS	$150,000.00	$150,000.00	$40,000.00	$40,000.00		$0.00	$190,000.00
11	Site Fencing	450	LF	$15.00	$6,750.00	$10.00	$4,500.00		$0.00	$11,250.00
12	20' Wide Double Swing Manual Gate	1	EA	$1,000.00	$1,000.00	$1,500.00	$1,500.00		$0.00	$2,500.00
13	Miscellaneous Site Improvements at Moss Landing Middle School Site	1	LS	$20,000.00	$20,000.00	$20,000.00	$20,000.00		$0.00	$40,000.00
14	Site Piping at Moss Landing Middle School Site	1	LS	$20,000.00	$20,000.00	$20,000.00	$20,000.00		$0.00	$40,000.00
15	Site Electrical Improvments and Lighting at Moss Landing Middle School Site	1	LS		$0.00		$0.00	$50,000.00	$50,000.00	$50,000.00
16	Electric Service at Moss Landing Middle School Site	1	LS		$0.00		$0.00	$10,000.00	$10,000.00	$10,000.00
17	Site Piping at Booster Pump Station Site	1	LS	$7,500.00	$7,500.00	$7,500.00	$7,500.00		$0.00	$15,000.00
18	Miscellaneous Site Improvements at Booster Pump Station Site	1	LS	$5,000.00	$5,000.00	$10,000.00	$10,000.00		$0.00	$15,000.00
19	Electric Service at Booster Pump Station Site	1	LS		$0.00		$0.00	$10,000.00	$10,000.00	$10,000.00
20	15 KW Back-up Generator at Booster Pump Station Site	1	LS	$20,000.00	$20,000.00	$10,000.00	$10,000.00		$0.00	$30,000.00
	Subtotals				$1,523,750		$1,820,900		$400,000	$3,744,650
	Division 1 Costs	@	2.00%		$30,475		$36,418		$8,000	$74,893
	Subtotals				$1,554,225		$1,857,318		$408,000	$3,819,543
	Taxes - Materials Costs	@	7.75%		$120,452					$120,452
	Subtotals				$1,674,677		$1,857,318		$408,000	$3,939,995
	Contractor Markup for Sub	@	12.00%						$48,960	$48,960
	Subtotals				$1,674,677		$1,857,318		$456,960	$3,988,955
	Contractor OH&P	@	10.00%		$167,468		$185,732		$45,696	$398,896
	Subtotals				$1,842,145		$2,043,050		$502,656	$4,387,851
	Estimate Contingency	@	30.00%							$1,316,355
	Subtotals									$5,704,206
	Escalate to Midpoint of Construct	@	12.5%							$712,250
	Estimated Bid Cost									$6,416,456
	Total Estimate									$6,416,460
	Total Estimate	at ENR	10435							**$6,400,000**
	Total Estimate	at ENR	11326							**$6,900,000**

This cost estimate is for comparison of Moss Landing Water System connection options and does not include costs associated with the Distribution System and Existing Well Site

OPINION OF PROBABLE CONSTRUCTION COST

Project: Springfield Water Supply Improvements, Pajaro Sunny Mesa Community Services District

Prepared By: NEP
Date Prepared: 10/3/2016
MNS Proj. No. PSMCS.150024

Building, Area: Alternative B - Option 3 - Tank at Middle School Site and Increase Pressure of Moss Landing System

Estimate Type:
- ☑ Conceptual
- ☐ Preliminary (w/o plans)
- ☐ Design Development @
- ☐ Construction
- ☐ Change Order
- ______ % complete

Current at ENR 10435
Escalated to ENR 11326
Months to Midpoint of Construction 36

Item No.	Description	Qty.	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-Contractor $/Unit	Sub-Contractor Total	Total
1	8" PVC Transmision Main - Moss Landing Connection to Struve Road & Struve to Springfield	7100	LF	$100.00	$710,000.00	$170.00	$1,207,000.00		$0.00	$1,917,000.00
2	8" PVC Transmission Main - Struve Road and Springfield Road	6100	LF	$90.00	$549,000.00	$80.00	$488,000.00		$0.00	$1,037,000.00
3	Existing Well Destruction	2	EA		$0.00		$0.00	$20,000.00	$40,000.00	$40,000.00
4	Existing Building and Chlorination Facility Demolition	1	LS	$1,000.00	$1,000.00	$5,000.00	$5,000.00		$0.00	$6,000.00
5	220,000-Gallon Bolted Steel Water Storage Tank	1	LS		$0.00		$0.00	$250,000.00	$250,000.00	$250,000.00
6	Tank Foundation	1	LS		$0.00		$0.00	$40,000.00	$40,000.00	$40,000.00
7	8" Flow Meter	1	LS	$2,500.00	$2,500.00	$500.00	$500.00		$0.00	$3,000.00
8	8" Gate Valve	6	EA	$3,000.00	$18,000.00	$650.00	$3,900.00		$0.00	$21,900.00
9	Back Pressure Sustaining Valve	1	LS	$10,000.00	$10,000.00	$1,500.00	$1,500.00		$0.00	$11,500.00
10	8" Flex Tend Expansion Joint	2	LS	$6,500.00	$13,000.00	$1,500.00	$3,000.00		$0.00	$16,000.00
11	Site Fencing	450	LF	$15.00	$6,750.00	$10.00	$4,500.00		$0.00	$11,250.00
12	20' Wide Double Swing Manual Gate	1	EA	$1,000.00	$1,000.00	$1,500.00	$1,500.00		$0.00	$2,500.00
13	Miscellaneous Site Improvements	1	LS	$20,000.00	$20,000.00	$20,000.00	$20,000.00		$0.00	$40,000.00
14	Site Piping	1	LS	$20,000.00	$20,000.00	$20,000.00	$20,000.00		$0.00	$40,000.00
15	Site Electrical Improvments and Lighting	1	LS		$0.00		$0.00	$50,000.00	$50,000.00	$50,000.00
16	Electric Service	1	LS		$0.00		$0.00	$10,000.00	$10,000.00	$10,000.00
17	PLC Reprogramming at Moss Landing Booster Pump Station	1	LS		$0.00		$0.00	$10,000.00	$10,000.00	$10,000.00
	Subtotals				$1,351,250		$1,754,900		$400,000	$3,506,150
	Division 1 Costs	@	2.00%		$27,025		$35,098		$8,000	$70,123
	Subtotals				$1,378,275		$1,789,998		$408,000	$3,576,273
	Taxes - Materials Costs	@	7.75%		$106,816					$106,816
	Subtotals				$1,485,091		$1,789,998		$408,000	$3,683,089
	Contractor Markup for Sub	@	12.00%						$48,960	$48,960
	Subtotals				$1,485,091		$1,789,998		$456,960	$3,732,049
	Contractor OH&P	@	10.00%		$148,509		$179,000		$45,696	$373,205
	Subtotals				$1,633,600		$1,968,998		$502,656	$4,105,254
	Estimate Contingency	@	10.00%							$410,525
	Subtotals									$4,515,780
	Escalate to Midpoint of Construct	@	12.5%							$563,858
	Estimated Bid Cost									$5,079,638
	Total Estimate									$5,079,640
	Total Estimate	at ENR	10435							**$5,100,000**
	Total Estimate	at ENR	11326							**$5,500,000**

This cost estimate is for comparison of Moss Landing Water System connection options and does not include costs associated with the Distribution System and Existing Well Site

Appendix B – Trenchless Pipeline Installation Technical Memorandum

TECHNICAL MEMORANDUM

To: Nicholas Panofsky (MNS)

CC: Paul Greenway (MNS)

From: Paul Headland (Aldea)

Date: 11/17/2015

Re: Draft -Springfield Water System Improvements-Preliminary HDD Feasibility Evaluation (Phase I)

SUMMARY STATEMENT

Based on the preliminary HDD feasibility evaluation for Alternative A, Alternative B1, and Alternative B2 HDD is considered a viable construction alternative for installation of the water transmission pipeline.

It should be noted that the proposed HDD bore alignments (assuming HDPE pipe) are considered to be long (3,000 to 4,500 feet) to extremely long (>4,500 feet). Alignment A (3,206 feet) can be performed in a single bore, Alignment B1 (6,633 feet) and Alignment B2 (6,528 feet) are considered extremely long for a single bore and the bores may need to be split into two separate bores or a single bore using HDD intersect method. Based on preliminary calculations we offer the following observations:

- Alternative A – it would be feasible to perform HDD installation using an 8 inch inside diameter HDPE or steel pipe in a single bore. Note that HDD construction cannot accommodate 90 degree bends and that the alignment will have to be developed with a radius of at least 600 feet assuming HDPE carrier pipe or 1,500 feet assuming a steel carrier pipe. The HDD drillpath will require easements due to the radius impacting some properties along the alignment.

  If pipeline installation using the HDD drillpath is not permitted due to the easements required then Alternative A would have to be performed using either of the following:

  - Three Short HDD Drives – these shorter drives would accommodate the 90 degree bends but would create more disruption and require more construction and pipe laydown areas to be made available.
  - Two Short Open Cut Sections & One HDD Drive - two short open cut sections along Springfield Road (714 feet) and Struve Road (343 feet), and HDD construction along Highway 1 (2604 feet).

- Alternative B1 - it would not be feasible to perform HDD construction using an 8 inch inside diameter HDPE pipe in a single bore. It would be feasible to perform HDD construction using an 8 inch inside diameter steel pipe in a single bore using the HDD intersect method. Construction could alternatively be performed to avoid easements by splitting the bore into two shorter bores or an open cut section along Struve Road (2461 feet) and HDD construction along Highway 1 (4298 feet).

- Alternative B2 - it would not be feasible to perform HDD construction using an 8 inch inside diameter HDPE pipe in a single bore. It would be feasible to perform HDD construction using an 8 inch inside diameter steel pipe in a single bore using the HDD intersect method. Construction could alternatively be performed to avoid easements by splitting the bore into two shorter bores or an open cut section along Struve Road (2134 feet) and HDD construction along Moss Landing Wildlife Area (4394 feet).

The decision for using the HDD intersect method is based on factors such as easement requirements, drillpath ground conditions, drill fluid properties, drillpath length, drillpath depth, drillpath geometry, drillpath alignment topography, entry and exit elevations, availability of HDD equipment, length of the conductor/casing sleeves, and the capacity of overburden to restrain drill fluid pressures.

The decision to install the pipeline using a single long HDD bore, multiple shorter HDD bores, or the HDD intersect method will need to be determined during detailed design.

1.0 PURPOSE

The purpose of Phase 1 of the project is to determine if the construction of the proposed water transmission pipeline is technically feasible using horizontal directional drilling (HDD) for the three (3) pipeline alignment alternatives (Alternative A, Alternative B1, and Alternative B2). This Preliminary HDD Feasibility Evaluation will address the following:

- Review HDD alignments
- Review of ground conditions (soils & groundwater)
- Suitability of ground conditions to HDD construction
- Evaluate drive lengths and alignments with respect to HDD feasibility
- Provide order of magnitude construction cost estimate for each alternative
- Provide preliminary construction schedule estimate for each alternative

2.0 PROJECT BACKGROUND

The Pajaro/Sunny Mesa Community Services District (District) acquired the Springfield Mutual Water Company (SMWC) in 2005. Since the acquisition, the District has been working with the residents of the Springfield/Struve Roads area to improve the potable water system. The Springfield Water System Improvements project is anticipated to serve approximately 66 parcels, and if approved for grant funding, the Moss Landing Mobile Home Park, which includes 105 mobile home sites.

The Springfield water system has documented water quality problems for a number of contaminants. The source of supply is a shallow well located in an active agricultural field. The District originally proposed a project which included a new well at the old school site, a storage reservoir, and a booster pumping station as well as new water distribution system. The District is in the process of obtaining an easement at the abandoned Moss Landing Middle School for new facilities, drilled an uncased well, and took one water quality sample. However, attempts to move forward with construction of this project have been unsuccessful due to lack of funding. The goal of the Springfield Water System Improvements project is to plan and design upgrades to the

Springfield water system to provide a high quality water source, which will provide long-term water supply reliability for the community.

The alternatives under consideration to address improvements to the public water system are as follows:

1) Alternative A - Drill a new well at the site acquired by the district adjacent to the Moss Landing Middle School site. Includes a water transmission pipeline approximately 3,661 feet in length between the Moss Landing Middle School and Moss Landing Mobile Home Park and Springfield residents.
2) Alternative B1 - Consolidate the Springfield water system with the Moss Landing water system by constructing an 8-inch diameter transmission line approximately 6,759 feet length, utilizing HDD on State Route 1 and open cut along Struve Rd.
3) Alternative B2 - Consolidate the Springfield water system with the Moss Landing water system by constructing an 8-inch diameter transmission line approximately 6,528 feet length, utilizing HDD through the Moss Landing State Wildlife Area and open cut along Struve Rd.
4) Alternative C - Drill a new well at the existing Springfield Mutual Well Site. This alternative will require the same system components as Alternative A with alternative pipeline alignments to convey water.

Alternative A, Alternative B1, and Alternative B2 only were evaluated for Task 1.

3.0 INFORMATION PROVIDED

The following information was provided for review during Phase 1 and was used in the evaluation of HDD as the construction method for pipeline installation.

- Request for Proposal (RFP)
- Addendum No. 1 dated February 17, 2015
- Addendum No. 2 dated February 20, 2015
- USDA & NRCS Custom Soil Resource Report & Map for Monterey County, CA (provided by MNS)
- AutoCAD drawing (CCSD-MAP.dwg) showing property boundaries(South of Struve Rd. Only), and existing utilities (provided by MNS)
- Word file with Plan & Profile image of existing “J7” Sewer along Struve Rd. (pp163 and 164 J7 Struve Rd.docx) (provided by MNS)
- Alignment figure in PDF format (provided by MNS)
- Parcel maps in PDF format (provided by MNS)
- Appendix 2 – C Springfield test Well completion report in PDF format (provided by MNS).

4.0 HORIZONTAL DIRECTIONAL DRILLING (HDD) METHOD

The HDD method is a two-stage process. The first stage consists of drilling a small diameter pilot hole (typically 1 to 5 inch diameter) along the desired alignment. The pilot hole is excavated using drill rods with a cutting head for the length of the proposed crossing. The hole is then enlarged (reamed) to a larger diameter by attaching a reamer to the drilling rod until the proposed borehole diameter is obtained. This reaming process can be completed in one step or several steps depending upon the proposed hole diameter. Throughout the reaming process, the hole is kept open (from collapsing) by thick fluid slurry. The final hole diameter is typically 50 percent larger than the proposed pipe diameter. Upon completion of the last reaming step, the carrier pipe is then pulled back through the excavated hole as the drill string is pulled back and extracted. The HDD technique can be used in various types of soil and rock.

The HDD technique requires a relatively large staging area on both sides of the operation at the entry point and the exit point of the proposed water main. Heavy equipment is required on each side of the HDD crossing. The entry side (rig side) requires easy access and a more stable ground. Maxi HDD work areas require space for a HDD rig unit, power unit, generators, drilling fluid mixing/recycling equipment, drill pipe, and downhole tools. A minimum area of approximately 60 feet wide by 150 feet long with no overhead obstructions is required. The exit side (pipe side) is where the pipeline is assembled using pipe-welding (steel pipe) or fusion welding (HDPE) processes prior to pullback. The width of the workspace should be approximately 30 feet to 50 feet wide. Also additional temporary workspace should be obtained in the immediate vicinity of the exit location similar to the entry side to facilitate operation and storage of additional equipment.

The HDD method is typically cost-effective for pipe installation of diameters up to 60 inches and lengths up to 6,000 feet. It is commonly used for pressurized pipelines similar to the proposed slough crossing of the water main. It is an ideal method where precision and accuracy of installation is not critical or detrimental to the installed pipe or existing surface and subsurface facilities/utilities. A potential risk of the HDD method is the potential for inadvertent returns such as mud seepage or “frac out” through the surrounding soils and rock to the surface which may affect exiting facilities and cause contamination of groundwater and surface water.

The drillpath depth is primarily controlled by the obstacle in this case the slough. A minimum of 15 feet of separation beneath the obstacle should be maintained (DCCA 1995). The recommended standard separation distance for challenging drilling conditions is 25 feet this minimum separation distance offers a margin for error in surveying methods both before and during construction.

<u>HDD Intersect Method</u> – this method is used when the length, the soil conditions, or a combination of the two do not allow the use of a single drilling rig to accomplish the bore. In an intersect HDD installation, two directional drilling rigs (a primary and secondary drilling rig) are placed at opposite ends of a project site and start drilling toward each other guided by a precision underground magnetic tracking device. Once the bores are within a pre-determined distance from each other, the primary rig advances its drill string, following behind the secondary rig's retreating downhole assembly. The advancing drill string is then steered toward and ultimately "falls" into the vacated borehole produced by the retreating drill string, creating a continuous single borehole. The borehole is then reamed to the appropriate size and product pipe is pulled.

HDD intersect method has proven to work well for long installations in lowering the required installation-induced down-hole fluid pressure associated with drilling fluid flow and thereby lowering hydraulic fracture potential. The flow path length for fluid flow is significantly decreased in comparison to a single HDD pilot bore. This method is also effective for short installations where conductor casings are required on either end of an HDD bore to support near-surface geologic materials that are considered unfavorable to HDD installation.

5.0 REVIEW OF HDD ALIGNMENTS

A key issue when laying out preliminary HDD alignments is an understanding of the minimum radius of curvature that can be accommodated by the steel drill pipe during construction and the pipeline material (steel or HDPE) during pipeline pullback. The following constraints have been used in developing a preliminary evaluation of the three HDD alignments:

- Drill Pipe - assuming a 4 inch steel drill pipe is used for HDD drilling purposes the radius in feet needs to be 100 times the diameter of the drill string in inches. Conservatively assuming a 4 inch diameter drill pipe the minimum required HDD drillpath radius will need to be 400 feet assuming a FS of 1.5 (4 inch x 40 = 160 feet / 160 x FS 1.5 = 320 feet). The safe minimum yield strength for steel pipe is approximately 30,000 psi (AWWA M11- Steel Water Pipe: A Guide for Design and Installation).
- Steel Carrier Pipe - If steel pipe is used the radius in feet needs to be 100 times the diameter of the pipe in inches. Conservatively assuming a 10 inch diameter carrier pipe the minimum required HDD drillpath radius will need to be 1,500 feet assuming a FS of 1.5 (10 inch x 100 = 1,000 feet / 1,000 x FS 1.5 = 1,500 feet). The pipe wall thickness will be determined during detailed design but is likely to be on the order of 0.5 inches thick.
- HDPE Carrier Pipe - If HDPE pipe is used the radius in feet needs to be 40 times the diameter of the pipe in inches. Conservatively assuming a 10 inch diameter carrier pipe the minimum required HDD drillpath radius will need to be 600 feet assuming a FS of 1.5 (10 inch x 40 = 400 feet / 400 x FS 1.5 = 600 feet). The safe pull stress for HDPE pipe is 1,100 psi (ASTM F 1962-05, Table X1.1 – Apparent Modulus at 73°F).). The pipe wall thickness will be determined during detailed design but is likely to be on the order of 1.00 inch thick.

Steel pipe is made from an alloy of primarily iron and carbon. The steel is then rolled into a cylinder and made into a pipe per requirements. Steel pipes have a high tensile strength and are capable of handling high pressures. The high compressive strength of steel makes it a good material for trenchless applications including HDD. Many types of welded and non-welded joints are available for steel pipe. A primary concern of steel pipe is corrosion. Corrosion issues can be addressed but also significantly add to the unit cost ($/LF) of the pipe material.

http://www.nwpipe.com/product/engineered-steel-water-pipe/

http://www.nwpipe.com/product/permalok-steel-casing-pipe/

HDPE pipe is a polyethylene thermoplastic made from petroleum. HDPE is stronger than typical polyethylene (PE) pipe. It is corrosion resistant and much more flexible than steel pipe. The flexibility of this material is desirable in HDD construction because smaller radius turns are possible. HDPE is typically less expensive than steel pipe. The continuous jointless conduit that results from the butt fusion of HDPE pipes make it an ideal piping material for pull-in installations such as HDD.

http://www.jmeagle.com/products/water_sewer/HDPE_water_sewer.html

Based upon the above it can be seen that steel pipe is much less flexible (100D radius vs 40D radius) than HDPE pipe but has a much higher tensile strength (30,000 psi vs 1,100 psi). The HDPE pipe can limit the required easements outside the existing right of ways due to tighter radius but the drillpath bore lengths are less due to the significantly lower tensile capacity of the HDPE pipe.

In general HDD alignments of 1,000 feet are considered short, alignments of 1,000 feet to 3,000 feet considered medium length, alignments of 3,000 to 4,500 feet are considered long, and alignments of > 4,500 feet are considered extremely long (Trenchless Technology, Najafi, M., 2013).

5.1 Alternative A

Alternative A comprises of approximately 3,206 feet of 8 inch inside diameter water transmission pipeline between the Moss Landing Middle School and Moss Landing Mobile Home Park and Springfield residents located on Struve Road. Route comprises three segments (Springfield Road, Cabrillo Highway, & Struve Road) connected by two 90 degree bends at Springfield Road and Cabrillo Highway, and Cabrillo Highway and Struve Road. HDD construction cannot accommodate 90 degree bends and the alignment will have to be developed with a radius of at least 600 feet assuming HDPE carrier pipe or 1,500 feet assuming a steel carrier pipe. The estimated HDD alignment length is approximately 3,847 feet (3,206 feet x 1.2 = 3,847 feet). The 20 percent additional alignment length is a safety factor added to account for alignment modifications, and vertical and horizontal curves.

The HDD drillpath which will be feasible to construct in a single bore will require easements due to the radius impacting some properties along the alignment. If pipeline installation using a single HDD drive is not permitted due to easement acquisitions then Alternative A could be performed using either three shorter HDD bores (714 feet, 2,604 feet, & 343 feet = 3,661 feet) or two open cut sections (714 feet & 343 feet) and a single HDD bore (2,604 feet) which would accommodate the 90 degree bends. Multiple open cut sections and HDD bores will cause more surface disruption and require more construction work areas and pipe laydown areas.

The base alignment of the pipeline, a HDD alignment assuming HDPE carrier pipe, and a HDD alignment assuming steel carrier pipe are presented on Drawing 1 in Attachment A (HDD Alignment Plans). In addition, the rig side (drill pipe entry/carrier pipe exit) and pipe side (drill pipe exit/carrier pipe entry) construction areas, and the pipe laydown area on the pipe side are shown on Drawing 1.

Easements - Easements will be required where the alignment falls outside the existing pipeline right of way. Below is a list of the properties that fall along the alignment, total of 10 parcels. The HDD alignment (single bore) approach will require a curved alignment where 90 degree bends are shown in order for the drill string during pilot hole drilling and carrier pipe during pipe pullback to go around the curves.

The properties adjacent to Alignment A are as follows:

- Parcel 1 - Moss Landing Middle School (Currently Closed), 8142 Moss Landing Road, Moss Landing, CA 95039 [APN - 413-014-001-000]
- Parcel 2 – Elkhorn Native Plant Nursery, Agricultural Preserve, PO Box 874 Soquel, CA 95073-0874 [APN - 413-014-003-000]
- Parcel 3, Residential – Single Family, 19 Springfield Road, Moss landing, CA 95039-9633 [APN - 413-051-015-000]

- Parcel 4 – Vacant, 1820 Hwy 1, Moss Landing, CA 95039 [APN - 413-051-030-000]
- Parcel 5 – Residential Mobile/Manufactured Home Park, 1900 Salinas Road, Watsonville, CA [APN - 413-051-017-000]
- Parcel 6 - Agricultural Land, Moss Landing, CA 95039 [APN - 413-051-025-000]
- Parcel 7 - Vacant Land, Moss Landing, CA 95039 [APN - 413-051-026-000]
- Parcel 8 – Valero Gas Station, 1940 Hwy 1 Moss Landing, CA 95039-9630 [APN - 413-061-037-000]
- Parcel 9 - Vacant Land, Moss Landing, CA 95039 [APN - 413-061-036-000]
- Parcel 10 - Residential, 67 Struve Road, Moss Landing, CA 95039-9638, [APN - 413-061-034-000]

The Monterrey County Parcel Map for Alignment A and additional details of the parcels are presented on Drawing 4 in Attachment B (Monterrey County Parcel Maps)

The properties impacted by the HDD drillpath (single bore) and requiring easements assuming HDPE carrier pipe are Parcel 1, Parcel 8, and Parcel 9. The properties impacted by the HDD drillpath (single bore) assuming steel carrier pipe are Parcel 1, Parcel 7, and Parcel 8. The steel pipe option will require larger easements due to the larger radius (100 x pipe diameter in inches).

Existing Utilities – based upon the information provided to date the existing utilities along crossing and immediately adjacent to Alternative A are a sewer main and associated manholes on Struve Road. Monterrey County does not have utilities on Springfield Road or Cabrillo Highway. The locations of the known utilities are presented on Figure 7 in Attachment C (Utility Location Maps).

5.2 Alternative B1

Alternative B1 comprises of approximately 6,633 feet of 8 inch diameter water transmission pipeline on Struve Rd and Cabrillo Highway (State Route 1). Route comprises two segments (Struve Road, & Cabrillo Highway) connected by one 120 degree bend at Struve Road and Cabrillo Highway. HDD construction cannot accommodate a tight 120 degree bends and the alignment will have to be developed with a radius of at least 600 feet assuming HDPE carrier pipe or 1,500 feet assuming a steel carrier pipe. The estimated HDD drillpath alignment length is approximately 7,960 feet (6,663 feet x 1.2 = 7,960 feet). The 20 percent additional alignment length is a safety factor added to account for alignment modifications, and vertical and horizontal curves.

The base alignment of the pipeline, a HDD alignment assuming HDPE carrier pipe, and a HDD alignment assuming steel carrier pipe are presented on Drawing 2 in Attachment A (HDD Alignment Plans). In addition, the rig side (drill entry/pipe exit) and pipe side (drill exit/pipe entry) construction areas, and the pipe laydown area on the pipe side are shown on Drawing 2.

Construction could alternatively be performed to avoid easements by splitting the bore into two shorter bores (2,461 feet & 4,298 feet = 6,759 feet) or an open cut section along Struve Road (2,461 feet) and an HDD construction along Highway 1 (4,298 feet).

Easements - Easements will be required where the alignment falls outside the existing pipeline right of way. Below is a list of the properties that fall along the alignment, total of 13 parcels.

The HDD alignment will require a curved alignment between where a 120 degree bend is shown in order for the drill string during pilot hole drilling and the carrier pipe during pipe pullback to go around the curves.

The properties adjacent to Alignment B1 are as follows:

- Parcel 1 - Agricultural, Struve Road, Watsonville, CA [APN - 413-012-014-000]
- Parcel 2 - Agricultural, 64 Struve Road, Moss Landing, CA 95039-9639 [APN - 413-013-001-000]
- Parcel 3 - Agricultural, Watsonville, CA [APN - 413-011-015-000]
- Parcel 4 - Agricultural, Watsonville, CA [APN - 413-031-001-000]
- Parcel 5 - Capurro Ranch, Sundance Berry Farms, Sunrise Growers, Robert Mann Packaging Inc. (RMP), Industrial, Moss Landing, CA 95039 [APN - 413-011-029-000]
- Parcel 6 - Tax Exempts, Watsonville, CA 95039 [APN - 413-032-001-000]
- Parcel 7 - Tax Exempts, Watsonville, CA 95039 [APN - 413-021-001-000]
- Parcel 8 – Tax Exempts, Watsonville, CA 95039 [APN - 413-023-009-000]
- Parcel 9 - Tax Exempts, Moss Landing, CA 95039 [APN - 413-021-002-000]
- Parcel 10 - Tax Exempts, Moss Landing, CA 95039 [APN - 413-022-009-000]
- Parcel 11 - Tax Exempts, Moss Landing, CA 95039 [APN - 413-022-010-000
- Parcel 12 – Commercial, Kayak Connection2370 Hwy 1, Moss Landing, CA 95039-9642 [APN - 413-022-008-000]
- Parcel 13 - Tax Exempts, Moss Landing, CA 95039 [APN - 413-022-006-000]
- Parcel 14 – Tax Exempts, 2375 Hwy 1, Watsonville, CA 95039 [APN - 413-023-005-000]

The Monterrey County Parcel Map for Alignment A and additional details of the parcels are presented on Drawing 5 in Attachment B (Monterrey County Parcel Maps).

The properties impacted by the HDD drillpath and requiring easements assuming HDPE carrier pipe are Parcel 1, Parcel 4, Parcel 8, Parcel 9, Parcel 10 and Parcel 11. The properties impacted by the HDD drillpath and requiring easements assuming steel carrier pipe (larger radius of 100 x D) are Parcel 1, Parcel 3, Parcel 4, Parcel 10 and Parcel 11. Construction could alternatively be performed to avoid easements by splitting the bore into two shorter bores (2461 feet & 4298 feet) or an open cut section along Struve Road (2461 feet) and an HDD construction along Highway 1 (4298 feet).

<u>Existing Utilities</u> - based upon the information provided to date the existing utilities along crossing and immediately adjacent to Alternative B1 are a water supply force main running parallel to Alternative B1 for approximately 2,400 feet along Struve Road and along Cabrillo Highway for approximately 1700 feet stopping at Jetty Rd. At the southern end of the alignment along Cabrillo Highway a sewer main is parallel to the alignment for approximately 700 feet. The location of the known utilities are presented on Figure 8 in Attachment C (Utility Location Maps).

In addition, along Struve Rd. a 16 inch, 14 inch, and 12 inch diameter water pipeline approximately 10 feet deep (likely installed using open cut methods) is aligned parallel to Alternative B1 for approximately 1,600 feet and terminating at Giberson Rd. A Plan & Profile image of existing "J7" Sewer along Struve Rd provided by MNS is presented on Drawing 17 and Drawing 18 in Attachment C (Utility Location Maps).

5.3 Alternative B2

Alternative B2 comprises of approximately 6,528 feet of 8-inch diameter water transmission pipeline on Struve Road, crossing the Cabrillo Highway, through the Moss Landing State Wildlife area, and back onto Cabrillo Highway. Route comprises three segments (Struve Road, Moss Landing Wildlife Area, & Cabrillo Highway) connected by two large radius bends (~2000 feet radius). HDD construction will be able to accommodate the original alignment developed as Alignment B2. The estimated HDD drillpath alignment length is approximately 7,834 feet (6,528 feet x 1.2 = 7,834 feet). The 20 percent additional alignment length is a safety factor added to account for alignment modifications, and vertical and horizontal curves.

The base alignment of the pipeline, which is acceptable using either HDPE or Steel carrier pipe is presented on Drawing 3 in Attachment A (HDD Alignment Plans). In addition, the rig side (drill entry/pipe exit) and pipe side (drill exit/pipe entry) construction areas, and the pipe laydown area on the pipe side are shown on Drawing 3.

Construction could alternatively be performed to avoid easements by splitting the bore into two shorter bores (2134 feet & 4394 feet = 6,528 feet) or an open cut section along Struve Road (2,134 feet) and an HDD bore across Moss Landing Wildlife Area (4394 feet).

<u>Easements</u> - Easements will be required where the alignment falls outside the existing pipeline right of way. Below is a list of the properties that fall along the alignment, 12 parcels. The properties adjacent to Alignment B1 are as follows:

- Parcel 1 - Agricultural, Struve Road, Watsonville, CA [APN - 413-012-014-000]
- Parcel 2 - Agricultural, 64 Struve Road, Moss Landing, CA 95039-9639 [APN - 413-013-001-000]
- Parcel 3 - Agricultural, Watsonville, CA [APN - 413-011-015-000]
- Parcel 4 - Agricultural, Watsonville, CA [APN - 413-031-001-000]
- Parcel 5 - Tax Exempts, Watsonville, CA 95039 [APN - 413-032-001-000
- Parcel 6 – Tax Exempts, Watsonville, CA 95039 [APN - 413-023-009-000]
- Parcel 7 – Moss Landing State Wildlife Area, Tax Exempts, Watsonville, CA [APN - 413-023-008-000]
- Parcel 8 - Tax Exempts, Moss Landing, CA 95039 [APN - 413-022-009-000]
- Parcel 9 - Tax Exempts, Moss Landing, CA 95039 [APN - 413-022-010-000]
- Parcel 10 – Commercial, Kayak Connection, 2370 Hwy 1, Moss Landing, CA 95039-9642 [APN - 413-022-008-000]
- Parcel 11 - Tax Exempts, Moss Landing, CA 95039 [APN - 413-022-006-000]
- Parcel 12 – Tax Exempts, 2375 Hwy 1, Watsonville, CA 95039 [APN - 413-023-005-000]

The Monterrey County Parcel Map for Alignment B2 and additional details of the parcels are presented Drawing 6 in Attachment B (Monterrey County Parcel Maps).

The properties impacted by the Alignment B2 HDD drillpath and requiring easements assuming HDPE or Steel carrier pipe are Parcel 1, Parcel 5, Parcel 6, Parcel 7, Parcel 8, Parcel 9, and

Parcel 11. Alternatively, if the option to construct two shorter bores (2134 feet & 4394 feet) or an open cut section along Struve Road (2134 feet) and an HDD bore across Moss Landing Wildlife Area (4394 feet) no easements will be required.

Existing Utilities - based upon the information provided to date the existing utilities along crossing and immediately adjacent to Alternative B2 are a water supply force main running parallel to Alternative B2 for approximately 2,400 feet along Struve Road. At the southern end of the alignment along Cabrillo Highway a sewer main is parallel to the alignment for approximately 700 feet. The location of the known utilities are presented on Figure 9 in Attachment C (Utility Location Maps).

In addition, along Struve Rd. a 16 inch, 14 inch, and 12 inch diameter water pipeline approximately 10 feet deep (likely installed using open cut methods) is aligned parallel to Alternative B1 for approximately 1,600 feet and terminating at Giberson Rd. A Plan & Profile image of existing "J7" Sewer along Struve Rd provided by MNS is presented on Drawing 17 and Drawing 18 in Attachment C (Utility Location Maps).

The following general comments are provided with respect to the HDD alignments:

- HDD alignment lengths are between 3,925 feet and 6,815 feet in length and considered to be long (3,500 to 4,500 feet) to extremely long (>4,500 feet)
- HDD alignments are within HDD method capabilities
- Ability to perform alignments lengths in a single drive, multiple drives, or HDD intersect method will need to be evaluated during detailed design.

6.0 REPRESENTATIVE EXAMPLES OF HDD PROJECTS

Examples of similar projects are presented below. It should be noted that in general the carrier pipe used is steel which due to its higher tensile strength has significant benefits when installing long and extremely long HDD installations with greater tensile stresses developing in the pipe during pullback.

Project - Houston Ship Channel, La Porte to Baytown, Texas
Contractor - Michels Corporation
Method - HDD Intersect
Length - 12,459 feet
Pipe Diameter - 18 inch
https://www.michels.us/blog/michels-completes-a-world-record/

Project - Hampton Roads Harbor, Virginia
Client - Virginia Natural Gas (VNG)
Contractor - Mears Group
Method - HDD
Length - 7,357 feet
Pipe Diameter - 24 inch (steel pipe)
http://www.mears.net/horizontal-directional-drilling/index.php/hdd/hdd/hampton-roads-harbor-va/

Project – Miami to Miami Beach Crossing, Miami, Florida
Client - Florida Power & Light (FPL)
Contractor - Mears Group
Method - HDD Intersect
Length - 5,188 feet, 5,917 feet, and 5,013 feet
Pipe Diameter - 9 inch (steel pipe)
http://www.mears.net/horizontal-directional-drilling/index.php/hdd/hdd/overtown-venetian-138-kv-line-project/

Project – Kinder Gas Pipeline, Lake Houston, Harris County, Texas
Client – Kinder Morgan
Contractor - Laney Directional Drilling Co
Method - HDD Intersect
Length – 10,971feet
Pipe Diameter – 6 inch (steel pipe)
http://www.pipeline-news.com/feature/hdd-used-replace-kinder-morgan-gas-line-under-lake-houston

7.0 REVIEW OF GROUND CONDITIONS (SOILS & GROUNDWATER)

Based upon the "Geologic Map of the Monterey 30' x 60' Quadrangle and Adjacent Areas", Regional Geologic Map Series, 1:100,000 Scale published by the California Department of Conservation, California Geological Survey, and dated 2002 (Wagner, Greene, Saucedo, & Pridmore) the ground conditions in the vicinity of the project site comprise the following

- Qb - Basin Deposits (Holocene) – silty Clay
- Qe – Eolian Sand (Holocene)
- Qt – Terrace Deposits (Holocene) – Gravel, Sand, Silt, and Clay deposited on stream cut surfaces
- Qmt – Marine Terrace Deposits (Pleistocene) – Gravel, Sand, Silt, and Clay deposited on wave cut surfaces
- Qod – Older Dune Sand (Pleistocene)
- Aromas Sand – Eolian and Fluvial deposits of Clay, Silt, Sand, and Gravel
    - Undivided (Qar)
    - Eolian (Qae)
    - Fluvial (Qaf) Deposits

Excerpts from the "Geologic Map of the Monterey 30' x 60' Quadrangle and Adjacent Areas" including geological map and legend associated with the project area are presented on Drawing 10 and Drawing 11 in Attachment D (Geological Map & Information Excerpts).

Based upon the USGS Fact Sheet 044-03 (dated August 2003) entitled "Geohydrology of Recharge and Seawater Intrusion in the Pajaro Valley, Santa Cruz and Monterey Counties, California" (http://pubs.usgs.gov/fs/fs-044-03/] the general project vicinity ground conditions comprise the following:

- Upper Aquifer System
  - Shallow Alluvial Aquifer (Younger & Older Alluvium) [~ 100 feet thick]
  - Upper Aromas Sand [~150 to 200 feet thick]
- Lower Aquifer System
  - Lower Aromas Sand [~200 feet thick]
  - Purisima Formation – Sandstone, Siltstone (marine)

Geological plan and profiles from the "Geohydrology of Recharge and Seawater Intrusion in the Pajaro Valley, Santa Cruz and Monterey Counties, California" are presented on Drawing 12 and Drawing 13 in Attachment D (Geological Map & Information Excerpts).

Groundwater is present within all the Pleistocene and Holocene age sediments at relatively shallow depths below the existing ground surface.

Based upon the "Maps Showing Geology and Liquifaction Potential of Northern Monterey and Southern Santa Cruz Counties, California", published by USGS, dated 1980 the following formations are present and liquefaction potential noted.

- Qfl – Artificial Fill (Holocene) – heterogeneous mixture of artificially deposited fill material ranging from well compacted sand and silt to poorly compacted sediment high in organic content. <u>Liquefaction potential ranges from low to high</u> depending on degree of compaction.
- Qb – Basin Deposits (Holocene) – unconsolidated plastic clay and silty Clay containing much organic material. Thickness up to 30m thick. <u>Moderate to high liquefaction potential</u> except where water is more than 10m below ground surface. Highly expansive soils develop in these deposits.
- Qsc – Coastal Terrace Deposits of Santa Cruz (Pleistocene) – semiconsolidated generally well worked sand with a few thin relatively continuous layers of gravel. Thickness variable, maximum thickness is 13m. <u>Low susceptibility to liquefaction</u>.
- Qa – Aromas Sand (Plesitocene) – heterogeneous sequence of mainly Aeolian and fluvial sand, silt, clay, and gravel. Total thickness may be greater than 250m. <u>Low susceptibility to liquefaction</u>.
- Qeu – Coastal Terrace Deposits, Undifferentiated (Pleistocene) – semiconsolidated moderately well sorted marine sand containing thin discontinuous gravel rich layers. Thickness variable, generally less than 6m thick. <u>Low susceptibility to liquefaction</u>.

In addition, the Monterey County (MC) GIS Geology Open Data file (liquefaction data set) shows the soils present along Alternative A, Alternative B1, and Alternative B2 alignments and the liquefaction susceptibility. The soil units present along the three (3) alignments are presented in Table 1.

http://montereycountyopendata.montereyco.opendata.arcgis.com/datasets/9dd4c3bb210140e286fcac742235257d_0

Table 1 – Liquefaction Susceptibility by Soil Type

Label	Name	Era	Period	Epoch	Liquefaction Susceptibility
Qb	Basin deposits	Cenozoic	Quaternary	Holocene	High
Qfl	Artificial fill	Cenozoic	Quaternary	Holocene	Variable
Qsc	Stream channel deposits	Cenozoic	Quaternary	Holocene	High
Qa	Aromas Sand, undifferentiated	Cenozoic	Quaternary	Early to Middle Pleistocene	Low
Qem	Eolian deposits	Cenozoic	Quaternary	Pleistocene	Low
Qct	Coastal terraces	Cenozoic	Quaternary	Pleistocene	Low
Qod2	Eolian deposits	Cenozoic	Quaternary	Late Pleistocene	Low

Confirmation of liquefaction potential and soil type present along the selected pipeline alignment should be closely reviewed during detailed design.

Liquefaction is the transformation of soil from a solid to a liquid state as a consequence of increased pore-water pressures, usually in response to strong ground shaking, such as those generated during a seismic event. Loose, granular soils are most susceptible to these effects while more stable silty clay and clay materials are generally somewhat less affected. The liquefaction potential is mentioned as the effects of drilling and vibration need to be considered during detailed design with respect to the presence of soils with liquefaction potential. Excerpts from the "Maps Showing Geology and Liquefaction Potential of Northern Monterey and Southern Santa Cruz Counties, California" showing the site location are presented on Drawing 14 and Drawing 15 in Attachment D (Geological Map & Information Excerpts).

In addition to the above information a test well record for a 630 feet deep well drilled from July 22 to July 25, 2008 by Maggiora Brothers was reviewed. The well is located approximately 30 yards south of the east end of Springfield Road at 1815 Highway 1, Moss Landing, California. The geology for the entire well depth was soil (sand, clay, silts & gravel). The test well log is presented on Drawing 16 in Attachment D (Geological Map & Information Excerpts). The findings presented on the well log concur with the review of available published literature presented above.

8.0 GROUND CONDITIONS SUITABILITY

Based upon an evaluation of the ground conditions based upon available geological information the presence of soils comprising clay, silt, sand, and gravel does not present a problems for pipeline construction using HDD methods.

9.0 DRIVE LENGTHS AND ALIGNMENTS HDD FEASIBILITY EVALUATION

A preliminary evaluation of the drill path was determined in general accordance with the guidelines presented in ASTM F 1962-05 "*Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings*".

HDD design parameters are outlined in ASTM F 1962 which form the basis of HDD bore design. Arguably the most critical design component of HDD crossings is the maximum pull stress. This parameter may determine the type of pipe required, HDD rig to be used, and ultimately determine the feasibility of the project. The following considerations are key to the design of the vertical bore alignment:

- *Depth of Cover.* This parameter is of concern in regards to inadvertent returns of the drilling mud to the surface as well as maximum pull stress. Generally speaking as depth increases so does maximum pull stress. An important determination of maximizing depth for frac-out concerns and minimizing depth for stress concerns is critical to design.
- *Entry/Exit Angles.* The entry and exit angles are of importance to the project to maintain appropriate depths and maximize the potential curve radii. If typical industry standard entry/exit angles are used they will have minimal impact on the maximum pull stress.
- *Drill Path Radii.* In HDD borings, at least two radii exist; one at the bottom of entry and the other at the divergence of the exit. For horizontally curved alignments greater than two radii may exist. These radii have been found to be critical to the maximum pull stress. To minimize the maximum pull stress it is important to maximize the radii.
- *Limiting Mud Pressure.* Drilling fluid pressure is calculated using the Delft Geotechnical cavity expansion theory as detailed in USACE – Installation of Pipelines beneath Levees Using HDD (CPAR-GL-98-1, dated April 1998).

The following assumptions have been made with respect to the preliminary level HDD drillpath alignments assuming HDPE pipe:

1) Pipe Outside Diameter = 10.75 inch (10 inch NPS)
2) Pipe Inside Diameter = 8.218 inch
3) Bore Entry Angle = 12° (Pipe Exit);
4) Bore Exit Angle = 12° (Pipe Entry);
5) Radius of Curvature = 600 feet (HDPE minimum)
6) Maximum Depth of Cover = 50 feet;
7) Total Horizontal Distance (HDPE)
    a. Alternative A = 3,206 feet
    b. Alternative B1 = 6,633 feet
    c. Alternative B2 = 6,528 feet
8) HDD alignment length = 1.5 x plan length (e.g. Alternative A = 3,206 feet x 1.20 = 3,847 feet)

Preliminary Estimates of pull back stresses for each alternative assuming HDPE carrier pipe are presented in Table 2.

Table 2 – Preliminary Estimate of Pull Back Stresses (HDPE Pipe)

Alternative	Drives	Estimated Total Length (feet)	Estimated Maximum Pull Back stress (psi)	HDPE Pipe Allowable Stress (psi)	Bore Length Acceptable
Alternative A	1	3,847	829	1,100	Yes
Alternative B1	1	7,960	1,510	1,100	No
Alternative B1	1	2,485	584	1,100	Yes
	2	5,475	1,059	1,100	Yes
Alternative B2	1	7,834	1,489	1,100	No
Alternative B2	1	2,561	598	1,100	Yes
	2	5,273	1,024	1,100	Yes

Notes: 1. Allowable stress based upon ASTM 1962 – Table X1.1 – Apparent Modulus of Elasticity and Safe Tensile Stress at 73°F.
2. Bore length acceptable if Estimated Maximum Pull Back Stress is less than Pipe Allowable Tensile Stress.

The safe minimum yield strength for steel pipe is approximately 30,000 psi (AWWA M11- Steel Water Pipe: A Guide for Design and Installation). It can be seen from Table 2 that steel pipe will have more than sufficient tensile capacity for construction assuming a single bore (full length) for all Alternatives.

Based upon Table 2 the following preliminary level observations can be made:

- Alternative A – it would be feasible to perform HDD installation using an 8 inch inside diameter HDPE or steel pipe.
- Alternative B1 & Alternative B2 - it would not be feasible to perform HDD construction using an 8 inch inside diameter HDPE pipe in a single bore. Construction could be performed by splitting the bore into two shorter bores.
- Alternative B1 & Alternative B2 - it would be feasible to perform HDD construction using an 8 inch inside diameter steel pipe in a single bore.

10.0 CONSTRUCTION COST ESTIMATE

A preliminary level estimate of construction cost is provided based upon past projects, and references relating to cost evaluation of HDD projects. Table 3 and Table 4 show some representative costs in $/foot/inch.

Table 3 – Unit Cost by Product Type

Product Type	Water	Wastewater
Number of projects	40	23
Average unit cost ($/foot/inch)	16.7	28.3

Reference – “Analysis of Parameters Affecting Costs of Horizontal Directional Drilling Projects in the United States for Municipal Infrastructure” (Vilfrant, 2010)

Table 4 – Unit Cost by Soil Classification

USCS	GW-GC	SW-SC	ML-OL	MH-OH	PT
Number of projects	7	15	33	5	3
Average unit cost ($/foot/inch)	44.66	24.74	13.74	19.72	32.4

Reference – "Analysis of Parameters Affecting Costs of Horizontal Directional Drilling Projects in the United States for Municipal Infrastructure" (Vilfrant, 2010)

Using $16.70/foot/inch (water pipe) and $24.74/foot/inch (SW/SC Soils) we have a range of between $133.60 to $197.92 per foot of 8 inch pipeline installation using HDD. The project soils at HDD alignment depth a primarily Sand, Silt, and Clay and for cost estimating purposes the higher unit price for Sand soils has been used. For preliminary project cost estimating purposes a rate of $200/foot has been used for estimating project alignment costs as presented in Table 5.

Table 5 – Estimated HDD Construction Costs (Alignment A, Alignment B1, & Alignment B2)

Alternative	Plan Length (feet)	Estimated HDD Drillpath Length (feet)	Estimate Construction Cost ($)
Alternative A	3,661	4,393	$878,640
Alternative B1	6,759	8,110	$1,622,000
Alternative B2	6,528	7,834	$1,566,800

11.0 CONSTRUCTION SCHEDULE ESTIMATE

A preliminary level estimate of the construction schedule is as follows:

- Drill Site Mobilization & Set-up = 2 weeks
- Pilot Hole Drilling = 2 weeks
- Reaming = 1 week
- Pipe Fusion = 2 weeks (can be performed during drilling operations)
- Pullback = 3 days
- Demobilization = 1 week

Total construction duration is estimated to be approximately 7 weeks assuming pipe fusion takes place during drilling operations (pilot hole & reaming).

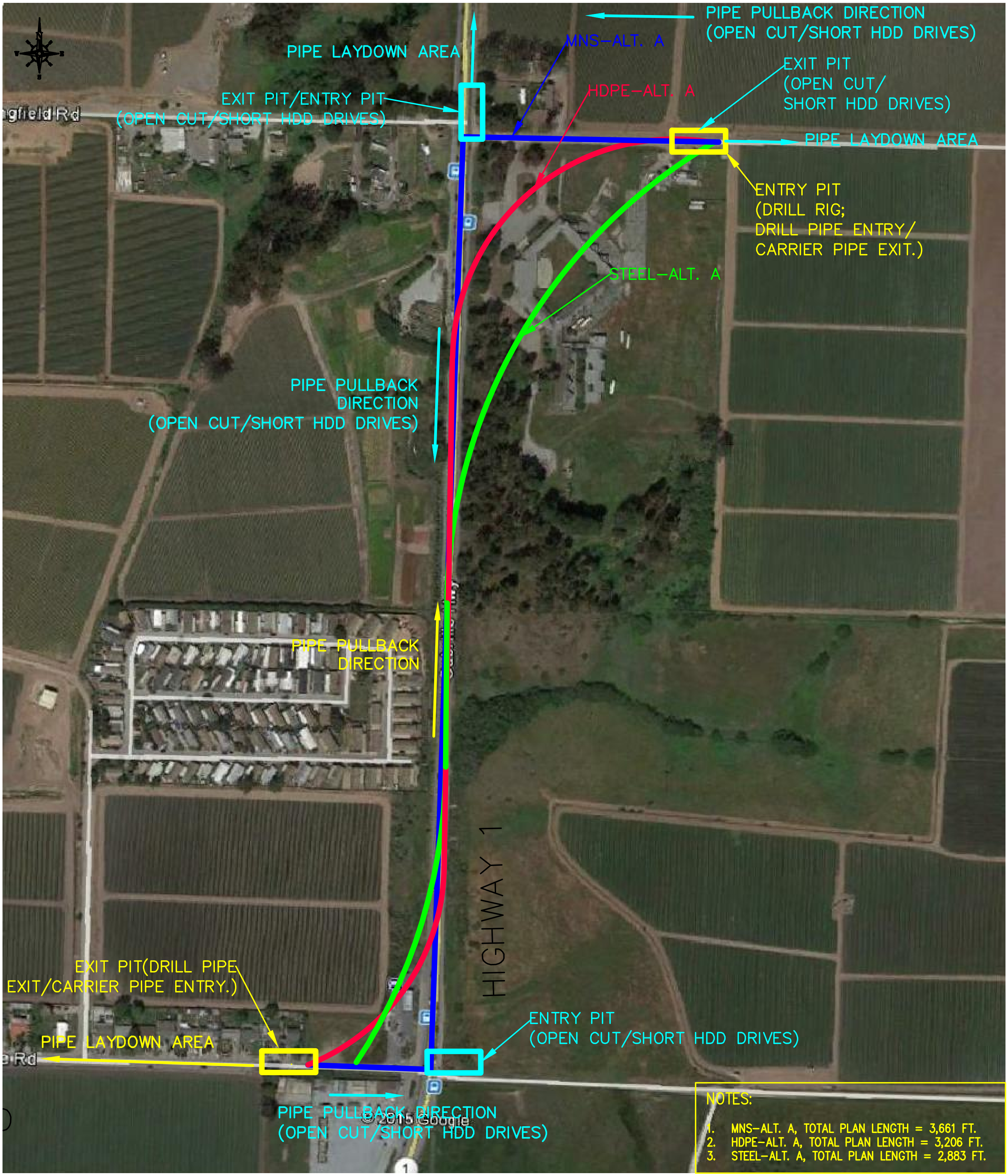
12.0 OTHER CONSIDERATIONS

Geotechnical Investigation - a geotechnical investigation will be required during the detailed design phase of the project. It is recommended that a series of three to five borings be performed along the selected route alternative to confirm design ground conditions and collect samples for laboratory testing to provide soil parameters required for design.

Geotechnical Baseline Report (GBR) – a GBR (or GBR Sheets) should be prepared for the project in accordance with ASCE Guidelines (ASCE, 2007).

ATTACHMENT A

(HDD ALIGNMENT PLANS)



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CLIENT/OWNER: MNS ENGINEERS INC

DESIGNER: ALDEA SERVICES LLC
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aldeaservices.com

PROJECT: Springfield Water System Improvements			
DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: HDD – Alternative A	
DRAWN BY: GM	APPROVED BY: XX	DRAWING NO: 1	REV:
SCALE: 1/32" = 1'	DATE: 11/11/15	FILE NAME: XX	SHEET 1 OF 1

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PROJECT: Springfield Water System Improvements

DESIGNED BY:	XX	CHECKED BY:	PH	DRAWING TITLE:	HDD – Alternative B1		
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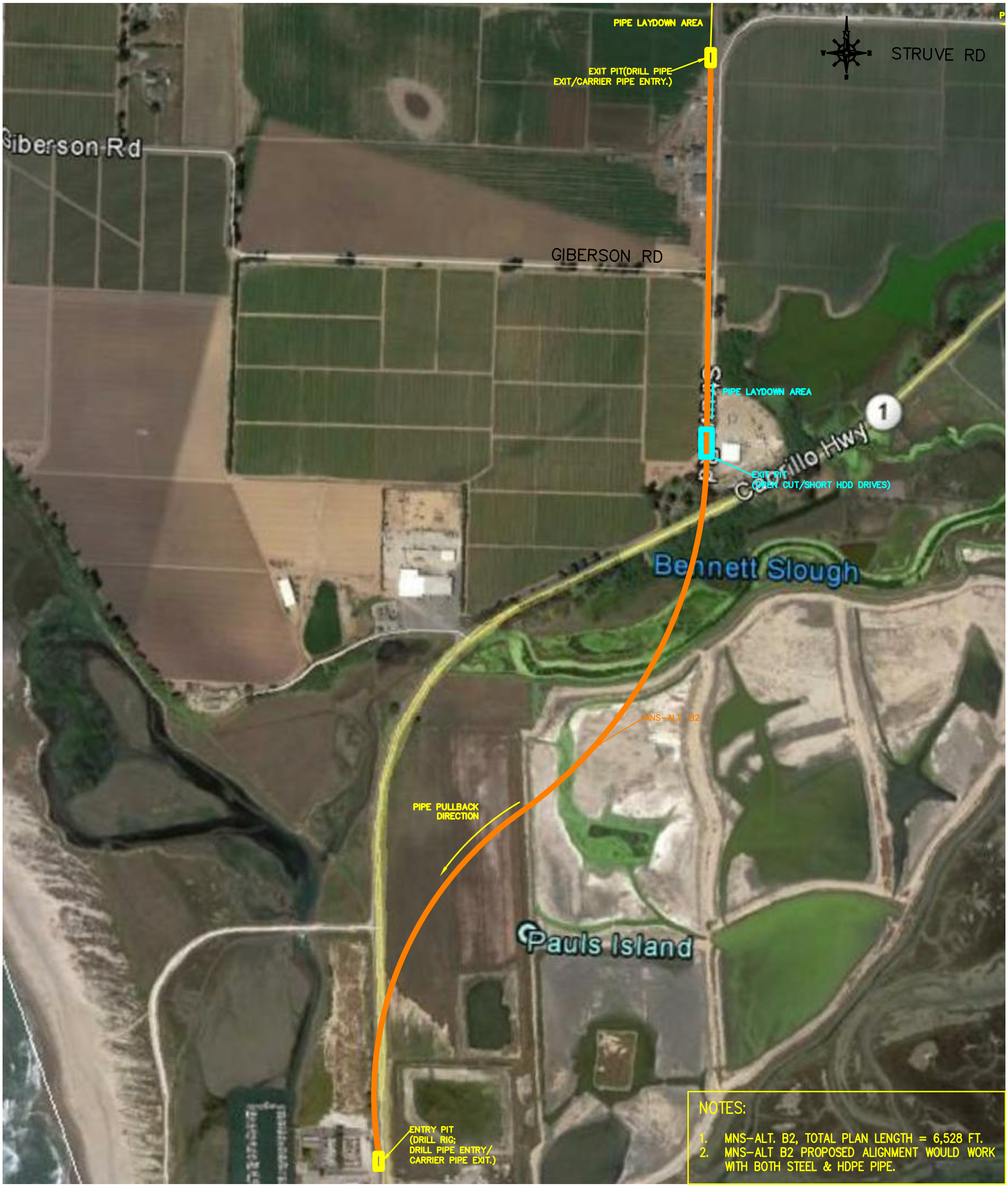

NOTES:

1. MNS-ALT. B2, TOTAL PLAN LENGTH = 6,528 FT.
2. MNS-ALT B2 PROPOSED ALIGNMENT WOULD WORK WITH BOTH STEEL & HDPE PIPE.

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DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: HDD – Alternative B2	
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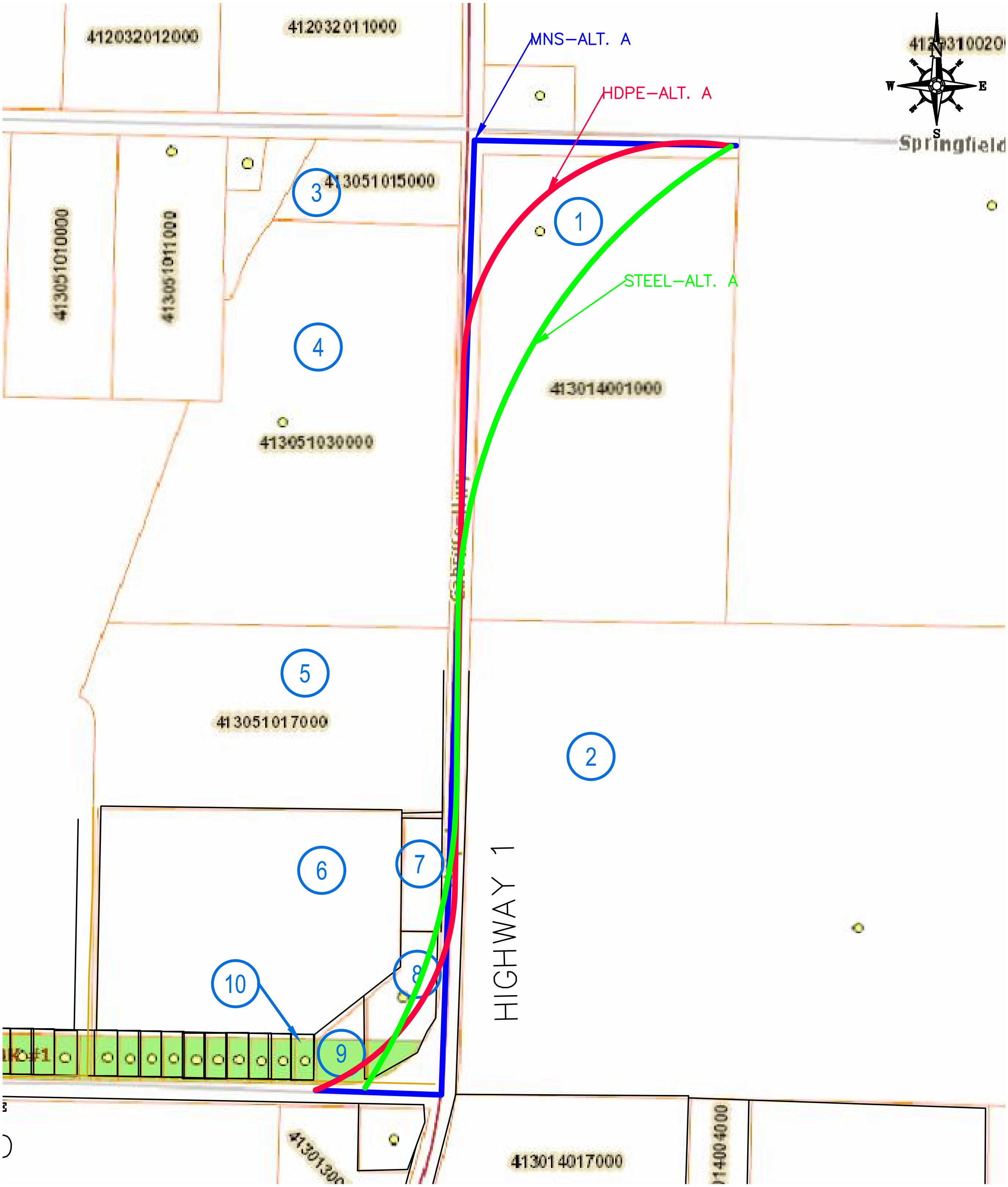
ATTACHMENT B

(MONTERREY COUNTY PARCEL MAPS)



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PROJECT:	Springfield Water System Improvements		
DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: Parcel Map – HDD Alternative A	
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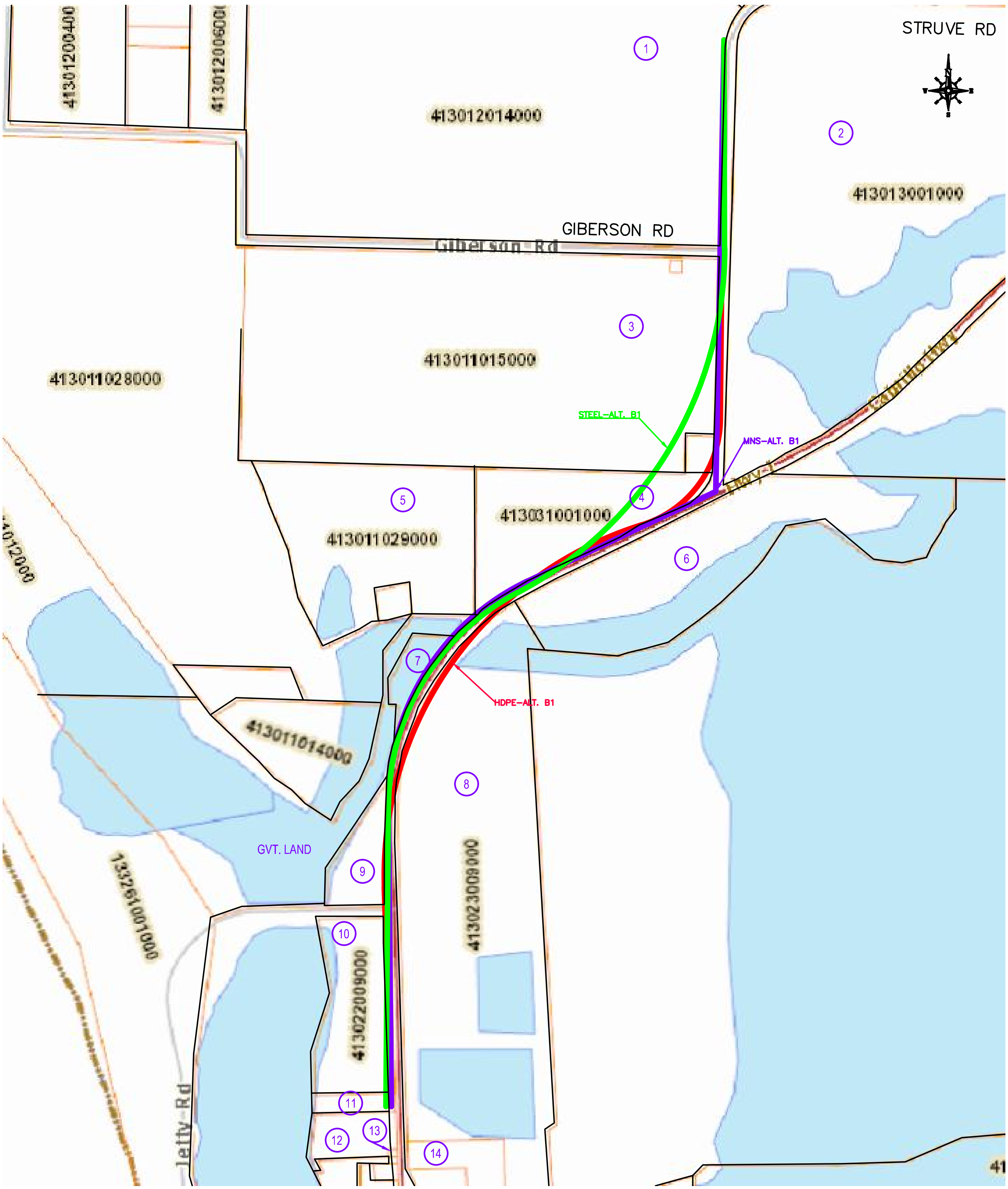

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PROJECT:	Springfield Water System Improvements				
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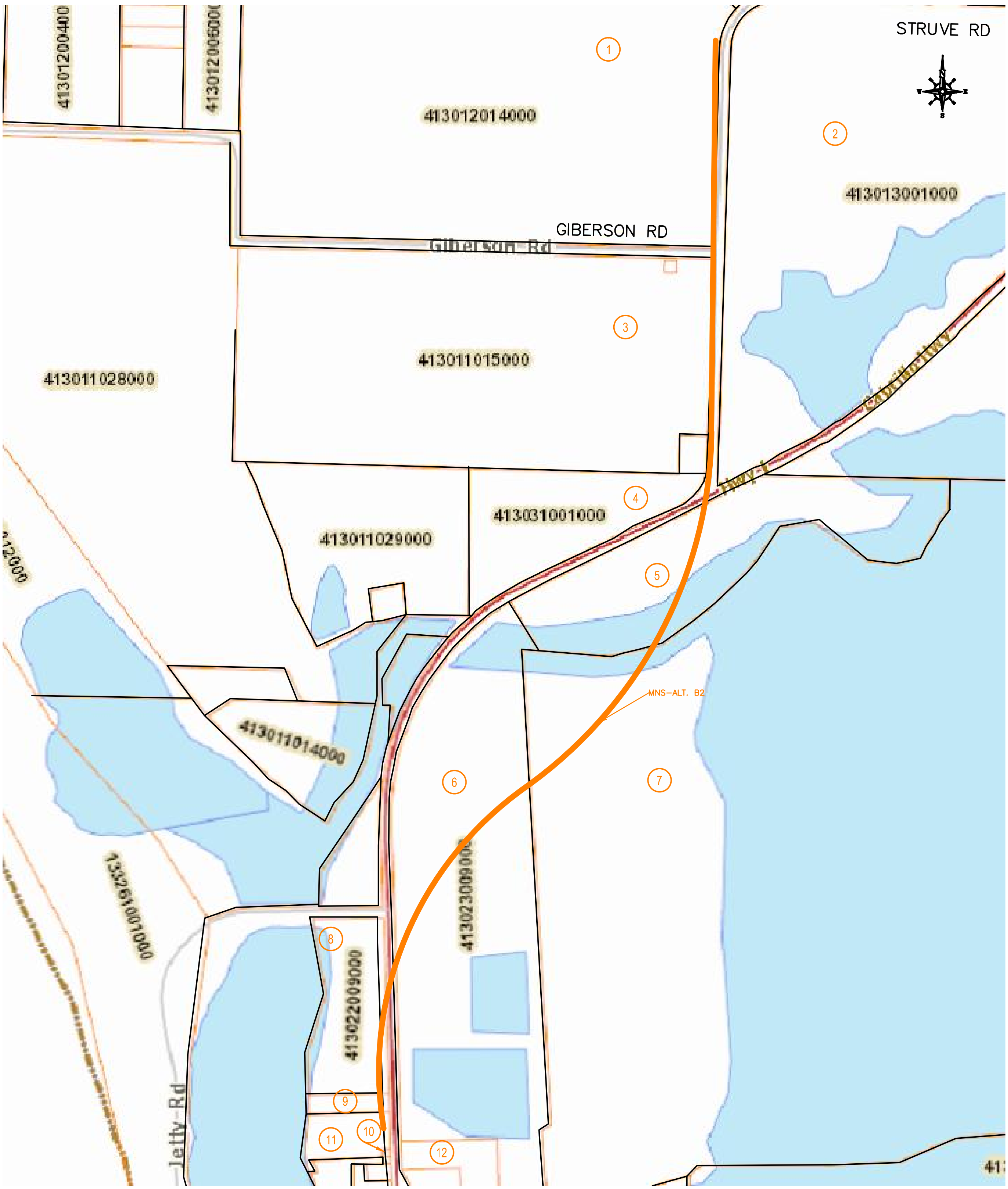

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PROJECT:	Springfield Water System Improvements				
DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE:	Parcels – HDD Alternative B2		
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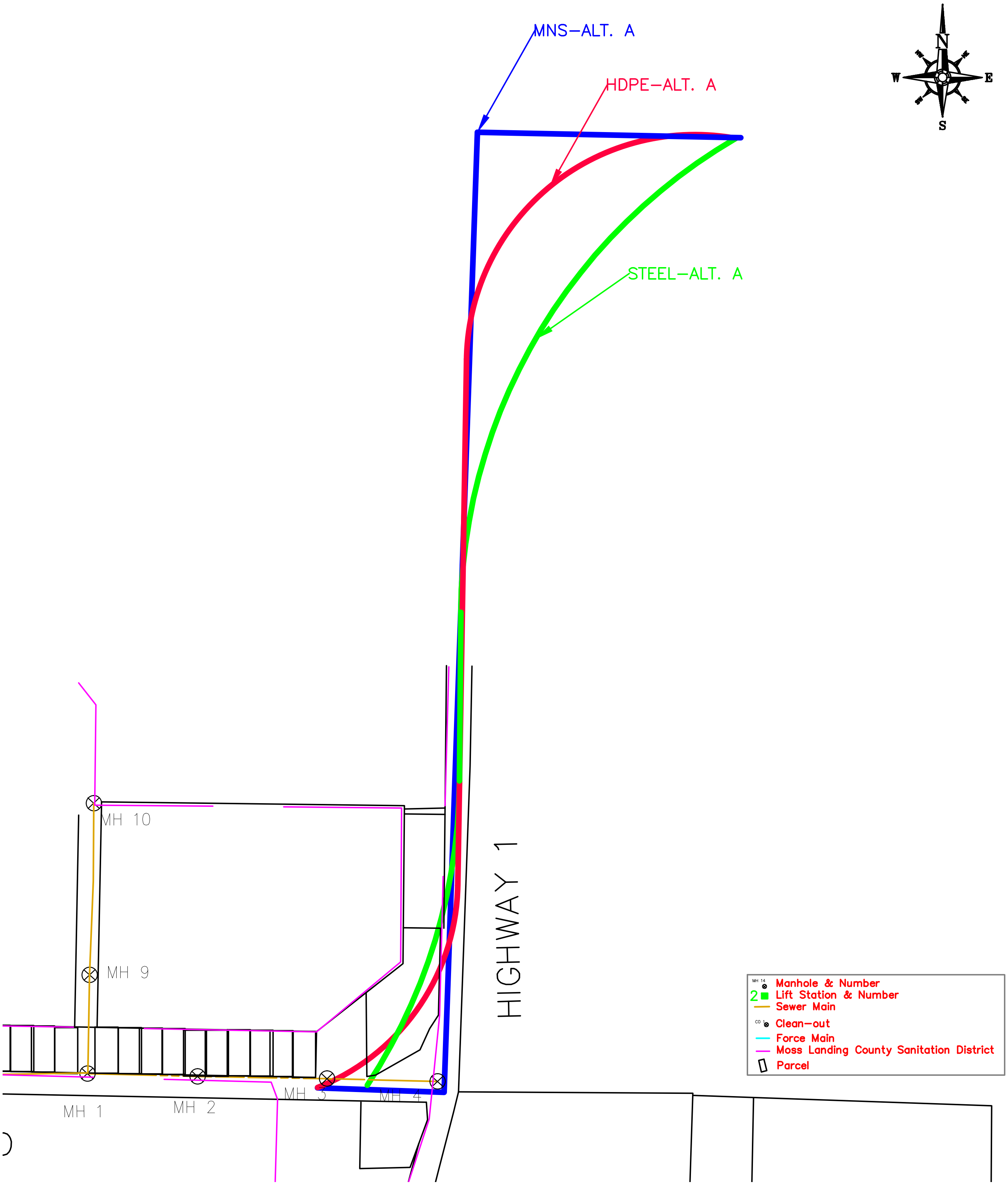
ATTACHMENT C

(UTILITY LOCATION MAPS)



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CLIENT/OWNER:	DESIGNER:	PROJECT:	Springfield Water System Improvements		
MNS ENGINEERS INC	ALDEA SERVICES LLC 5301 Buckeystown Pike, Suite 425 Frederick, MD 21704 Phone (301)355-9703 Fax (301)355-9705 aldeaservices.com	DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: Utilities - HDD Alternative A	
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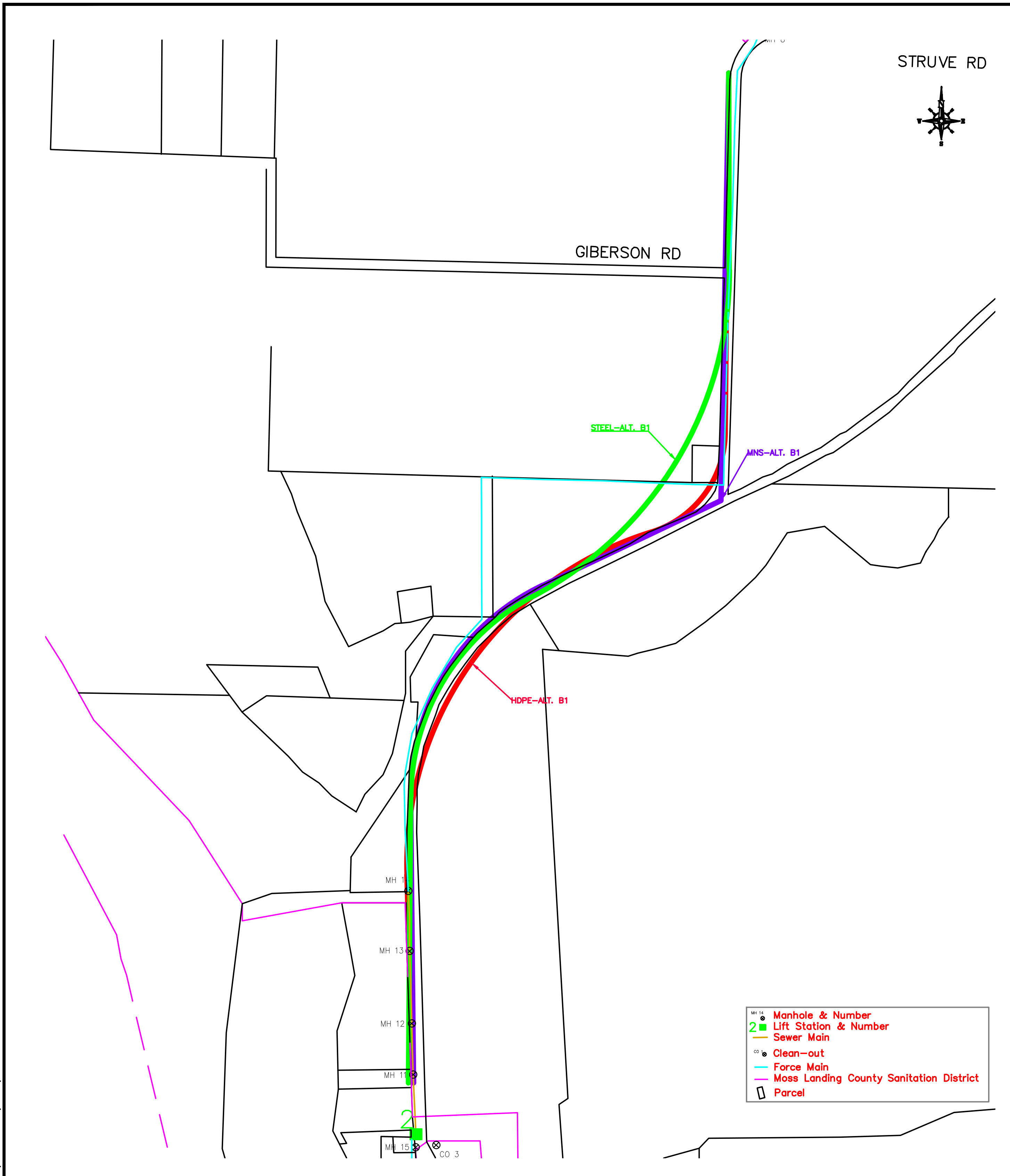

CLIENT/OWNER:	DESIGNER:	PROJECT:	Springfield Water System Improvements		
MNS ENGINEERS INC	ALDEA SERVICES LLC 5301 Buckeystown Pike, Suite 425 Frederick, MD 21704 Phone (301)355-9703 Fax (301)355-9705 aldeaservices.com	DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: Utilities – HDD Alternative B1	
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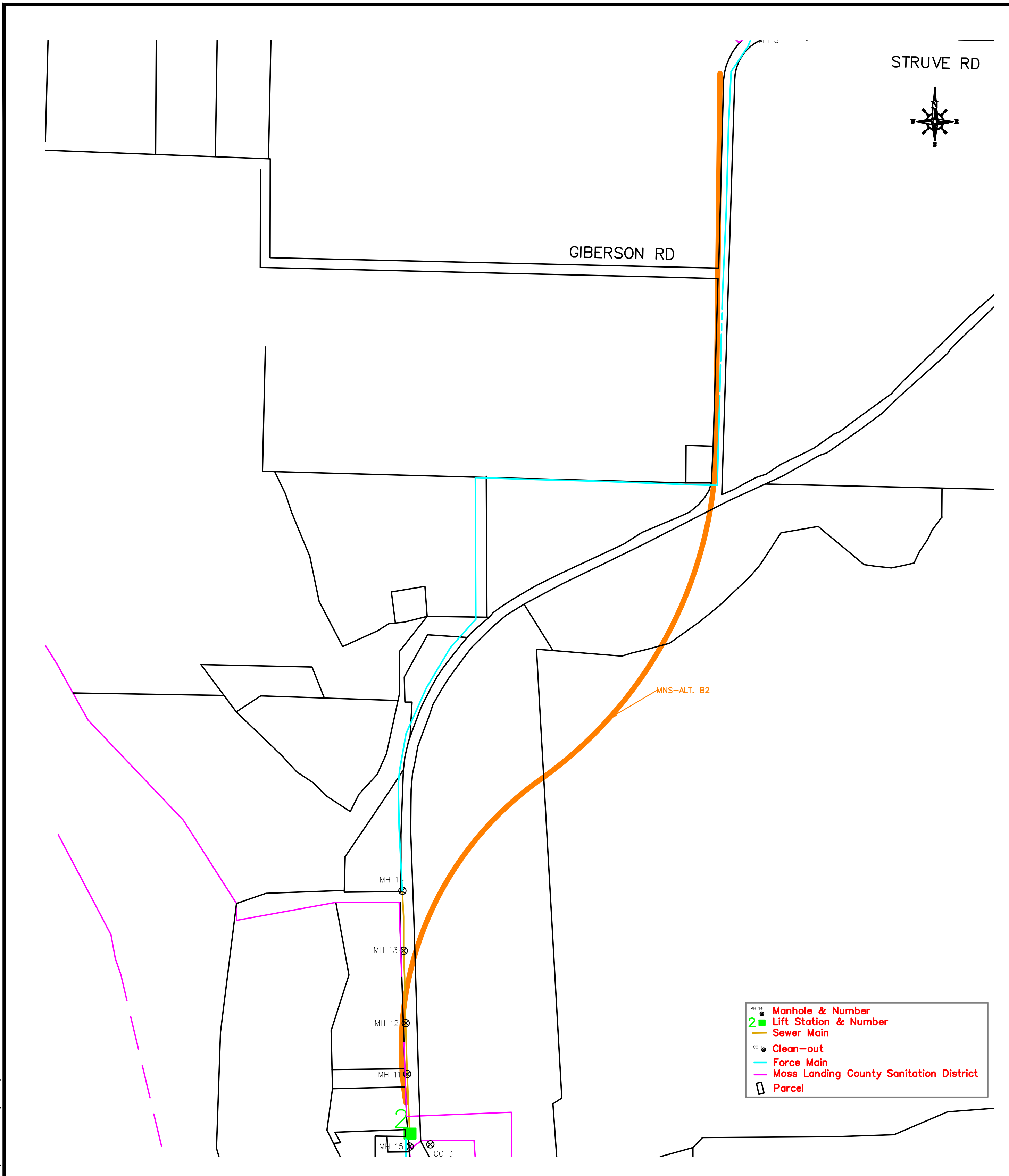

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PROJECT: Springfield Water System Improvements

DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: Utilities – HDD Alternative B2	
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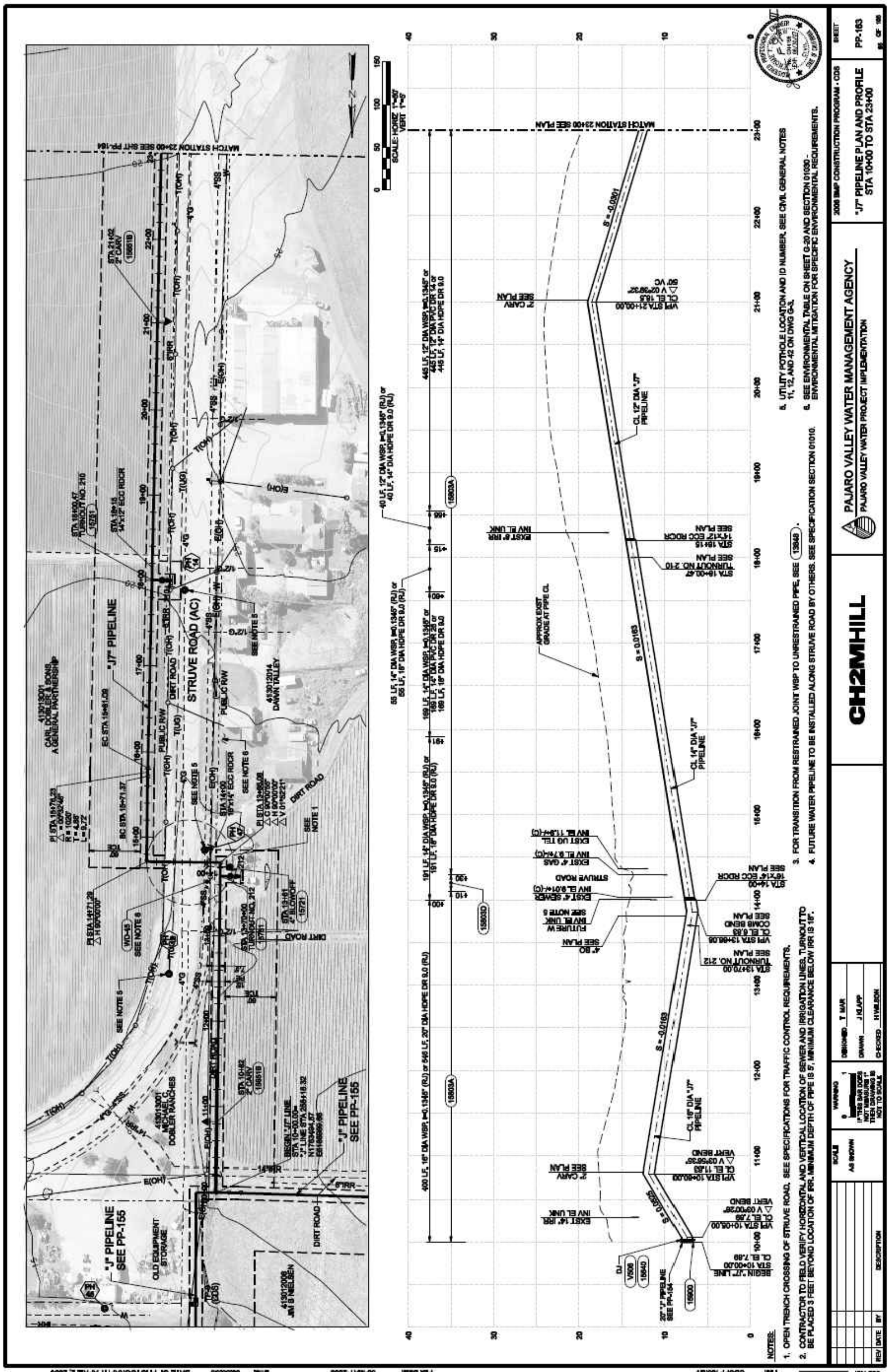

NOTES:
1. Plan & Profile image of existing "J7" Sewer along Struve Rd provided by MNS

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MNS ENGINEERS INC	ALDEA SERVICES LLC 5301 Buckeystown Pike, Suite 425 Frederick, MD 21704 Phone (301)355-9703 Fax (301)355-9705 aldeaservices.com	DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: "J7" Water Pipeline
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		SCALE:	DATE: 11/11/15	FILE NAME: XX / SHEET 1 OF 2

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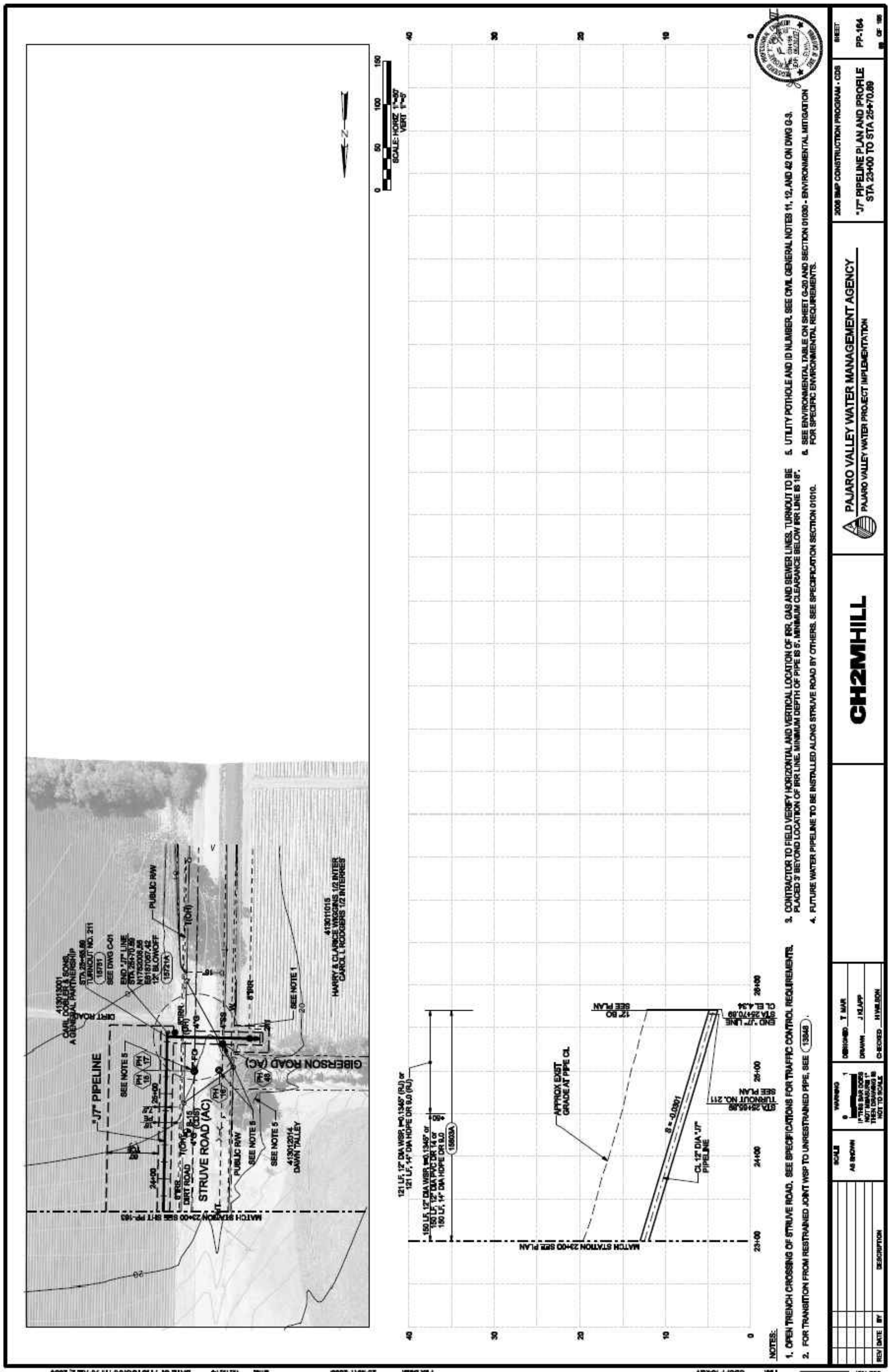

NOTES:
1. Plan & Profile image of existing "J7" Sewer along Struve Rd provided by MNS

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MNS ENGINEERS INC	ALDEA SERVICES LLC 5301 Buckeystown Pike, Suite 425 Frederick, MD 21704 Phone (301)355-9703 Fax (301)355-9705 aldeaservices.com	DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: "J7" Water Pipeline	
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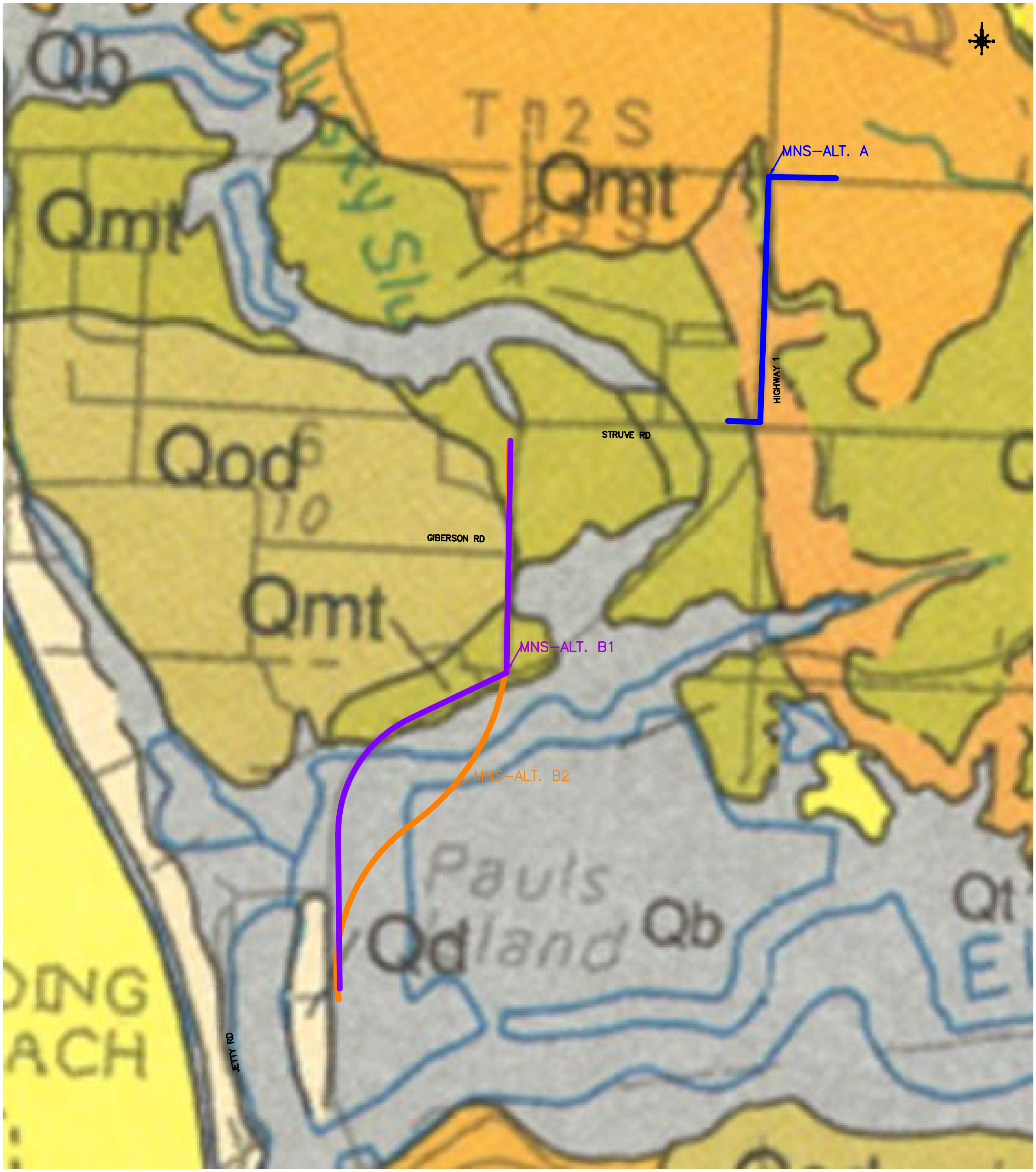
ATTACHMENT D

(GEOLOGICAL MAP & INFORMATION EXCERPTS)



NOTES:

1. Map above excerpted from Geologic Map of the Monterey 30'x 60' Quadrangle and Adjacent Areas", Regional Geologic Map Series, 1:100,000 Scale, published by the California Department of Conservation, California Geological Survey , and dated 2002.

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		DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: Geologic Map of Monterey
		DRAWN BY: GM	APPROVED BY: XX	DRAWING NO: 10	REV:
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NOTES:

1. Legend above excerpted from Geologic Map of the Monterey 30' x 60' Quadrangle and Adjacent Areas", Regional Geologic Map Series, 1:100,000 Scale, published by the California Department of Conservation, California Geological Survey , and dated 2002.

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PROJECT:	Springfield Water System Improvements		
DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: Geologic Map of Monterey – Legend	
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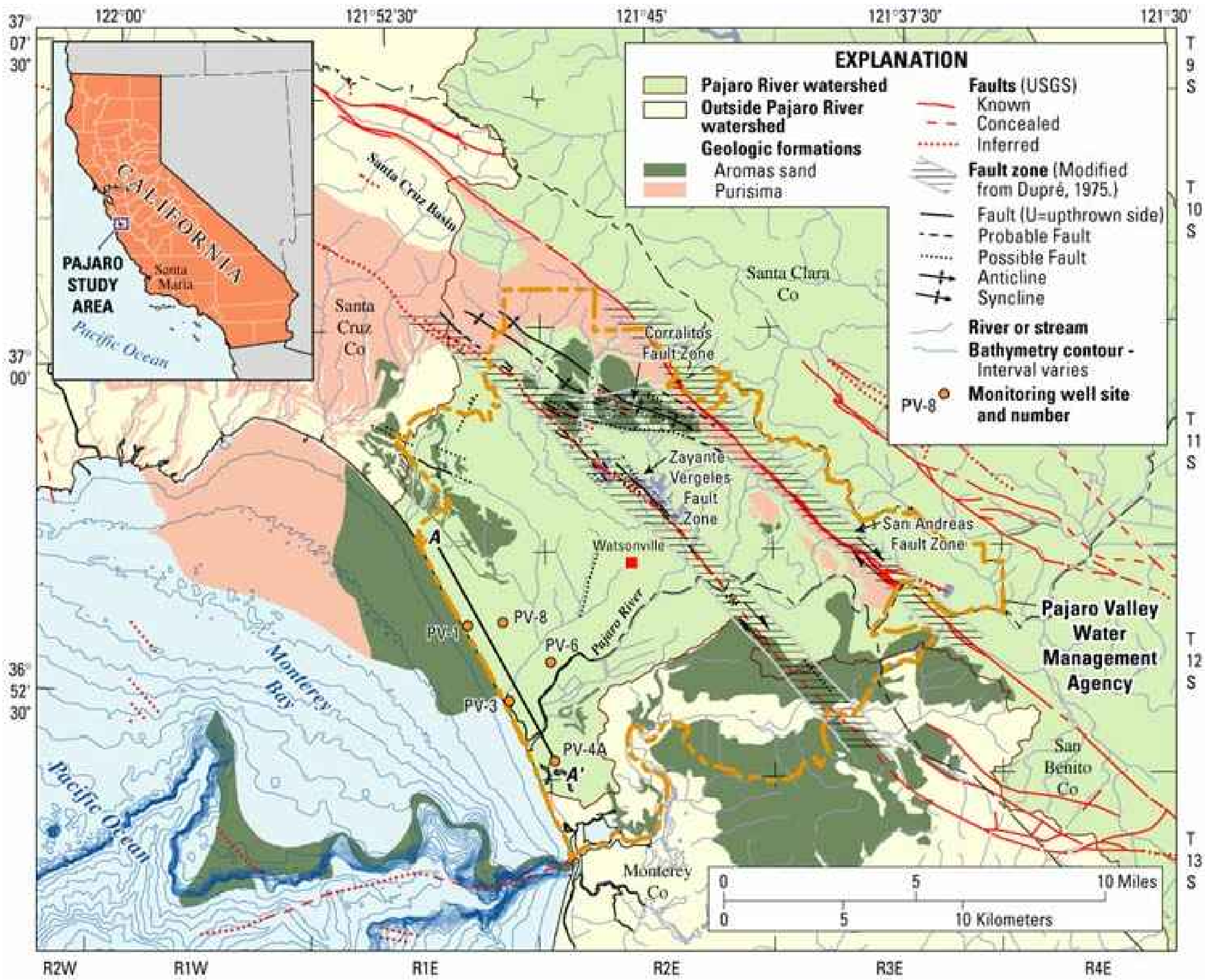

NOTES:

1. Geological plan excerpted from the USGS and Pajaro Valley Water Management Agency "Geohydrology of Recharge and Seawater Intrusion in the Pajaro Valley, Santa Cruz and Monterey Counties, California".

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PROJECT:	Springfield Water System Improvements				
DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: Pajaro Valley Geologic Plan			
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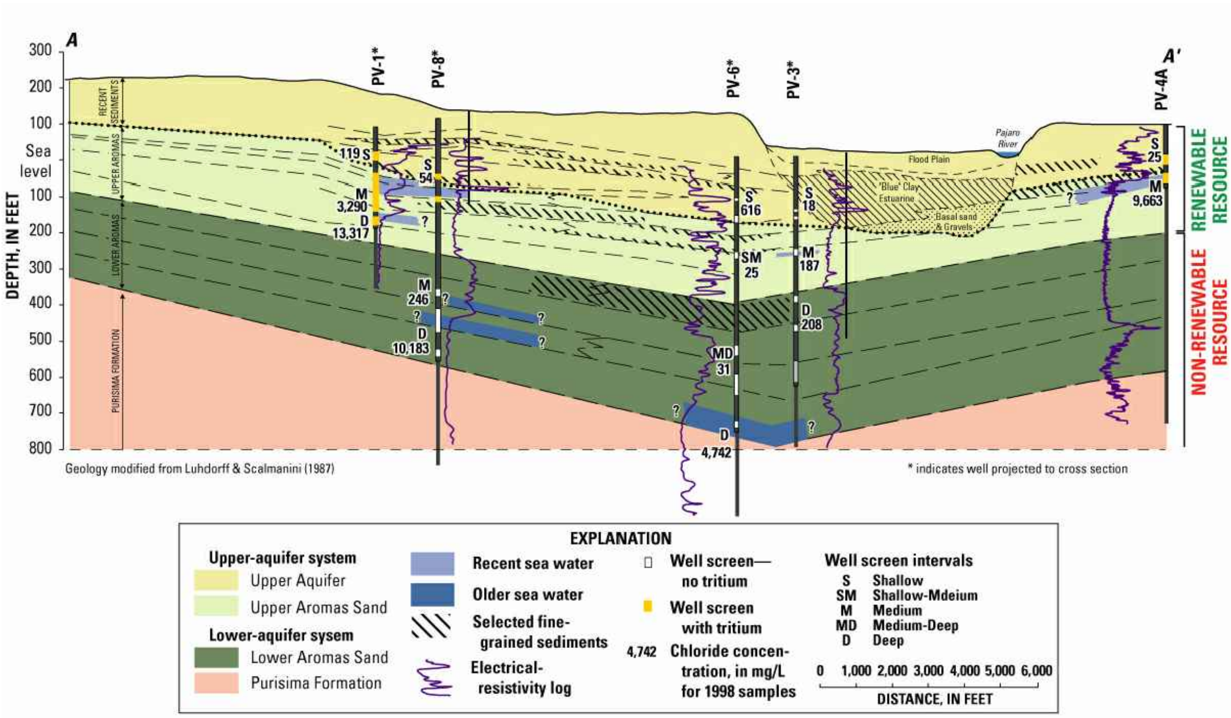

NOTES:

1. Geological profile excerpted from the USGS and Pajaro Valley Water Management Agency "Geohydrology of Recharge and Seawater Intrusion in the Pajaro Valley, Santa Cruz and Monterey Counties, California".

CLIENT/OWNER:	DESIGNER:	PROJECT: Springfield Water System Improvements		
MNS ENGINEERS INC	ALDEA SERVICES LLC 5301 Buckeystown Pike, Suite 425 Frederick, MD 21704 Phone (301)355-9703 Fax (301)355-9705 aldeaservices.com	DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: Pajaro Valley Geologic – Profile A–A'
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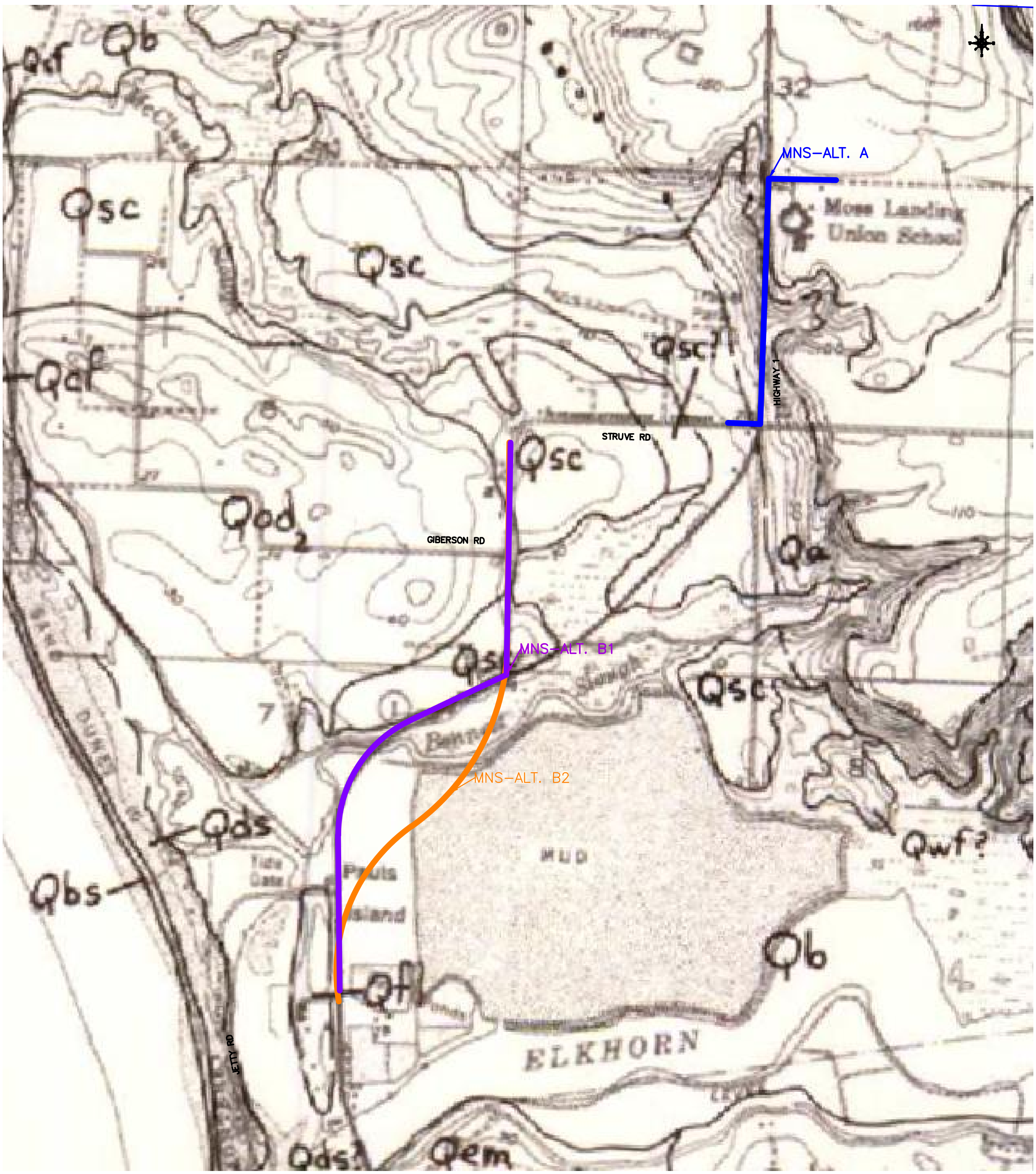

NOTES:
1. Geologic Map above excerpted from Maps Showing Geology and Liquifaction Potential of Northern Monterey and Southern Santa Cruz Counties, California", published by USGS, dated 1980

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DESCRIPTION OF GEOLOGIC UNITS

Qem — EOLIAN DEPOSITS OF MANRESA BEACH——Weakly to moderately consolidated, moderately well sorted silt and sand deposited in extensive coastal dune fields. Locally grades conformably into underlying coastal terrace deposits of Santa Cruz; elsewhere overlies fluvial facies of terrace deposits of Watsonville. Upper 3—6 m is indurated owing to clay and iron oxide cementation in weathered zone. Permeability and porosity are moderate except in soil zones, where they are generally low. Extensive erosion likely where lower unconsolidated sand exposed to a free face. Relatively low susceptibility to flooding and for liquefaction

Qa — AROMAS SAND (Pleistocene)——Heterogeneous sequence of mainly eolian and fluvial sand, silt, clay, and gravel. Slight angular conformities present throughout the unit; older deposits more complexly folded and faulted than younger deposits. Total thickness may be greater than 250 m. Characterized by maximally developed soils, most with duripans. Low susceptibility to flooding and for liquefaction. Unit locally divided into:

Qae — Eolian deposits——Moderately well sorted sand as much as 60 m thick that contains no intervening fluvial deposits. Several sequences of eolian deposits may be present, each separated by paleosols. The upper 3—6 m of each dune sequence is oxidized and relatively well indurated, and all primary sedimentary structures have been destroyed by weathering; the lower parts of each dune sequence may be relatively unconsolidated below the weathering zone. Porosity and permeability, as well as degree of consolidation, are thus a function of the relative position within the weathering profile. Perched water tables may be present where eolian deposits overlie less permeable fluvial deposits; springs may develop in these areas, and slumps and landslides may develop as well. Severe erosion may occur within this unit when the weathering zone and its protective duripan are breached and the relatively unconsolidated sands are exposed, as evidenced by the extensive colluvial slopes that mantle much of the outcrop area

Qaf — Fluvial deposits——Semiconsolidated, moderately to poorly sorted silty clay, silt, sand, and gravel deposited by meandering and braided streams as well as alluvial fans. Includes beds of relatively well sorted gravel ranging from 3 to 30 m thick that are locally important as aquifers in the region. Locally includes buried soils high in expansive clays, which act as aquicludes. Landslides are common in this unit

Qsc — COASTAL TERRACE DEPOSITS OF SANTA CRUZ——Semiconsolidated, generally well worked sand with a few thin, relatively continuous layers of gravel. Deposited in nearshore high—energy marine environment. Locally grades upward into eolian deposits of Manresa Beach. Thickness variable; maximum approcimately 13 m. Unit thins to north where it ranges from 3 to 6 m thick. As mapped, locally includes many small areas of fluvial and colluvial silt, sand, and gravel, especially at or near old wave—cut cliffsjand some areas of eolian sand. Moderate permeability and porosity. May contain perched water table where underlain by relatively impermeable deposits. Relatively low susceptibility to flooding; low liquefaction susceptibility

Qfl — ARTIFICIAL FILL——Heterogeneous mixture of artificially deposited fill material ranging from well—compacted sand and silt to poorly compacted sediment high in organic content; only locally delineated. Liquefaction susceptibility ranges from high to low, depending on degree of compaction

OLDER COASTAL DUNES——Weakly consolidated, well—sorted sand deposited during at least two periods in the Fort Ord area. Similar in origin and in part correlative with the eolian deposits of Sunset Beach. Physical properties and engineering characteristics similar to eolian deposits of Sunset Beach. Characterized by poorly or medially developed soils. Mapped separately as:

Qod1 — Younger dunes

Qod2 — Older dunes

Qb — BASIN DEPOSITS——Unconsolidated plastic clay and silty clay contain much organic material. Locally contain interbedded thin layers of silt and silty sand. Deposited in a variety of environments including estuaries, lagoons, tidal flats, marsh—filled sloughs, flood basins, and lakes. Thickness highly variable; may be as much as 30 m thick underlying some sloughs. High susceptibility to flooding. Moderate to high liquefaction susceptibility except where water table is more than 10 m below the surface. Highly expansive soils develop on these deposits

Qeu — COASTAL TERRACE DEPOSITS, UNDIFFERENTIATED——Semiconsolidated, moderately well sorted marine sand containing thin, discontinuous gravel—rich layers. May be overlain by poorly sorted fluvial and colluvial silt, sand, and gravel. Thickness variable; generally less than 6 m thick. May be relatively well indurated in upper part of weathered zone; capped by maximally developed soils, some with duripans. Moderate to low porosity and permeability. Local perched water tables in areas where marine sand overlies relatively impervious deposits. Low susceptibility to flooding and for liquefaction

NOTES:
1. Geologic Legend above excerpted from Maps Showing Geology and Liquifaction Potential of Northern Monterey and Southern Santa Cruz Counties, California", published by USGS, dated 1980

CLIENT/OWNER: MNS ENGINEERS INC	DESIGNER: ALDEA SERVICES LLC, 5301 Buckeystown Pike, Suite 425, Frederick, MD 21704, Phone (301)355-9703 Fax (301)355-9705, aldeaservices.com	PROJECT: Springfield Water System Improvements			
		DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: Geology and Liquefaction Legend	
		DRAWN BY: GM	APPROVED BY: XX	DRAWING NO: 15	REV:
		SCALE:	DATE: 10/23/15	FILE NAME: XX	SHEET 1 OF 1

P:\1076.00_SRGFLDWTRSYSIMP\DRAWINGS\DWG\SPRINGFIELD - HDD ALTERNATIVES.DWG

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California
Well Completion Report
Refer to Instruction Pamphlet
No. e0119536

Page 1 of 1
Owner's Well Number 71081-1
Date Work Began 07/22/2008 Date Work Ended 7/25/2008
Local Permit Agency Monterey County Division of Environmental Health
Permit Number 07-11219 Permit Date 10/18/07

DWR Use Only – Do Not Fill In
State Well Number/Site Number
N Latitude W Longitude
APN/TRS/Other

Geologic Log

Orientation ⦿ Vertical ○ Horizontal ○ Angle Specify ______
Drilling Method Mud Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	30	Red sand with clay
30	50	White clay
50	70	Gravel and sand
70	90	Red sand
90	110	Sand and Brown silty clay
110	295	Red sand
295	335	Blue clay and sand
335	360	Blue clay
360	450	Red sand
450	470	Red sand and clay
470	630	Red sand

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Total Depth of Boring 630 Feet
Total Depth of Completed Well 630 Feet

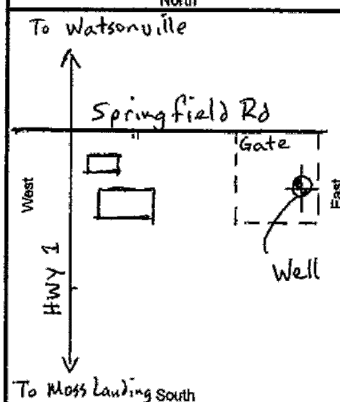
Well Owner

Name Pajaro Sunny Mesa CSD
Mailing Address 136 San Juan Road
City Royal Oaks State CA Zip 95076

Well Location

Address 1815 Highway 1
City Moss Landing County Monterey
Latitude ____ Deg. Min. Sec. N Longitude ____ Deg. Min. Sec. W
Datum ____ Decimal Lat. ____ Decimal Long. ____
APN Book 413 Page 014 Parcel 001
Township ____ Range ____ Section ____

Location Sketch
(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

⦿ New Well
○ Modification/Repair
○ Deepen
○ Other ______
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
⦿ Test Well
○ Vapor Extraction
○ Other ______

Water Level and Yield of Completed Well

Depth to first water ______ (Feet below surface)
Depth to Static Water Level ______ (Feet) Date Measured ______
Estimated Yield * ______ (GPM) Test Type ______
Test Length ______ (Hours) Total Drawdown ______ (Feet)
*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size If Any (Inches)

Annular Material

Depth from Surface Feet to Feet	Fill	Description

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other ______
Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief
Name Maggiora Bros. Drilling, Inc.
Person, Firm or Corporation
595 Airport Blvd. Watsonville CA 95076
Address City State Zip
Signed [signature] 10-27-10 249957
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

NOTES:
1. Appendix 2 – C Springfield test Well completion report in PDF format (provided by MNS)

P:\1076.00_SRGFLDWTRSYSIMP\DRAWINGS\DWG\SPRINGFIELD – HDD ALTERNATIVES.DWG

CLIENT/OWNER:	DESIGNER:	PROJECT: Springfield Water System Improvements		
MNS ENGINEERS INC	ALDEA SERVICES LLC, 5301 Buckeystown Pike, Suite 425, Frederick, MD 21704, Phone (301)355-9703 Fax (301)355-9705, aldeaservices.com	DESIGNED BY: XX	CHECKED BY: PH	DRAWING TITLE: Geology and Liquefaction Legend
		DRAWN BY: GM	APPROVED BY: XX	DRAWING NO: 16	REV:
		SCALE:	DATE: 10/23/15	FILE NAME: XX	SHEET 1 OF 1

Appendix C – Equipment Information

Well Pumps

TECHNICAL BROCHURE
B50-320L R7

50L, 65L, 95L, 120L, 160L, 250L, 320L

6" Stainless Steel Submersible Pumps

60 HZ HIGH CAPACITY – FOR 6" AND LARGER WELLS

GOULDS WATER TECHNOLOGY
a xylem brand

FEATURES

Powered for Continuous Operation: All ratings are within the working limits of the motor. Pump can be operated continuously.

New Design Features: Cast 304 SS discharge head and motor adapter.

Field Serviceable: Easy to install and service. All parts easily dismantled if field service is ever necessary.

Diverse Application: Designed for commercial, municipal and agricultural water needs.

Stainless Steel Construction: Durable in most waters.

Bearings: Replaceable, silicon carbide bearings allow excellent abrasives handling and wear resistance.

Built-in Check Valve: Positive sealing, stainless steel check valve assembly incorporated into discharge head.

Impellers: New stainless steel impeller design provides improved efficiency.

Maximum Temperature: 140°F (60°C) for pump.

Four-Fluted Shaft Design: Four sided stainless steel shaft eliminates impeller keys and provides positive drive.

Coupling: Removable heavy duty stainless steel, splined coupling for maximum load-carrying capability.

Suction Strainer: Stainless steel strainer restricts gravel and other debris from entering the pump.

Cable Guard: Stainless steel cable guard surrounds and protects motor leads.

Fasteners: All fasteners are stainless steel.

CentriPro Motors: Designed to NEMA standards. Stainless steel casing resists corrosion. Water filled design provides a constant supply of lubrication. Hermetically sealed stator assures moisture free windings. Durable Kingsbury type thrust bearing absorbs all thrust. Replaceable motor lead assembly.

Certified to NSF/ANSI 61, Annex G.

SPECIFICATIONS

Model	Horsepower Range	Discharge Connection	Recommended GPM Operating Range	GPM at Best Efficiency	Minimum* Well Size	Rotation at Discharge End
50L	3 - 20	3" NPT	17 - 70	50	6" / 8" *	CCW
65L	3 - 40		20 - 90	65		
95L	5 - 40		25 - 130	90		
120L	5 - 50		40 - 170	120		
160L	3 - 60		50 - 240	160	6"	
250L	7.5 - 60		70 - 300	250		
320L	7.5 - 60	4" NPT	100 - 400	320		

* Minimum well size refers only to dimensional fit in a well, the specifier or installer must determine the minimum required well diameter that will insure an adequate supply of water to the pump and also properly cool the motor. See Water End Data Chart for specific diameter by model number.

AGENCY LISTINGS

NSF/ANSI 372 – Drinking Water System Components – Lead Content

CLASS 6853 01 - Low Lead Content Certification Program - - Plumbing Products

NSF/ANSI 61-G

Pump/Water End - Drinking Water System Components - Certified to NSF/ANSI 61, Annex G

"L" SERIES MATERIALS OF CONSTRUCTION

Ref. No.	Part Name	Material	Material Code
1	Discharge Head	Stainless steel	ASTM CF-8 (AISI 304 cast)
2	Check Valve Support	Stainless steel	ASTM CF-8 (AISI 304 cast)
3	Check Valve	Stainless steel	AISI 304 SS
4	Elastomers	Ethylene propylene	EPDM
5	Bolts and Screws	Stainless steel	AISI 304 SS
6	Shaft Sleeve and Bushing	Tungsten carbide	–
7	Thrust Bearing	PTFE+Graphite	–
8	Impeller	Stainless steel	AISI 304 SS
9	Diffuser	Stainless steel	AISI 304 SS
10	Spacer	Stainless steel	AISI 431 SS
11	Tie Rod	Stainless steel	AISI 304 SS
12	Cable Guard	Stainless steel	AISI 304 SS
13	Wear Rings	Technopolymer PPO	Engineered polymer
14	Strainer	Stainless steel	AISI 304 SS
15	Shaft	Stainless steel	AISI 431 SS
16	Shaft Coupling	Stainless steel	AISI 431 SS
17	Motor Adapter	Stainless steel	ASTM CF-8 (AISI 304 cast)

SYSTEM COMPONENTS

- **Pump/Water End:**
  - 50L-250L with 3" NPT discharge.
  - 320L with 4" NPT discharge.
  - 3 HP Water Ends Have 4" Motor Adapters
  - 5 & 7.5 HP Water Ends Have Either a 4" or 6" Motor Adapter (see Water End Data chart)
  - 10 HP and Larger Water Ends Have 6" Motor Adapters
- **Motor:**
  - 4" motor required for 3 HP and 5 HP pumps.
  - 4" or 6" motors can be used for 7.5 HP pumps.
  - 6" motor required for 10 HP and larger pumps.
- **Control Box:** Required for all single phase motors.
- **Magnetic Starter:** A magnetic starter with Class 10 overloads is required for all three phase units.

WATER ENDS AND MOTORS MUST BE ORDERED SEPARATELY AND ARE PACKAGED SEPARATELY.

ORDER NUMBER CODE

65 L 03

Pump Size/ Gallons per minute at Best Efficiency Point: 50, 65, 95, 120, 160, 250, 320

Pump Series: L

Horsepower Code = HP
03 = 3
05 = 5 (4" motor)
05-6 = 5 (6" motor)
07-4 = 7.5 (4" motor)
07 = 7.5 (6" motor)
10 = 10
15 = 15
20 = 20
25 = 25
30 = 30
40 = 40
50 = 50
60 = 60

WATER END (PUMP) DATA

Model	Order No.	No. Stages	Min. HP Required	Required Motor Dia.	Dimensions & Weights					
					Length		Diameter		Weight	
					in.	mm	in.	mm	lbs.	kg.
50L	50L03	4	3	4	20.6	522	5.59	142	25	11
	50L05R**	7	5	4/6	25.8	656	5.67	144	35	16
	50L05**	8	5		27.8	706			40	18
	50L07**	11	7.5		33.3	844			49	22
	50L10	15	10	6	40.2	1020			57	26
	50L15	23	15		56.9	1446			82	37
	50L20	28	20		65.8	1670			94	43
65L	65L03	3	3	4	18.6	472	5.59	142	26	12
	65L05**	5	5	4/6	22.2	564	5.67	144	31	14
	65L07**	7	7.5		25.8	656			35	16
	65L10	10	10	6	31.3	794			44	20
	65L15	16	15		42.1	1070			60	27
	65L20	21	20		53.0	1346			75	34
	65L25	27	25		63.9	1622			90	41
	65L30*	32	30		98.7	2508	6.97*	177	220	100
	65L40*	41	40		115.0	2922			253	115
95L	95L05**	3	5	4/6	18.6	472	5.59	142	26	12
	95L07**	5	7.5		22.2	564	5.67	144	31	14
	95L10	7	10	6	25.8	656			35	16
	95L15	10	15		31.3	794			44	20
	95L20	14	20		38.5	978			53	24
	95L25	17	25		43.9	1116			62	28
	95L30	21	30		53.0	1346			75	34
	95L40*	28	40		67.3	1710	6.97*	177	156	71
120L	120L05**	2	5	4/6	16.8	426	5.59	142	22	10
	120L07**	3	7.5		19.5	495	5.67	144	26	12
	120L10	5	10	6	24.9	633			33	15
	120L15	7	15		30.4	771			40	18
	120L20	10	20		38.5	978			51	23
	120L25	12	25		43.9	1116			57	26
	120L30	15	30		52.1	1323			68	31
	120L40	20	40		65.7	1668			86	39
	120L50*	24	50		80.9	2055	6.97*	177	179	81
160L	160L03	1	3	4	14.5	367	5.59	142	18	8
	160L05**	2	5	4/6	17.2	436	5.67	144	22	10
	160L07**	3	7.5		19.9	505			26	12
	160L10	4	10	6	22.6	574			31	14
	160L15	6	15		28.0	712			37	17
	160L20	8	20		33.5	850			44	20
	160L25	9	25		36.2	919			46	21
	160L30	11	30		41.6	1057			53	24
	160L40	15	40		52.5	1333			68	31
	160L50	18	50		60.6	1540			77	35
	160L60	20	60		65.7	1668			86	39
250L	250L07**	2	7.5	4/6	20.8	528	5.67	144	26	12
	250L10	3	10	6	25.3	643			33	15
	250L15	5	15		34.4	873			44	20
	250L20	7	20		43.4	1103			55	25
	250L25	8	25		48.0	1218			60	27
	250L30	9	30		52.5	1333			66	30
	250L40	13	40		70.6	1793			88	40
	250L50	16	50		84.2	2138			104	47
	250L60	19	60		97.8	2484			128	58
320L	320L07**	2	7.5	4/6	21.8	553	5.67	144	27	12
	320L15	4	15	6	30.8	783			38	17
	320L20	5	20		35.4	898			45	20
	320L25	6	25		39.9	1013			50	22
	320L30	8	30		49.0	1243			61	27
	320L40	11	40		62.5	1588			78	35
	320L50	13	50		71.6	1818			89	40
	320L60	16	60		84.2	2138			104	47

* Note pump diameter – high pressure models have an exterior casing and larger diameters, verify they will fit your well.

** Pumps can be configured to accomodate a 4" or 6" motor. See product order code.

MOTOR DATA

NOTE: 4" diameter motors are required for 3 and 5 HP "L" Series pumps.
4" or 6" diameter motors can be used for 7.5 HP "L" Series pumps. See Water End Data Chart.
6" diameter motors are required for 10 HP and larger "L" Series pumps.

CENTRIPRO 4" MOTORS

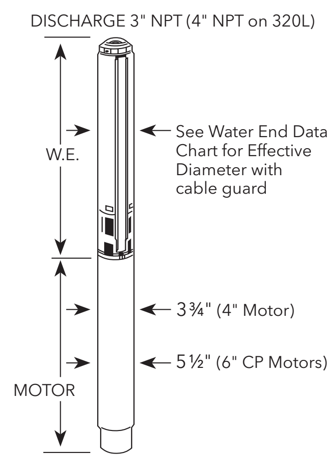
Single Phase Motors – Dimensions and Weights					
Motor Order No.	**HP**	**Motor Dia.**	**Volts**	**Length in. (mm)**	**Weight lbs. (Kg)**
M30412	3	4"	230	18.3 (466)	40 (18.1)
M50412	5			27.7 (703)	70 (31.8)
Three Phase Motors – Dimensions and Weights					
M30430	3	4"	200	15.3 (389)	32 (14.5)
M30432			230		
M30434			460		
M50430	5	4"	200	21.7 (550)	55 (24.9)
M50432			230		
M50434			460		
M75430	7.5	4"	200	27.7 (703)	70 (31.8)
M75432			230		
M75434			460		

CENTRIPRO 6" MOTORS

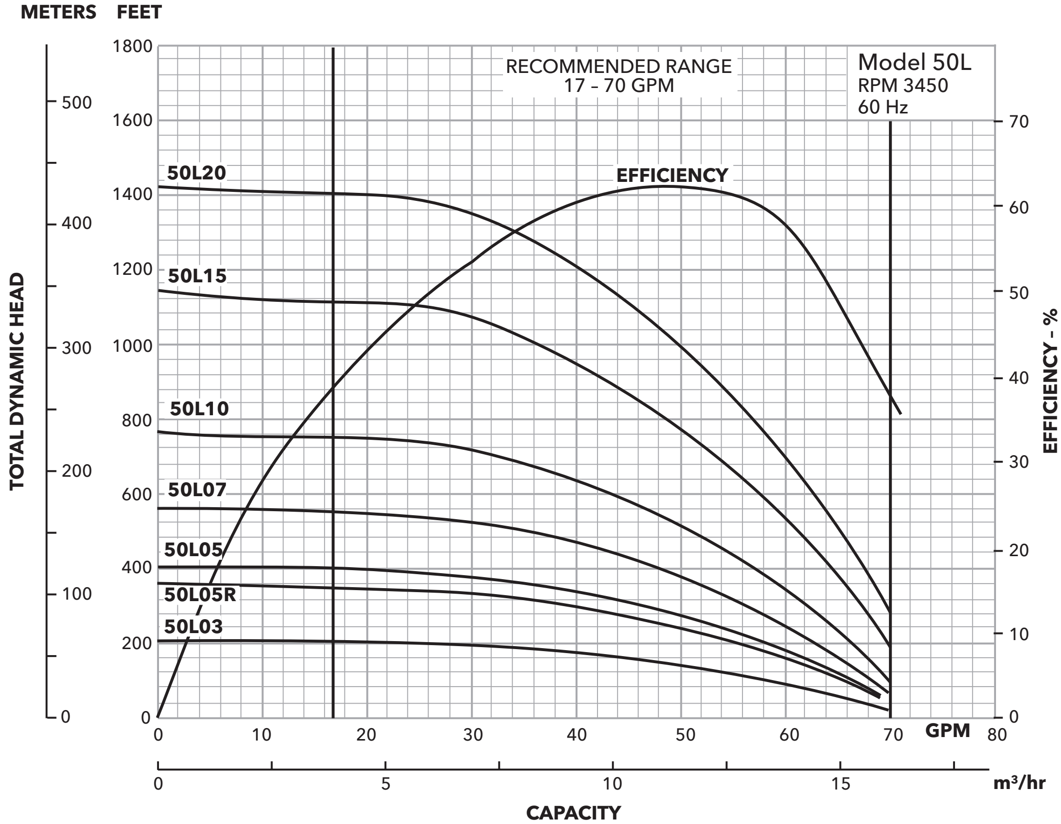
Single Phase Motors – Dimensions and Weights					
Motor Order No.	**HP**	**Motor Dia.**	**Volts**	**Length (inches)**	**Weight (lbs)**
6M071	7.5	6"	230	29.9	128
6M101	10	6"	230		
6M151	15	6"	230	33.5	148
Three Phase Motors – Dimensions and Weights					
6M078	7.5	6"	200	24.8	99
6M072			230		
6M074			460		
6M108	10		200	27.0	110
6M102			230		
6M104			460		
6M158	15		200	29.9	128
6M152			230		
6M154			460		
6M208	20		200	31.5	137
6M202			230		
6M204			460		
6M258	25		200	36.2	161
6M252			230		
6M254			460		
6M308	30		200	38.2	176
6M302			230		
6M304			460		
6M404	40			40.6	187
66M504	50			41.7	198
86M504	50	6" x 8"		46.4	353

CENTRIPRO FM-SERIES 6" MOTORS

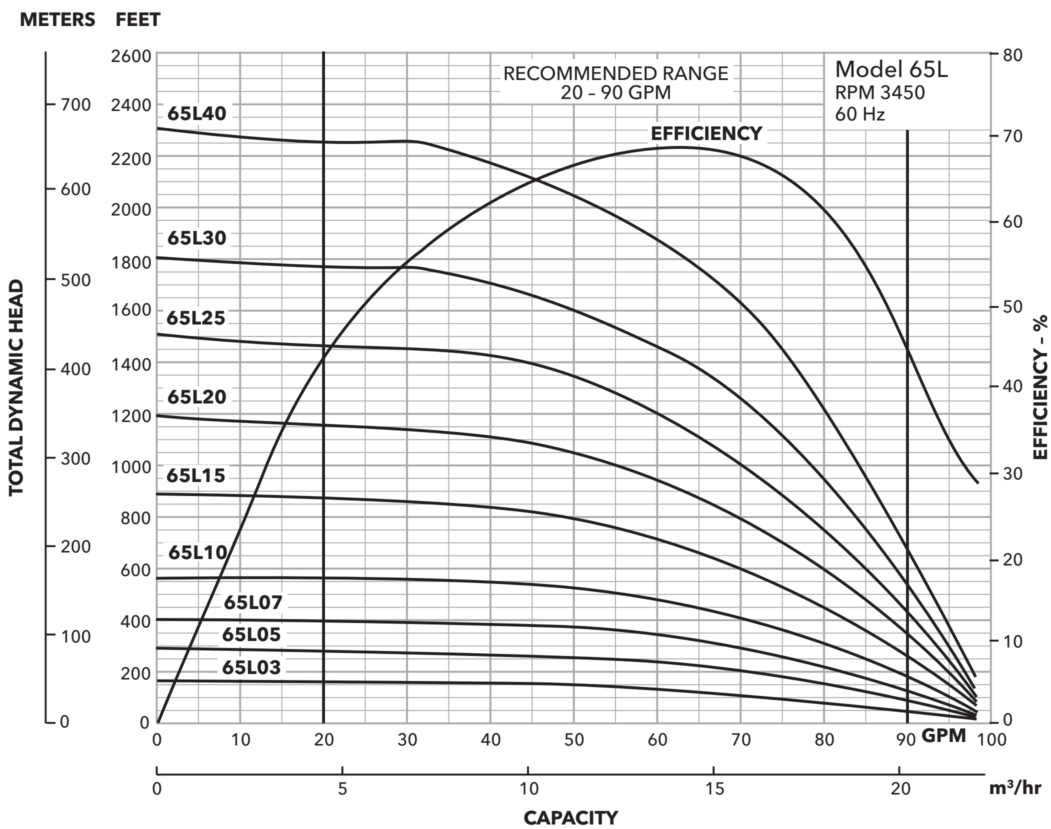
Single Phase Motors Dimensions and Weights					
Motor Order No.	**HP**	**Motor Dia.**	**Volts**	**Length (inches)**	**Weight (lbs)**
6F051	5	6"	230	25.6	143
6F071	7.5			28.1	161
6F101	10			30.3	161
6F151	15			32.8	181
Three Phase Motors Dimensions and Weights					
Motor Order No.	**HP**	**Motor Dia.**	**Volts**	**Length (inches)**	**Weight (lbs)**
6F058	5	6"	200-208	23.0	107.0
6F052			230		
6F054			460		
6F078	7.5		200-208	24.3	117.0
6F072			230		
6F074			460		
6F108	10		200-208	25.6	124.0
6F102			230		
6F104			460		
6F158	15		200-208	28.1	127.0
6F152			230		
6F154			460		
6F208	20		200-208	30.3	152.0
6F202			230		
6F204			460		
6F258	25		200-208	32.8	164.0
6F252			230		
6F254			460		
6F308	30		200-208	35.6	185.0
6F302			230		
6F304			460		
6F404	40		460	39.3	207.0
6F504	50		460	54.1	285.0



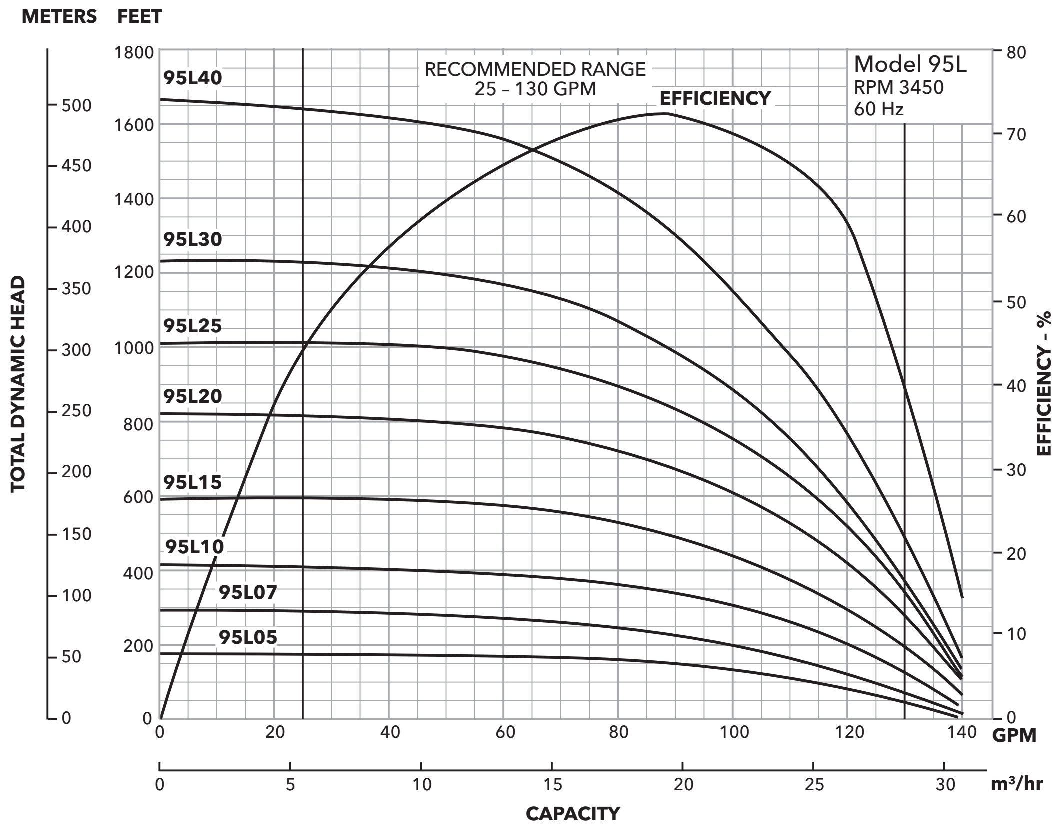
MODEL 50L



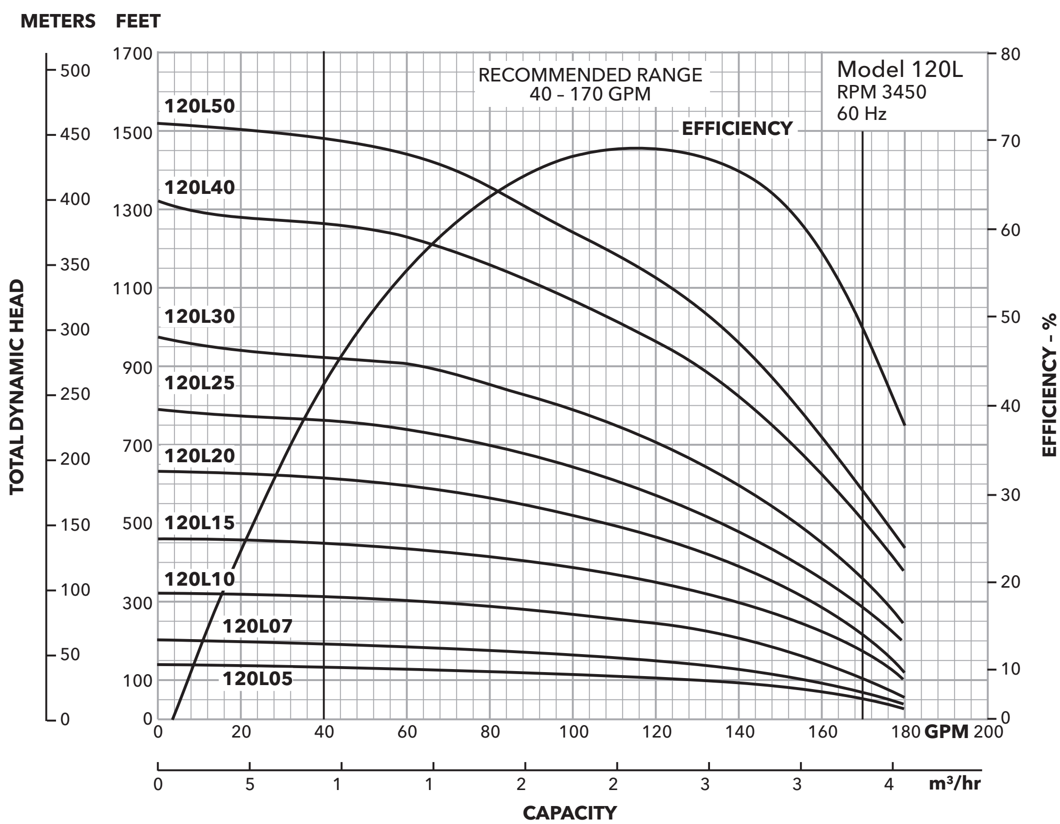
MODEL 65L



MODEL 95L



MODEL 120L



Duty/Fire Pumps

SUBMITTAL

Quote ID: 3302-191120-007:0:3 QTY: 1
VIS-WFTM 7CHC, 3 Stages
RF MACDONALD CO/FRESNO FRESNO

PERFORMANCE ON DESIGN CURVE AT 1765 RPM

	Shut Off	Design [2]	Run Out [5]		
Flow (USGPM)	0.0	200.0	338.0	**Best Efficiency**	80.40 % at 208.0 USgpm
TDH-Bowl (ft)	93.0	80.5	43.9	**Design Flow % BEP**	96.15 %
TDH-Disch Flange (ft)	91.1	77.6	39.5	**Pump Efficiency**	78.89 %
Bowl Efficiency (%)	-	80.30	60.10	**Overall Efficiency**	0.00 %
Guaranteed Bowl Efficiency (%)	-	76.28	-	**NOL Power**	6.2 Hp at 338.0 USgpm
Power (Hp)	2.6	5.1	6.2	**Guaranteed NOL Power**	6.7 Hp at 338.0 USgpm
Guaranteed Power (Hp)	-	5.5	-	**Max Power (NOL) at Max Trim**	7.4 Hp at 338.0 USgpm
NPSHr (ft) [1]	-	5.0	11.3	**Guaranteed Max Power (NOL) at Max Trim**	8.0 Hp at 338.0 USgpm
NPSH Margin (ft) [1]	-	41.3	35.0	**Specified NPSH Ratio**	1.1
Hydraulic Thrust(lb)	326.0	281.0	154.0	**Thrust Load Power Loss**	0.04070 Hp
Thrust (lb)	389.0	342.2	210.0	**Total Flow Derate Factor**	1.00
Pressure-Bowl (psi)	40.3	34.8	19.0	**Total Head Derate Factor**	1.00
Pressure-Disch Flange (psi)	39.4	33.6	17.1	**Total Efficiency Derate Factor**	1.00
Min Submergence (Inch) [3]	-	14.09	17.94	**Actual Submergence**	161.65 in
Friction Loss (ft) [4]	-	1.03	2.50	**Shaft Friction Power Loss**	-0.02 Hp
Lineshaft Elongation (Inch)	0.00000	0.00000	-	**Min Flow (MCSF)**	52.0 USgpm
Column Elongation (Inch)	0.00055	0.00055	-	**kWh per 1000 gal**	0.00000
Lateral (Inch)	0.12945	0.12945	-	**Impeller Running Clearance**	0.13 in

[1] at 1st impeller eye [2] rated values [3] from bottom of pump [4] from bowl to disch flange [5] based on user entered TDH

OPERATING CONDITIONS

Specified Flow	200.00 USgpm
Design TDH (Bowl)	80.5 ft
Rated Speed	1765 RPM
Atmospheric Pressure	14.70 psi
TPL	17.73 ft
Pumping Level	1.00 ft
NPSHa at 1st Impeller	46.3 ft
Well Diameter	14 inch [356mm] Casing

FLUID CHARACTERISTICS

Fluid	Water
Fluid Temperature	68.0 °F
Specific Gravity	1.0000
Viscosity	1.0017 cP
Vapor Pressure	0.3393 psi
Density	62 lbs/ft³

MATERIALS & DIMENSIONS

Bowl Data

Bowl Material	Cast Iron with Glass Enamel
Bowl Material Derate Factor	1.00
Impeller Material	316SS
Impeller Matl Derate Factor	1.00
Bowl Shaft Material	416SS
Impeller Attachment	Taper Lock
Taper Lock Material	416SS
Discharge Bowl Material	Cast Iron
Suction Type	Bowl
Bowl Bolting Material	316SS
Motor Adapter	8" [203.2 mm]
Motor Adapter Bearing	Bronze
Discharge Bowl Bearing	Bronze
Intermediate Bowl Bearing	Bronze
Impeller Trim	4.94 in
Max Impeller Trim	5.25 in

Bowl Data

Thrust K-Factor	3.5 lb/ft
Thrust K-Factor	3.5 Lb/Ft
Bowl Pressure Limit	350 psi
Shut Off Lateral	0.12945 in
Design Lateral	0.12945 in
Bowl Assembly Length (BL)	37.33 in
Bowl Shaft Diameter	1 3/16" [30.2 mm]
Impeller Balance	Dynamic Two Plane Balance
Bowl Wear Ring	416SS
Impeller Wear Ring	Not Included
Bowl Diameter (D)	7.50 in
Min Column Diameter	4 in
Max Column Diameter	6 in
Bowl Shaft Length	55.50 in
Bowl Shaft Power Limit	128.15 Hp

DO NOT USE FOR CONSTRUCTION UNLESS CERTIFIED

Certified By		
Project	Pajaro PCW Vertical Turbine VIC Submersible Pumps	
Tag		
PO Number		
Serial Number		

SUBMITTAL

Quote ID: 3302-191120-007:0:3 QTY: 1
VIS-WFTM 7CHC, 3 Stages
RF MACDONALD CO/FRESNO FRESNO

Bowl Specials

Column Data

Column Type	Threaded
Column Diameter	4" [102mm]
Column Pipe Material	Carbon Steel
Max Column Section Length	120 in

Column Specials

Head Data

Well Diameter	14 inch [356mm] Casing
Discharge Elbow Material	Carbon Steel
Head Flanged Rating	150 # Flange
Well Head Size	4" [102mm]
Sanitary Well Seal	Yes

Head Specials

Includes Power Cable Sealing Design

Motor Data

Driver Type	Submersible
Manufacturer	Hitachi
HP Rating	7.5 Hp
Speed [Poles]	1800 rpm [4 pole]
Voltage	460 V
Phase / Frequency	3 PH / 60 Hz
Efficiency / Config	Standard
Motor Adapter	8" [203.2 mm]
Motor Flange	8 in
ML [Motor Length]	37.40 in
MD [Motor Diameter]	8.00 in
SF / Insulation**	1.15 Y
Motor Provided By	Xylem
Motor Mounted By	Customer
Motor Part Number	S11931H
Driver Size Criteria	Max power on design curve (NOL)
Allow Service Factor	No

Motor Specials

SS Motor Shroud

Coating Data

Bowl OD	Tnemec 141 (NSF approved): Expoxy applied at 16 mils min
Column ID	Tnemec 141 (NSF approved): Expoxy applied at 16 mils min
Column OD	Tnemec 141 (NSF approved): Expoxy applied at 16 mils min
Can ID	Not Included
Can OD	Not Included
Head ID	Tnemec 141 (NSF approved): Expoxy applied at 16 mils min
Head OD	Tnemec 141 (NSF approved): Expoxy applied at 16 mils min
Steel Sub Base	Not Included

Testing Data

Performance Testing	Bowl Assembly Only Non-Witness Lab Motor
Acceptance Grade	2B
Hydrostatic Testing	Bowl Assembly Non-Witness

Miscellaneous Specials

Weight Data

Total Bowl Weight	136 lbs
Unit Bowl Weight	80 lbs / 28 lbs
Total Column Weight	119 lbs
Unit Column Weight	11 lbs
Head Weight	**Refer to Factory**
Motor Weight	364 lbs
Total Weight	**Refer to Factory**
Total Rotating Weight	50 lbs

INFO, WARNING & ERROR MESSAGES

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BaseValue	Invalid	BaseValue is invalid
	Invalid	is invalid
	Warning	Dimensions could not be found for one or more components, please override dimensions that show 9999.0 with the correct values.

Our offer does not include specific review and incorporation of any Statutory or Regulatory Requirements and the offer is limited to the requirements of the design specifications. Should any Statutory or Regulatory requirements need to be reviewed and incorporated then the Customer is responsible to identify those and provide copies for review and revision of our offer.

Our quotation is offered in accordance with our comments and exceptions identified in our proposal and governed by our standard terms and conditions of sale – Xylem Americas attached hereafter.

For units requiring performance test, all performance tests will be conducted per ANSI/HI 14.6 standards unless otherwise noted in the selection software submittal documents. Test results meeting with grade 2B tolerances for pumps with a rated shaft power of 134HP or less and grade 1B for greater than 134HP will be considered passing.

Customer is responsible for verifying that the recommendations made and the materials selected are satisfactory for the Customer's intended environment and Customer's use of the selected pump. Customer is responsible for determining the suitability of Xylem recommendations for all operating conditions within Customer's and/or End User's control. Xylem disclaims all warranties, express or implied warranties, including, but not limited to, warranties of merchantability and fitness for a particular purpose and all express warranties other than the limited express warranty set forth in the attached standard terms and conditions of sale – Xylem Americas attached hereafter.

Xylem does not guarantee any pump intake configuration. The hydraulic and structural adequacies of these structures are the sole responsibility of the Customer or his representatives. Further, Xylem accepts no liability arising out of unsatisfactory pump intake field operating conditions. The Customer or his representatives are referred to the Hydraulic Institute Standards for recommendations on pump intake design. To optimize the hydraulic design of a field pump intake configuration, the Customer should strongly consider performing a detailed scale model pump intake study. However, the adequacies of these recommendations are the sole responsibility of the Customer.

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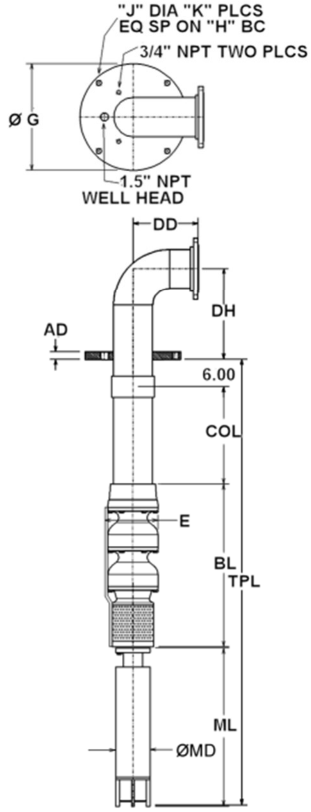
OUTLINE DRAWING

Quote ID: 3302-191120-007:0:3 QTY: 1
VIS-WFTM 7CHC, 3 Stages
RF MACDONALD CO/FRESNO FRESNO



DIMENSIONS

Discharge Head Size	4.00 in
J [Mounting Flange Hole Dia]	1.12 in
H [Mounting Flange Bolt Circle]	18.75 in
Dim G [Mounting Flange Dia]:	21.00 in
DD [Disch Flange Stickout]	7.38 in
DH [Disch Flange Height]	11.00 in
AD [Mounting Flange Thickness]	9999.00 in
Column Length (COL)	132.00 in
E	7.50 in
BL [Bowl Assembly Length]	37.33 in
TPL [Total Pump Length]	212.73 in
ML [Motor Length]	37.40 in
MD [Motor Diameter]	8.00 in
Head Flange	4"-150#

PUMP DATA

Column Diameter	4" [102mm]
Lineshaft Diameter	1 in [25.4 mm]
Specified Flow	200.00 USgpm
Specified TDH	80.00 ft
Pumping Level	1.00 ft
Motor Manufacturer	Hitachi
Driver Type	Submersible
Selected Motor Power	7.50 Hp
Motor Speed	1765 RPM
Phase / Frequency	3 PH / 60 Hz
Voltage	460 V

WEIGHTS

Total Bowl Weight	136 lbs
Unit Bowl Weight	80 lbs / 28 lbs
Total Column Weight	119 lbs
Unit Column Weight	11 lbs
Head Weight	**Refer to Factory**
Motor Weight	364 lbs
Total Weight	**Refer to Factory**
Total Rotating Weight	50 lbs

NOTES	
1	Total Pump Length ± 1.0 inch.
2	Tolerance on all dimensions is .12 or ± .12 inch per 5 ft, whichever is greater.
3	All dimensions shown are in inches unless otherwise specified.
4	Drawing not to scale.
5	½" NPT – Gauge Conn (plugged)
6	Driver may be rotated at 90º intervals about vertical centerline for details refer to driver dimension drawing.
7	Refer to product IOM for impeller setting requirements.
8	This assembly has been designed so that its natural frequency responses avoid the specific operating speeds by an adequate safety margin. The design has assumed the foundation to be rigid.

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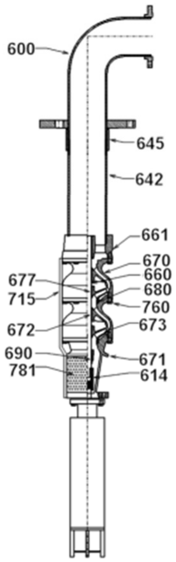
CROSS SECTION DRAWING

Quote ID: 3302-191120-007:0:3 QTY: 1
VIS-WFTM 7CHC, 3 Stages
RF MACDONALD CO/FRESNO FRESNO



BILL OF MATERIALS

ITEM	PART NAME	CODE	MATERIAL	ASTM#
Head Assembly				
600	Well Head	9645	Carbon Steel Fab	A53
Column Assembly				
642	Column Pipe Material	6501	Black Pipe Sch 40	A 53
645	Column Coupling	9645	Carbon Steel Fab	A53
Bowl Assembly				
614	Coupling-Sub Motor	2218	SST 416	A582M
660	Shaft - Bowl	2227	SST 416	A582 S41600
661	Discharge Bowl	1003	Cast Iron Cl30	A48 CLASS 30B
664	Bearing - Discharge Bowl	1618	Bronze Bismuth	B584 Modified
670	Bowl - Intermediate	6911	Cast Iron Cl30 Enamel	A48
671	Motor Adapter	1018	Ductile Iron 65-45-12	A536
672	Bearing - Intermediate Bowl	1618	Bronze Bismuth	B584 Modified
673	Impeller	1203	SST 316	A744M
677	Taper Lock-Impeller	2217	SST 416	A582M
680	Wear Ring-Bowl	1232	SST CA15	A743M
681	Wear Ring - Impeller	NA	Not Included	NA
690	Bearing - Motor Adapter	1618	Bronze Bismuth	B584 Modified
715	Guard-Cable	3215	SST 304	A240M
758	Capscrew-(Motor)	2228	SST 304	A276
781	Screen-Suction	3211	SST 316	A240M
789	Washer - Upthrust	6266	Tivar 1000	None
NA	Check Valve	NA	Not Included	NA

DO NOT USE FOR CONSTRUCTION UNLESS CERTIFIED

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Project	Pajaro PCW Vertical Turbine VIC Submersible Pumps
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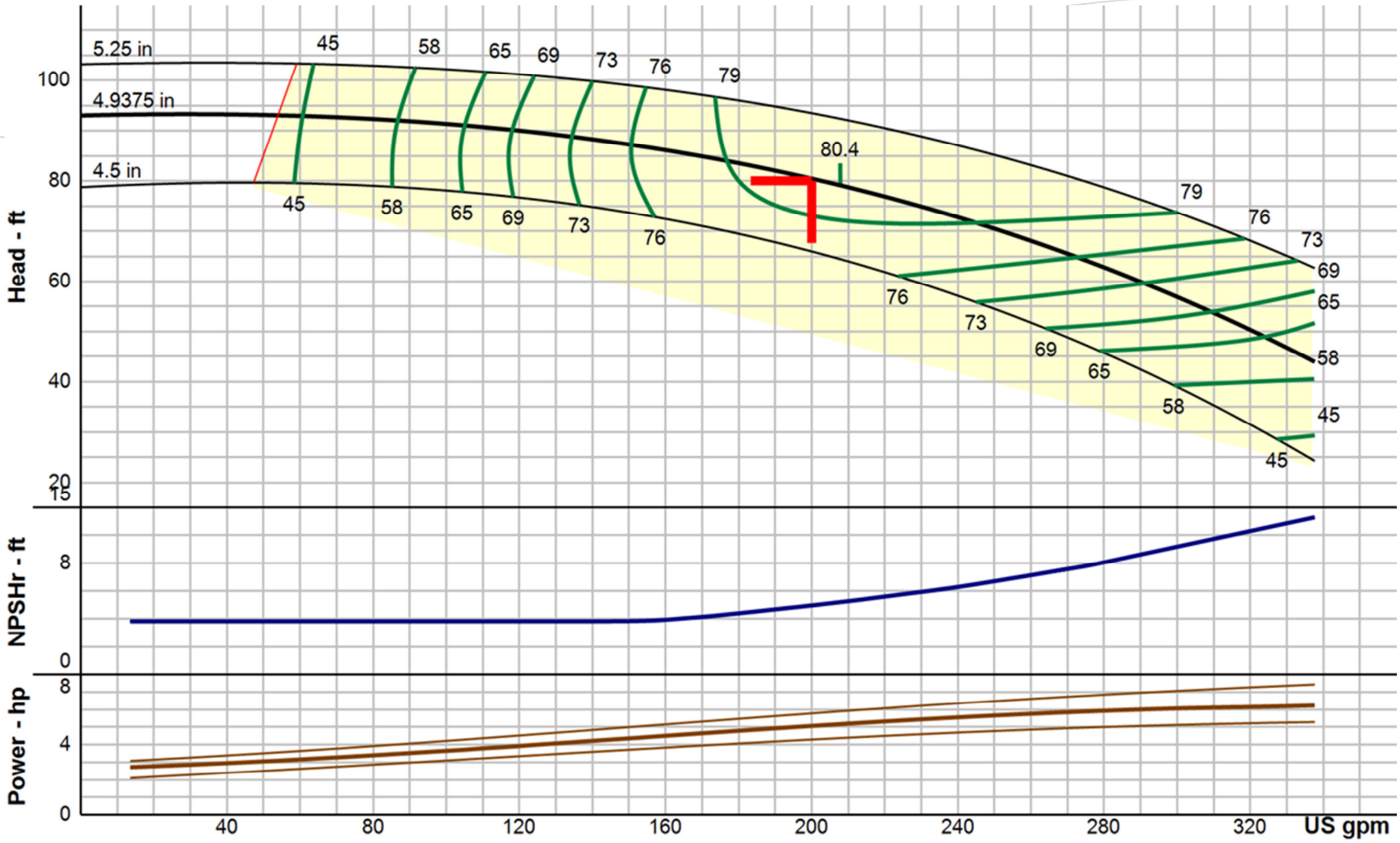
PERFORMANCE CURVE

Quote ID: 3302-191120-007:0:3 QTY: 1
VIS-WFTM 7CHC, 3 Stages
RF MACDONALD CO/FRESNO FRESNO



Curve & hydraulic data presented is nominal performance based on ANSI/HI 14.6 acceptance grade 2B.
Design values are guaranteed within the following tolerances: Flow ± 8%, Head ± 5%, and optionally either Power + 8% or Efficiency - 5% at manufacturer's discretion.

CURVE DATA

Specified Flow	200.00 USgpm
Specified TDH	80.00 ft
Rated Speed	1765 RPM
Atmospheric Pressure	14.70 psi
Pumping Level	1.00 ft
NPSHa at Grade	33.9 ft
NPSHa at 1st Impeller	46.3 ft
Well Diameter	14 inch [356mm] Casing
Fluid	Water
Fluid Temperature	68.0 °F
Specific Gravity	1.0000
Viscosity	1.0017 cP
Vapor Pressure	0.3393 psi
Density	62 lbs/ft³
Design Flow	200.0 USgpm
Min Flow (MCSF)	52.0 USgpm
Design TDH (Bowl)	80.5 ft
Design TDH (Disch Flange)	77.6 ft
Design Pressure (Bowl)	34.8 psi
Design Pressure (Disch Flange)	33.6 psi
Shut Off TDH (Bowl)	93.0 ft

Shut Off TDH (Disch Flange)	91.1 ft
Shut Off Pressure (Bowl)	40.3 psi
Shut Off Pressure (Disch Flange)	39.4 psi
Run Out Flow	338.0 USgpm
Run Out TDH (Bowl)	43.9 ft
Run Out TDH (Disch Flange)	39.5 ft
Run Out Pressure (Bowl)	19.0 psi
Run Out Pressure (Disch Flange)	17.1 psi
Bowl Efficiency at Design	80.30 %
Guaranteed Bowl Efficiency	76.29 %
Best Efficiency	80.40 %
BEP Flow	208.0 USgpm
Design Flow % BEP	96.15 %
Pump Efficiency	78.89 %
Friction Loss at Design	1.03 ft
Power at Design	5.1 Hp
Guaranteed Power	5.5 Hp
NOL Power	6.2 Hp
Guaranteed NOL Power	6.7 Hp
Max Power (NOL) Flow	338.0 USgpm
Max Power (NOL) at Max Trim	7.4 Hp
Guaranteed Max Power (NOL) at	8.0 Hp

Max Trim	
Max Power (NOL) Flow at Max Trim	338.0 USgpm
Recommended Power	7.50 Hp
Allow Service Factor	No
kWh per 1000 gal	0.00000
NPSHr at Design	5.0 ft
NPSH Margin at Design	41.3 ft
Min Submergence at Design	14.09 in
Actual Submergence	161.65 in
Thrust at Design	342.2 lb
Thrust at Shut Off	389.0 lb
Thrust at Run Out	210.0 lb
Bowl Material	Cast Iron with Glass Enamel
Bowl Material Derate Factor	1.00
Impeller Material	316SS
Impeller Matl Derate Factor	1.00
Total Flow Derate Factor	1.00
Total Head Derate Factor	1.00
Total Efficiency Derate Factor	1.00
Curve ID	E6207CCPC2

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SUBMITTAL

Quote ID: 3302-191120-007:0:4 QTY: 1
VIS-WFTM 13CMC, 1 Stage
RF MACDONALD CO/FRESNO FRESNO

PERFORMANCE ON DESIGN CURVE AT 1730 RPM

	Shut Off	Design [2]	Run Out [5]		
Flow (USGPM)	0.0	1150.0	1555.0	**Best Efficiency**	83.00 % at 1065.0 USgpm
TDH-Bowl (ft)	95.0	74.2	51.2	**Design Flow % BEP**	107.98 %
TDH-Disch Flange (ft)	94.0	71.1	49.4	**Pump Efficiency**	81.47 %
Bowl Efficiency (%)	-	82.30	73.80	**Overall Efficiency**	0.00 %
Guaranteed Bowl Efficiency (%)	-	78.18	-	**NOL Power**	27.5 Hp at 1497.0 USgpm
Power (Hp)	19.1	26.2	27.2	**Guaranteed NOL Power**	29.7 Hp at 1497.0 USgpm
Guaranteed Power (Hp)	-	28.3	-	**Max Power (NOL) at Max Trim**	29.1 Hp at 1541.0 USgpm
NPSHr (ft) [1]	-	15.0	28.8	**Guaranteed Max Power (NOL) at Max Trim**	31.4 Hp at 1541.0 USgpm
NPSH Margin (ft) [1]	-	31.3	17.5	**Specified NPSH Ratio**	1.1
Hydraulic Thrust(lb)	921.0	717.0	496.0	**Thrust Load Power Loss**	0.10398 Hp
Thrust (lb)	1092.8	869.2	626.6	**Total Flow Derate Factor**	1.00
Pressure-Bowl (psi)	41.1	32.1	22.2	**Total Head Derate Factor**	1.00
Pressure-Disch Flange (psi)	40.7	30.8	21.4	**Total Efficiency Derate Factor**	1.00
Min Submergence (Inch) [3]	-	28.53	33.86	**Actual Submergence**	163.38 in
Friction Loss (ft) [4]	-	0.46	0.79	**Shaft Friction Power Loss**	-0.02 Hp
Lineshaft Elongation (Inch)	0.00000	0.00000	-	**Min Flow (MCSF)**	266.0 USgpm
Column Elongation (Inch)	0.00077	0.00066	-	**kWh per 1000 gal**	0.00000
Lateral (Inch)	0.12923	0.12934	-	**Impeller Running Clearance**	0.13 in

[1] at 1st impeller eye   [2] rated values   [3] from bottom of pump   [4] from bowl to disch flange   [5] based on user entered TDH

OPERATING CONDITIONS

Specified Flow	1150.00 USgpm
Design TDH (Bowl)	74.2 ft
Rated Speed	1730 RPM
Atmospheric Pressure	14.70 psi
TPL	18.29 ft
Pumping Level	1.00 ft
NPSHa at 1st Impeller	46.3 ft
Well Diameter	16 inch [406mm] Casing

FLUID CHARACTERISTICS

Fluid	Water
Fluid Temperature	68.0 °F
Specific Gravity	1.0000
Viscosity	1.0017 cP
Vapor Pressure	0.3393 psi
Density	62 lbs/ft³

MATERIALS & DIMENSIONS

Bowl Data

Bowl Material	Cast Iron with Glass Enamel
Bowl Material Derate Factor	1.00
Impeller Material	Bronze
Impeller Matl Derate Factor	1.00
Bowl Shaft Material	416SS
Impeller Attachment	Taper Lock
Taper Lock Material	416SS
Discharge Bowl Material	Cast Iron
Suction Type	Bowl
Bowl Bolting Material	316SS
Motor Adapter	8" [203.2 mm]
Motor Adapter Bearing	Bronze
Discharge Bowl Bearing	Bronze
Intermediate Bowl Bearing	Bronze
Impeller Trim	9.06 in
Max Impeller Trim	9.20 in

Bowl Data

Thrust K-Factor	9.5 lb/ft
Thrust K-Factor	9.5 Lb/Ft
Bowl Pressure Limit	340 psi
Shut Off Lateral	0.12923 in
Design Lateral	0.12934 in
Bowl Assembly Length (BL)	37.38 in
Bowl Shaft Diameter	1 15/16" [49.2 mm]
Impeller Balance	Dynamic Two Plane Balance
Bowl Wear Ring	416SS
Impeller Wear Ring	Not Included
Bowl Diameter (D)	12.38 in
Min Column Diameter	8 in
Max Column Diameter	10 in
Bowl Shaft Length	32.50 in
Bowl Shaft Power Limit	600.39 Hp

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SUBMITTAL

Quote ID: 3302-191120-007:0:4 QTY: 1
VIS-WFTM 13CMC, 1 Stage
RF MACDONALD CO/FRESNO FRESNO

Bowl Specials

Column Data

Column Type	Threaded
Column Diameter	8" [203mm]
Column Pipe Material	Carbon Steel

Column Data

Max Column Section Length	120 in

Column Specials

Head Data

Well Diameter	16 inch [406mm] Casing
Discharge Elbow Material	Carbon Steel
Head Flanged Rating	150 # Flange

Head Data

Well Head Size	8" [203mm]
Sanitary Well Seal	Yes

Head Specials

Includes Power Cable Sealing Design

Motor Data

Driver Type	Submersible
Manufacturer	Hitachi
HP Rating	30 Hp
Speed [Poles]	1800 rpm [4 pole]
Voltage	460 V
Phase / Frequency	3 PH / 60 Hz
Efficiency / Config	Standard
Motor Adapter	8" [203.2 mm]
Motor Flange	8 in
Motor Shroud	Included
ML [Motor Length]	44.09 in

Motor Data

MD [Motor Diameter]	8.00 in
SF / Insulation**	1.15 Y
Motor Provided By	Xylem
Motor Mounted By	Customer
Motor Part Number	S16931H
Driver Size Criteria	Max power on design curve (NOL)
Allow Service Factor	No

Motor Specials

SS Motor Shroud

Coating Data

Bowl OD	Tnemec 141 (NSF approved): Expoxy applied at 16 mils min
Column ID	Tnemec 141 (NSF approved): Expoxy applied at 16 mils min
Column OD	Tnemec 141 (NSF approved): Expoxy applied at 16 mils min
Can ID	Not Included

Coating Data

Can OD	Not Included
Head ID	Tnemec 141 (NSF approved): Expoxy applied at 16 mils min
Head OD	Tnemec 141 (NSF approved): Expoxy applied at 16 mils min
Steel Sub Base	Not Included

Testing Data

Performance Testing	Bowl Assembly Only	Non-Witness	Lab Motor
Acceptance Grade	2B		
Hydrostatic Testing	Bowl Assembly, Discharge Head	Non-Witness	

Miscellaneous Specials

Weight Data

Total Bowl Weight	425 lbs
Unit Bowl Weight	425 lbs
Total Column Weight	246 lbs
Unit Column Weight	22 lbs

Weight Data

Head Weight	290 lbs
Motor Weight	450 lbs
Total Weight	1411 lbs
Total Rotating Weight	83 lbs

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VIS-WFTM 13CMC, 1 Stage
RF MACDONALD CO/FRESNO FRESNO

INFO, WARNING & ERROR MESSAGES

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OUTLINE DRAWING

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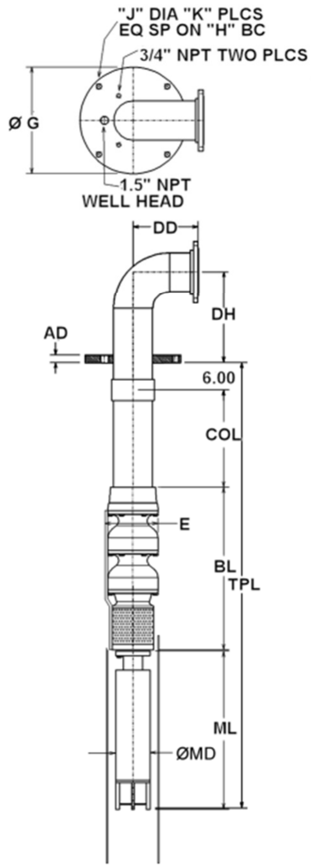

DIMENSIONS

Discharge Head Size	8.00 in
J [Mounting Flange Hole Dia]	1.12 in
H [Mounting Flange Bolt Circle]	21.25 in
Dim G [Mounting Flange Dia]:	23.50 in
DD [Disch Flange Stickout]	14.38 in
DH [Disch Flange Height]	20.00 in
AD [Mounting Flange Thickness]	1.56 in
Column Length (COL)	132.00 in
E	13.75 in
BL [Bowl Assembly Length]	37.38 in
TPL [Total Pump Length]	219.47 in
ML [Motor Length]	44.09 in
MD [Motor Diameter]	8.00 in
Head Flange	8"-150#

PUMP DATA

Column Diameter	8" [203mm]
Lineshaft Diameter	1 in [25.4 mm]
Specified Flow	1150.00 USgpm
Specified TDH	73.00 ft
Pumping Level	1.00 ft
Motor Manufacturer	Hitachi
Driver Type	Submersible
Selected Motor Power	30.00 Hp
Motor Speed	1730 RPM
Phase / **Frequency**	3 PH / 60 Hz
Voltage	460 V

WEIGHTS

Total Bowl Weight	425 lbs
Unit Bowl Weight	425 lbs
Total Column Weight	246 lbs
Unit Column Weight	22 lbs
Head Weight	290 lbs
Motor Weight	450 lbs
Total Weight	1411 lbs
Total Rotating Weight	83 lbs

NOTES	
1	Total Pump Length ± 1.0 inch.
2	Tolerance on all dimensions is .12 or ± .12 inch per 5 ft, whichever is greater.
3	All dimensions shown are in inches unless otherwise specified.
4	Drawing not to scale.
5	½" NPT – Gauge Conn (plugged)
6	Driver may be rotated at 90º intervals about vertical centerline for details refer to driver dimension drawing.
7	Refer to product IOM for impeller setting requirements.
8	This assembly has been designed so that its natural frequency responses avoid the specific operating speeds by an adequate safety margin. The design has assumed the foundation to be rigid.

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CROSS SECTION DRAWING

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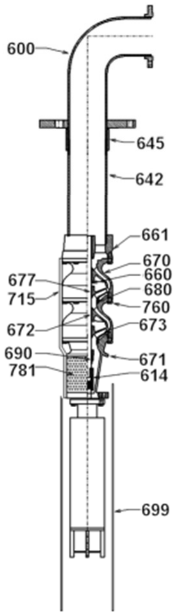

BILL OF MATERIALS

ITEM	PART NAME	CODE	MATERIAL	ASTM#
Head Assembly				
600	Well Head	9645	Carbon Steel Fab	A53
Column Assembly				
642	Column Pipe Material	6501	Black Pipe Sch 40	A 53
645	Column Coupling	9645	Carbon Steel Fab	A53
Bowl Assembly				
614	Coupling-Sub Motor	2218	SST 416	A582M
660	Shaft - Bowl	2227	SST 416	A582 S41600
661	Discharge Bowl	1003	Cast Iron Cl30	A48 CLASS 30B
664	Bearing - Discharge Bowl	1618	Bronze Bismuth	B584 Modified
670	Bowl - Intermediate	6911	Cast Iron Cl30 Enamel	A48
671	Motor Adapter	1018	Ductile Iron 65-45-12	A536
672	Bearing - Intermediate Bowl	1618	Bronze Bismuth	B584 Modified
673	Impeller	1398	Silicon Bronze C87610	B584
677	Taper Lock-Impeller	2217	SST 416	A582M
680	Wear Ring-Bowl	1232	SST CA15	A743M
681	Wear Ring - Impeller	NA	Not Included	NA
690	Bearing - Motor Adapter	1618	Bronze Bismuth	B584 Modified
715	Guard-Cable	3215	SST 304	A240M
758	Capscrew-(Motor)	2228	SST 304	A276
781	Screen-Suction	3211	SST 316	A240M
789	Washer - Upthrust	6266	Tivar 1000	None
NA	Check Valve	NA	Not Included	NA

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PERFORMANCE CURVE

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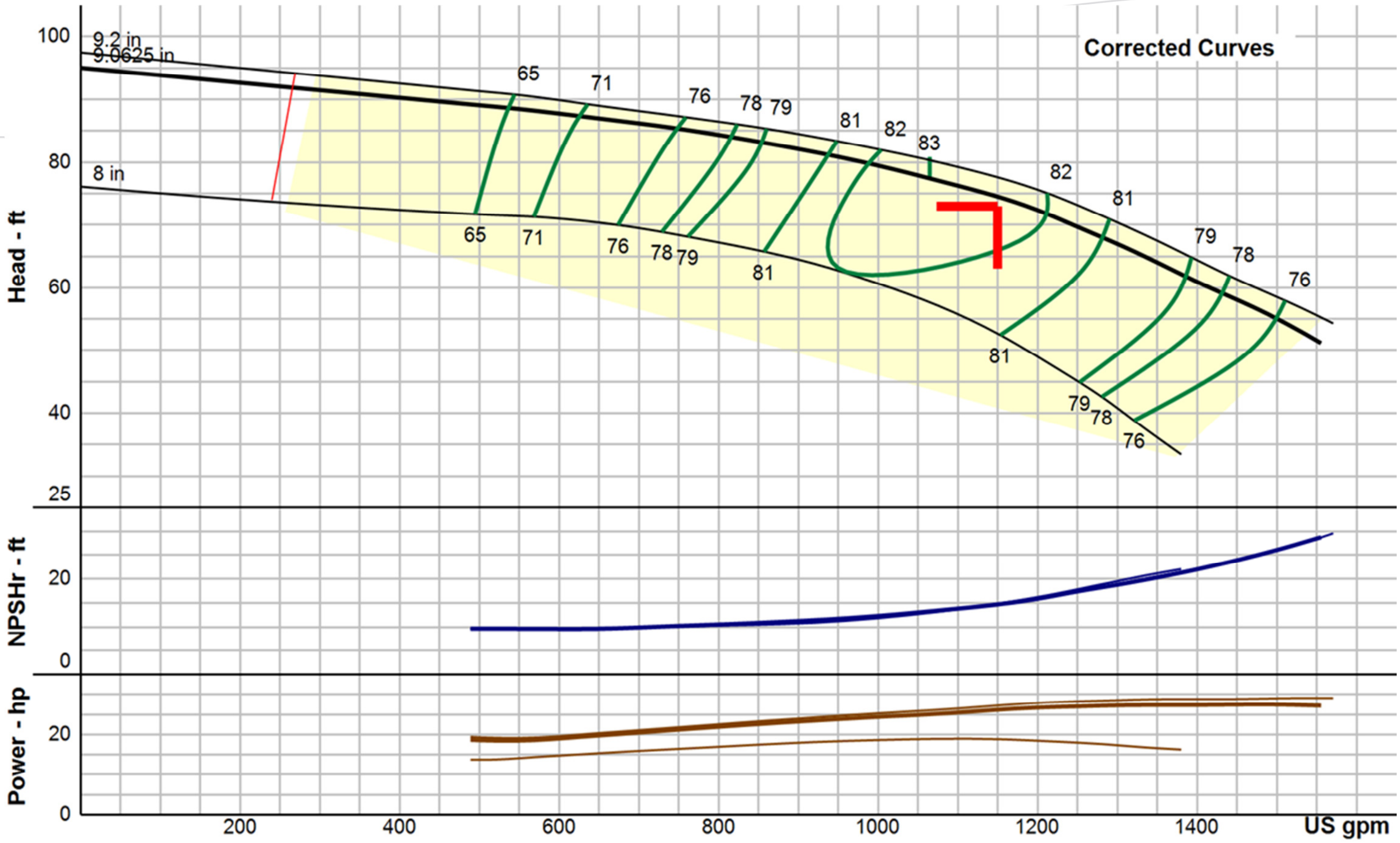
VIS-WFTM 13CMC, 1 Stage
RF MACDONALD CO/FRESNO FRESNO



Curve & hydraulic data presented is nominal performance based on ANSI/HI 14.6 acceptance grade 2B.
Design values are guaranteed within the following tolerances: Flow ± 8%, Head ± 5%, and optionally either Power + 8% or Efficiency - 5% at manufacturer's discretion.

CURVE DATA

Specified Flow	1150.00 USgpm
Specified TDH	73.00 ft
Rated Speed	1730 RPM
Atmospheric Pressure	14.70 psi
Pumping Level	1.00 ft
NPSHa at Grade	33.9 ft
NPSHa at 1st Impeller	46.3 ft
Well Diameter	16 inch [406mm] Casing
Fluid	Water
Fluid Temperature	68.0 °F
Specific Gravity	1.0000
Viscosity	1.0017 cP
Vapor Pressure	0.3393 psi
Density	62 lbs/ft³
Design Flow	1150.0 USgpm
Min Flow (MCSF)	266.0 USgpm
Design TDH (Bowl)	74.2 ft
Design TDH (Disch Flange)	71.1 ft
Design Pressure (Bowl)	32.1 psi
Design Pressure (Disch Flange)	30.8 psi
Shut Off TDH (Bowl)	95.0 ft

Shut Off TDH (Disch Flange)	94.0 ft
Shut Off Pressure (Bowl)	41.1 psi
Shut Off Pressure (Disch Flange)	40.7 psi
Run Out Flow	1555.0 USgpm
Run Out TDH (Bowl)	51.2 ft
Run Out TDH (Disch Flange)	49.4 ft
Run Out Pressure (Bowl)	22.2 psi
Run Out Pressure (Disch Flange)	21.4 psi
Bowl Efficiency at Design	82.30 %
Guaranteed Bowl Efficiency	78.19 %
Best Efficiency	83.00 %
BEP Flow	1065.0 USgpm
Design Flow % BEP	107.98 %
Pump Efficiency	81.47 %
Friction Loss at Design	0.46 ft
Power at Design	26.2 Hp
Guaranteed Power	28.3 Hp
NOL Power	27.5 Hp
Guaranteed NOL Power	29.7 Hp
Max Power (NOL) Flow	1497.0 USgpm
Max Power (NOL) at Max Trim	29.1 Hp
Guaranteed Max Power (NOL) at	31.4 Hp

Max Trim	
Max Power (NOL) Flow at Max Trim	1541.0 USgpm
Recommended Power	30.00 Hp
Allow Service Factor	No
kWh per 1000 gal	0.00000
NPSHr at Design	15.0 ft
NPSH Margin at Design	31.3 ft
Min Submergence at Design	28.53 in
Actual Submergence	163.38 in
Thrust at Design	869.2 lb
Thrust at Shut Off	1092.8 lb
Thrust at Run Out	626.6 lb
Bowl Material	Cast Iron with Glass Enamel
Bowl Material Derate Factor	1.00
Impeller Material	Bronze
Impeller Matl Derate Factor	1.00
Total Flow Derate Factor	1.00
Total Head Derate Factor	1.00
Total Efficiency Derate Factor	1.00
Curve ID	E6413CGPC1

DO NOT USE FOR CONSTRUCTION UNLESS CERTIFIED		
Certified By		
Project	Pajaro PCW Vertical Turbine VIC Submersible Pumps	
Tag		
PO Number		
Serial Number		

Chlorine Analyzer

CL17 CHLORINE ANALYZER

Applications

- Beverage
- Collection Systems
- Drinking Water
- Field Use
- Food QC Lab
- Pharmaceutical
- Power
- Semiconductor
- Wastewater

Dependable, colorimetric DPD free or total chlorine analysis.

Accurate, Reliable Results

The Hach CL17 Chlorine Analyzer uses colorimetric DPD chemistry to monitor water continuously for free or total residual chlorine. The CL17 analysis method is not affected by changes in chlorine concentration, sample pH, temperature, flow or pressure, thus offering more accuracy than other methods in today's market.

Simple, Predictable Maintenance

Monthly routine maintenance for the CL17 can usually be performed in 15 minutes, including changing reagents and cleaning the colorimetric cell. No special tools are required. For typical use, the CL17 will operate unattended for 30 days. Challenging applications may require more frequent cleaning.

Factory Calibrated

The CL17 Chlorine Analyzer is factory calibrated. A built-in electronic calibration curve is preprogrammed into the instrument. This instrument does not require recalibration unless specified by your regulatory agency for compliance reporting purposes.

EPA Compliant

The CL17 is compliant with US EPA regulation 40 CFR 140.74. Both Method 4500-CL G and Method 334.0 can be used for measuring residual chlorine in drinking water.

HACH®
Be Right™

Specifications*

Range	0 to 5 mg/L free or total residual chlorine
Accuracy	± 5 % or ±0.03 mg/L (ppm) as CL_2, whichever is greater
Lower Limit of Detection (LOD)	0.03 mg/L (ppm)
Cycle Time	2.5 minutes
Inlet Pressure	1 to 5 psig (0.07 to 0.34 bar), .5 psi is optimum
Pressure Limit	Inlet Pressure to Sample Conditioning: 1.5 to 75 psi (0.1 bar to 5.2 bar)
Inlet	1/4-inch OD polyethylene tube, quick-disconnect fitting
Drain	1/2-inch ID flexible hose, hose barb
Air Purge	0.1 cfm (0.17 m^3/h) instrument quality air at max. 20 psig (ca. 1.4 bar) with 1/4-inch OD tube, quick disconnect fitting
Sample Flow Rate	200 to 500 mL per minute minimum
Sample Temperature	5 to 40 °C (41 to 104 °F)
Operating Temperature Range	5 to 40 °C (41 to 104 °F)
Operating Humidity	Up to 90% at 40 °C (104 °F) maximum
Interferences	Other oxidizing agents such as bromide, chlorine dioxide, permanganate and ozone will cause a positive interference. Hexavalent chromium will cause a positive interference: 1 mg/L Cr^{6+} = approximately 0.02 mg/L as Cl_2. Hardness must not exceed 1,000 mg/L as $CaCO_3$.
Recorder Outputs	One 0/4-20 mA with an output span programmable over any portion of the 0 to 5 mg/L range. Recommended load impedance 3.6 to 500 ohms, 130 V isolation from earth ground.
Alarm	Two alarms selectable for sample concentration alarm, analyzer system warning, or analyzer system shut-down alarm. Each is equipped with an SPDT relay with contacts rated for 5A resistive load at 230 V AC.
Certifications	Europe, CE Approved with: EN 61326-1 CISPR 11 EN 61010-1 IEC 60529 North America: UL 61010A-1 CAN/CSA C22.2 No. 1010.1-92
Power Requirements (Voltage)	100 - 115/230 V AC
Power Requirements (Amps)	2.5 A
Power Requirements (Hz)	50/60 Hz
Display	LCD, 3-1/2 inch digit measurement readout and six-character alphanumeric scrolling text line
Light Source	Class 1 LED (light emitting diode) with a peak wavelength of 520 nm; 50,000 hours estimated minimum life
Enclosure Construction	ABS plastic, two clear polycarbonate windows, IP62-rated with the gasketed door latched.
Mounting Style	Wall mount
Dimensions Metric (H x W X D)	454 mm x 314 mm x 179 mm
Weight	23.13 lbs. (10.49 kg)

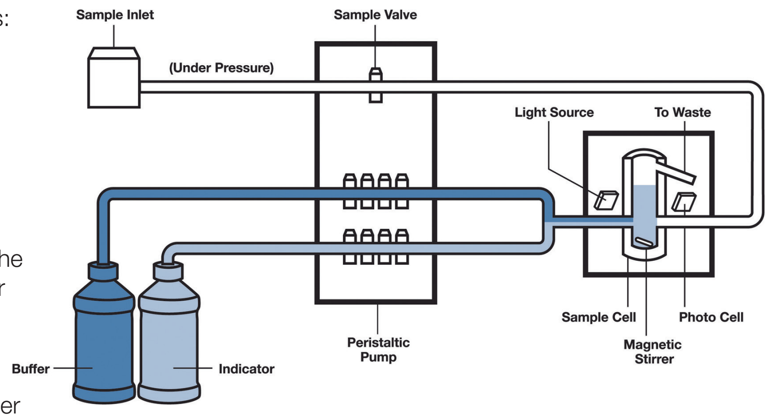
Subject to change without notice.

Principle of Operation

The CL17 Chlorine Analyzer has three operating components:

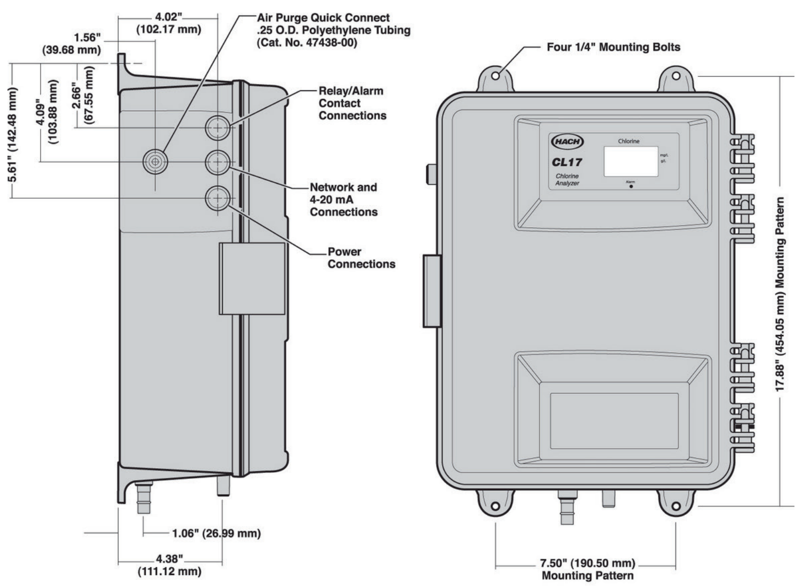
- A linear peristaltic pump to precisely control the volume of incoming samples and reagents.
- A colorimeter with seal-free, solid-state mixing system that includes a self-cleaning stir bar.
- One-month supply of reagents (indicator and buffer)

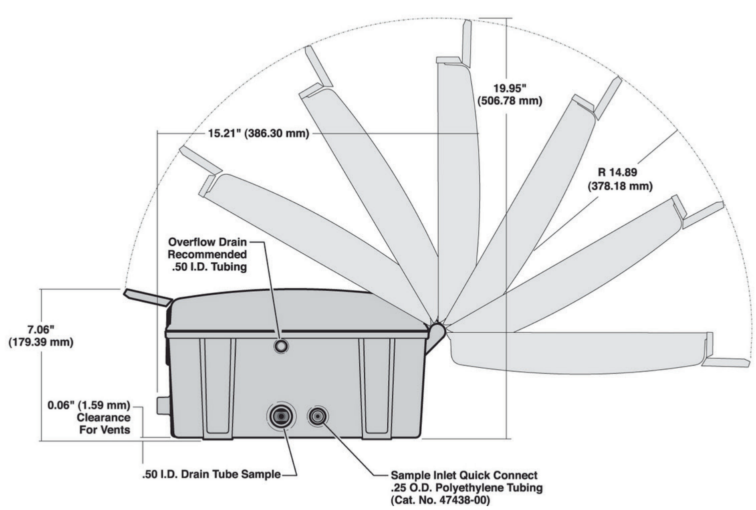
A zero reference point is established with the first sample in the cycle by measuring blank absorbance. (This compensates for the sample's color intensity and turbidity before the chlorine measurement is made.) Then, indicator and buffer reagents are added to the sample while a magnetic stirrer mixes the solution and the sample changes color. A compact colorimeter then measures the light transmitted through the sample. The measured color intensity is compared to a reference standard. Finally, the sample cell is flushed with new sample so that the cycle can repeat itself every 2.5 minutes.



Dimensions

The CL17 is designed to be wall-mounted with four 1/4-inch screws. Adequate clearance must be left at the sides and bottom of the case for plumbing and electrical connections. The sample inlet connection is 1/4-inch quick-disconnect fitting and the drain connection is 1/2-inch I.D. flexible hose. Electrical connections are inside the instrument case. Holes for three 1/2-inch conduit fittings are provided.





Ordering Information

Hach CL17 Chlorine Analyzers are shipped with a one-month supply of reagents, maintenance kit, installation kit, and manual. (The power cord is ordered separately.)

5440001 Model Cl17 Free Residual Chlorine Analyzer

5440002 Model Cl17 Total Residual Chlorine Analyzer

5440003 Model Cl17 Free Residual Chlorine Analyzer with AquaTrend® Network Capability

5440004 Model Cl17 Total Residual Chlorine Analyzer with AquaTrend® Network Capability

Accessories

5448800 North American Power Cord Kit with Strain Relief, 125V

5448900 European Power Cord Kit with Strain Relief, 230V

5444300 Maintenance Kit, 1 year, includes tubing, caps, funnel, and fittings

5444301 Maintenance kit, 1 year, includes preassembled tubing, caps, funnel, and fittings.

4643600 Sample Inlet Flow Meter

5449000 Cl17 Calibration/Verification Kit

Reagents

Reagents

2556900 Free Chlorine Reagent Set

2557000 Total Chlorine Reagent Set

2297255 Cl17 DPD Indicator Powder (Free and Total)

2314011 CL17 Free Chlorine Indicator Solution

8867711 CL17 Free Chlorine Buffer Solution

2263411 CL17 Total Chlorine Indicator Solution

2263511 CL17 Total Chlorine Buffer Solution

HACH COMPANY World Headquarters: Loveland, Colorado USA

United States: 800-227-4224 tel 970-669-2932 fax orders@hach.com
Outside United States: 970-669-3050 tel 970-461-3939 fax int@hach.com
hach.com

LIT1626 Rev 7
C14 Printed in U.S.A.

Flow Meter

Propeller

CONFIGURATION SHEET

MODEL MW500 / MZ500

MAIN LINE FLOWMETER

DESCRIPTION

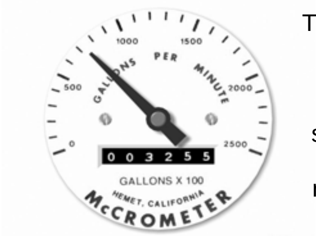
Model MW500 and MZ500 Main Line Propeller Flowmeters are manufactured to comply with the applicable provisions of the American Water Works Association Standard No. C704-02 for propeller type flowmeters. The model MW500 is designed for a maximum continuous working pressure of up to 150 psi and is fitted with AWWA Class D flanges. The model MZ500 is designed for a continuous working pressure of up to 300 psi and is fitted with ANSI B16.5 Class 300 flanges. The impeller and drive assembly are easily removed through the top flange connection. The meter flow tubes are coated with fusion-bonded epoxy for maximum corrosion protection, and integral flow straightening vanes reduce upstream flow turbulence. As with all McCrometer propeller flowmeters, standard features include a magnetically coupled drive, instantaneous flowrate indicator and straight reading, six-digit totalizer.

Impellers are manufactured of high-impact plastic, capable of retaining their shape and accuracy over the life of the meter. Each impeller is individually calibrated at the factory to accommodate the use of any standard McCrometer register. The MW500 and MZ500 can be field-serviced without the need for factory recalibration. Factory lubricated stainless steel bearings are used to support the impeller shaft. The shielded bearing design limits the entry of materials and fluids into the bearing chamber providing maximum bearing protection.

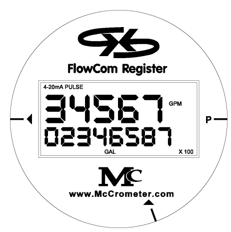
The instantaneous flowrate indicator is standard and available in gallons per minute, cubic feet per second, liters per second and other units. The register is driven by a flexible steel cable encased within a protective vinyl liner. The register housing protects both the register and cable drive system from moisture while allowing clear reading of the flowrate indicator and totalizer.

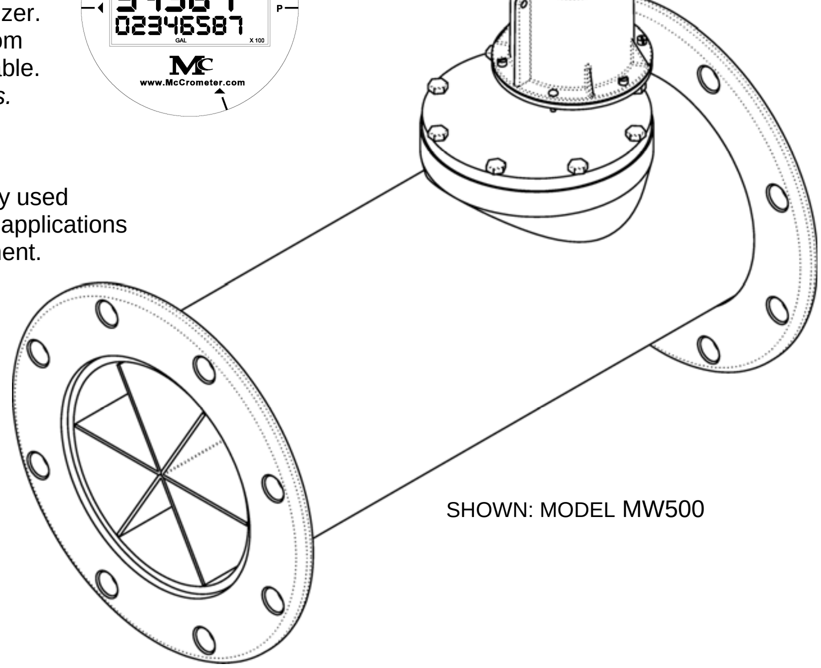
INSTALLATION

Standard installation is horizontal mount. If the meter is to be mounted in the vertical position, please advise the factory. A straight run of full pipe the length of five diameters ahead and one diameter behind the meter is the minimum normally recommended.



The McCrometer Propeller flowmeter comes with a standard instantaneous flowrate indicator and straight-reading totalizer. An optional FlowCom register is also available. *Typical face plates.*





SHOWN: MODEL MW500

APPLICATIONS

The McCrometer propeller meter is the most widely used flowmeter for municipal and wastewater treatment applications as well as agricultural and turf irrigation measurement. Typical applications include:

- Water and wastewater management
- Center pivot systems
- Sprinkler irrigation systems
- Drip irrigation systems
- Golf course and park water management
- Gravity turnouts from underground pipelines
- Commercial nurseries

Lit#24517-20 Rev 2.1/10-12

McCROMETER
3255 West Stetson Avenue
Hemet CA 92545 USA
951-652-6811 / FAX 951-652-3078
www.mccrometer.com

MAIN LINE FLOWMETER MODEL MW500 / MZ500

SPECIFICATIONS

PERFORMANCE

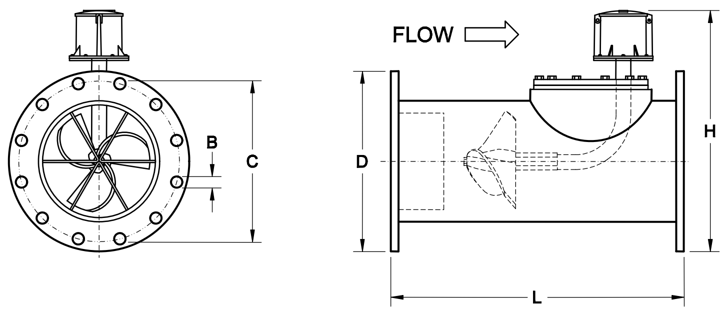
ACCURACY: ±2% of reading guaranteed throughout range.
RANGE: See dimensions chart below
HEAD LOSS: See dimensions chart below
MAXIMUM TEMPERATURE: (Standard Construction) 160°F constant
PRESSURE RATING: Model MW500: 150 psi
Model MZ500: 300 psi

MATERIALS

BEARING ASSEMBLY: Impeller shaft is 316 stainless steel. Ball bearings are 440C stainless steel.
MAGNETS: (Permanent type) Alnico
BEARING HOUSING: Brass; Stainless Steel optional
REGISTER: An instantaneous flowrate indicator and six-digit straight-reading totalizer are standard. The register is hermetically sealed within a die cast aluminum case. This protective housing includes a domed acrylic lens and hinged cover with locking hasp.
IMPELLER: Impellers are manufactured of high-impact plastic, retaining their shape and accuracy over the life of the meter. High temperature impeller is optional.

OPTIONS

- International flange standards available
- Other than standard laying lengths available
- Register extensions available
- Forward/reverse flow measurement
- All stainless steel construction
- High temperature construction
- “Over Run” bearing assembly for higher-than-normal flowrates
- Electronic propeller meter available in all sizes of this model
- A complete line of flow recording/control instrumentation
- Certified calibration test results
- Canopy boot



McCROMETER reserves the right to change design or specifications without notice.

MW500/MZ500	DIMENSIONS														
Meter and Nominal Pipe Size	**2**	**2 1/2**	**3**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**24**	**30**	**36**
Maximum Flow U.S. GPM	250	250	250	600	1200	1500	1800	2500	3000	4000	5000	6000	8500	12,500	17,000
Minimum Flow. U.S. GPM	40	40	40	50	90	100	125	150	250	275	400	475	700	1200	1500
Approx. Head Loss in Inches at Max. Flow	29.50	29.50	29.50	23.00	17.00	6.75	3.75	2.75	2.00	1.75	1.50	1.25	1.00	1.00	1.00
MW500															
Approx. Shipping Weight-lbs.	36	36	43	54	115	135	197	325	465	530	744	890	1,293	1450	1650
B (inches)	3/4	3/4	3/4	3/4	7/8	7/8	1	1	1 1/8	1 1/8	1 1/4	1 1/4	1 3/8	1 3/8	1 5/8
C (inches)	4 3/4	5 1/2	6	7 1/2	9 1/2	11 3/4	14 1/4	17	18 3/4	21 1/4	22 3/4	25	29 1/2	36	42 3/4
D (inches)	6	7	7 1/2	9	11	13 1/2	16	19	21	23 1/2	25	27 1/2	32	38 3/4	46
H (inches)	11 3/4	12 1/4	12 1/2	15 1/4	16 1/4	18 1/2	21 3/4	24 1/4	25 1/4	28 1/2	29 1/4	32 1/2	36 3/4	42 3/4	49 1/4
L (inches)	14	16	16	20	22	24	26	28	42	48	54	60	60	60	60
No. of Bolts per Flange	4	4	4	8	8	8	12	12	12	16	16	20	20	28	32
No. of Topplate Bolts	6	6	6	6	8	8	12	12	12	12	16	16	16	16	16
MZ500															
Approx. Shipping Weight-lbs.	50	55	62	90	145	220	340	430	650	820	1,315	1,508	2,165		
B (inches)	3/4	7/8	7/8	7/8	7/8	1	1 1/8	1 1/4	1 1/4	1 3/8	1 3/8	1 3/8	1 5/8		
C (inches)	5	5 7/8	6 5/8	7 7/8	10 5/8	13	15 1/4	17 3/4	20 1/4	22 1/2	24 3/4	27	32		
D (inches)	6 1/2	7 1/2	8 1/4	10	12 1/2	15	17 1/2	20 1/2	23	25 1/2	28	30 1/2	36		
H (inches)	12	12 1/2	12 7/8	15 3/4	17	19 1/4	22 1/2	25	26 1/4	29 1/2	32 3/4	34	38 3/4		
L (inches)	20	20	20	24	26	28	30	32	42	48	54	60	60		
No. of Bolts per Flange	8	8	8	8	12	12	16	16	20	20	24	24	24		

Note: *Flanges meet ASTM-A-181 specs.* *Larger flowmeters on special order.*

Lit#24517-20 Rev 2.1/10-12

McCROMETER
3255 West Stetson Avenue
Hemet CA 92545 USA
951-652-6811 / FAX 951-652-3078
www.mccrometer.com

Hydropneumatic Tank Controller

hydropneumatic **surge** & **pressure** controller

SCP 700

PULSCO

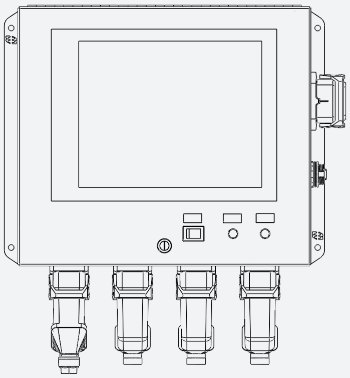
The PULSCO **ADVANTAGE**

PULSCO's Skypark 700 Series hydropneumatic controller are pre-engineered solutions for either surge or pressure control systems. The **Skypark 700 Series** has been designed for ease of installation, maintenance, and operation. The control logic was developed based on PULSCO's expertise and experience in fulfilling customer needs. The controllers fully stand alone or can be easily connected to any SCADA or PLC network regardless of communication protocol. The **Skypark 700 Series** is ideal for new installations or refurbishments.

- Designed to meet most surge and pressure control applications out of the box.
- Off the shelf models available for quick turnaround.
- Intuitive touch screen interfaces.
- Supports both Ethernet and relay communication to SCADA systems.
- Alarm & data logs saved on the controller, easily downloadable in CSV format to a USB.
- Automatic reboot after power interruption.
- Remote monitoring services available.

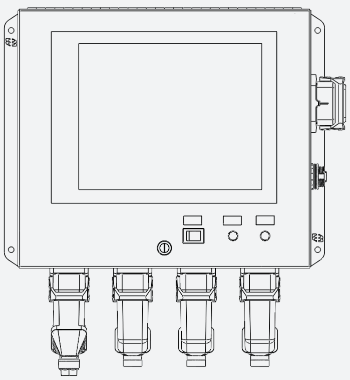
700-1801

SkyparkSeries™ hydropneumatic controller



Skypark 740 (SCP-740)
Pressure Controller

The controls maintain water system pressure between a specified range to reduce system pumps cycling.



Skypark 750 (SCP-750)
Surge Controller

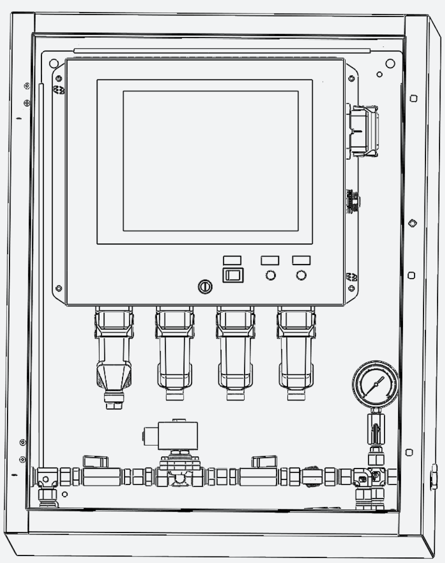
The controls maintain the volume of air required to mitigate pressure spikes in pipelines caused by sudden pump startup, shutdown, or valve closure.

Off the shelf units
Multi-tank control
Analog input surge suppression
Standard 120v (additional voltages available)

Interface
12" HMI color touch screen
Change set points using keypad entry display
View and download event history

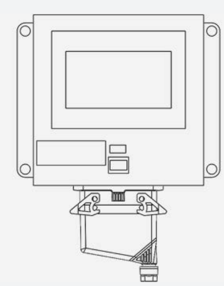
Communication
Standard ethernet TCP/IP
(additional protocol support available)
Remote session support
Remote monitoring services available

Installation
Wall mounted NEMA 4X enclosure.
Indoors or outdoors
Rated for operation from -20 to 120 ˚F (-28 to 48 ˚C)
No drilling needed for conduit connections



Skypark 7X0-PA (SCP-7X0-PA)
Pneumatic Assembly

Either the SCP-740 or the SCP-750 are integrated with complete level control assembly for ease of job site installation. The add and vent air solenoids, bypass and isolation ball valves, pressure gauge, and all piping and fittings needed for a full and complete level control assembly are pre-piped and wired inside a NEMA 4 outer enclosure.



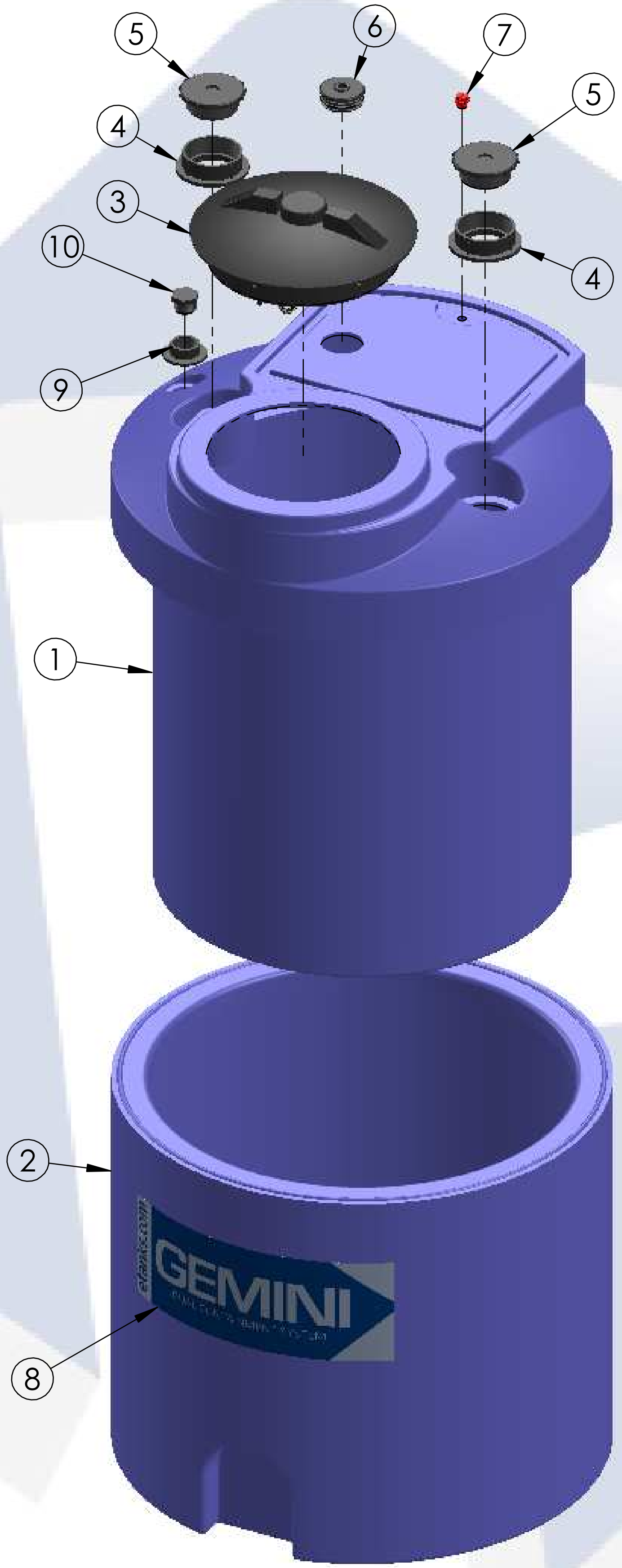
Skypark 730 (SCP-730)

Small and affordable panel for two-analog and four-digital outputs. Wall-mount NEMA 4 with 7" HMI touch screen interface. Ethernet TCP/IP communication standard with downloadable data log.

Sodium Hypochlorite Storage Tank

20 GALLON GEMINI	PART NUMBER	
	BLUE	NATURAL
STANDARD (1.5 SPG)	01-14871	01-1073
HD (1.9 SPG)	01-29773	01-29764

ISO VIEW
(ASSEMBLED)



TRIMETRIC VIEW
(EXPLODED)

ITEM NO.	DESCRIPTION	QTY.
1	20G GEMINI PRIMARY TANK	1
2	20G GEMINI SECONDARY TANK	1
3	8" TWIST LID ASSEMBLY	1
4	2" FNPT SPIN WELD FITTING, PE	2
5	2" THREADED PLUG, PE	2
6	2" CAPLUG / GROMMET SUB-ASSY	1
7	RED CAPLUG / O-RING SUB-ASSY	1
8	MOLD IN GRAPHIC	1
9	3/4" FNPT SPIN WELD FITTING, PE	1
10	3/4" THREADED PLUG, PE	1

NOTES:
1. CAPACITY: 20 GAL. NOMINAL
2. APPROXIMATE WEIGHT: 28 LBS
3. TANK MATERIAL: LLDPE W/ UV INHIBITOR
4. SERVICE PRESSURE: ATMOSPHERIC

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES: ±1/4"
ANGULAR: ± .5°
ONE PLACE DECIMAL: ± .25
TWO PLACE DECIMAL: ± .125
THREE PLACE DECIMAL: ± .063

TANK MATERIAL: LLDPE
INNER TANK S/N:
OUTER TANK S/N:
CUSTOMER PO#
DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	MSM	11/25/13
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

ALTERNATIVE VERSIONS

MATERIALS: XLPE, PPL, PVDF
COLORS: NATURAL, BLUE OR BLACK
AVAILABLE WITH FRP WRAP

CALL FOR PART NUMBERS

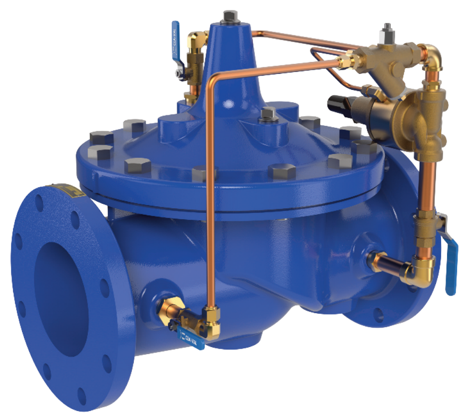
PEABODY engineering

PROJECT: **20 GALLON GEMINI TANK ASSEMBLY**
CUSTOMER: **PEABODY STANDARD**
SITE/LOCATION: -
DRAWING#: **SEE TABLE**
SIZE: **B**
DESC.: **PEABODY 20 GALLON GEMINI**
REV.: **A**
SCALE: 1:6
SHEET 1 OF 2

Back Pressure Sustaining Valve

CLA-VAL®

MODEL 650-01
Pressure Relief & Pressure Sustaining Valve



- **Accurate Pressure Control**
- **Optional Check Feature**
- **Fast Opening to Maintain Line Pressure**
- **Slow Closing to Prevents Surges**
- **Completely Automatic Operation**

The Cla-Val Model 650-01 Pressure Relief Valve is actuated by line pressure through a pilot control system, opening fast to maintain steady line pressure but closing gradually to prevent surges. Operation is completely automatic and pressure settings may be easily changed. This valve can be used for pressure relief, pressure sustaining, back pressure, or unloading functions in a bypass system.

If a check feature is added, and a pressure reversal occurs, the downstream pressure is admitted into the main valve cover chamber, closing the valve to prevent return flow.

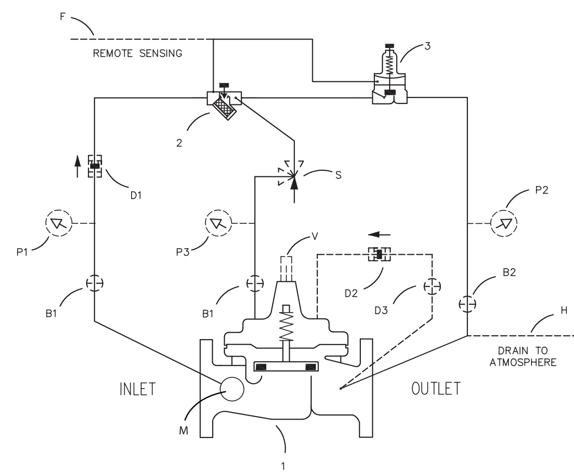
Schematic Diagram

Item	Description
1	100-20 Hytrol Main Valve
2	X42N-2 Strainer & Needle Valve
3	CRL-60 Pressure Relief Control

Optional Features

Item	Description
B	CK2 Isolation Valve
D	Check Valves with Isolation Valve
F	Remote Pilot Sensing
H	Drain to Atmosphere
M	X144 e-FlowMeter
P	X141 Pressure Gauge
S	CV Speed Control (Opening)
V	X101 Valve Position Indicator

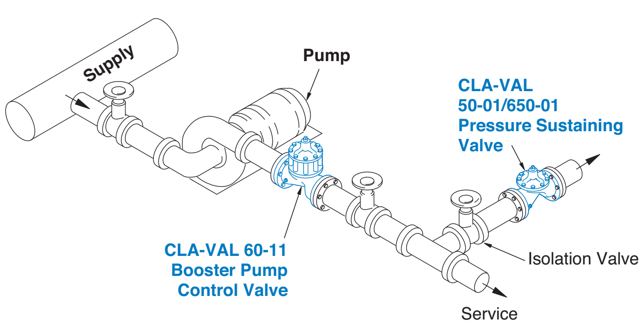
see page 3 for approvals



Typical Applications

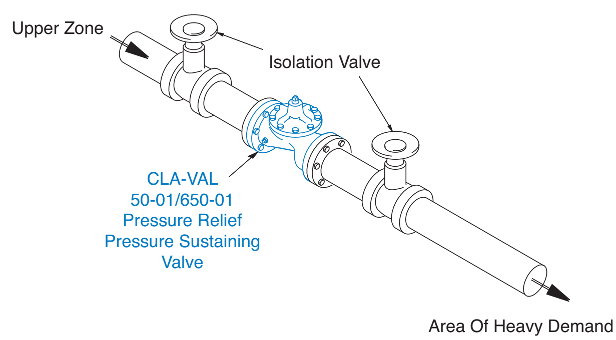
Pressure Relief Service

This fast opening, slow closing relief valve provides system protection against high pressure surges on pump start up and pump shut down by dissipating the excess pressure to a safe location.



Pressure Sustaining Service

When installed in a line between an upper zone and a lower area of heavy demand, the valve acts to maintain desired upstream pressure to prevent "robbing" of the upper zone. Water in excess of pressure setting is allowed to flow to an area of heavy demand, control is smooth, and pressure regulation is positive.

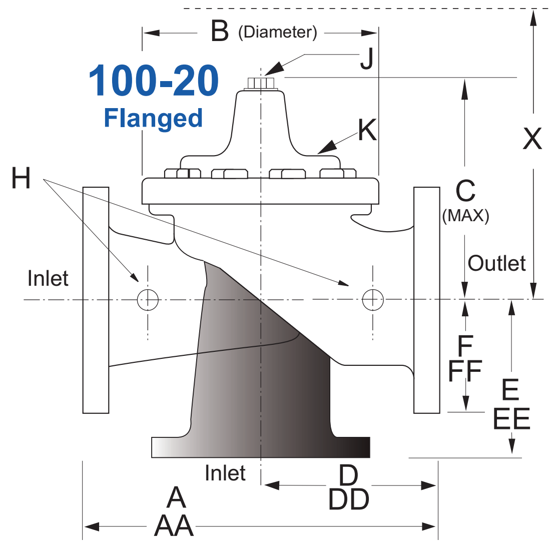


Model 650-01 (Uses 100-20 Hytrol Main Valve)

Pressure Ratings (Recommended Maximum Pressure - psi)

Valve Body & Cover		Pressure Class		
		Flanged		
Grade	Material	ANSI Standards*	150 Class	300 Class
ASTM A536	Ductile Iron	B16.42	250	400
ASTM A216-WCB	Cast Steel	B16.5	285	400
UNS 87850	Bronze	B16.24	225	400

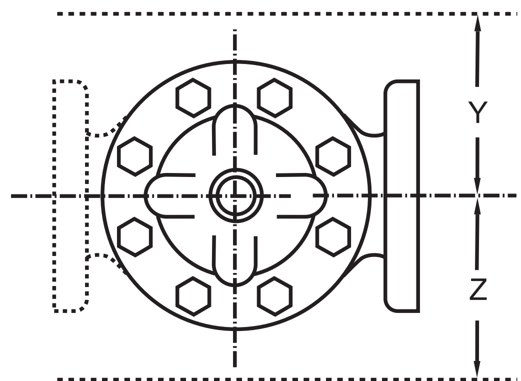
Note: * ANSI standards are for flange dimensions only.
Flanged valves are available faced but not drilled.
Valves for higher pressure are available; consult factory for details



Materials

Component	Standard Material Combinations		
Body & Cover	Ductile Iron	Cast Steel	Bronze
Available Sizes	3" - 48" 80 - 1200 mm	3" - 16" 80 - 400 mm	3" - 16" 80 - 400 mm
Disc Retainer & Diaphragm Washer	Cast Iron	Cast Steel	Bronze
Trim: Disc Guide, Seat & Cover Bearing	Bronze is Standard Stainless Steel is Optional		
Disc	Buna-N® Rubber		
Diaphragm	Nylon Reinforced Buna-N® Rubber		
Stem, Nut & Spring	Stainless Steel		

For material options not listed, consult factory.
Cla-Val manufactures valves in more than 50 different alloys.



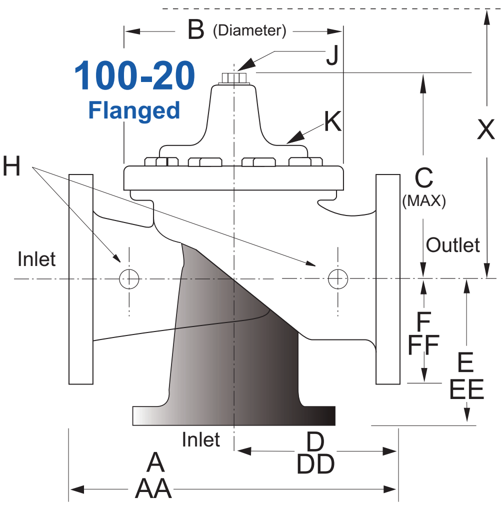
Model 650-01 Dimensions (In Inches)

Valve Size (Inches)	3	4	6	8	10	12	14	16	18	20	24	30	36	48
A 150 ANSI	10.25	13.88	17.75	21.38	26.00	30.00	34.25	35.00	42.12	48.00	48.00	63.25	65.00	88.0
AA 300 ANSI	11.00	14.50	18.62	22.38	27.38	31.50	35.75	36.62	43.63	49.62	49.75	63.75	67.00	90.62
B Diameter	6.62	9.12	11.50	15.75	20.00	23.62	27.47	28.00	35.44	35.44	35.44	53.19	56.00	66.00
C Maximum	7.00	8.62	11.62	15.00	17.88	21.00	20.88	25.75	25.00	31.50	31.50	43.94	54.75	59.00
D 150 ANSI	—	6.94	8.88	10.69	CF*	17.00	CF*	CF*	CF*	CF*	21.06	—	—	—
DD 300 ANSI	—	7.25	9.38	11.19	CF*	17.75	CF*	CF*	CF*	CF*	CF*	—	—	—
E 150 ANSI	—	5.50	6.75	7.25	CF*	13.75	CF*	CF*	CF*	CF*	15.94	—	—	—
EE 300 ANSI	—	5.81	7.25	7.75	CF*	14.75	CF*	CF*	CF*	CF*	CF*	—	—	—
F 150 ANSI	3.75	4.50	5.50	6.75	8.00	9.50	11.00	11.75	15.88	14.56	17.00	19.88	25.50	34.00
FF 300 ANSI	4.12	5.00	6.25	7.50	8.75	10.25	11.50	12.75	15.88	16.06	19.00	22.00	27.50	38.50
H NPT Body Tapping	0.375	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
J NPT Cover Center Plug	0.50	0.50	0.75	0.75	1.00	1.00	1.25	2.00	2.00	2.00	2.00	2.00	2.00	2.00
K NPT Cover Tapping	0.375	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
Stem Travel	0.60	0.80	1.10	1.70	2.30	2.80	3.40	4.50	4.50	4.50	6.50	7.50	7.50	8.50
Approx. Ship Weight (lbs)	45	85	195	330	625	900	1250	1380	2365	2551	2733	6500	8545	13100
Approx. **X** Pilot System	13	15	27	30	33	36	36	41	40	46	55	68	79	86
Approx. **Y** Pilot System	10	11	18	20	22	24	26	26	30	30	30	39	40	47
Approx. **Z** Pilot System	10	11	18	20	22	24	26	26	30	30	30	39	42	49

***Consult Factory**

For sizes 18 through 36-inches, use the 650-66 E-Sheet

Model 650-01 Metric Dimensions (Uses 100-20 Hytrol Main Valve)

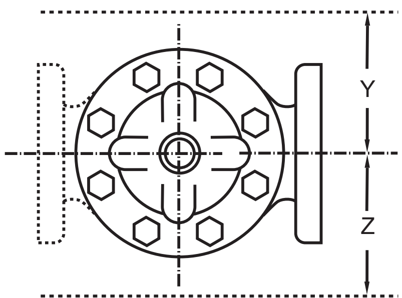


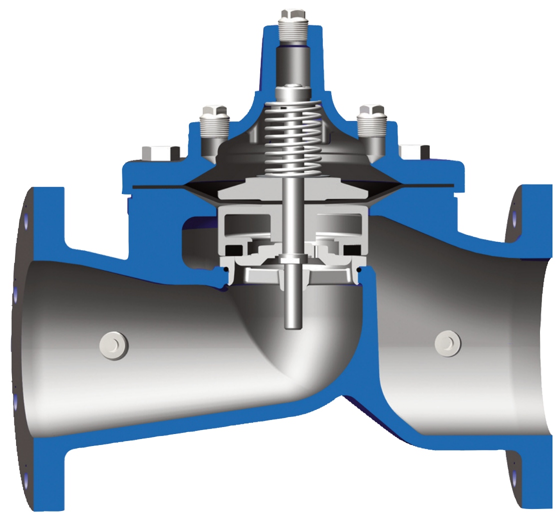
Valve & Pilot Approvals

NSF/ANSI 372: National Lead Free Mandate "Reduction of Lead in Drinking Water Act"

NSF International recognizes Cla-Val as complying with NSF/ANSI 61 and all applicable requirements.

Cla-Val fulfills the requirements described in the American Water Works Association's (AWWA) Standard for Pilot-Operated Control Valves: C530:12





Model 650-01 Dimensions (In mm)

Model 100-20 Reduced Port Hytrol Main Valve

Valve Size (mm)	80	100	150	200	250	300	350	400	450	500	600	750	900	1200
A 150 ANSI	260	353	451	543	660	762	870	889	1070	1219	1219	1607	1651	2235
AA 300 ANSI	279	368	473	568	695	800	908	930	1108	1260	1263	1619	1702	2302
B Diameter	168	232	292	400	508	600	698	711	900	900	900	1351	1422	1676
C Maximum	178	219	295	381	454	533	530	654	635	800	800	1116	1391	1499
D 150 ANSI	—	176	226	272	CF*	432	CF*	CF*	CF*	CF*	535	—	—	—
DD 300 ANSI	—	184	238	284	CF*	451	CF*	CF*	CF*	CF*	CF*	—	—	—
E 150 ANSI	—	140	171	184	CF*	349	CF*	CF*	CF*	CF*	405	—	—	—
EE 300 ANSI	—	148	184	197	CF*	368	CF*	CF*	CF*	CF*	CF*	—	—	—
F 150 ANSI	95	114	140	171	203	241	279	289	403	370	432	505	648	864
FF 300 ANSI	105	127	159	191	222	260	292	324	403	408	483	559	699	978
H NPT Body Tapping	0.375	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
J NPT Cover Center Plug	0.50	0.50	0.75	0.75	1.00	1.00	1.25	2.00	2.00	2.00	2.00	2.00	2.00	2.00
K NPT Cover Tapping	0.375	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
Stem Travel	15	20	28	43	58	71	86	86	114	114	114	165	191	216
Approx. Ship Weight (kgs)	20	39	89	150	284	409	568	627	681	1157	1249	2951	3876	5942
Approx. **X** Pilot System	331	381	686	762	839	915	915	1042	1016	1169	1397	1728	2007	2185
Approx. **Y** Pilot System	254	280	458	508	559	610	661	661	762	762	762	991	1016	1194
Approx. **Z** Pilot System	254	280	458	508	559	610	661	661	762	762	762	991	1067	1245

***Consult Factory**

For sizes 450 through 1200mm, use 650-66 E-Sheet

650-01 Valve Selection		100-20 Pattern: Globe (G), Angle (A), End Connections: Flanged (F) Indicate Available Sizes														
	Inches	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
	mm	80	100	150	200	250	300	350	400	450	500	600	750	900	1000	1200
Basic Valve 100-20	Pattern	G	G, A	G, A	G, A	G	G	G	G	G	G	G	G	G	G	G
	End Detail	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
Suggested Flow (gpm)	Maximum	260	580	1025	2300	4100	6400	9230	9230	16500	16500	16500	28000	33500	57000	57000
	Maximum Surge	440	990	1760	3970	7050	11000	15900	15900	28200	28200	28200	56500	58600	90000	90000
Suggested Flow (Liters/Sec)	Maximum	16	37	65	145	258	403	581	581	1040	1040	1040	1764	2115	3596	3596
	Maximum Surge	28	62	111	250	444	693	1002	1002	1777	1777	1777	3560	3700	5678	5678

100-20 Series is the reduced internal port size version of the 100-20 Series.

Notes:
- For sizes 18 through 36-inches / 450mm though 900mm, use 650-66 E-Sheet
- Many factors should be considered in sizing pressure relief valves including inlet pressure, outlet pressure and flow rates.
- For sizing questions or cavitation analysis, consult Cla-Val with system details.

Pilot System Specifications

Adjustment Ranges

0 to 75 psi Max.
20 to 105 psi
20 to 200 psi *
100 to 300 psi

***Supplied unless otherwise specified. Other ranges are available, please consult factory.**

Temperature Range
Water: to 180°F

Materials

Standard Pilot System Materials
- Pilot Control: Low Lead Bronze
- Trim: Stainless Steel Type 303
- Rubber: Buna-N® Synthetic Rubber

Optional Pilot System Materials
Pilot Systems are available with optional Aluminum, Stainless Steel or Monel materials.

Pilot Approvals

NSF/ANSI 372: National Lead Free Mandate "Reduction of Lead in Drinking Water Act"

When Ordering, Specify:

1. Catalog No. 650-01
2. Valve Size
3. Pattern - Globe or Angle
4. Pressure Class
5. Threaded, Flanged, Grooved
6. Trim Material
7. Adjustment Range
8. Desired Options
9. When Vertically Installed

Main Valve Options

EPDM Rubber Parts
Optional diaphragm, disc and o-ring fabricated with EPDM synthetic rubber

Viton® Rubber Parts - suffix KB
Optional diaphragm, disc and o-ring fabricated with Viton® synthetic rubber

Epoxy Coating - suffix KC
NSF 61 Listed and FDA approved, fusion bonded epoxy coating

Dura-Kleen® Stem - suffix KD
Fluted design prevents dissolved minerals build-up on the stem

LFS Trim
Designed to regulate precisely and smoothly at typical flow rates as well as lower than the industry standard of 1 fps, without decreasing the valve's capacity

Valve Options

X141 Pressure Gauge

X101AR Valve Position Indicator with Air Release

X101 Valve Position Indicator

X144 e-FlowMeter

X43H Strainer

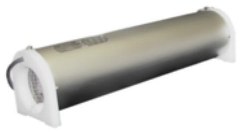
Stainless Steel Pilot

Tank Mixer

Medora Corporation
3225 Highway 22 • Dickinson, ND 58601
Tel: (701) 225-4495 • www.MedoraCo.com

www.gridbee.com

www.solarbee.com



Budget Estimate (Purchase)
GridBee GS Series Electric Potable Water Tank Mixers

Last Updated: March 14, 2018 - Note: Please verify price before ordering.

Performance Guaranteed or your Money Back. The GS Mixers are the most effective and competitively priced mixers on the market, with the lowest life cycle cost and the best warranty. Specifications are available at www.MedoraCo.com
Installing the mixer is well within the capabilities of most cities and contractors. Usually the unit is installed directly under the hatch, no need to center it in tank. A GS Series Electric Mixer 11 minute Installation Video is available at: http://potablewater.medoraco.com/mixers/gridbee-electric

Description	GS-12	GS-9
GS Submersible Electric Mixer: with 75 ft of in-tank submersible electrical cable	**$9,580**	**$6,880**
GS Submersible Electric Mixer: with 150 ft of in-tank submersible electrical cable	**$9,970**	**$7,270**
Freight cost for each basic system:	**$100**	**$80**
Horsepower, Voltage, Phase: GS Mixers are available on request at the same price: 240vAC 1PH and 460vAC 3PH	0.50 hp, 120vAC, 1PH	
Mixer length x diameter, inches: 12" or larger hatch size required, no need to enter or drain the tank	36" x 10"	24" x 10"
Weight: submersible mixer only	75 lbs	65 lbs
Maximum recommended tank volumes for moderate conditions:* * The GS-12 is recommended for higher turnover rate, or ice issues, or areas with high heat.	8 MG (million gallons)	3 MG (million gallons)

Options

Mix-Guard Replacement Program: Covers beyond the warranty,
it replaces the mixer for Acts of God, lightning, vandalism, power problems, handling damage or any other issue.
Annual Cost: While in 5 year warranty: GS-12 $450, GS-9 $350 - When beyond the 5 year warranty: GS-12 $850, GS-9 $690

Chemical injection interior hose: per 100 ft	**$230**
Chemical injection exterior hose: per 50 ft SS braided hose w/ quick connect	**$360**
Chemical injection hose penetration thru fitting: for steel tanks	**$445**

Control Box A (120v): UL listed, NEMA 4X, 120vAC/1ph, with SCADA monitoring, HOA switch, indicator light, locking latch	**$1,090** Shipped with mixer for electrical contractor installation
Control Box B (120v) : UL listed, NEMA 4X, 120vAC/1ph, w/ timer but No SCADA, on/off switch, indicator light, locking latch	**$695** Shipped with mixer for electrical contractor installation
Control Box A (240v): UL listed, NEMA 4X, 240vAC/1ph, with SCADA monitoring, HOA switch, indicator light, locking latch	**$1,400** Shipped with mixer for electrical contractor installation
Factory Delivery and Placement: Installing the above mixer is within the scope of work that most cities and contractors can perform	**$13,000** Varies with tank height and tank construction
STH-8400 Submersible Electric Potable Water Tank Heater: 316 SS, includes a control panel, float switch, 50' of electrical cable, chain, etc. Fits through 12" or larger roof opening. Nominal 240VAC/1PH	**$6,800 + $100 Freight** Typically used in cold climates when the tank has less then 10% turnover
Portable Disinfectant Boost System: An electric or engine-driven air compressor (4 cfm @ 60 psi) is required to operate the air-powered diaphragm pump; air compressor is not included	**$8,720** **FOB Factory** 

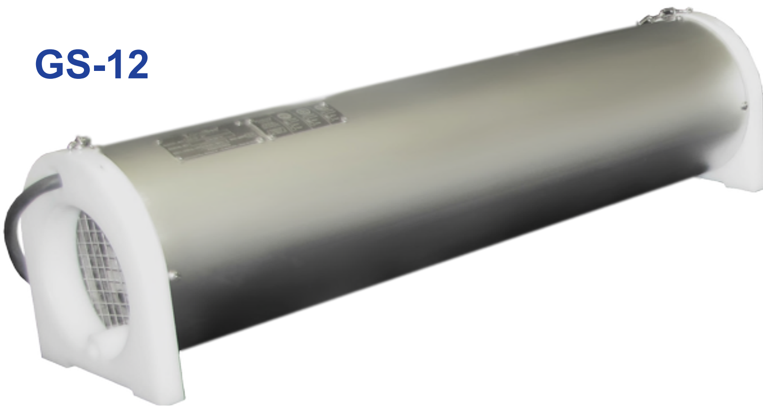
Manual Digital Thermometers: Do your own before and after temperature profile with: Fish Hawk TD to 300' depth in 5' increments: $250

GridBee®

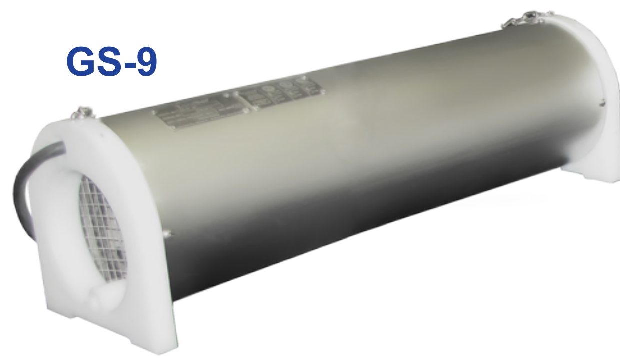
GS Electric Mixers

Effective. Efficient. Affordable.

GS-12



GS-9



Benefits

- Active mixing 24 hours a day
- Creates a consistent mix & water age surface to floor
- Ensure uniform disinfectant distribution
- Minimize chemical disinfectant usage & disinfection by-products
- Eliminate ice damage to tanks in cold climates
- Reduce nitrification in chloraminated systems
- Prevent stagnation, thermal stratification, and short-circuiting
- Eliminate energy intensive & costly deep-cycling and/or flushing of tanks
- Lowest life-cycle cost
- 5-year warranty
- Installation & other videos available on YouTube

Features

- Engineered for easy deployment. Everything you need is in the box!
- No tank entry required
- Quiet operation
- Utilizes efficient sheet mixing technology
- SCADA control panels available
- Liquid disinfectant boosting port
- 316SS Construction

GridBee® SolarBee®
Potable Water Equipment
Certified to
NSF/ANSI Standard 61
& NSF/ANSI Standard 372
(Formerly Annex G for lead-free content)
For more information visit:
www.medoraco.com/NSF-UL-CSA

Best Warranty in The Industry!

Medora Corporation GridBee® SolarBee®

www.medoraco.com | 866-437-8076 | info@medoraco.com

1722_20161108

GridBee®

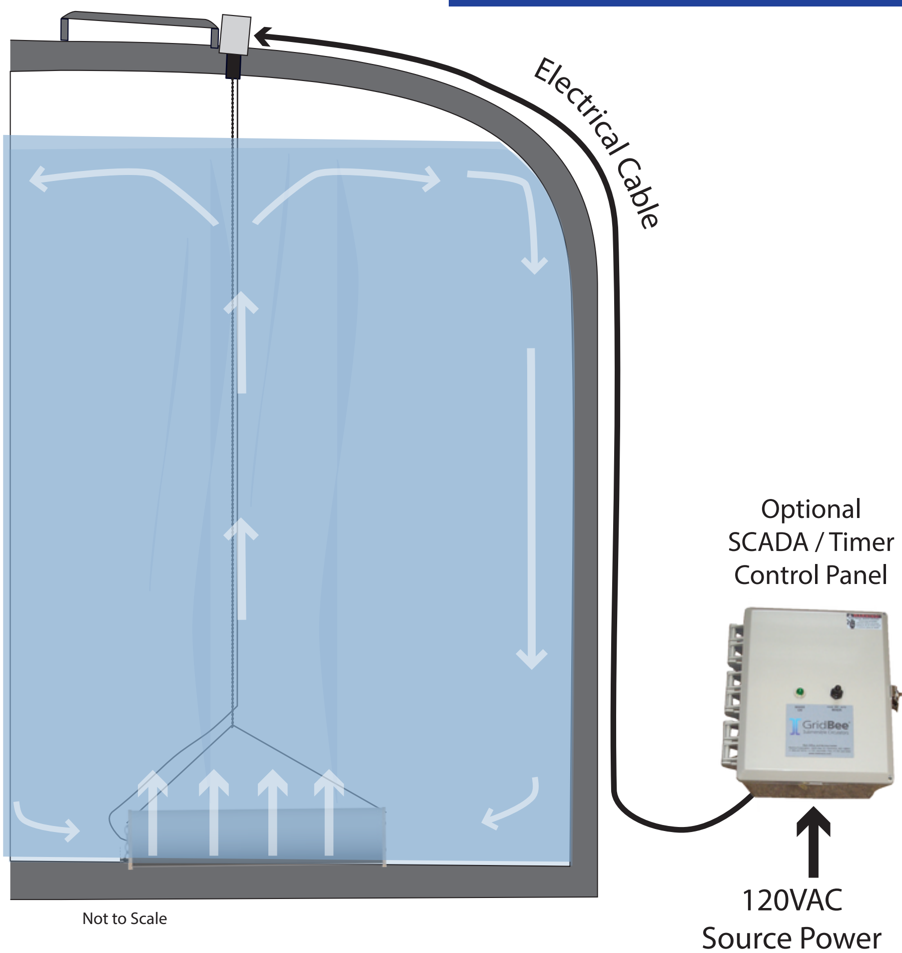
GS Electric Mixers

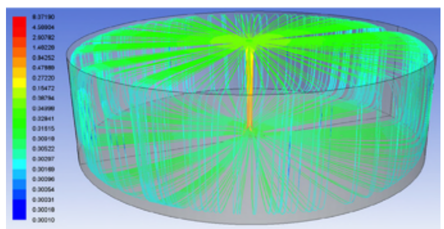
Overview

GridBee GS Mixers are easily installed through a 12 inch diameter or larger hatch or other tank opening. They thoroughly mix the entire tank volume from the tank floor to the water surface resulting in consistent disinfectant residuals, even temperature profiles, and uniform water age.

Everything Needed for a Fast & Efficient Deployment is Included!

Watch GridBee GS-12 Installation Video on YouTube!





CFD Model

Chain

Top of Tank Junction Box

Chain Grab Tools

Kellem Grip

Cord Fixture Bolt

Hole Saw

Lexel Sealant

Cord Seal Cap

Specifications

GS-12	Assembled machine is 3 ft (0.9 m) long X 10 inch (25.4 cm) in diameter and weighs 75 lbs (34 kg).
GS-9	Assembled machine is 2 ft (0.6 m) long X 10 inch (25.4 cm) in diameter and weighs 65 lbs (34 kg).

Medora Corporation GridBee® SolarBee®

www.medoraco.com | 866-437-8076 | info@medoraco.com

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Appendix D – Hydrogeologic Report

DRILLING, WATER QUALITY, AND YIELD RESULTS, SPRINGFIELD WELL NO. 2, PAJARO / SUNNY MESA COMMUNITY SERVICES DISTRICT, MONTEREY COUNTY, CALIFORNIA

Report prepared for:
MNS Engineers, Inc.

Prepared by:
Mark Woyshner
Gustavo Porras
Barry Hecht

Balance Hydrologics, Inc.

May 2018

A report prepared for:

Paul Greenway and Nick Panofsky, PE
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Drilling, Water Quality, and Yield Results, Springfield Well No. 2, Pajaro / Sunny Mesa Community Services District, Monterey County, California

 Project Assignment: 215021

by

Mark Woyshner
Hydrologist/Hydrogeologist

Gustavo Porras
Hydrologist/Geologic Engineer

Barry Hecht, CHg, CEG
Senior Principal

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CERTIFIED HYDROGEOLOGIST
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May 25, 2018

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1. INTRODUCTION

The Pajaro/Sunny Mesa Community Services District (District) provides potable water service to various unincorporated communities, serving approximately 1,470 residents. The service areas are physically separate, each having their own water system. The Springfield community water system[1] (CA2700771) serves 34 connections along Struve Road in northern Monterey County. Springfield is a disadvantaged community of about 200 residents, many of them farmworkers. For the period 2009 to 2018 (**Table 1**), the Average Annual Demand (AAD) of the system was 6.6 million gallons (20 acre-feet), with an Average Day Demand (ADD) of 18,000 gallons (or 12.5 gpm continuous pumping). The maximum ADD for the period of record was 21,393 gallons during 2017 (or 14.9 gpm continuous pumping), and the Maximum Day Demand (MDD) was 42,150 gallons on June 15, 2016 (or 29.3 gpm continuous pumping).

The Springfield water system is currently on active status without system storage. Raw water storage is available solely in the aquifer; there is no substantive treated water storage. Water is supplied to the distribution system by one well, located a little over a mile from the Monterey Bay and from the Elkhorn Slough to the south and east of the site (**Figure 1**). The well is within a low-lying area at elevation 19 feet above sea level (asl), and surrounded by agricultural land-uses. The well was completed in April 1982 to a depth of 172 feet below ground surface (ft bgs) with perforations between 122 and 172 feet. Contaminated with nitrate and seawater, the well has not met State Title 22 drinking water standards since at least 1996. Current nitrate levels hover close to 300 mg/L (as NO_3), chloride concentrations exceed 900 mg/L and total dissolved solids (TDS) concentrations are approximately 3,000 mg/L. The maximum contaminant levels (MCLs) for these contaminants are 45 mg/L for nitrates, 250 mg/L (with an upper level at 500 mg/L) for chloride, and 500 mg/L (with an upper limit of 1,000 mg/L) for TDS.[2] Pajaro Valley Water Management Agency (PVWMA) implements water-quality objectives of 150 mg/L for chloride, and also for sodium (100 mg/L) and sodium absorption ratio (SAR=4.0), which were selected with consideration to the relative salt tolerances of crops grown in the Pajaro Valley and based on guidelines for irrigation in the Central

[1] A Community Water System is a public water system that has 15 to 199 service connections used by year-long residents, or regularly serves at least 25 year-long residents, and regulated by the county health department. Large water systems that have 200 or more service connections used by year-long residents are regulated by the California State Water Resources Control Board.

[2] Chloride and TDS are metrics generally used to characterize the extent seawater intrusion. Nitrate has a Title 22 primary standard intended to protect public health, while chloride and TDS are secondary standards and consumer acceptance levels.

Coast Regional Basin Plan (CCRWQCB, 2011). The water well drillers report and analytical lab reports for the Springfield Well No. 1 are found in **Appendix A**.

The District has been working with the residents of the Springfield/Struve Roads area to improve the water system since 2005 when the system was acquired. The District acquired a 100-ft by 130-ft easement at the northeast corner of the discontinued Moss Landing Middle School (APN 413-014-001; POR OF LOT 2 SEC 2 T13S R2W) for a new well, storage and treatment facilities. The property is located within a rural, farming setting on Springfield Road, 700 ft east from Highway 1. The address for the property is 1812 Springfield Road, Moss Landing, California 95039-9652. The site is at elevation 142 ft asl (WGS84, based on Google Earth) and located approximately 3,500 feet northeast from the existing Springfield Well No. 1 (**Figure 1**). A test hole was drilled at the site in July 2008 to a depth of 630 ft bgs. A geophysical electric log was conducted and a groundwater quality sample collected. The geophysical log suggests fresh water at depth; the lab results showed the nitrate concentration at 4.9 mg/L (as nitrate), chloride concentration was 40 mg/L, and TDS 370 mg/L. The well drillers report, geophysical log, and analytical lab report for the test hole are found in **Appendix B**.

The District was awarded a California Department of Water Resources (DWR) Integrated Regional Water Management (IRWM) Implementation grant funding for planning and preparation of contract documents to upgrade the water system. Three alternatives are proposed with regard to improving the Springfield water supply:

- Alternative A. Drill a new well at the school site (preferred);
- Alternative B. Connect to the Moss Landing Water System approximately 7,200 feet to the south of the community; and,
- Alternative C. Drill a new (deeper) well at the existing well site.

The new well may also serve the Moss Landing Mobile Home Park, which has 105 connections, and 30 single family home connections along Springfield & Giberson Roads, as well as storage per County Fire District requirements. The ADD is estimated to increase to 62,400 gallons (or 43 gpm), and the MDD to 119,000 gallons (83 gpm). The AAD would increase to 23 million gallons (or 70 acre-feet).

1.1 Purpose of Report

The test-hole site at the northeast corner of Moss Landing Middle School appeared to be a favorable location for a new water-supply well based on:

a) the results of lithologic and geophysical logging and water-quality sampling from the test hole at this location indicates 'fresh' water quality (**Appendix B**);

b) the site is not prone to flooding (**Figure 2** and **Figure 3**); and

c) water storage at the site would be at a higher elevation, providing head to the distribution system.

In November 2017, the District installed the Springfield Well No. 2 (a test well) at the middle school site, and followed with a step-drawdown test, a constant-rate pumping and recovery test, and sampling for Title 22 water-quality and groundwater age-dating analyses. This report summarizes the results of the well drilling and testing and assesses its potential as a sustainable water-supply source.

In addition, we reviewed published reports relevant to the site, drillers reports (well logs) provided to us by DWR (summarized and illustrated as lithologic profiles across the project site), and water-quality data[3] to address the following questions:

a) To what degree will Alternative A, the Springfield Well No. 2 solve the Springfield system's water-quality limitations?

b) If Alternative A is not feasible, then will Alternative C, a deeper well the existing well site provide suitable water quality from a regional hydrogeologic perspective?

1.2 Acknowledgments

This work was conducted with technical assistance and guidance of Martin Feeney, PG CEG CHg, Consulting Hydrogeologist and of Nick Panofsky, PE, Senior Project Engineer at MNS Engineers, Inc. Maggiora Bros. Drilling installed the new Springfield Well No. 2 and assisted with the yield test by installing the pump, piping, portable generator, and discharge hoses, as well as troubleshooting field problems that arose. Newman Well Surveys performed the e-log during drilling the Springfield Well No. 2. Pajaro / Sunny Mesa staff assisted with access and troubleshooting field problems. Guadalupe Rocha coordinated pumping of his irrigation well on Springfield Road during the yield test, and permitted our monitoring of water levels in the well. Scott Hawkins of Hawkins

[3] Water-quality data from wells in the vicinity of the project site monitored by the Pajaro Valley Water Management Agency (PVWMA) are considered proprietary under their agreement with the well owners and were not available for this study.

Engineering permitted our monitoring of water levels in the well supplying water to their business at 1813 Springfield Rd, Moss Landing, CA 95039. Mark Harris, facilities director for the discontinued Moss Landing Middle School permitted our monitoring of water levels in the well supplying water to the school site (aka. PVWMA well #992). School facilities caretaker and family graciously tolerated living with the inconveniences of noise and drainage during the drilling and pumping of the Springfield Well No. 2. Roger Van Horn, R.E.H.S., Supervisor Drinking Water Protection Service / Well Program, Monterey County Health Department, Environmental Health Bureau provided oversight for the installation, yield and water-quality testing of the Springfield Well No. 2.

2. HYDROGEOLOGIC SETTING

The project site is located within the Pajaro Valley Groundwater Basin (DWR sub-basin 3.2) and within the Springfield subarea, which extends from the coast to the Elkhorn Slough and northward to the Pajaro River alluvial floodplain. The hydrogeology of Pajaro Valley and adjacent parts of the Monterey Bay has been compiled in numerous studies and summarized in the following reports: Hanson and others, 2014; DDA, 2013; Hanson, 2003a, 2003b; Johnson and others, 1988; Luhdorff & Scalmanini, 1988; Fugro West, 1995; and HEA, 1978. Quoting and paraphrasing from these reports and from published geologic maps and reports (Rosenberg, 2001; Dupre, 1990; and Dupre and Tinsley, 1980), we prepared this report section describing of the geologic and hydrogeologic conditions related to the project site. In summary, water supply in the Springfield subarea is locally constrained by water-quality problems. Chronic storage depletion and groundwater pumping drawing water levels below sea level have induced seawater intrusion largely in the upper Aromas Sands and overlying sands and gravels (“alluvial aquifer”). Recharge to the aquifer has caused widespread nitrate contamination, limiting sources for potable water supplies. Attempts to mitigate seawater intrusion in the subarea by reducing groundwater pumping have shown success (PVWMA Basin Management Plan Update).

2.1 Depositional History

The alluvial aquifers in the Pajaro Valley are underlain by granitic basement rocks of Cretaceous age (Salinian Block) that generally occur at depths of 2,000 to 4,000 ft along the coast and are exposed locally along ridges just east of Royal Oaks Park, several miles to the east in Prunedale. Overlying these basement rocks are minimally permeable consolidated rocks of Eocene to Miocene age composed of mostly marine shales, mudstones, clay, silt, fine sand, conglomerate, and minor deposits of volcanic rock.

In the early Pliocene, a primary hydrologic connection between the San Joaquin Valley and the Pacific Ocean is believed to have existed within the ancestral Santa Cruz Basin, which extended along the northeast side of the Gabilan Range through the Santa Cruz Mountains. Throughout the Pliocene, this marine depositional basin received generally fine- to coarse-grained sediments, which became the upper Purisima Formation. The Purisima Formation is poorly consolidated and underlies the Pajaro Valley at depths ranging from at or near land surface along the northern and eastern boundaries, to as much as 800 or 900 feet near the mouth of the Pajaro River (and near the project site).[4]

By late Pliocene, uplift of the Santa Cruz Mountains segmented the Santa Cruz Basin to form the Watsonville Basin. The Watsonville area has since been a stable to subsiding depositional center and the locus of fluvial, alluvial-fan, and eolian activity throughout the Quaternary, or about the last 2.7 million years. These deposits are mapped as Aromas Sands, which unconformably overly the Purisima Formation. The Upper and Lower Aromas members of this formation are considered to be the primary aquifers in the Pajaro Valley. The average specific capacity (Cs) of wells in the Springfield subarea – nearly all of which are developed in the Aromas aquifer -- is 4.1 gallons per minute per foot of drawdown (gpm/ft), and the maximum is 40 gpm/ft (Fugro, 1995).

Similar to the Purisima Formation, the Aromas Sands thicken coastward. The upper part of the Aromas Sands outcrops in the northern part of the Watsonville area. Together with higher rainfall (up to 30 inches per year), the sandy formation north and west of the town of Corralitos, it is a major groundwater recharge area for the Pajaro Valley. In this area north of the alluvial floodplain of the Pajaro River, the Aromas Sands are characterized as a heterogeneous mixture of cross-stratified sand, silt and gravel deposited by a series of aggrading fluvial and alluvial-fan systems. The Aromas Sands extend south under the Springfield subarea, where they are complexly interbedded with eolian and marine deposits (near the project site). South of the Pajaro River, the Aromas Sands outcrop on the fringe of the Springfield terrace subarea, where they are overlain by younger but similarly complex eolian and marine deposits (**Figure 4**). Aromas Sands also outcrop east of the Elkhorn Slough.

It is believed that an ancestral San Benito River once entered the Monterey Bay via the Elkhorn Slough, to be subsequently diverted into the Watsonville region by movement along the San Andreas Fault and/or capture by the Pajaro River. The ancestral San Benito River would seem to have been an early source of sediment forming the Aromas Sands deposit at the project site, while later deposition would be from the Pajaro River.

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[4] South of the ancestral Santa Cruz Basin, the Purisima Formation consists of relatively less permeable marine silt, clay, and fine sand units, suggesting deposition outside of the main drainage. The upper Purisima Formation is believed to inter-tongue with the deposits that comprise the 400-ft aquifer of the Salinas Valley, interpreted to consist of continental deposits associated with the lower Paso Robles Formation.

In addition, multiple glacioeustatic[5] cycles are recorded in the Aromas sands, with fining-upward sequences of fluvial and estuarine sediments during periods of rising sea level (transgression), and fluvial dissection and eolian and littoral marine sediments deposited during periods of declining sea level. Massive fine-grained deposits are present to the south of the Springfield subarea and at depth along the coast (as noted at deep boreholes PV-5, PV-4 and PV-4A in **Appendix C** and boreholes E and F in **Appendix D**), likely representing deposition within an ancestral submarine canyon. The Elkhorn Slough and related estuarine mud deposits also broarder Springfield area east of the project site. The presence of these thick fine-grained deposits appear to have possibly isolated the area from the effects of inland pumping and documented seawater intrusion south and east of these deposits.

Terrace deposits, unconsolidated alluvium, dune deposits, and younger marine sediments blanket the Aromas Sands (**Figure 4**), and are variable spatially and ranging in thickness from about 15 to 380 feet in the Pajaro Valley. A fine-grained confining layer ranging from 15 to 55 feet thick (referred to as the basal confining layer) generally separates these deposits from the Aromas Sands. While the Watsonville area has been a stable or subsiding basin through the Quaternary, a series of coastal terraces have formed to the north is response to glacioeustatic fluctuation in sea level superimposed on the tectonically uplifting Santa Cruz Mountains. Six sets of marine terraces have been mapped in the Santa Cruz region, ranging in elevation from 60 to 790 feet above sea level. The lowest terrace complex (Santa Cruz terrace) consists of three distinct interglacial shorelines, the youngest likely relating to the Springfield coastal terrace (at the project site). The coastal terraces at the project site, though, are mostly buried by and interbedded with eolian deposits.

2.2 Hydrogeologic Framework

For the purpose of groundwater flow modeling, the hydrogeologic framework representing the Pajaro Basin has been simplified to six discrete model layers:

- Two layers of the alluvial/eolian/marine deposits representing a shallow coarse-grained layer and a basal fine-grained confining unit;

[5] Seven or eight times during the past 1,000,000 years, so much of the earth's water was locked up in glaciers that sea level fell about 300 to 420 feet. Each time glaciers melted, sea level rose back up to essentially the same level it now occupies. These are called '*glacioeustatic cycles'.* Glacioeustatic cycles are known to have occurred back into the start of the Pliocene epoch or even earlier.

- Three layers of the Aromas Sand representing the upper Aromas, an upper Aromas basal finer-grained confining unit, and a lower Aromas unit; and
- One layer representing a combination of the Purisima Formation and other minor pre-Pliocene bedrock units.

2.3 Springfield Area Lithology

Drillers reports (well logs) were requested and received from the California Department of Water Resources (DWR) for the project vicinity shown in **Figure 1**. The logs were reviewed and 31 of the deepest logs selected for lithologic analysis, in addition to the logs from the existing source Well No. 1 and test hole. Each log is identified in **Figure 5** with a unique DWR log number. The lithology from each well was entered into the borehole manager of RockWorks16 (by RockWare®) for cross-sections plotting and interpretation. Lithologic categories were based on logged grain sizes (clay, clay and sand, clay with gravel, gravel and sand, sand, and sand with clay) and color (blue/grey, red/brown, and white/yellow). Also included were categories of shale/clay layer, sandstone/hard layer, oyster shells, and top soil. As a preliminary evaluation, the data were used to create a three-dimensional lithologic model using lateral blending to interpolate lithologic categories between the boreholes. The model results were then used to profile intervening lithology types on selected cross sections of logs.

Profile A-A' (**Figure 6**) extends 11,000 feet eastward from wells PV-4 and PV-4A (near the coast), through McClusky Slough, well 315502 (the deepest log at 1,260 ft), and through the existing water-supply well and proposed new well site for the Springfield water system. Profile A-A' includes a 1,600 ft swath on each side of the section, within which lithologic logs were projected to the section line. Profile B-B' (**Figure 7**) extends 13,000 feet northeastward from PV-5 (near the coast), through the existing water-supply well and proposed new well site for the Springfield water system, and ends at PV-7 (north of the project site and near Elkhorn Slough).

The profiles generally show the well-layered coarse-grained deposits separated by segments of fine-grained deposits. The deepest well in the area (DWR no. 315502) identifies thick segments of blue clay with streaks of brown sandy clay below 700 ft and hard shale and clay starting at a depth of 920 ft, interbedded with sandstone and layers of find sand and sandy clays. This 900-ft depth is interpreted as the top of the Purisima Formation. The well is screened to draw groundwater from the Purisima and had chloride concentrations unacceptable for agriculture.

The fine-grained deposits in the overlying Aromas Sands are variable spatially and in depth and thickness. Thick segments of blue clay are identified along the coast below an elevation of about 150 feet below sea level (bsl), and interbedded with sands and clayey sands at depth. USGS staff (Muir, 1972, and Johnson and others, 1980) have characterized Elkhorn Slough as a 550-foot-deep uniform plug of blue clays. Thin deposits of sand and gravel, likely older terrace deposits, are interbedded with brown clay generally overlay the blue clay.

Clay horizons thin considerably inland. In the vicinity of the existing well and proposed new well location, the upper and lower Aromas Sands can be generally differentiated by blue clays found at an elevation of 150 ft to 250 ft bsl. It is likely that this zone corresponds to the blue clay identified at the project test hole (Well No. 2) site at a depth of 295 ft to 360 ft (**Appendices B and F**). Clay horizons are thicker east of the project site (near Elkhorn Slough) with generally more brown clay beds (indicating oxidized zones).

Aromas Sand deposits persist across the Springfield area and form the aquifers from which wells draw water. The upper and lower Aromas Sands are well layered and appear to be reasonably connected across the project area, suggesting that lower Aromas Sands should be present at depth at the Springfield water system existing-well location. Likewise, seawater intrusion and nitrate contamination documented in the upper Aromas Sands would likely extend beneath the new well site when pumped.

2.4 Aquifer Recharge

The aquifers across the Springfield terrace and lowlands are composed of well-layered marine and terrestrial coarse-grained deposits separated by inter-fingering fine-grained deposits. The fine-grained deposits potentially restrict vertical movement of groundwater, though their discontinuous extent, particularly in the Springfield area, may allow for vertical flow of local rainfall recharge through and around these aquitards. Well pumping drawdown increases groundwater gradients and can capture local rainfall recharge, as seen in the Springfield Well No. 1, which at a depth 172 ft bgs is contaminated with nitrate and potentially other agricultural chemicals. The Springfield Well No. 2 site, however, is not contaminated by nitrate-laden local recharge at a depth of 600 ft bgs (further discussed in water quality sampling results section below).

The Pajaro River is also a source of recharge, as identified from boron concentrations in groundwater (**Figure 8;** see HEA, 1978 and Woyshner and Hecht, 2012). However, the lateral extent to which the Pajaro River recharges alluvial aquifer is not known. The river is sealed off from the Springfield area by recent heavy blue clays of the recently-deposited Pajaro Valley floor (Rosenberg's basinal clays, 2001), but high permeabilities beneath the valley floor in the alluvial aquifer likely allow subsurface flow beneath the valley, both from the river water recharged further upstream and from the large dunefields of the San Andreas Terrace immediately northwest of the river.

Hydraulic gradients across the Springfield area, however, have been flat to landward during recent times (**Appendix I**). Fugro (1995) plotted groundwater contours across the Springfield subarea for the dry seasons of 1979, 1983, and 1994. Groundwater elevations had fallen from roughly sea level with a zero hydraulic gradient, to 10 to 20 feet below sea level with northwesterly hydraulic gradient at the project area in 1994. North of the project area, the hydraulic gradient was easterly, drawing seawater toward inland pumping. Similar results are shown for Fall of 1987, 1992, 1998, and 2006 (Hanson and others, 2014), and for recent measurements by PVWMA (Feeney, 2016). These results, as well as seawater intrusion evidence (see Section 2.5 below) do not support the notion of recharge from the Pajaro River reaching the Springfield area during recent years.

The boron plume beneath the floor of the eastern Pajaro Valley, nevertheless, was deflected toward Elkhorn Slough in the 1960s and 1970s (see **Figure 8**), which is most easily understood as a manifestation of southeastward recharge from those dunefields. If so, then managed recharge of the San Andreas dunefields may benefit the Springfield aquifers, potentially as far south as the project site.

2.5 Seawater Intrusion

The Alluvium[6], Aromas Sands, and Purisima Formation are hydrogeologically connected to the ocean through a number of outcrops in Monterey Bay. Coarse-grained deposits persist over large areas and control the depth of well pumping and related seawater intrusion, while the fine-grained deposits may potentially constrain seawater intrusion vertically. Groundwater levels have been near or below sea level at most coastal monitoring wells, and at some inland water-supply wells (including the Springfield subarea). Since the 1970s, groundwater levels have been below the estimated water

[6] For simplicity, the unconsolidated alluvium, eolian deposits, and younger marine sediments the blanket the Aromas Sands are generally referred to as the alluvial aquifer.

levels required to impede seawater intrusion (even during the wet years peaking in 1998 and 2006).

The upper confined or semiconfined Quaternary aquifer -- consisting of the main water-bearing unit of the alluvium and the upper part of the Aromas Sand -- exhibits seawater intrusion. The aquifer's depth near the coast is interpreted as corresponding to an intruded interval of 100 to 200 feet below sea level. The existing Springfield water system Well No. 1 is in this seawater intruded zone. The shallow-alluvial aquifer and parts of the upper Aromas Sands are also being replenished by recharge, and represents a renewable groundwater resource (**Figure 9**).

The Springfield area, as well as other coastal areas of the Pajaro basin, is affected by two forms of seawater intrusion: 1) a relatively shallow, pumping-induced intrusion generally well above the base of fresh groundwater; and 2) a base of natural groundwater intrusion related to the difference in specific gravities between fresh and saline water (see **Figure 9**). The deep seawater intrusion has been dated as old seawater (Hanson 2003a, b). Fresh groundwater is generally found between the shallow zone intruded with seawater and the deep old seawater, and was dated to have been recharged thousands of years ago at some parts of the upper and the lower Aromas Sands. It is unclear if pumping in the interval 300–600 ft below sea level has caused seawater intrusion along the coastal margin but it seems reasonable to be expected.

The Pajaro Valley Water Management Agency operates a Coastal Distribution System pipeline (CDS) that delivers supplemental water to the coast for growers to reduce groundwater pumping. The CDS pipeline to the Springfield subarea has operated since 2009. Significant improvement to chloride, sodium and TDS concentrations in groundwater was observed until water year 2014 when CDS supplies became limited, deliveries reduced, and groundwater pumping increased because of the drought. Concentrations have since returned to pre CDS levels, illustrating the sensitivity of the sea intrusion to existing groundwater pumping.

2.6 Locally Significant Seawater Intrusion

Resistivity logs (also called electric logs, or ‘e-logs’) are useful to identify seawater intrusion[7] and are available for several deep boreholes in the Springfield area (**Figure 10**). Two sets of e-logs were available: a) Seven e-logs shown from the Capurro Ranch well study (Eaton Drilling, 1993), shown in **Appendix C** and locations on Profile C-C’ (**Figure 11**); and b) Five well logs from the Pajaro Valley groundwater investigation (L&S, 1988), shown in **Appendix D** and locations on Profile D-D' (**Figure 12**).

A good example of a seawater intrusion signature is found at the 160 to 190 ft depth at PV-4A (**Appendix C**), where chlorides in the 7,000 to 9,000 mg/L range have been observed (Hanson, 2003a, b; L&S, 1988). Near-coast borehole PV-4 also shows seawater intrusion, and it is uncertain whether boreholes PV-4B and PV-5 show seawater intrusion. At the inland borehole PV-7 (approximately 4,000 ft north of the proposed-well site), old seawater may be present below a depth of 790 ft.

Of the Capurro borehole sites in 1993 (**Appendix D**), Site F (near PV-4 and PV-4A) likely shows a seawater intrusion signature, and interestingly, as does site D at the 175 to 210 ft depth interval. Site D is closest to the existing water-supply well, about 1,000 ft to the southwest. A freshwater water signature is found at site D from 280 ft to 490 ft, implying freshwater also at depth at the existing water-supply well site. There is possibly saltwater perched on clays at about 500 ft to 515 ft at site D. It is uncertain if near-coastal borehole site E is intruded with seawater, and as with PV-4B, site G is unclear. Inland sites A, B and C show freshwater signatures (**Figure 10**). This potentially freshwater area corresponds with the area shown outside of the elevated chloride and sulfate envelope (Hanson, 2003) in **Figure 13**.

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[7] In general silt, clay and shale have the lowest resistivity, and sand and gravel with fresh water have medium to high resistivity. Resistivity decreases as salinity increases, and a sand aquifer intruded with seawater would have a low resistivity.

3. INSTALLATION AND YIELD TESTING OF SPRINGFIELD WELL NO. 2

Maggiora Bros. Drilling (Maggiora) of Watsonville, California was contracted by the District to carry out the drilling, development, and pump-testing of the Springfield Well No. 2. Newman Well Surveys subcontracted to Maggiora to perform down-hole geophysical surveys, consisting of resistivity, spontaneous potential, and gamma logs, generally referred to as an e-log (**Appendix F**). Gustavo Porras of Balance Hydrologics was present during the drilling activities to take hydrologic observations (**Appendix E**) and to log the lithologic composition of the borehole cuttings (**Appendix F**). He also coordinated and monitored the aquifer tests, conducted following the completion of the well, and collected water-quality samples for laboratory analyses.

3.1 Water Well Drilling and Development

The Springfield Well No. 2 was drilled from November 6 to 8, 2017. Based on the 2008 driller's log and e-log, the target depth for the placement of 100 feet of perforated well casing was the lower Aromas Red Sands formation, below blue clay found at a depth of 295 to 360 ft bgs and inter-fingering clay noted from 450 to 470 ft bgs. An Ingersoll Rand TH60 mud-rotary rig and 8 3/4-inch bit were used to drill a pilot hole to a depth of 615 feet below ground surface (bgs). Drill cuttings were sampled at a 5-foot interval for lithological identification. The borehole was e-logged on November 8th. A comparison of the logs with the 2008 logs confirmed that the groundwater quality had not degraded from seawater intrusion, a known issue in the Pajaro Groundwater Basin.

The borehole was reamed to 16 inches on November 13th to the 15th, with casing installed on November 16th. On November 17th, an 8/16" gravel pack material and the cement seal was placed in the well annulus using a tremie. Balance staff and an inspector for Monterey County observed placement of the pack material from the bottom of the well to a depth of 470 ft bgs, and then placement of the cement sanitary seal from 470 ft to ground surface. Starting on November 20th, the well was swabbed and air-lift developed in 20-ft sections. Balance staff were not present during development of the well. After development, we measured the static depth to water in the well at 145 ft bgs on December 8, 2017.

3.2 Well Yield Testing

Balance planned and directed a step-drawdown test ('step test') and a 9-hour constant-rate yield test, with Maggiora as the pumping contractor. Following well completion, Maggiora installed a Berkeley submersible turbine pump model 7T-350 with a 60 HP pump at a depth of 470 feet below ground surface (bgs) and a 4-inch diameter steel pipe extended from the pump to the surface, where a butterfly valve was installed to control the flow rate. Pumped water was discharged to a 4-inch diameter flexible hose extending about 300 feet south onto the school field, an area extending approximately 600 feet south from the site.

In addition to monitoring drawdown in the well Springfield Well No. 2 while conducting the yield tests, we concurrently monitored water levels in three other wells (**Figure 14**):

- The domestic well located 440 feet west from the Springfield well at the Hawkins Engineering house, 1813 Springfield Rd, Moss Landing, CA 95039;
- The School Well located 700 feet south from the Springfield well, labeled PVWMA well 992; and,
- Guadalupe Rocha's irrigation well located 1,500 feet east from the Springfield well.

All four wells were equipped with a submersible Micro-Diver® datalogger, which recorded water level every 5 minutes.[8] Hand measurements of the depth to water were also periodically taken with a Solinst® electronic-tape water-level sounder and used to calibrate the datalogger records.

On Tuesday December 19, 2017, the step test was conducted (**Figure 15**), which consisted of pumping at 327 gpm for three hours (the minimum flow rate possible with a 100 psi backpressure), then increasing to 425 gpm for three hours (the maximum flow rate with butterfly valve completely open). Following review of the step-test results by Roger Van Horn at Monterey County Environmental Health, who corresponded with the State Water Board, an 8-hour constant-rate pumping test was required to be conducted at the same time as the Rocha agricultural well was being used. In accord with this request, we conducted a 9-hour constant-rate pumping test at 400 gpm on Wednesday, February 21, 2018, after Guadalupe Rocha started using his well for the season (**Figure 18**).[9] The use of the Rocha well started on February 12th as rainfall had

[8] The Micro-Diver datalogger installed in the Rocha well became tangled in the well and all data were not retrievable.

[9] Per Monterey County source capacity testing procedures, the Springfield well was pumped for one hour on the day before the constant rate test for the purpose of obtaining an accurate static water level value.

been below normal since the start of the water year, with 0.12 inches during October, 0.92 inches during November, 0.32 inches during December, 3.14 inches during January, and 0.17 inches during February.[10] It did not rain during the yield tests and had not rained for 21 days prior to the step test[11] and for 27 days prior to the constant-rate test.

On the day of the constant-rate test, the Rocha well was pumped at a rate of 900 gpm, which started about an hour before pumping the Springfield well, and ended about an hour before the Springfield well pumping stopped. The School Well and the Hawkins Well both appeared unaffected by simultaneously pumping the Springfield well and the Rocha well, relative to apparent short-term pumping spikes at each well (**Figure 20**). A 9-hour drawdown recovery test immediately followed the pumping test. Drawdown in the Springfield well recovered 98 percent of its total drawdown by the end of the 9-hour recovery period (**Figure 18**).

3.3 Aquifer Properties

Results of transmissivity, specific capacity, saturated hydraulic conductivity, and well efficiency calculations are summarized in **Table 2**.

Transmissivity (T) is a common aquifer coefficient that characterizes how easily water moves through the aquifer (a measure of permeability), and can be used to quantify groundwater flow and to estimate well efficiency. Drawdown data collected at the Springfield No. 2 well during the step test (**Figure 16** and **Figure 17**), the constant-rate pumping test (**Figure 19**) and recovery test (**Figure 21**) were analyzed using the modified nonequilibrium equation graphical method (Cooper and Jacob, 1946) to estimate T. The transmissivity was estimated at 24,000 gallons per day per foot (gpd/ft).

Specific capacity (Cs) is the well function describing the quantity of water that a well can produce per unit drawdown of water level in the well. It is the pumping rate divided by the water level drawdown in the well, in gallons per minute per foot drawdown. The estimated 24-hour Cs for the Springfield well is 8.8 gpm/ft (**Figure 19**).[12]

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[10] Measured at the Castroville CIMIS station (No. 019).

[11] With the exception of 0.02 inches on December 3rd.

[12] The 24-hour Cs can be used to estimate drawdown at the source well for the estimated maximum day demand on the well by the water system.

The average specific capacity of wells in the Springfield subarea is 4.1 gpm/ft (Fugro, 1995).

The efficiency of a pumped well is expressed as the theoretical drawdown divided by the actual drawdown, and is best estimated with a distance-drawdown graph (if available). A more commonly applied alternative method of estimating well efficiency is given by dividing the estimated 24-hour Cs by a theoretical Cs, which is estimated using a relationship to Transmissivity (T). [13] The theoretical Cs for confined aquifers is given by Cs = T / 2,000. The estimate for well efficiency ranges from 66 percent (using the pumping test derived T) to 73 percent (using the recovery test derived T) (**Table 2**).[14] Though higher pumping rates can decrease efficiency, in most wells a substantial portion of the head loss is attributed to laminar flow rather than turbulent flow. In the Springfield well, 66 percent of the head loss can be attributed to laminar flow (**Table 2**).

Hydraulic conductivity (K, also known as permeability) is used in the groundwater flow model and was estimated by dividing T by the aquifer thickness (b), which is the depth for the well minus the depth of the overlying confining clay layer. The estimated saturated hydraulic conductivity is $5x10^{-3}$ centimeters per second (cm/s), which is also expressed as 106 gpd/ft^2 or 14.2 ft/day. The transmissivity and hydraulic conductivity values are similar to reported values by Hanson and others (2014).

3.4 Boundary Effects

When a well is pumped it introduces a stress to the aquifer and lowers hydraulic pressures and water levels in the vicinity of the well. With continued pumping, this effect propagates outward from the well, which can be conceptually represented as a "cone of depression". A recharge boundary is shown in the time-drawdown graph as reduced drawdown after the cone of depression encounters a stream, lake, or other recharge source. Vertical leakage from overlying beds is also shown as reduced drawdown in the time-drawdown graph. Conversely, a no-flow or low-permeability boundary results in increased drawdown after the cone of depression encounters a zone of lower permeability such as a change in lithology or a fault. After 7 hours of pumping the Springfield well at 400 gpm, reduced drawdown can be noted in the

[13] The relationship of aquifer transmissivity (T) to specific capacity (Cs) is found in Appendix 16.D of Driscoll (1983) or p. 128 of DWR Bulletin No. 118-2 (June 1974).

[14] Estimates using recovery data from a pumped well are generally more accurate than the estimates using drawdown data because residual-drawdown measurements are more accurate.

time-drawdown graph (**Figure 19**), which is most reasonably attributed to vertical leakage from overlying beds, considering the depositional history and geologic framework of the Springfield area and the relatively distal locations of potential recharge sources. No low-permeability or no-flow boundaries were observed in the time-drawdown graph.

3.5 Area of Influence

As an initial assessment, the area of influence of a pumped well is commonly estimated using the Cooper-Jacob (1946) distance-drawdown equation, which is an approximation of the Theis (1935) analytical model[15]. Based on the estimates of aquifer transmissivity from the 9-hour pumping and recovery test (discussed above) and using a reported nominal storage coefficient[16] for the lower Aromas aquifer (Hanson and others, 2014), we estimated the radius of influence for the Springfield well for two cases (**Table 3**):

- Case A, the area of influence which would develop at hour 7 (prior to observed vertical leakage from overlying beds) during the 9-hour constant-rate pumping test at 400 gpm using a transmissivity value estimated with the residual drawdown data; and,
- Case B, the area of influence which might develop during late dry-season conditions while pumping at the proposed average day demand of the expanded Springfield water system -- 43 gpm for 60 days -- as an example of seasonal pumping.[17]

As a confirmation, the selected storage coefficient (S) of 0.0015 allowed for the Case A calculated drawdown to match with the observed drawdown at hour 7 of the 9-hour pumping test. Though the results of Case A predict drawdown at the Hawkins Well and School Well from pumping the Springfield well, in fact, the School Well and the Hawkins Well both appeared unaffected by simultaneously pumping the Springfield Well and

[15] In practice, area-of-influence calculations are generally applied for guidance in groundwater management with the caveat of having quantitatively low resolution as a predictive tool. The resolution to a unit of 1-foot would seem reasonable for the conditions at the site.

[16] The storage coefficient is the volume of water released from the aquifer given a unit decline in hydraulic head per unit surface area. Similar to porosity, it is unitless. The storage term in unconfined aquifers is known as specific yield (Sy) and ranges in value from 0.01 to 0.30, while in confined aquifers it is called storativity (S) and ranges 0.005 to 0.0005. Aquifers with S values of 0.005 to 0.01 appear transitional.

[17] We chose 60 days to compare results with the groundwater model results.

the Rocha well, while occasional drawdown spikes were recorded in each well from brief pumping (**Figure 20**). This suggests the School Well and the Hawkins Well are perhaps marginally isolated from the Springfield Well, which draws groundwater from a depth of 490 to 590 feet (elevation -350 to -450 ft) in the lower Aromas aquifer.

Also as an initial (first order) assessment, we used the WinFlow Solver[18], an analytical tool in AquiferWin32® v5 software, to illustrate a conceptual area of influence (or cone-of depression) if the well were pumped at the proposed average day demand (ADD) of 43 gpm for the expanded Springfield water system (as shown in Case B in **Table 3**). The analytical models developed (**Figure 22**) illustrates drawdown for two-dimensional steady-state groundwater flow in a horizontal plane. Results are shown for general (and simplified) groundwater conditions with and without areal recharge. The recharge rate applied was within an assumed area around the well, selected to match the ADD pumping rate of the well. The 1-ft drawdown contour is commonly used to estimate a theoretical area of influence. **Table 4** summarizes the parameters and assumptions of the calculations.

We also ran a two-dimensional transient groundwater flow model with particle tracking to illustrate the radial distance from the well equivalent to the amount pumped at a given time step, and given an effective porosity of 0.2 and an aquifer depth of 225 ft (the depth from the bottom of the well to the overlying confining clay of the lower Aromas aquifer). Results for 60 days and for 60 years of continuous pumping at the ADD rate of 43 gpm are shown in **Figure 23**. Drawdown at 60 days resembles the steady-state model results. At 60 years of pumping, the volume of water pumped is equivalent to an area based on the radial distance of 1,140 ft (shown in **Figure 23**) multiplied by the aquifer depth of 225 ft and the porosity of 0.2. At a practical level, though, the extraction of groundwater from the aquifer would not occur nearly as uniformly as this calculation, but rather, groundwater flow would follow preferential paths within the aquifer to the perforations in the well casing. Extracted groundwater would be replaced by groundwater flow within the aquifer, with lateral flow generally prevailing but also with vertical flow from overlying beds (as was apparent in the pumping test results). Though impossible to predict given the limitations of the available data, as a rough indication with many caveats, this calculation suggests potentially many

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[18] Developed by Strack (1989), primary assumptions for the calculations are that groundwater flow is in the direction of a horizontal hydraulic head, occurs in an infinite homogeneous aquifer (the same in all directions and locations). Though these assumptions are never strictly met in any real-world aquifer system, they are suitable and common practice to assist the placement of pumping wells and as a first assessment of localized changes to groundwater elevations.

decades (to possibly more than a century) of similar water quality as described in Section 4 (below), if pumped at the proposed ADD. This suspicion is largely owing to the depth and thickness of the aquifer relative to the pumping rate, and assuming groundwater quality is locally similar in the vicinity of the well as identified in **Figure 23**. Related time-step calculations are as follows:

Time Step (years)	Groundwater Pumped [1] (MG)	Aquifer Volume [2] (cu ft)	Area around well [3] (sq ft)	Radius from well [4] (ft)
10	228	1.52E+08	6.77E+05	464
20	456	3.05E+08	1.35E+06	657
30	684	4.57E+08	2.03E+06	804
40	912	6.10E+08	2.71E+06	929
50	1,140	7.62E+08	3.39E+06	1,038
60	1,368	9.14E+08	4.06E+06	1,137
70	1,596	1.07E+09	4.74E+06	1,229
80	1,824	1.22E+09	5.42E+06	1,313
90	2,052	1.37E+09	6.10E+06	1,393
100	2,280	1.52E+09	6.77E+06	1,468
200	4,560	3.05E+09	1.35E+07	2,077

Notes:

1. Based on the proposed average day demand pf 62,424 gallons per day.
2. Based on an effective porosity of 0.2.
3. Based on an aquifer thickness of 225 ft.
4. Based on $A = \pi r^2$

4. WATER QUALITY

4.1 Springfield Well No. 2

We collected groundwater samples from the Springfield Well No. 2 while conducting the yield tests and delivered the samples to California certified analytical laboratories for the following initial suite analyses recommended by Monterey County Environmental Health and required by the California Title 22 drinking water standards for public water systems:

- General mineral, general physical, Title 22 inorganics (includes boron) by Soil Control Labs;
- Hexavalent Chromium (EPA test method 218.7) by BSK Labs;
- Perchlorate (EPA test method 314.0) by BSK Labs;
- Chlorinated acid herbicide organic chemicals (EPA test method 515.4) by BSK Labs;
- Volatile organic chemicals (EPA test method 324.2) by BSK Labs;
- Semi-Volatile organic chemicals (EPA test method 325.3) by BSK Labs;
- Carbamate organic chemicals (EPA test method 531.1) by BSK Labs;
- Diquat (EPA test method 549.2) by BSK Labs;
- Gross Alpha (SM 7110C) by BSK Labs; and
- Radium-228 (EPA test method 904.0) by Pace Analytical.

The lab reports are found in **Appendix G** and results summarized in **Table 5**. All results were below the Title 22 maximum contaminant levels (MCLs). In addition, all of the organic chemicals tested were not detected, with the exception of Toluene (likely a residual from well casing manufacturing) which tested 0.63 µg/L, marginally exceeded the method reporting limit of 0.5 µg/L but well below its MCL of 150 µg/L. In particular, total dissolved solids (TDS) was 410 mg/L and chloride was 54 mg/L, indicating that the aquifer is not intruded with sea water, either recent or ancient. Nitrate (as N) was 0.12 mg/L, marginally exceeded the method reporting limit of 0.1 mg/L, and far lower than other available drinking waters in the area.

In addition to the Springfield Well No. 2 samples, groundwater samples were also previously collected by the District on July 28, 2008 from the test hole at the Springfield Well No. 2 site and analyzed for general mineral, general physical and Title 22 inorganics (**Appendix B**). The major ions results were plotted in a Piper diagram (**Figure 24**), a commonly-used method to characterize (or 'fingerprint') and water from different sources for comparison.[19] Groundwater from Springfield Well No. 2 is characterized as a calcium-magnesium-sodium bicarbonate groundwater, a type of groundwater common in Monterey Bay Area. It is also a 'hard' water, equally from calcium and magnesium ions.

4.2 Springfield Well No. 1

The Springfield Well No. 1 draws on shallow groundwater from perforations between 122 and 172 ft bgs. Groundwater samples were previously collected by the District on September 30, 2011 from the Springfield Well No. 1 and analyzed for general mineral, general physical and Title 22 inorganics (**Appendix A**). The water from Springfield Well No. 1 is dominated by chloride and has a significantly higher TDS concentration relative to the sample from Springfield Well No. 2. Current nitrate levels are close to 300 mg/L, chloride concentrations exceed 900 mg/L and TDS concentrations are approximately 3,000 mg/L. Cation proportions, however, are similar in the samples from the two Springfield wells (**Figure 24**), which likely suggests a cation exchange control, otherwise the proportion of sodium would be greater and calcium less. This suggests that areal recharge from agricultural fields may be as or more significant than seawater intrusion.

4.3 Water Quality Implications to Discontinued Use of the Springfield Well No. 1

As described in an above section of this report, the Aromas Sands are hydrogeologically connected to the ocean, and the Springfield area, as well as other coastal areas of the Pajaro basin, is affected by seawater intrusion. Two forms of seawater intrusion have been identified: 1) a relatively shallow, pumping-induced intrusion (as seen in the Springfield Well No 1); and 2) a base of natural intrusion related to the difference in specific gravities between fresh and saline water. The Pajaro Valley Water Management Agency has also implemented a Coastal Distribution System pipeline that delivers supplemental water to the coast for growers to reduce groundwater pumping for agricultural irrigation.

[19] Piper diagrams (Piper, 1944) show the relative concentration of major cations and anions, in milliequivalents per liter, to the total ionic content of the water.

The Springfield Well No. 2 draws groundwater from a zone of the lower Aromas aquifer, which is apparently not intruded with seawater and not contaminated with nitrates. Discontinuing the use of the Springfield Well No. 1 and potentially also the source well serving the Moss Landing Mobile Home Park should improve the local conditions for shallow, pumping-induced seawater intrusion, as well as drawing down nitrates and agricultural chemicals. Likewise, replacing these shallow source wells with groundwater pumped from the Springfield Well No. 2 -- distributing recharge and flow to the well over a broader area more centrally located in the Springfield area – should also initially improve these local conditions, but not without uncertainty to the long-term cumulative effects. The evaluation of long-term cumulative effects requires consideration of the pumping rates of other wells in the area and how they currently, and in the future, will vary by season, in particular, other wells drawing on the lower Aromas aquifer.

5. GROUNDWATER AGE DATING

The age of groundwater is the length of time since the water has been isolated from the atmosphere, or the time since groundwater recharge. A groundwater sample from a well is always a mixture of water molecules with an age distribution that may span a wide range. Several methods have been developed to estimate groundwater age, and owing to uncertainties in each method, multiple methods are typically used for a given field condition to cross-check results. In addition, age-dating techniques are used as means to independently affirm a conceptual understanding of the groundwater system based on other lines of evidence – such as geologic, hydrogeologic, geophysical, water quality, modeling and historical evidence -- rather than as a conclusive result.

5.1 Earlier Published Work for the Springfield Area

Hanson (2003a, b) plotted major ion data from surface-water sources and groundwater depths collected within the coastal Pajaro Valley and grouped the results relative to the source and groundwater age. Seven water-type groups were identified: 1) Recent ground water; 2) Older ground water; 3) Recent seawater intrusion; 4) Older seawater; 5) Very old ground water; 6) Pajaro River water; and 7) Local runoff. PV4-A in the Springfield subarea showed recent seawater intrusion, located near the coast on Jensen Road north of McClusky Slough (**Figure 5** and **Figure 9**).

We added the two water samples from the Springfield Wells No. 1 and 2 to the Hanson's Piper diagram (**Figure 25**). The Springfield Well No. 2 sample is grouped with samples from shallow wells and from agricultural drain water, characterized as Recent Fresh Groundwater. In fact, it is nearly identical to the signature of agricultural drain water, suggesting that groundwater recharge from the agricultural fields surrounding the supply well may be a primary source of recharge to the well. This inference is supported by the high nitrate concentrations in the well water (consistently on the order of 300 mg/L). It is, though, reasonable to conclude that both agricultural drainage and seawater intrusion constrain drinking water supplies in the project area.

The sample Springfield Well No. 2 is grouped along with samples from nested wells (PV-6), located at the corner of W. Beach St. and San Andreas Rd. (**Figure 9**). Samples collected at PV-6 were characterized as Older Fresh Groundwater at depths up to 640 ft. Hanson (2003a, b) suggested that the old fresh water is a non-renewable resource (not locally recharged by rain), which implies that groundwater pumping from this deeper zone would be replace largely by lateral flow, potentially enhancing seawater intrusion. The sample collected from the 730 to 750 ft depth interval at PV-6 was characterized as Old Seawater (connate groundwater). Likewise, the e-log at PV-7, located about 4,000 ft north of the test-well site, suggests seawater at a depth of 790 ft. By analogy with PV-6 and PV-7, old seawater could be present deeper than drilled at the Springfield No. 2 site.

5.2 Groundwater Age-Dating Methods

Relatively common methods used to estimate groundwater age include:

a) the travel time of groundwater from the point of recharge as calculated by Darcy's law combined with an equation of continuity;

b) the decay of radionuclides which have entered water from contact with the atmosphere, such as tritium (hydrogen-3) and carbon-14;

c) the accumulation in groundwater of products of radioactive reactions in the subsurface, such as radiogenic helium (helium-4);

d) anthropogenic constituents such as chlorofluorocarbons (CFCs) and sulfur hexafluoride (SF6); and

e) matching the chronology of past climates with paleoclimate indicators in water, such as the ratio of stable isotopes of water (hydrogen-2/oxygen-18) or the concentration of noble gasses.

There other methods as well (Clark and Fritz, 1997; Cook and Herczeg, 2000; Davis and Bentley, 1982; Kendall and McDonnell, 1998).

We used seven laboratory methods to date the groundwater samples collected from the Springfield Well No. 2: tritium-helium; chlorofluorocarbon (CFCs); sulfur hexafluoride (SF6); radiogenic helium; carbon-14; stable isotopes of oxygen and hydrogen; and noble gases. Tritium-helium, CFCs and SF6 date the young or modern fraction of groundwater, while radiogenic helium and carbon-14 methods date the old (or ancient) groundwater fraction. Concentrations of noble gases and the stable isotopes of oxygen and hydrogen were used to interpret the recharge temperature and conditions.

We collected groundwater samples on December 19, 2017 following 4 hours of pumping the well during a step-drawdown test terminating at a rate of 425 gallons per minute. USGS sampling methods[20] were used, and for the noble gas and helium isotope samples, we used the crimped copper-tube sampling method. Samples were sent to two laboratories and analyses:

- Samples were sent to the Dissolved and Noble Gas Lab at the University of Utah[21] for CFC, SF_6, tritium, and noble gas analyses; and,
- Samples were sent to the Environmental Isotope Laboratory at the University of Waterloo[22] for the analysis of isotopes of oxygen (^{18}O), hydrogen (^{2}H, ^{3}H), and carbon (^{13}C, ^{14}C).

5.3 Groundwater Age Dating Results

Results for age-dating analyses of groundwater samples collected from the Springfield Well No. 2 (summarized in **Table 6**) indicate a mixture of modern water and pre-modern water, with pre-modern groundwater dated at 2,300 years before present. The presence of modern water suggests recent recharge to the lower Aromas aquifer, implying that the aquifer has a potential to be managed as a renewable freshwater resource. The following sub-sections detail the results.

5.3.1 Tritium-Helium

The tritium-helium method dates 'modern' groundwater, that component of groundwater recharged subsequent to the late-1950s and early 1960s, when atmospheric testing of nuclear arsenals took place, peaking in 1963. It also helps to coarsely estimate the fraction of pre-modern groundwater in a sample, and dates groundwater wholly recharged before 1952 where samples contain no tritium (or at a practical level < 1 pCi/L or < 0.3 TU). In this report, water containing measurable tritium is interpreted as modern water, and water not containing measurable tritium is interpreted as pre-modern.[23] Given the depth of the Springfield Well No. 2, we considered it possible to obtain a zero-tritium result.

[20] https://water.usgs.gov/lab/

[21] https://noblegaslab.utah.edu/index.php

[22] http://www.uweilab.ca/

[23] The problem to define the tritium concentration at the time of groundwater recharge is complex, and most studies make only a qualitative judgment of groundwater age based on tritium concentrations.

Tritium (^3H) is a naturally-occurring radioactive isotope of hydrogen with a half-life of 12.32 years and derived in the stratosphere interaction with cosmic radiation. Continental heating mixes the upper atmosphere and releases tritium from the stratosphere into the troposphere – a phenomenon known as the ‘Spring Leak’. Tritium is removed from the lower atmosphere by precipitation and molecular exchange, and the ocean is a sink. Across North America, tritium concentrations in precipitation, therefore, generally increase with latitude and distance from the ocean. Within California, tritium concentrations are lowest at the coast and increase inland.

Normally in very low abundance, tritium concentrations in the atmosphere increased several orders of magnitude above the background levels from above ground nuclear weapons testing during the 1950s and early 1960s, releasing tritium to the atmosphere until the nuclear test ban went into effect in 1963. Since that time, tritium’s decay to stable helium isotope (^3He) has since progressively decreased tritium concentrations in the atmosphere. In groundwater, tritium is isolated from the atmosphere and also undergoes natural decay. Measurement of both tritium and its daughter product helium-3 in a groundwater sample allows for the calculation of the initial tritium concentration present at the time of groundwater recharge. This helium ingrowth method is described in detail on the USGS Reston Groundwater Dating Laboratory website[24]. Given that the concentrations are so small, tritium is reported in a unique concentration unit call a ‘tritium unit’ or TU.[25] The reported age is the mean age of that portion of the groundwater sample that contains measurable tritium.

Tritium concentrations in the groundwater sample collected from the Springfield Well No. 2 were 0.05 TU which is interpreted as not detected. In addition, the measured noble gas concentrations did not facilitate calculation of helium-3 daughter product to estimate the concentration the time of recharge. These results do not confirm the presence of modern water (<60 years).

5.3.2 Chlorofluorocarbons and Sulfur Hexafluoride

Chlorofluorocarbons – CCl_3F (CFC-11), CCl_2F_2 (CFC-12), $Cl_2FC\text{-}CClF_2$ (CFC-113) – are synthetic compounds and have no natural sources. The measurement of CFC concentrations in groundwater can date that fraction of groundwater recharged from

24 https://water.usgs.gov/lab/3h3he/background/

25 One tritium unit (TU) is equivalent to one tritium atom per 10^{18} hydrogen atoms. Tritium is also reported in terms of activity (pico-Curies per liter, *p*Ci/L) or decay (disintegrations per minute per liter, dpm/L), whereas 1 TU = 7.2 dpm/L = 3.2 *p*Ci/L.

the 1940s (at on the onset of industrial production) through the mid to late 1990s when atmospheric concentrations peaked. Sulfur hexafluoride (SF_6) is a trace atmospheric gas but with significant synthetic production beginning in the 1960s for use in high voltage electrical switches. Unlike CFCs with declining atmospheric mixing ratios, atmospheric concentrations of SF_6 continue increase, and therefore can potentially date post-1990s groundwater. The dating methods and its applications are detailed in International Atomic Energy Agency (IAEA, 2006), Plummer and Busenberg (2000), and Ekwurzel and others (1994).

CFCs were first synthesized in 1928 as replacements for the toxic ammonia, methyl chloride, and sulfur dioxide refrigerants that were in use since the late 1800s. Commercial production began in 1930 and CFCs gradually replaced older refrigerants in cooling devices. After the mid-1940s, CFCs became the preferred aerosol propellants, and were widely used as solvents and degreasers, and as blowing agents for plastic foam. By the 1950s and 1960s, CFCs were widely used in the air-conditioning of homes, commercial buildings and automobiles. CFCs are a prime contributor to stratospheric ozone depletion, and as a result of the Montreal Protocol on Substances that Deplete the Ozone Layer (an international agreement to phase out production of CFCs) air mixing ratios of CFC-11, CFC-12 and CFC-113 peaked in the northern hemisphere in about 1994, 2001 and 1996, respectively. The estimate of the atmospheric lifetime of CFC-11 is 45 ± 7 years, 87 ± 17 years for CFC-12, and 100 ± 32 years for CFC-113.[26]

SF_6 a colorless, odorless, nonflammable, nontoxic, extremely stable gas with excellent insulating and arc-quenching properties. Its estimated atmospheric lifetime is 800 to 3200 years, and is also stable in reducing groundwater environments. Industrial production of SF_6 began in 1953 with the introduction of SF_6-filled electrical switches. The SF_6 atmospheric mixing ratio has since rapidly increased owing to the following conditions: (1) its long lifetime in the atmosphere; (2) its low solubility in water; (3) its high stability in soils and groundwater; and (4) the other lack of natural sinks. SF_6 is an

[26] The atmospheric lifetime, or residence time, of a molecule can be simply thought of as the time it remains in the atmosphere. [Note: there is a trend to use lifetime when referring to the loss by a chemical process, and residence time when the loss is by a physical process, but the two terms are generally interchangeable.] The lifetime of an atmospheric pollutant, such as a CFC, is the time for the concentration to return to its natural (or baseline) level as a result of either being converted to another chemical compound or being taken out of the atmosphere via a sink. Species may have multiple different loss processes, and the combination of these processes estimates the overall lifetime. For many long-lived species, such as CFCs, loss processes include photochemical breakdown in the stratosphere, oxidation and deposition processes in the troposphere, and degradation in the hydrosphere or in soils.

extremely potent greenhouse gas, with the highest value measured for any gas, estimated to be 23,900 times that of CO_2. Because of its low solubility, apparent ages can be very sensitive to excess air.

Given that the bomb tritium signal has decayed to a point where results can be difficult to interpret in many groundwater systems, especially in coastal California, CFCs and SF_6 results can strengthen the interpretation of tritium results. Our basic approach is to confirm the recharge of modern water, and water containing measurable CFCs and SF_6 is interpreted as modern water, and water not containing measurable CFCs and SF_6 is interpreted as pre-modern.

The CFC and SF_6 results in the groundwater sample collected from the Springfield Well No. 2 indicate a component of modern (or young) groundwater (see **Table 6**).

5.3.3 Carbon-14

Like tritium, carbon-14 is formed in the upper atmosphere by interaction with cosmic rays, and also was formed during above-ground nuclear-weapons testing until the ban in 1963. Atmospheric carbon-14 is incorporated into carbon dioxide (CO_2), mixed in the atmosphere, and distributed in precipitation as a bicarbonate ion. Carbon-14 is consumed by plants and accumulates in soil, carbonate rocks and minerals. Carbon-14 is distributed subsurface as bicarbonate and carbonate ions in groundwater recharge. With a half-life of 5,730 years, carbon-14 dates pre-modern groundwater, on the order of hundreds to thousands of years. Carbon-14 age estimates can be complicated with abundance of carbonate minerals or organic material in the aquifer or recharge areas. Where chemical complications are minimal (such as at the Springfield well site), groundwater dates with a +/- 20 percent accuracy may be possible, otherwise estimates may easily have an error band of roughly 100 percent (Davis and Bentley. 1982). Carbon-14 results indicated pre-modern groundwater fraction recharged approximately 2,300 years before present. This result is in line with published results in the Springfield area (see Section 5.1 and results from Hanson's (2003) PV-4A sample).

5.3.4 Radiogenic Helium

The subsurface accumulation of ^4He is from the decay of heavy radionuclides in the earth's crust – primarily uranium (U) and thorium (Th) decay – and known as 'radiogenic helium' or 'terrigenic helium'. It increases in groundwater with time, and hence increases along a groundwater flow path. However, the newly formed ^4He resides in solid material and the rate at which is diffuses into groundwater is not well known, and thus precise age dating is not possible. Similar to Carbon-14, the method dates pre-modern groundwater, on the order of hundreds to thousands of years. Groundwater with a subsurface residence time greater than a few hundred years usually contains detectable radiogenic helium.

The problem to define the radiogenic helium concentration at the time of groundwater recharge is complex and based on the measurement of noble gases in groundwater. Noble gas derived parameters (recharge temperature, excess air, terrigenic helium-4, terrigenic helium isotope ratio and tritiogenic helium-3) were calculated using the unfractionated excess air (UA) model, simplest excess-air model. The calculation of radiogenic helium in the Springfield Well No. 2 sample was inconclusive and did not confirm the presence of pre-modern water.

5.3.5 Noble Gases

The solubility of the noble gases (He, Ne, Ar, Kr, and Xe) in water vary as a function of temperature and pressure. The concentrations of noble gases in groundwater should, therefore, reflect the surface temperature at the time of groundwater recharge, provided that recharge is reasonably rapid and goes directly to the aquifer. Water table temperatures inferred from dissolved noble gas concentrations (noble-gas temperatures, NGT) are useful as a quantitative proxy for air temperature change since the last glacial maximum (Cey and others, 2009). The result of the noble-gas recharge temperature was 13.3°C (56°F), similar to current recharge temperatures. As with most groundwater, water temperatures approximate the mean annual air temperature for the region. The mean annual average air temperature at the Castroville CIMIS station #19 is 11.7°C (53.1°F).[27] The higher noble-gas recharge temperature corresponds to the geothermal gradient of 25°C per 1000 meters (or about 1°F per 75 ft), as well as uncertainties related to the calculation of the noble-gas recharge temperature.

The concentrations of noble gases in groundwater are also used to estimate the quantity of 'excess air' – air bubbles entrained during recharge and fluctuations in the water table that subsequently dissolve at depth in groundwater. The concentration of excess air provides valuable information about the recharge process, and is an important consideration when calculating the tritium-helium age, as well as

[27] http://www.cimis.water.ca.gov/UserControls/Reports/MonthlyReportViewer.aspx

groundwater age using CFCs and SF_6. Excess air was calculated at 33 percent of equilibrium Neon equilibrium at the noble-gas recharge temperature.

5.3.6 Stable Isotopes of Water

The two stable isotopes of hydrogen (^{1}H and ^{2}H) and the three stable isotopes of oxygen (^{16}O, ^{17}O, and ^{18}O) are frequently used to help understand the origin and movement and groundwater. Oxygen-18 and hydrogen-2 (deuterium) are heavy isotopes[28] and their relative abundances in water change slightly (or fractionate) during physical phase change processes such as evaporation, condensation, and snowmelt. They are either enriched or depleted based the greater energy required to break the hydrogen bonds of heavy isotopes than water containing lighter isotopes (and consequently, they will react more slowly). Heavy isotopes, therefore, are enriched in the more condensed phases. Water with a higher deuterium and oxygen-18 content is generally found near the coast, at low elevations, in warm rains, and in water which has undergone partial evaporation. Lower deuterium and oxygen-18 content (i.e., greater negative values) is found inland, at higher elevations, in cooler climates, and in evaporated water. The stable isotopes of water plot within the range of coastal waters under current climatic conditions (**Figure 25**).

At a given coastal location where there are no imported Sierran waters (such as from Hetch Hetchy) to confound results and a negligible groundwater flow gradient, stable isotopes of water may support a conclusion of pre-modern groundwater recharged during a colder climate. This was the case of coastal groundwater sample (PV-3D) in the Pajaro Groundwater Basin (Hanson, 2003a, b). These results are shown in **Figure 25**, as an example.

The relationship of $\delta^{18}O$ to $\delta^{2}H$ is known as the meteoric (or meteorological) water line (MWL). If a local meteoric water line (LMWL) is not available (reflecting local variations in climate, rainfall seasonality, and geography), it is common practice to use the global meteoric water line (GMWL) as a reference against which to compare sampling results. Departures from the GMWL can be caused by evaporation (known as an evaporation line), deuterium excess (from re-evaporation and precipitation of terrestrial water),

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[28] Isotopes are atoms of the same element that have different numbers of neutrons, thus have different masses. Deuterium (^{2}H) has one neutron and one proton, and is approximately equal to twice the mass of protium (^{1}H). All isotopes of oxygen have eight protons but an oxygen atom with a mass of 18 (^{18}O) has 2 more neutrons than oxygen with a mass of 16 (^{16}O). Oxygen-18 and deuterium occur in water at abundances of 0.204% of all oxygen atoms and 0.015% of all hydrogen atoms, respectively.

seawater intrusion, and groundwater reaction with minerals. **Figure 25** shows a seawater mixing line as well as the global meteoric water line.

6. CONCLUSIONS AND RECOMMENDATIONS

The Pajaro/Sunny Mesa Community Services District (District) has acquired grant funding to evaluate alternatives to replace the source well (Springfield Well No. 1) for the Springfield community water system, which is contaminated with nitrate and seawater. The Springfield Well No. 1 is located a little over a mile from the coast and from the Elkhorn Slough, at an elevation of 19 feet above sea level (ft asl). It draws groundwater from a depth of 122 to 172 feet below ground surface (ft bgs), from a zone demonstrated to be intruded with seawater across the area. The well is surrounded with agricultural fields in sandy soils, within a gently sloping shallow swale draining to McClusky Slough, and subject flooding and recharge from agricultural drainage. Both seawater and agricultural drainage are likely sources of contamination to the existing well.

The preferred alternative to replace the Springfield Well No. 1 with a new well (Springfield Well No. 2) at a site approximately 3,500 feet northeast from the existing well, at the northeast corner of the discontinued Moss Landing Middle School. Another alternative proposed is to install a new well deeper at the Springfield Well No. 1 site. Springfield Well No. 2 is further from the ocean but closer to the Elkhorn Slough than Springfield Well No. 1, and at an elevation 142 ft asl, rather than 19 ft asl. During drilling of Springfield Well No. 2 in November 2017 to a depth of 600 ft bgs, the geophysical logging indicated water-quality conditions similar to the favorable conditions measured at a test hole drilled at the site in 2008, thus supporting completion of the test well.

The Springfield Well No. 2 was completed to a depth of 600 feet with an 8-inch diameter PVC casing, with 100 feet of screen casing from 490 to 590 feet (an elevation from -348 to -448 feet), and with a 470-ft cement seal from the surface. Subsequent yield testing (a step-drawdown test and a constant-rate pumping and recovery test) and water-quality sampling confirmed that the Springfield Well No. 2 is suitable for use as a new water-supply source well. In addition, the well site is not prone to flooding, and water storage at the site would be at a higher elevation than at the Springfield Well No. 1 site, providing head to the distribution system.

The two project sites are located within the southern portion of Springfield subarea of the Pajaro Valley Groundwater Basin. Primary aquifers within the basin are found in the Aromas Sands and overlying alluvial deposits. The Aromas Sands have a complex depositional history and are composed of well-layered marine and terrestrial coarse-grained deposits separated by extensive fine-grained deposits. Coarse-grained deposits persist over large areas and control the depth of well pumping. The fine-grained deposits potentially restrict vertical movement of groundwater, though their discontinuous extent, particularly in the Springfield area, may allow for vertical flow of local rainfall recharge through and around these aquitards. In fact, drawdown data from the 9-hour constant-rate pumping test indicated vertical seepage from overlying beds. Thicker segments of fine-grained deposits interbedded with sand layer are found south and east of the project sites, related to the Elkhorn Slough, and west of the site along the coast. Although the Aromas Sands are complexly layered, the deposits have been generally grouped as lower and upper aquifers, separated by a defined fine-grained layer, and an overlying alluvial aquifer. This geologic framework is generally applicable at both project sites.

Seawater intrusion across the Springfield subarea is fundamentally related to a chronic storage depletion from groundwater pumping drawing water levels below minimum levels required to inhibit seawater intrusion. Two forms of seawater intrusion have been identified:

1) A relatively shallow, pumping-induced intrusion in the upper Aromas Sands and alluvial aquifer. Attempts to mitigate seawater intrusion by reducing groundwater pumping have shown success, though generally not effective during dry years when alternative supplies are limited and groundwater pumping increased.

2) A base of natural groundwater intrusion dated as old seawater is related to the difference in specific gravities between fresh and saline water. Based on geophysical logs and water-quality data related to the logs, old seawater can be assumed in the Springfield subarea below depths of 700 to 800 ft bgs.

In general, the Springfield Well No. 2 draws on fresh groundwater potentially found between the two forms of seawater intrusion. The groundwater at these depths has generally been characterized as "old fresh groundwater", dated with a sample collected from the well to have been recharged 2,300 years before present. The groundwater sample from the well was also found to contain modern (<60 years) groundwater. The well draws groundwater from an elevation from 348 to 448 feet below sea level. With pumping, it is reasonable to assume a fair likelihood for this deeper groundwater to be intruded with seawater, particularly if the groundwater flow is largely vertically confined. Results from the 9-hour constant rate pumping test at 400 gpm indicated vertical leakage from overlying beds, which is consistent with the depositional history and geologic framework of the aquifers, and thus suggest that areal recharge may be significant. The existing extent of intrusion in the zone of deep fresh groundwater is uncertain and likely variable spatially. Based on geophysical logs, inland areas and areas in the southern portion of the Springfield subarea would seem to be less intruded with seawater, which corresponds with water quality results from the Springfield Well No. 2.

The key to managing the source aquifer as a renewable resource is to develop an understanding of recharge. Generally speaking, groundwater is not a sustainable resource, unless extraction is balanced by recharge, and identifying the sources of recharge and flow to a well is critical for sustainable groundwater management. Recharge is particularly relevant at both project sites because they are situated in an area sensitive to seawater intrusion and contamination from overlying agricultural chemicals. Preliminary calculations suggest that the general size of Springfield area surrounding the Springfield Well No. 2 is of a reasonable magnitude that areal recharge may potentially compensate pumping at the proposed 43 gpm average day demand for the expanded Springfield water system. It is also known that the Pajaro River recharges the groundwater basin, though other pumpers between the river and the project sites limit this source of recharge.

In conclusion, based on the evidence presented in this report, the Springfield Well No. 2 is suitable for use as a new source well for the Springfield public water system. Preliminary area-of-influence calculations suggest (with a high degree of uncertainty) that it may continue to be suitable for many decades (and possibly more) if pumped at the proposed 43 gpm average day demand. The well, however, has a yield that far exceeds demand requirements for the expanded water system, which thus has an inherent risk and tendency to over-pump the aquifer. In this regard, we recommend (a) developing a monitoring program to help guide the use of the well with a goal to better understand recharge rates sources to the well, and (b) frequent collaboration with Pajaro Valley Water Management Agency on results of their groundwater quality monitoring in the Springfield area and the state of their Coastal Distribution System (CDS) delivery of supplemental water to the Springfield area.

Little water-quality information is available specifically at depth at the Springfield Well No. 1 site. However, based on information assembled in this report, evaluating groundwater conditions by drilling and e-logging a pilot hole, and completing and testing a well deeper at the Springfield Well No. 1 site, would be a reasonable approach and may be potentially productive, if the need arises.

7. GENERAL LIMITATIONS

Balance Hydrologics has prepared this memo for the client's exclusive use on this particular project. It was prepared in general accordance with the accepted standard of practice existing in California and Nevada at the time the investigation was performed. No other warranties, expressed or implied, are made.

This preliminary evaluation is based in large part on work performed by experts and contractors in related fields, information provided by the client, and upon hydrogeologic reference values commonly used in the area or developed by sources generally held to be reliable, such as geologic and isohyetal maps. We have not independently verified their validity, accuracy or representativeness to this or other sites. If readers are aware of additional data, observations, conditions, or forthcoming changes to the bases of our decisions, please let us know at the first opportunity, such that this report may be revised.

It should be recognized that interpretation and evaluation of subsurface conditions is a difficult and inexact art. Judgment leading to conclusions and recommendations presented above were partially based on existing information and personal communications during drought conditions, which in total represent an incomplete picture of the site. Data collected for this study have shown intraformational variability in texture that greater than previously thought, probably because textural variability had not been specifically sought in the larger-scale regional studies. More extensive studies can substantially reduce some of the uncertainties associated with such questions. If the client wishes to reduce the uncertainty beyond the level associated with this study, Balance should be notified for additional consultation.

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TABLES

Table 1. Groundwater pumped from the Springfield water system well, 2009 to 2018, Monterey County, California.

	2009 (gallons)	2010 (gallons)	2011 (gallons)	2012 (gallons)	2013 (gallons)	2014 (gallons)	2015 (gallons)	2016 (gallons)	2017 (gallons)	2018 (gallons)	Average (gallons)	Maximum (gallons)
January	335,852	422,620	573,716	471,988	454,784	569,976	531,828	552,099	563,992	617,848	509,470	617,848
February	299,200	401,676	513,876	381,480	418,132	471,240	487,696	433,990	429,726	449,548	428,656	513,876
March	394,196	382,976	509,388	372,504	463,012	534,820	584,936	620,092	685,168	628,320	517,541	685,168
April	539,308	421,124	554,268	397,188	454,784	536,316	557,260	504,152	476,326	570,724	501,145	570,724
May	483,956	442,816	639,540	467,500	673,948	605,132	523,600	514,624	706,112	na	561,914	706,112
June	494,428	648,516	559,504	546,788	552,024	682,924	604,384	676,416	774,928	na	615,546	774,928
July	601,392	599,896	597,652	588,676	667,964	657,492	534,072	606,852	721,072	na	619,452	721,072
August	586,432	568,480	602,888	586,432	634,304	594,660	585,684	670,806	620,765	na	605,606	670,806
September	543,796	572,220	548,284	523,600	699,380	513,876	634,304	699,305	878,975	na	623,749	878,975
October	512,380	531,080	499,664	628,320	540,056	559,504	526,667	560,925	734,536	na	565,904	734,536
November	558,756	617,848	454,036	442,068	537,812	550,378	412,597	624,580	640,288	na	537,596	640,288
December	463,760	501,908	428,604	485,452	609,620	520,758	455,532	526,966	576,708	na	507,701	609,620
Total Annual Demand	**5,813,456**	**6,111,160**	**6,481,420**	**5,891,996**	**6,705,820**	**6,797,076**	**6,438,560**	**6,990,807**	**7,808,596**	incomplete	**6,594,280**	**7,808,596**
Average Day Demand (ADD)	15,927	16,743	17,757	16,098	18,372	18,622	17,640	19,101	21,393	incomplete	18,054	21,393
ADD Per Capita [1]	80	84	89	80	92	93	88	96	107	incomplete	90	107
ADD Per Connection [2]	468	492	522	473	540	548	519	562	629	incomplete	531	629
Average Continuous Rate (gpm)	11.1	11.6	12.3	11.2	12.8	12.9	12.2	13.3	14.9	incomplete	12.5	14.9
Max Month	July	June	May	October	September	June	September	August	September	incomplete	--	--
Max Day Date	na	na	5/10/11	10/3/12	9/23/13	3/25/14	6/17/15	6/15/16	7/5/15	incomplete	--	--
Max Day Demand (MDD)	na	na	28,424	25,058	26,928	34,932	26,255	42,150	35,156	incomplete	**31,272**	42,150
MDD Per Connection [2]	--	--	836	737	792	1,027	772	1,240	1,034	incomplete	920	1,240
Max Day Rate (gpm)	na	na	19.7	17.4	18.7	24.3	18.2	29.3	24.4	incomplete	21.7	29.3

Notes:

1. The Average Daily Demand Per Capita assumes a total of 200 consumers.
2. The Average Daily Demand per Connection assumes 34 connections.
3. Data source: Metered results reported by Pajaro/Sunny Mesa Community Services District.

Table 2. Summary of yield test calculations, Springfield Well #2 well, Pajaro / Sunny Mesa CSD, Monterey County, CA

	Step Test (12/19/2017)		Constant-Rate Test (2/21/2018)	
	Step 1	Step 2	Pumping	Recovery
Total depth (feet bgs)	600	600	600	600
Depth to bottom of confined aquifer, (feet bgs)	375	375	375	375
Pumping duration (hours)	3.17	2.83	9	9
Pumping rate, Q (gpm)	328	425	400	400
Drawdown at end of pumping, s (feet)	34.7	48.9	43.4	--
Recovery at 9 hours (ft)	--	--	--	42.6
Percent recovery	--	--	--	98%
Estimated 24-hr drawdown, s (feet)	--	--	45.6	--
24-hr specific capacity, Cs=Q/s (gpm/ft)	--	--	8.8	--
Drawdown slope, s	4	4	4	4.4
Transmissivity, T (gpd/ft) [1]	21648	28050	26400	24000
Aquifer thickness, b (ft) [3]	225	225	225	225
Hydraulic conductivity, K=T/b (gpd/ft^2)	96	125	117	107
Hydraulic conductivity, K (cm/s)	4.5E-03	5.9E-03	5.5E-03	5.0E-03
Well efficiency [4]				
Theoretical specific capacity, Cs (gpm/ft) [2]	--		13.2	12.0
Efficiency, $E = Cs_{(24\text{-hr})} / Cs_{(theoretical)}$	--	--	66%	73%
s/Q (ft/gpm)	0.106	0.115	--	--
slope, C	--	--	9.47E-05	--
intercept, B	--	--	7.48E-02	--
Percentage of head loss attributed to laminar flow, $L_p = BQ/(BQ+CQ^2)$	--	--	66%	--

Notes:

1. Method assumes (a) full penetration of the aquifer, and perhaps more importantly, (b) the hydraulic conductivity ("permeability") of the shallow and deeper zones are similar (homogeneous conditions), and (c) the hydraulic conductivity is the same in all directions (isotropic conditions). Although the assumptions are never strictly met in any natural aquifer system, they are commonly suitable to roughly estimate bulk aquifer properties. Results seem reasonable for comparative purposes despite marked geologic differences.
2. The relationship of aquifer transmissivity (T) to specific capacity (Cs) is found in Appendix 16.D of Driscoll (1983) or p. 128 of DWR Bulletin No. 118-2 (June 1974).
3. Aquifer thickness, b = well depth - bottom of confining clay
4. Well efficiency, E, is the ratio of the theoretical drawdown (assuming no turbulence) to the actual drawdown in the well.

Table 3. Estimated radius of influence of pumping Springfield Well No. 2, Pajaro / Sunny Mesa CSD, Monterey County, California.

Case A. Constant-rate pumping test at 400 gpm (7 hours)

Given:

Transmissivity, T	24000	gpd/ft	3208 ft^2/day
Storativity, S	0.0015		selected to match drawdown at perimeter of the 16-inch drill hole with theoretical drawdow
Pumping rate, Q	400	gpm	0.89 cfs
Pumping duration, t	0.29	days	7 hours
Drawdown in well	43.37	ft	pumping test data
Well efficiency	66%		pumping test result
Theoretical drawdown at 100% efficiency	28.62	ft	at perimeter of the 16-inch drill hole

Find: drawdown, s(r,t):

Distance from well r (ft)	$u=(1.87*r^2*S)/(T*t)$	W(u)	Drawdown s max (ft) = (264*Q/T) * W(u)	
0.67	1.8E-07	6.50	**28.59**	radius of 16-inch diameter drill hole
5	1.0E-05	4.75	**20.89**	
10	4.0E-05	4.15	**18.24**	
50	1.0E-03	2.75	**12.09**	
100	4.0E-03	2.15	**9.44**	
440	7.8E-02	0.86	**3.78**	Hawkins well
700	2.0E-01	0.46	**2.01**	School well
1500	9.0E-01	-0.21	**0.00**	Rocha well
3000	3.6E+00	-0.81	**0.00**	Elkhorn Slough

Case B. Dry-seasson pumping at 43 gpm (60 days)

Given:

Transmissivity, T	24000	gpd/ft	3208 ft^2/day
Storativity, S	0.0015		
Pumping rate, Q	43	gpm	0.10 cfs
Pumping duration, t	60	days	

Find: drawdown, s(r,t):

Distance from well r (ft)	$u=(1.87*r^2*S)/(T*t)$	W(u)	Drawdown s max (ft) = (264*Q/T) * W(u)	
0.67	8.7E-10	8.81	**4.17**	radius of well casing
5	4.9E-08	7.06	**3.34**	
10	1.9E-07	6.46	**3.06**	
50	4.9E-06	5.06	**2.39**	
100	1.9E-05	4.46	**2.11**	
440	3.8E-04	3.17	**1.50**	Hawkins well
700	9.5E-04	2.77	**1.31**	School well
1500	4.4E-03	2.11	**1.00**	Rocha well
3000	1.8E-02	1.51	**0.71**	Elkhorn Slough

Method:

Theoretical drawdown was calculated using Cooper and Jacob modified nonequilibrium Theis equation (Driscoll, F.G., 1986, Groundwater and Wells, 2nd Ed., p. 219).
The modified nonequilibrium equation is valid for values of u less than about 0.05, otherwise values are approximate.
Theis' nonequilibrium equation is based on the following assumptions:

a) The water-bearing formation is uniform in character and the hydraulic conductivity is the same in all directions.
b) The formation is uniform in thickness and infinite in areal extent.
c) The formation receives no recharge from any source.
d) The pumped well penetrates, and receives water from, the full thickness of the water-bearing formation.
e) The water removed from storage is discharged instantaneously when the head is lowered.
f) The pumping well is 100 percent efficient.
g) All water removed from the well comes from aquifer storage.
h) Laminar flow exists throughout the well and aquifer.
i) The water table or potentiometric surface has no slope.

Notes:

1. The modified nonequilibrium equation is valid for values of u less than about 0.05, otherwise values are approximate.
2. Transmissivity (T) estimated from 9-hour constant-rate pumping test at 400 gpm and recovery results.

Table 4. Parameters and assumptions for area of influence calculations, Springfield water system, Pajaro / Sunny Mesa CSD, Monterey County, CA.

Scenario	Average Day Demand steady state flow no recharge	Average Day Demand steady state flow areal recharge at ADD rate	Average Day Demand transient flow no recharge	
Well pumping (gpm)				
Springfield Well No.1	43	43	43	
Springfield Well No.2	0	0	0	
Software				
Graphical user interface	AquiferWin32 v.5	AquiferWin32 v.5	AquiferWin32 v.5	
Analytical solver [1]	WinFlow	WinFlow	WinFlow	
Simulation	2-D steady state	2-D steady state	2-D transient flow	
Aquifer parameters [3]				
Aquifer top (ft) (confining clay)	-375	-375	-375	
Aquifer bottom (ft) (bottom of well)	-600	-600	-600	
Porosity	0.2	0.2	0.2	
Hydraulic parameters [3]				
Hydraulic conductivity (gpd/ft^2)	106	106	106	
Storage coefficient	0.0015	0.0015	0.0015	
Leakage factor (ft)	0	0	0	
Base map [4]				
Origin X (ft)	0	0	0	
Origin Y (ft)	0	0	0	
Height (ft)	30344	30344	30344	
Width (ft)	32137	32137	32137	
Contour window				
Origin X (ft)	10000	10000	10000	
Origin Y (ft)	9000	9000	9000	
Height (ft)	15000	15000	15000	
Width (ft)	14000	14000	14000	
Reference head (green arrow on figures) [5]				
Head (ft of water)	0	0	0	
Gradient	0	0	0	
Angle from x-axis (E=0; N=90)	0	0	0	
X location (ft from lower left corner)	28930.5	28930.5	28930.5	
Y location (ft from lower left corner)	3928.05	3928.05	3928.05	
Areal recharge				
Radii of oval around well (ft)	0	R1=6000, R2=8000	0	
Recharge area (sq ft)	0	150796447	0	
Rate (ft per day)	0	0.000055343	0	
Target drawdown results			60 days	60 years
Rocha Well (ft)	1.01	0.08	1.00	2.22
School Well (ft)	1.33	0.38	1.32	2.54
Hawkins Well (ft)	1.51	0.56	1.50	2.72

Notes:

1. The WinFlow Solver simulates two dimensional steady-state and transient groundwater flow. The steady-state module simulates groundwater flow in a horizontal plane using analytical functions developed by Strack (1989). The transient module uses equations developed by Neuman (1972) for unconfined aquifers.
2. Nominal values based on available information.
3. Values based on step test and 9-hr constant-rate test.
4. USGS 7.5 minute topographic quadrangle maps Moss Landing, CA and Prundale, CA.
5. The reference head defines a point where the head an hydraulic gradient is known. In the steady-state model, the reference head is always constant and never changes during simulations.

Table 5

Summary of water-quality results of groundwater samples collected from the Springfield Well No. 2, Pajaro / Sunny Mesa Community Services District, Monterey County, California.

PARAMETER	UNITS	RL	MCL	LABORATORY RESULTS				
				Test Hole	Completed Springfield Well #2			
DESCRIPTORS								
Sample I.D.	--	--	--	Test Hole	Well #2	Well #2	Well #2	Well #2
Latitude (GoogleEarth, WGS84)	deg min sec	--	--	37.162214	37.162214	37.162214	37.162214	37.162214
Longitude (GoogleEarth, WGS84)	deg min sec	--	--	-122.011046	-122.011046	-122.011046	-122.011046	-122.011046
Ground elevation (GoogleEarth, WGS84)	feet	--	--	142	142	142	142	142
Lab used	--	--	--	Soil Control	Soil Control	BSK Associates	Pace Analytical	BSK Associates
Lab number	--	--	--	8070803-01	7120730-01	A7L2428	30240447	A8B2807
Sample collected by	--	--	--	rs	gp	gp	gp	gp
Field filtered (for acid-preserved samples)	--	--	--	no	yes	yes	yes	yes
FIELD MEASUREMENTS								
Date	MM/DD/YY			7/28/2008	12/19/2017	12/19/2017	12/19/2017	2/21/2018
Time	HH:MM			11:45	17:00	16:25	16:25	18:37
Pumping rate	gpm	--	--		425	425	425	410
Pumping duration	hours				4	4	4	9
Specific conductance (@ 25°C)	umhos/cm				657	657	657	659
Conductance (@ field temp)	umhos/cm				695	695	695	691
Temperature	deg C				22	22	22	22.5
WATER QUALITY INDICATORS								
Alkalinity (total)	mg/L CaCO3	2	--	220	240			
Hardness (total)	mg/L CaCO3	5	--	220	250			
Hydroxide	mg/L CaCO3	2	--	0	0			
pH	pH Units	0.1	--	8.2	7.8			
Specific conductance (@ 25°C)	umhos/cm	1	900/1600	570	700	690		
Total dissolved solids (TDS)	mg/L	10	500/1000	370	410			
TDS/SC	--	--	--	*0.65*	*0.59*			
Color	color units	5	15	12	0			
Odor threshold at 60°C	TON	1	3	0	0			
Turbidity	NTU	0.02	5	94	0.1			
GENERAL MINERALS								
Bicarbonate (as CaCO3)	mg/L	--	--	*221*	*246*			
Bicarbonate (HCO3)	mg/L	2	--	270	300			
Calcium (Ca)	mg/L	0.5	--	43	41			
Carbonate (as CaCO3)	mg/L	--	--	*0*	*0*			
Carbonate (CO3)	mg/L	2	--	0	0			
Chloride (Cl)	mg/L	1	250/500	40	55			
Magnesium (Mg)	mg/L	0.5	--	27	35			

Table 5

PARAMETER	UNITS	RL	MCL	LABORATORY RESULTS				
				Test Hole	Completed Springfield Well #2			
Potassium (K)	mg/L	0.5	--	2.5	2.5			
Sodium (Na)	mg/L	0.5	--	51	51			
Sulfate (SO4)	mg/L	1	250/500	33	54			
Major Cations (Ca+Mg+K+Na)	meq/L	--	--	*6.65*	*7.21*			
Major Anions (HCO3+CO3+Cl+SO4)	meq/L	--	--	*6.24*	*7.59*			
Ion Balance (Cations/Anions)	--	--	--	*1.07*	*0.95*			
TITLE 22 PRIMARY STANDARDS, INORGANIC								
Aluminum (Al)	mg/L	0.05	1	4.6	0			
Antimony (Sb)	mg/L	0.006	0.006	0	0			
Arsenic (As)	mg/L	0.002	0.010	0	0			
Barium (Ba)	mg/L	0.1	1	0	0			
Beryllium (Be)	mg/L	0.001	0.004	0	0			
Cadmium (Cd)	mg/L	0.001	0.005	0	0			
Chromium (Cr)	mg/L	0.001	0.05	0.016	0.0073			
Copper (Cu)	mg/L	0.05	1.0/1.3	0	0			
Cyanide (CN) (total)	mg/L	0.1	0.2	0	0			
Fluoride (F)	mg/L	0.1	2	0.14	0.15			
Lead (Pb)	mg/L	0.005	0.015	0	0			
Mercury (Hg)	mg/L	0.001	0.002	0	0			
Nickel (Ni)	mg/L	0.01	0.1	0.013	0			
Nitrate as (NO3)	mg/L	1	45	4.9	*0.53*			
Nitrate as (N)	mg/L	0.1	10	*1.11*	0.12			
Nitrite (as N)	mg/L	0.1	1	0	0			
Nitrate + Nitrite (as N)	mg/L	0.1	10	1.1	0.12			
Selenium (Se)	mg/L	0.005	0.05	0	0			
Thallium (Tl)	mg/L	0.001	0.002	0	0			
TITLE 22 SECONDARY STANDARDS, INORGANIC								
Iron (Fe)	mg/L	0.05	0.3	7.9	0			
Manganese (Mn)	mg/L	0.02	0.05	0.18	0			
Sliver (Ag)	mg/L	0.01	0.1	0	0			
Zinc (Zn)	mg/L	0.05	5	0.13	0			
OTHER CONSTITUENTS								
Boron (B)	mg/L	0.1	--	0.17	0.27			
MBAS (surfactants)	mg/L	0.025	0.5	0	0			
Perchlorate (ClO4-)	ug/L	2	1.0/6.0			0		
Hexavalent Chromium (Cr6)	ug/L	0.05	--			6.6		

Table 5

PARAMETER	UNITS	RL	MCL	LABORATORY RESULTS	
				Test Hole	Completed Springfield Well #2
RADIONUCLIDES					
Gross Alpha	pCi/L	0.758 (MDA95)	15		2.52 +/- 0.291 (MDA95=1.06)
Radium-228	pCi/L	0.821 (MDC)	5		0.549 +/- 0.322 (MDC=0.616)
Chlorinated Acid Herbicides by GC-ECD (EPA 515.4)					
2,4,5-T	ug/L	1			0
2,4,5-TP (Silvex)	ug/L	1			0
2,4-D	ug/L	10			0
Bentazon	ug/L	2			0
Dalapon	ug/L	10			0
Dicamba	ug/L	105			0
Dinoseb	ug/L	2			0
Pentachlorophenol	ug/L	0.2			0
Picloram	ug/L	1			0
Surrogate: DCPAA	Acceptable range: 70-130 %				94%
Volatile Organics by GC-MS (EPA 524.2)					
1,3-Dichloropropane	ug/L	0.5			0
1,4-Dichlorobenzene	ug/L	0.5			0
2,2-Dichloropropane	ug/L	0.5			0
2-Butanone	ug/L	5			0
2-Chlorotoluene	ug/L	0.5			0
2-Hexanone	ug/L	10			0
4-Chlorotoluene	ug/L	0.5			0
4-Methyl-2-Pentanone	ug/L	5			0
Acetone	ug/L	10			0
Benzene	ug/L	0.5			0
Bromobenzene	ug/L	0.5			0
Bromochloromethane	ug/L	0.5			0
Bromodichloromethane	ug/L	0.5			0
Bromoform	ug/L	0.5			0
Bromomethane	ug/L	0.5			0
Carbon Tetrachloride	ug/L	0.5			0
Chlorobenzene	ug/L	0.5			0
Chloroethane	ug/L	0.5			0
Chloroform	ug/L	0.5			0
Chloromethane	ug/L	0.5			0
cis-1,2-Dichloroethene	ug/L	0.5			0
cis-1,3-Dichloropropene	ug/L	0.5			0
Dibromochloromethane	ug/L	0.5			0
Dibromomethane	ug/L	0.5			0
Dichlorodifluoromethane	ug/L	0.5			0

Table 5

PARAMETER	UNITS	RL	MCL	LABORATORY RESULTS				
				Test Hole	Completed Springfield Well #2			
Dichloromethane	ug/L	0.5				0		
Di-isopropyl ether (DIPE)	ug/L	3				0		
Ethyl tert-Butyl Ether (ETBE)	ug/L	0.5				0		
Ethylbenzene	ug/L	0.5				0		
Hexachlorobutadiene	ug/L	0.5				0		
Isopropylbenzene	ug/L	0.5				0		
m,p-Xylenes	ug/L	0.5				0		
Methyl-t-butyl ether (MTBE)	ug/L	0.5				0		
Naphthalene	ug/L	0.5				0		
n-Butylbenzene	ug/L	0.5				0		
n-Propylbenzene	ug/L	0.5				0		
o-Xylene	ug/L	0.5				0		
para-Isopropyltoluene	ug/L	0.5				0		
sec-Butylbenzene	ug/L	0.5				0		
Styrene	ug/L	0.5				0		
tert-Amyl Methyl Ether (TAME)	ug/L	3				0		
tert-Butyl alcohol (TBA)	ug/L	2				0		
tert-Butylbenzene	ug/L	0.5				0		
Tetrachloroethene (PCE)	ug/L	0.5				0		
Toluene	ug/L	0.5				0.63		
trans-1,2-Dichloroethene	ug/L	0.5				0		
trans-1,3-Dichloropropene	ug/L	0.5				0		
Trichloroethene (TCE)	ug/L	0.5				0		
Trichlorofluoromethane	ug/L	5				0		
Vinyl Chloride	ug/L	0.5				0		
Surrogate: 1,2-Dichlorobenzene-d4	Acceptable range: 70-130 %					104%		
Surrogate: Bromofluorobenzene	Acceptable range: 70-130 %					105%		
Total 1,3-Dichloropropene	ug/L	0.5				0		
Total Trihalomethanes	ug/L	0.5				0		
Total Xylenes	ug/L	0.5				0		
Semi-Volatile Organics by GC-MS (EPA 525.3)								
Alachlor	ug/L	1				0		
Atrazine	ug/L	0.5				0		
Benzo(a)pyrene	ug/L	0.1				0		
Bis(2-ethylhexyl) adipate	ug/L	3				0		
Bis(2-ethylhexyl) phthalate	ug/L	3				0		
Bromacil	ug/L	10				0		
Butachlor	ug/L	0.38				0		
Diazinon	ug/L	0.25				0		
Dimethoate	ug/L	10				0		
Metolachlor	ug/L	0.5				0		

Table 5

PARAMETER	UNITS	RL	MCL	LABORATORY RESULTS				
				Test Hole	Completed Springfield Well #2			
Metribuzin	ug/L	0.5				0		
Molinate	ug/L	2				0		
Propachlor	ug/L	0.5				0		
Simazine	ug/L	1				0		
Thiobencarb	ug/L	1				0		
Surrogate: 1,3-Dimethyl-2-nitrobenzene	Acceptable range: 70-130 %					108%		
Surrogate: Benzo(a)pyrene-d12	Acceptable range: 70-130 %					123%		
Surrogate: Triphenyl Phosphate	Acceptable range: 70-130 %					100%		
Carbamates by HPLC (EPA 531.1)								
3-Hydroxycarbofuran	ug/L	3						0
Aldicarb	ug/L	3						0
Aldicarb Sulfone	ug/L	2						0
Aldicarb Sulfoxide	ug/L	3						0
Carbaryl	ug/L	5						0
Carbofuran	ug/L	5						0
Methomyl	ug/L	2						0
Oxamyl	ug/L	20						0
Diquat by HPLC (EPA 549.2)								
Diquat	ug/L	4				0		

NOTES

Observer key: gp = Gustavo Porras (Balance Hydrologics); rs = Rodney Schmidt (Pajaro Sunny Mesa)

RL = lab reporting limit, a level down to which can be quantified with reliability; a result below this level is shown as 0 or not detected; blank value = not tested

MCL = California Title 22 Maximum Contaminant Level as listed by California Administrative Code, Title 22.

Bold red font indicates a laboratory result exceeding its MCL.

MDA95 = minimal detectable activity; MDC = minimal detectable concentration

Table 6

Results for age-dating analyses of groundwater samples collected from the Springfield Well No. 2, Pajaro / Sunny Mesa Community Services District, Monterey County, California

Sample location	Springfield Well No. 2
Latitude (GoogleEarth, WGS84)	36.837933°N
Longitude (GoogleEarth, WGS84)	121.768676°W
Ground surface elevation (GoogleEarth, WGS84)	142
Well depth (ft)	600
Aquifer type	Pleistocene Aromas Sands Formation
Sample date	12/19/2017
Sampled by	Balance
Well use (gpm)	425 (end of step test)
Depth to water (ft)	195
Specific conductance (µmhos/cm at 25°C)	700
Water temperature (°C)	22
Laboratory used	U. Waterloo (isotopes, C14) U. Utah (CFCs, SF6, tritium, noble gases)
Stable isotope ratios	
$\delta^{2}H$ (per mil)	-40.49 (repeat -40.52)
$\delta^{18}O$ (per mil)	-6.44 (repeat -6.59)
$\delta^{13}C$ (per mil)	-16.00 (-15.66)
Carbon-14 ± CSU (percent modern carbon)[1]	66.09 ± 0.24
Uncorrected radiocarbon age (years BP)[2]	3,300
Corrected radiocarbon age (years BP)[3]	2,300
Tritium result[4]	
Tritium activity ± CSU (pCi/L)	0.15± 0.08
Tritium Units (TU)	0.05± 0.02
Initial tritium estimate at recharge[5]	
Tritium activity ± CSU (pCi/L)	calculation not possible
Tritium Units (TU)	calculation not possible
Tritium/Helium-3 age (years)	Pre-modern (>60 yrs)
Dissolved noble gases	
Argon (cm^3STP/g)	4.27E-04
Helium-3/Helium-4 (R)	1.23E-06
Helium-4 (cm^3STP/g)	6.14E-08
Krypton (cm^3STP/g)	8.67E-08
Neon (cm^3STP/g)	2.61E-07
Xenon (cm^3STP/g)	1.21E-08
Excess Air (% of equil. Ne)[6]	33%
Radiogenic helium (% of equil. He)[7]	0%
Radiogenic helium age (years)	0
Noble-gas recharge temperature (°C)[8]	13.3
Chlorofluorocarbons[9]	
CFC-11 (pptv)	128
CFC-12 (pptv)	137
CFC-113 (pptv)	12.8
CFC-11 (piston-flow model recharge year)	1976
CFC-12 (piston-flow model recharge year)	1970
CFC-113 (piston-flow model recharge year)	1975
Sulfur hexafluoride[10]	
SF6 (pptv)	2.05
SF6 (piston-flow model recharge year)	1988

Table 6

Results for age-dating analyses of groundwater samples collected from the Springfield Well No. 2, Pajaro / Sunny Mesa Community Services District, Monterey County, California

Notes:

[1] C-14 measurements are normalized to -25 permil using $\delta^{13}C$ values to correct for fractionation by photosynthesis.

[2] RCAge (years BP) = -8033*LN(PMC/100) - (year sampled - 1950)/1.03; where -8033 represents the mean lifetime of Carbon-14 (Stuiver and Polach, 1977) and 0 BP = 1950 AD.

[3] The half-life of C-14 is 5,730 yrs. Assuming only radioactive decay of 100 pmc in the recharging groundwater and neglecting geochemical reactions that occur between groundwater and aquifer materials, groundwater having 90 pmc would have recharged 370 years before present (BP), and ground water having 50 pmc would have been recharged 5,730 years BP. C-14 activity of groundwater at the time of recharge is rarely equal to 100 pmc because of reactions that occur between infiltrating water, soil gases (primarily carbon dioxide), and carbonate minerals in the unsaturated zone. C-14 activity of recharge water in well-leached, carbonate-poor settings should be about 85±3 pmc (Vogel and Ehhart 1963). Our result was corrected with a C-14 activity of 88 pmc, reported by Hanson (2003) in the lower Pajaro Valley including the Springfield area. Reported recharge water values by Izbicki and Michel (2004) in the Mohave Desert area, and by Balance Hydrologics in the Montara area agree with this value.

[4] Tritium is reported in terms of activity (picocuries per liter, pCi/L), or decay (disintegrations per minute per liter, dpm/L. One tritium unit (TU) = 7.2 dpm/L = 3.2 pCi/L.

[5] In groundwater, tritium is isolated from the atmosphere and undergoes natural decay to the stable helium isotope (3He) with a half-life of 12.34 years. The daughter product helium-3 is added to the tritium result to estimate the tritium concentration at time of recharge and age. Results less than 1 pCi/L (0.31 TU) are assumed to be primarily pre-modern groundwater, recharged before mid-1950s.

[6] Measured dissolved gas concentrations are often greater than expected for equilibrium conditions, and this 'excess air' is attributed to entrainment of air bubbles in the vadose zone during recharge and water table fluctuation, which subsequently dissolve at depth under higher fluid pressure. Typical amounts of excess air observed in groundwater range from 0 to 30 cubic centimeters (STP)-air per kg-water.

[7] Reported as a percent of equilibrium, radiogenic helium increases in groundwater with time from the decay of heavy radionuclides, and hence increases along a groundwater flow path.

[8] The conservative behavior of noble gases allows for the estimation of water table temperatures at the time of groundwater recharge, which is generally near the mean annual surface temperature. It is common to measure the concentrations multiple noble gases in a groundwater sample to calculate the noble-gas recharge temperature (as well as the excess air).

[9] Chlorofluorocarbons (CFCs) are synthetic compounds and have no natural sources. CFC concentrations in groundwater can date that fraction of groundwater recharged from the 1940s at on the onset of industrial production through the mid to late 1990s when atmospheric concentrations peaked. CFC-12 has the highest range of atmospheric concentrations, and therefore is most sensitive for dating groundwater. CFCs do degrade under anaerobic conditions.

[10] Sulfur hexafluoride (SF6) is primarily of anthropogenic origin but also occurs naturally in fluid inclusions in some minerals and igneous rocks, and in some volcanic and igneous fluids. SF6 is extremely stable, with an estimated atmospheric lifetime of 800 to 3200 years. Significant production of SF6 began in the 1960s for use in high voltage electrical switches. Atmospheric concentrations continue to increase.

[11] Unit definitions: CSU = 1-sigma combined standard uncertainty; cm3STP/g = cubic centimeters per gram at standard temperature and pressure; pptv = parts per trillion by volume.

FIGURES

Figure 1. Existing well 1 and test well 2, Springfield water system, Pajaro / Sunny Mesa Community Services District, Monterey County, California. Source of base map: USGS 7.5-minute quadrangle, Moss Landing, 1994

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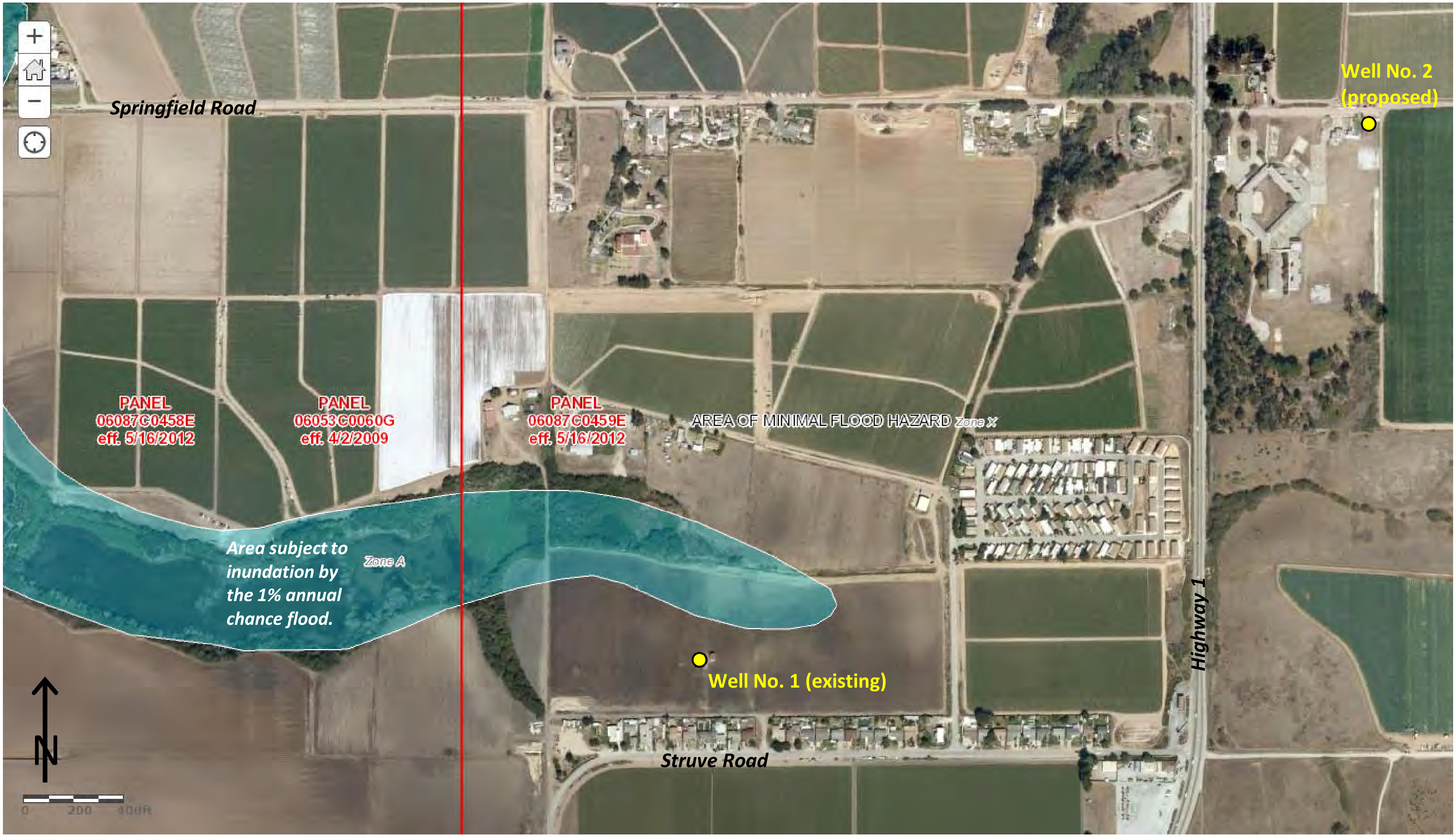

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Figure 2. FEMA flood hazard at existing well no. 1 and proposed well no. 2, Springfield water system, Moss Landing, CA. The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. Zone A identifies the area subject to inundation by the 1% annual flood chance with no published base-flood elevations. Zone X is outside of the 0.2% annual chance floodplain. Source: Flood Insurance Rate Map (FIRM), Monterey County, California, panel 60 of 2050, map no. 06053C0060G, effective date April 2, 2009.

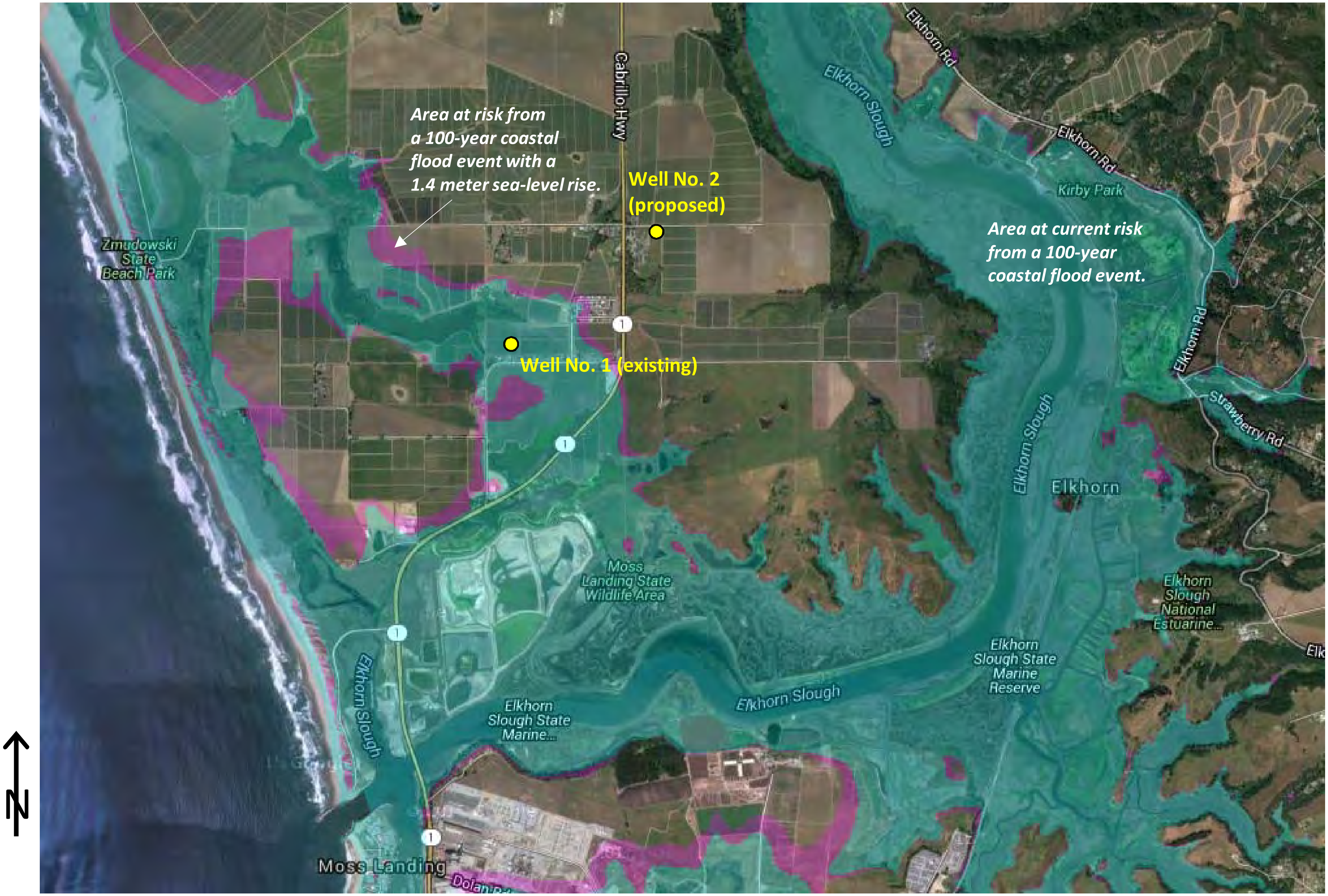

Figure 3. Coastal flooding and sea-level rise hazard at existing well no. 1 and proposed well no. 2, Springfield water system, Moss Landing, CA. Data not intended to be used in lieu of Flood Insurance Studies and Flood Insurance Rate Maps issued by the Federal Emergency Management Agency (FEMA).
Source: Pacific Institute, 2009. Sea Level Rise Maps. http://www.pacinst.org/reports/sea_level_rise/maps/.
Heberger and others, 2009, http://pacinst.org/publication/the-impacts-of-sea-level-rise-on-the-california-coast/

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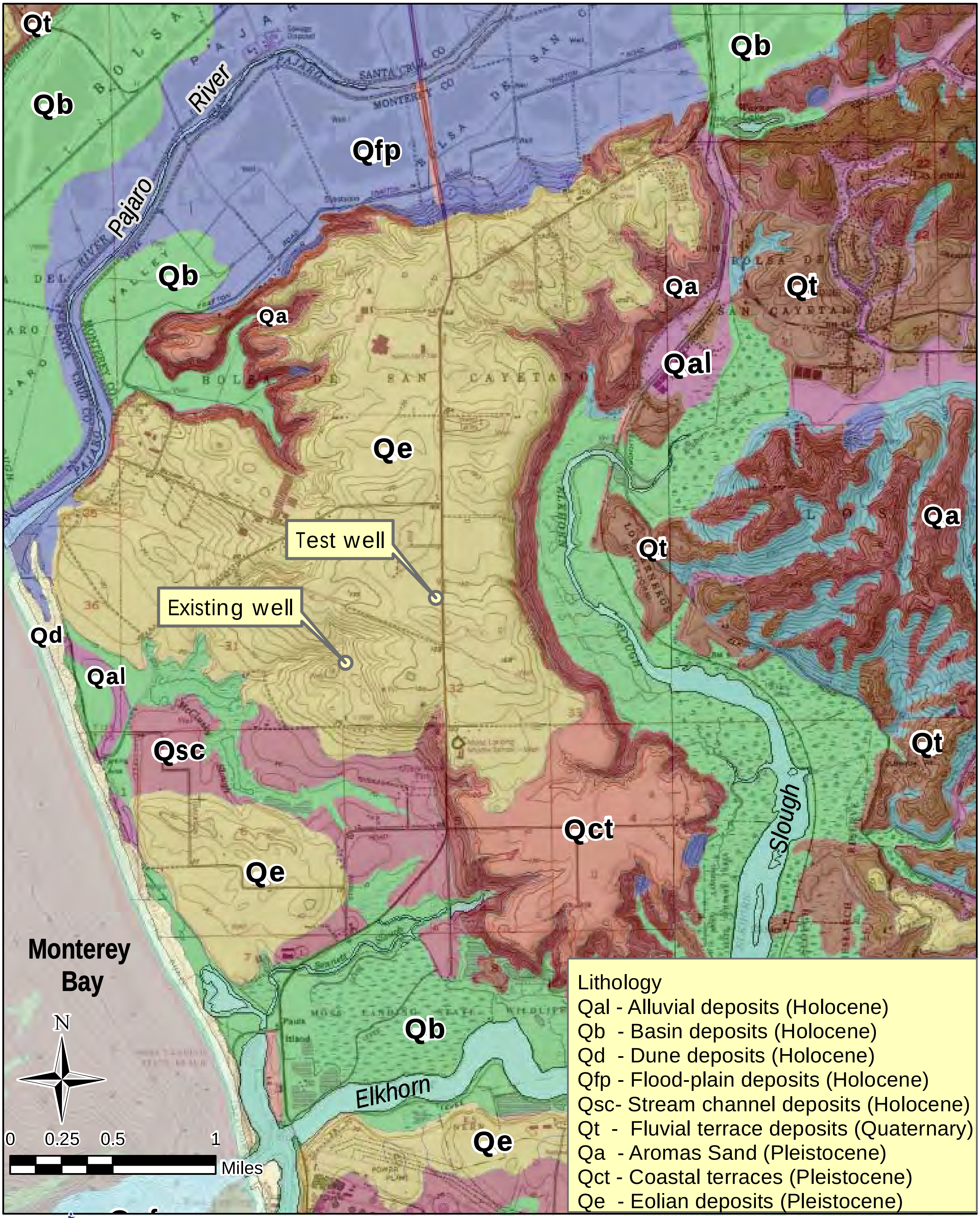

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Figure 4. Surface geology, Springfield water system, Pajaro Sunny Mesa Community Services District, Monterey County, California.

Source: Monterey County GIS and mapping data (Rosenberg, 2001)

215021 Pajaro Sunny Mesa_10-3-15.mxd

Figure 5. Lithologic log and profile locations, Springfield area, Pajaro/Sunny Mesa Community Services District, Monterey County, California. Photo source: Google Earth. Imagery Date: 4/13/2015. Well completion reports from California Department of Water Resources. The logs shown were used to create a three-dimensional lithologic model. Profile A-A' includes a 1,600 ft swath on each side of the section, within which lithologic logs were projected.

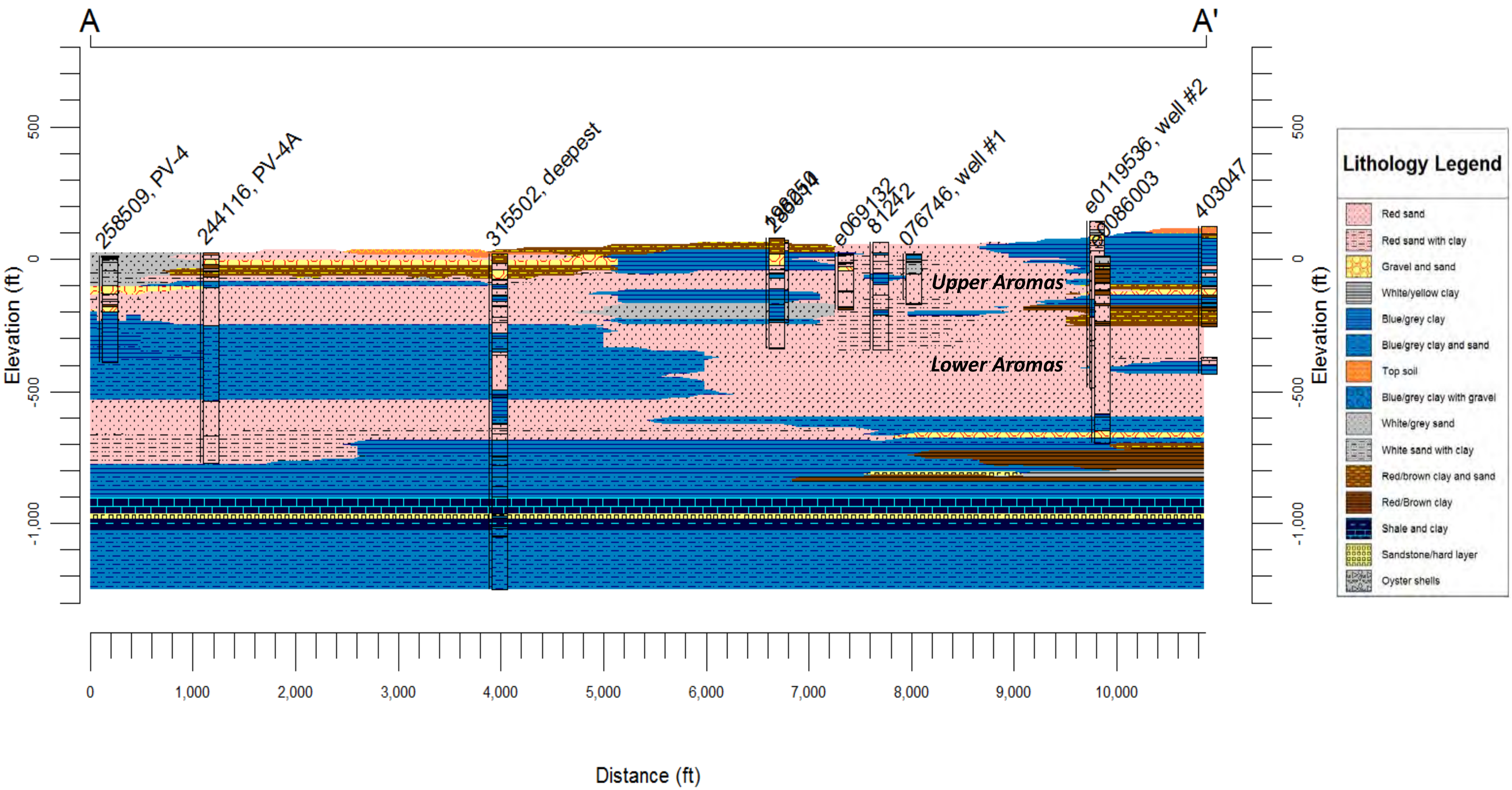

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Figure 6. Lithology profile A-A', Springfield area, Pajaro/Sunny Mesa Community Services District, Monterey County, California. The logs shown are projected within a 1,600 ft swath on each side of the cross section. Intervening lithology was based on lateral blending of data from all logs used to create a three-dimensional lithologic model.

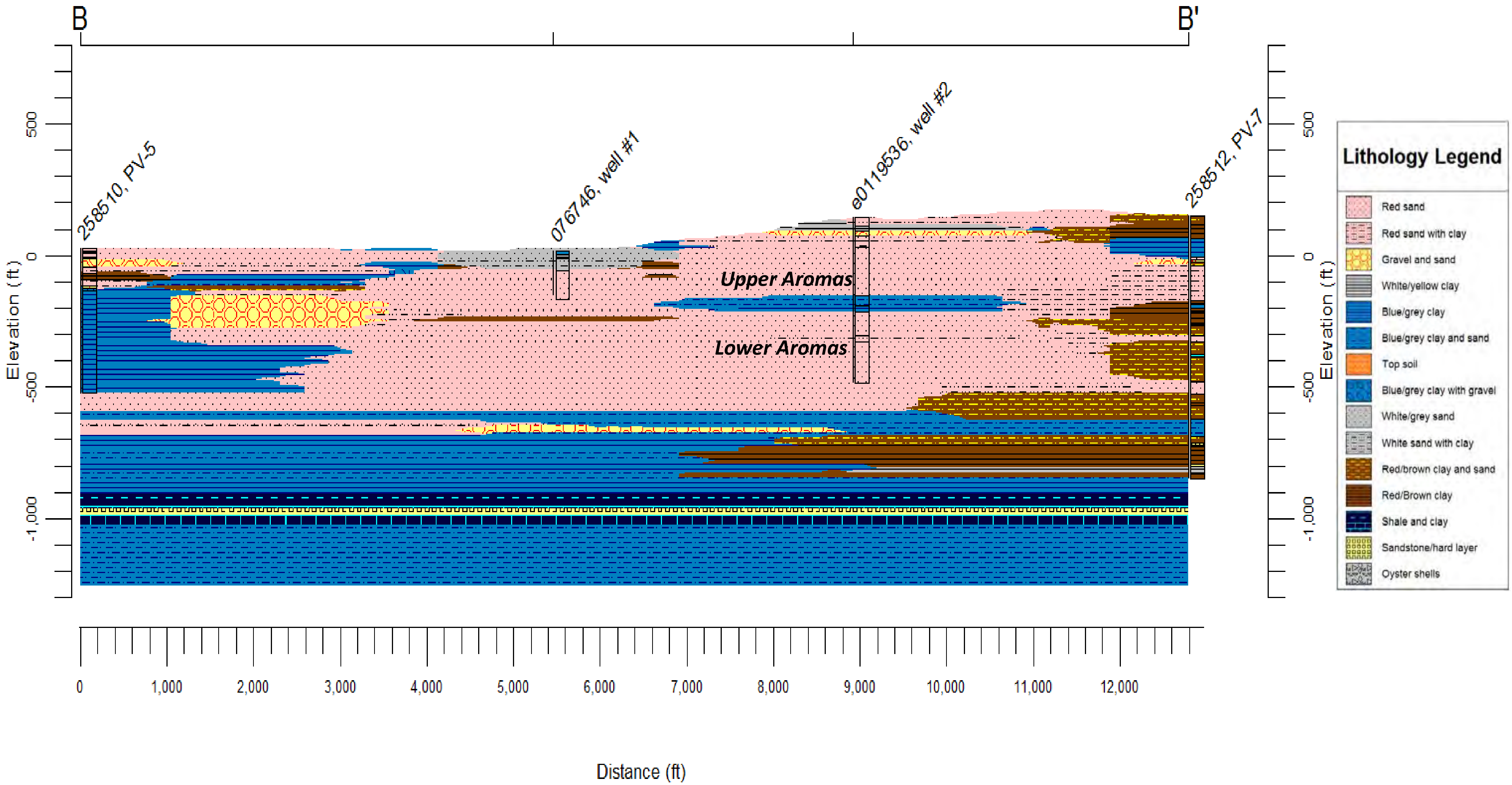

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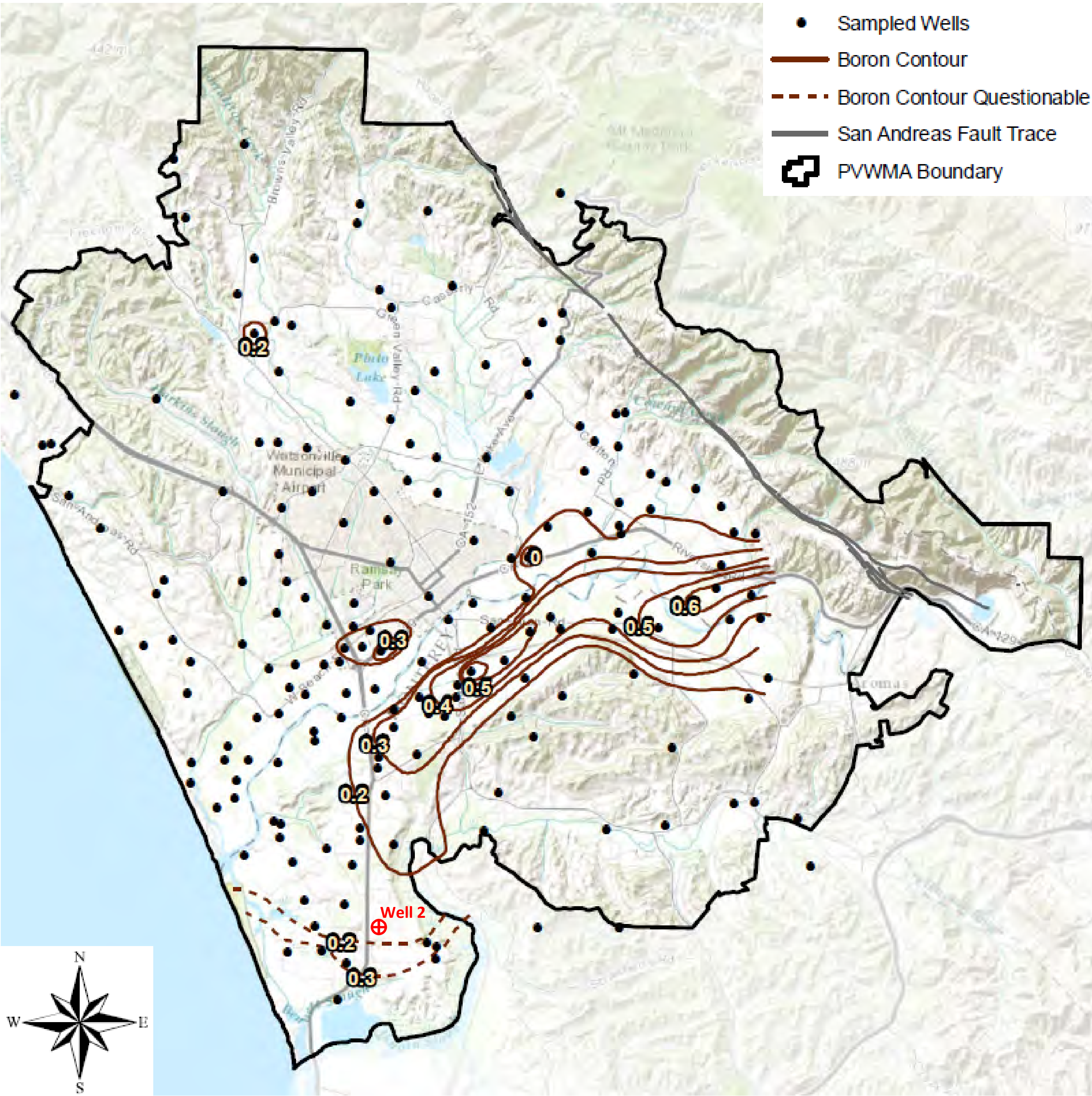
Figure 7. Lithology profile B-B', Springfield area, Pajaro/Sunny Mesa Community Services District, Monterey County, California. Intervening lithology was based on lateral blending of data from all logs used to create a three-dimensional lithologic model.



Boron plume identifies recharge from the Pajaro River. Other than sea water, the Pajaro River is the only significant natural source of boron in the Pajaro groundwater basin. The Pajaro River recharges moderate concentrations of naturally-occurring boron to groundwater as if flows west from the San Andreas Rift Zone, the source of the boron. Concentrations in the Pajaro River are highest when flows are low, and at times exceeding 1 mg/L, while the boron concentration of seawater is 4.5 mg/L (Hem, 1986). Boron concentrations in groundwater is, therefore, a water-quality fingerprint of groundwater recharge from the Pajaro River.

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Figure 8. Boron concentrations in groundwater, Pajaro River area, Monterey County, California. Data source: HEA, 1978; updated for PVWMA Basin Management Plan Update DEIR (Denise Duffy & Associates, 2013)

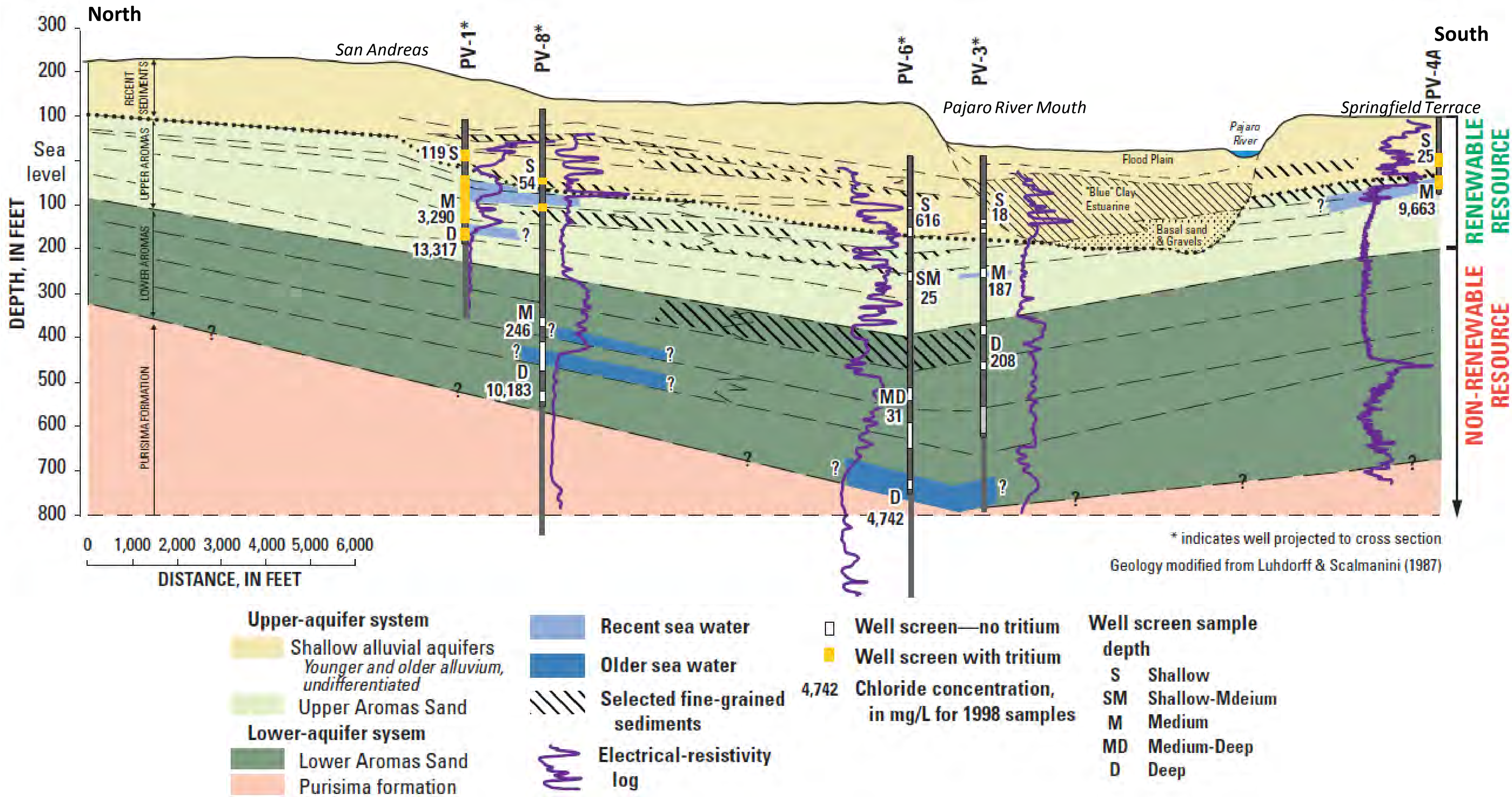

Figure 9. Geology and water-quality attributes along the coast in the Pajaro Valley, Santa Cruz and Monterey Counties, California. The alluvial aquifers are composed of well-layered marine and terrestrial coarse-grained deposits separated by extensive fine-grained deposits. The fine-grained deposits potentially restrict vertical movement of groundwater and constrain seawater intrusion (vertically). Coarse-grained deposits persist over large areas and control the pumpage and related seawater intrusion. Since the 1950s, groundwater levels have been near or below sea level at most coastal monitoring wells, and at some inland water-supply wells (including the Springfield subarea) been below the estimated water levels required to stop seawater intrusion. Groundwater recharged since 1950 and chemically and isotopically similar to local surface waters was characterized as a renewable resource, while underlying groundwater recharged thousands of years ago was generally characterized as a nonrenewable resource, implying a significant degree of aquifer confinement. Source: Hanson, 2003.

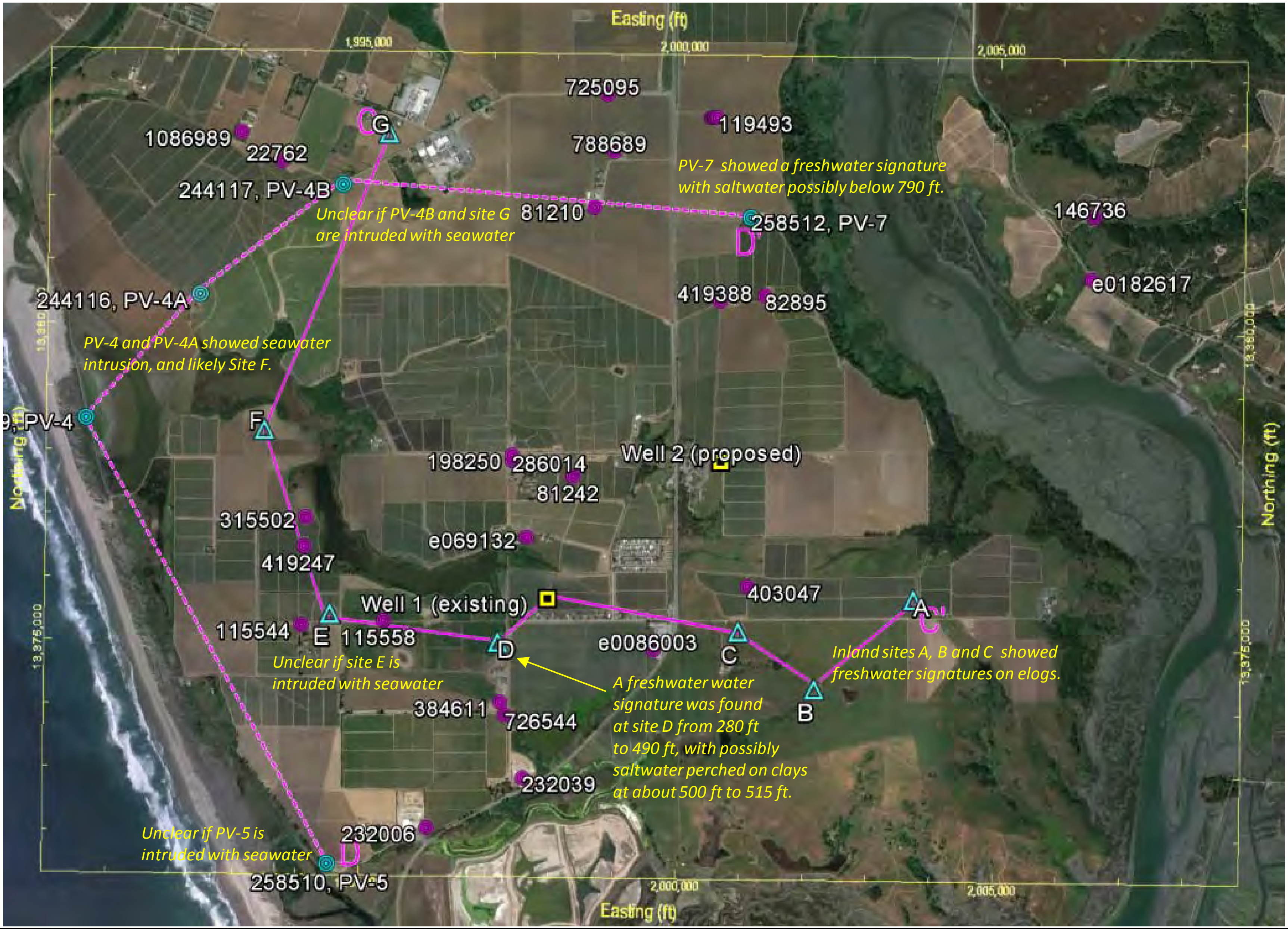

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Figure 10. Elog and profile locations, Springfield water system area, Monterey County, California.
Photo source: Google Earth. Imagery Date: 4/13/2015. Elog sources: Capurro Ranch well study, 3/31/1993, Eaton Drilling Co., Inc. (designated by letters A through G along profile C-C'); and Pajaro Valley groundwater investigation, November 1988, Luhdorff and Scalmanini Consulting Engineers (designated as PV series along profile D-D').

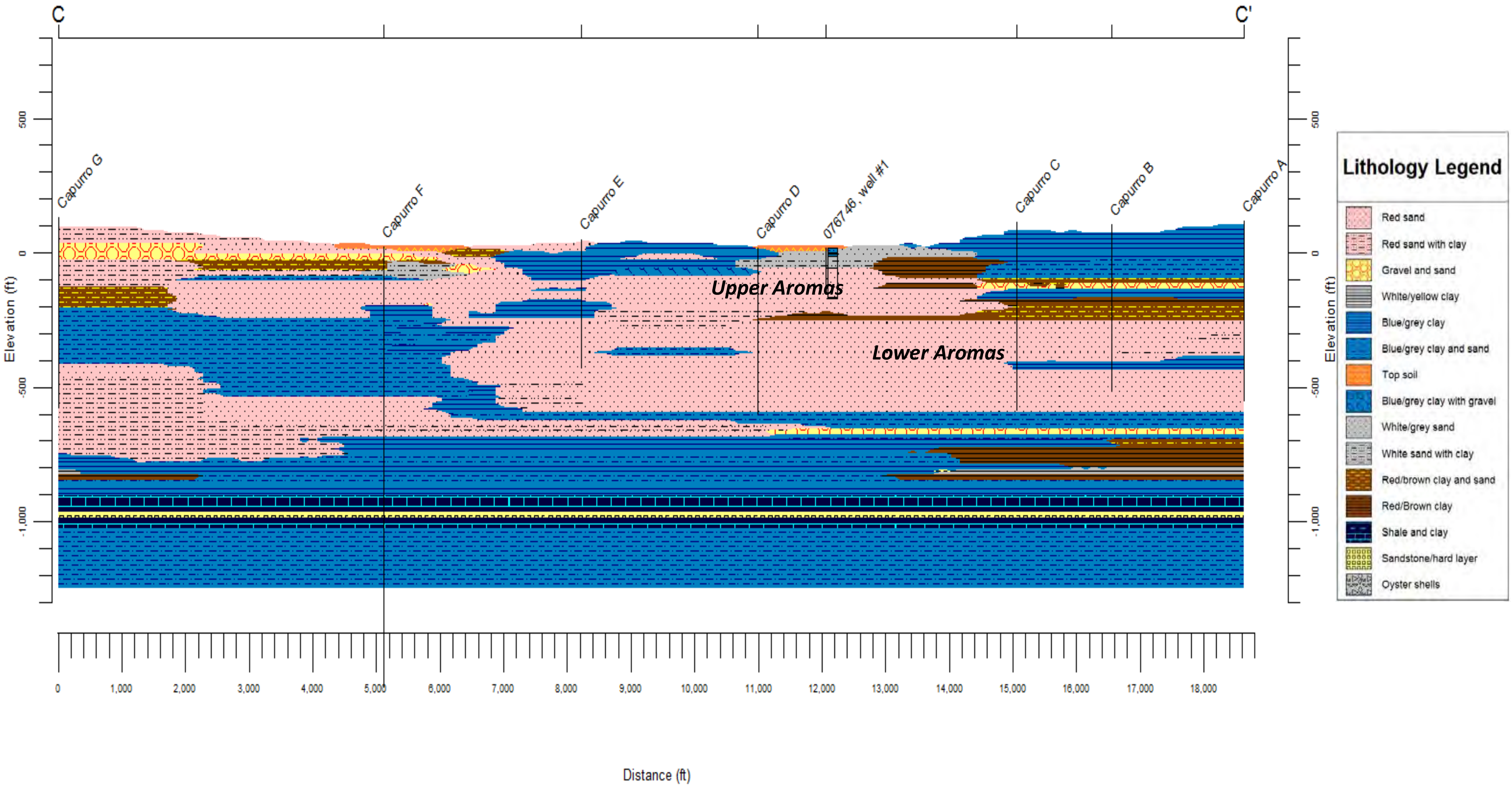

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Figure 11. Profile C-C', Elog locations, Springfield area, Pajaro/Sunny Mesa Community Services District, Monterey County, California. Elog source: Capurro Ranch well study, 3/31/1993, Eaton Drilling Co., Inc. Intervening lithology based on lateral blending of data from DWR well completion reports used to create a three-dimensional lithologic model.

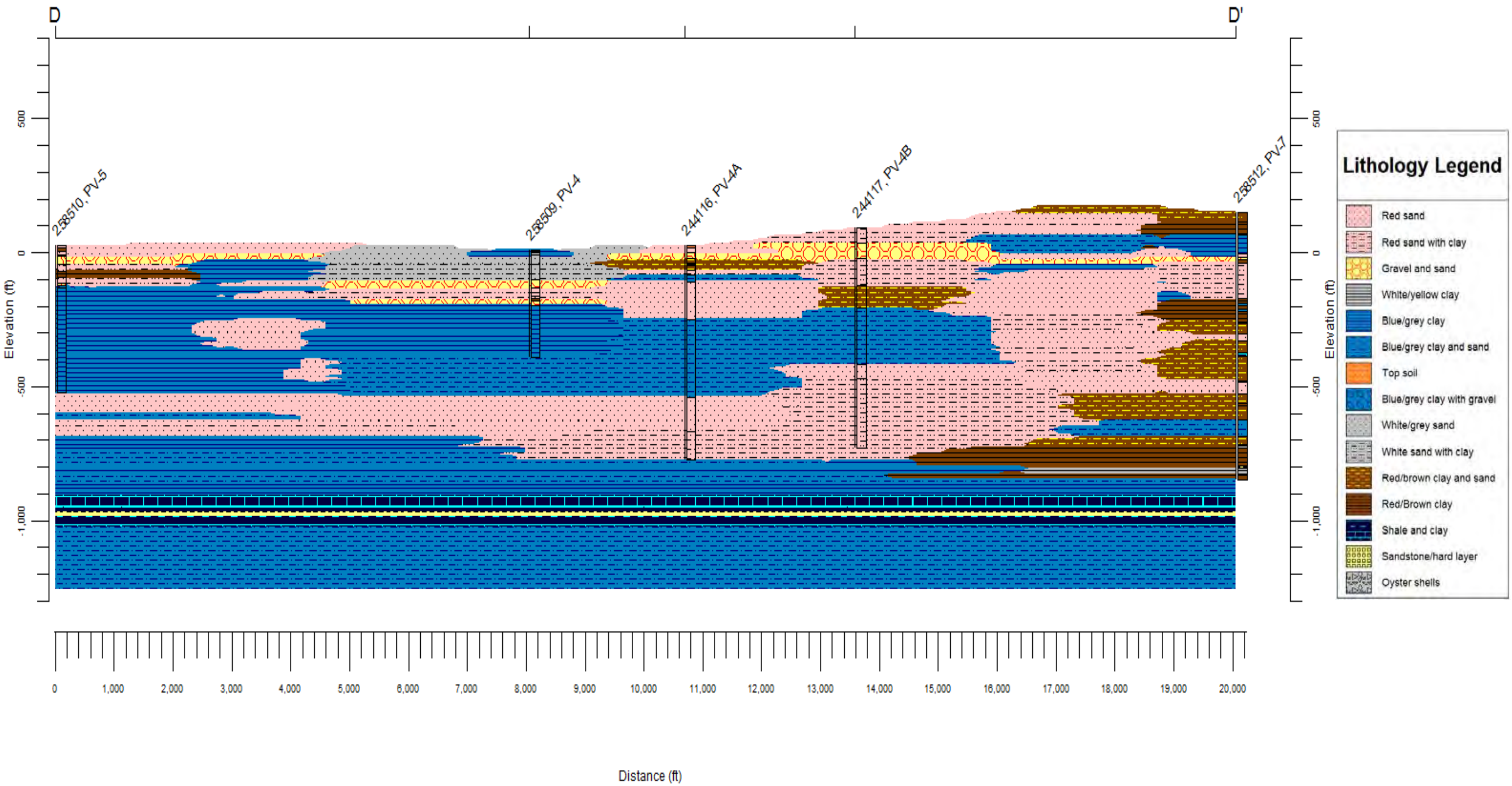

Figure 12. Profile D-D', Elog locations, Springfield area, Pajaro/Sunny Mesa Community Services District, Monterey County, California. Elog source: Pajaro Valley groundwater investigation, November 1988, Luhdorff and Scalmanini Consulting Engineers. Intervening lithology based on lateral blending of data from DWR well completion reports used to create a three-dimensional lithologic model.

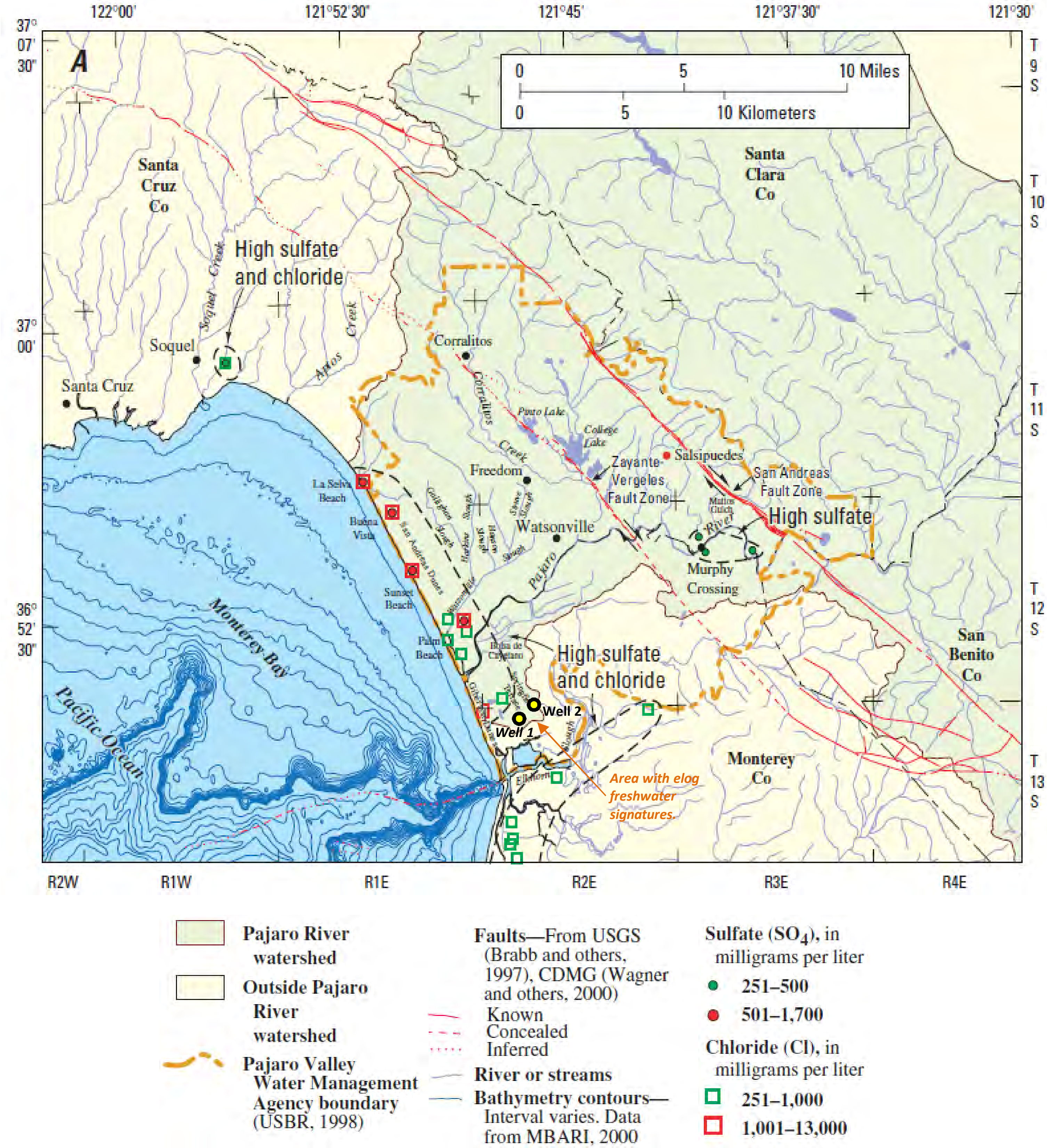

Figure 13. Inferred chloride and sulfate concentrations in groundwater, Pajaro Valley, Monterey County, California. Figure source: Hanson, 2003, Figure 18. Elog sources: Two sets of elogs were available: a) Seven elogs shown from the Capurro Ranch well study (Eaton Drilling, 1993); and b) Five well logs from the Pajaro Valley groundwater investigation (L&S, 1988).

Figure 14. Test well no. 2 relative to neighboring wells, Springfield water system, Pajaro / Sunny Mesa Community Services District, Monterey County, California.
Source or base photo: Google Earth.

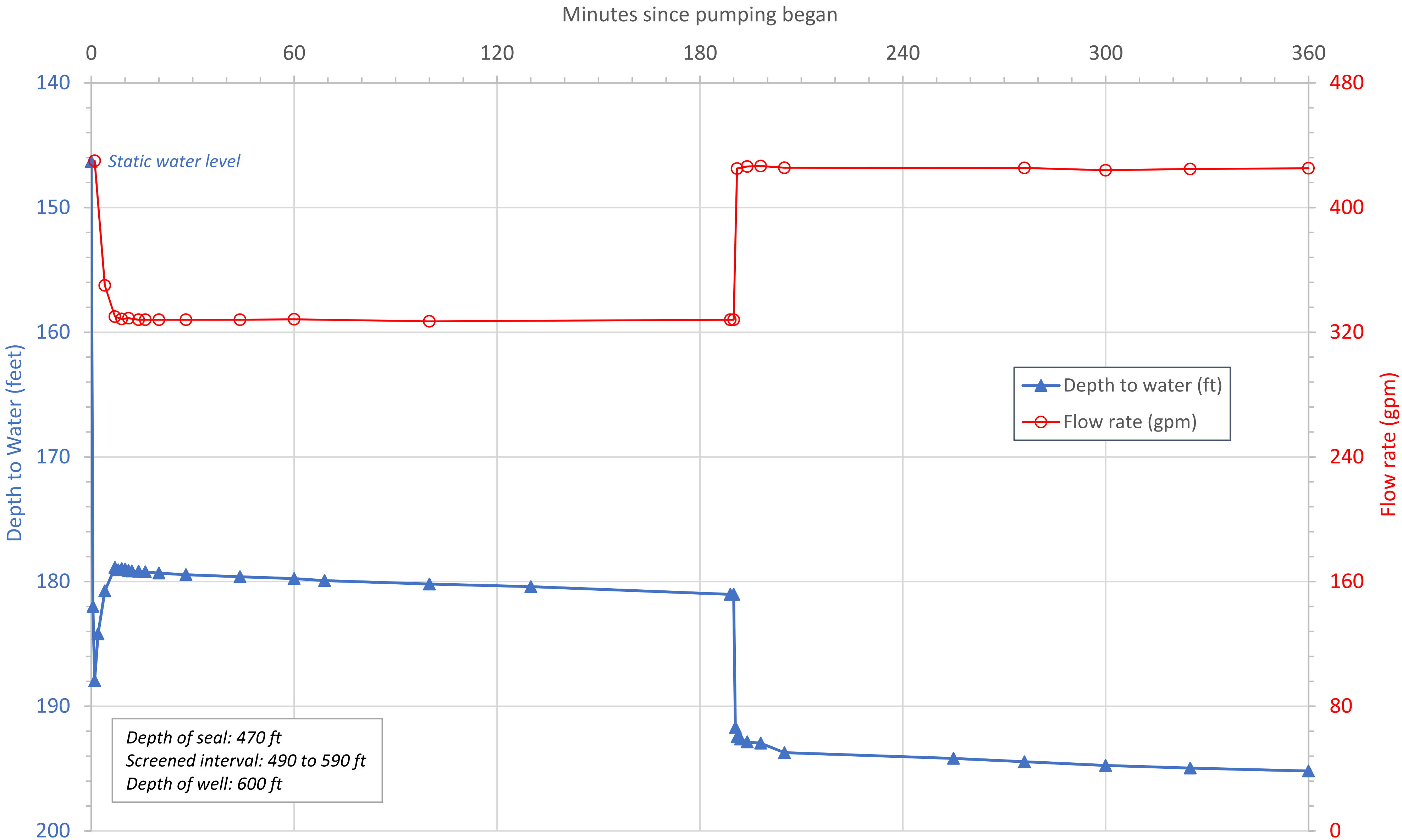

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Figure 15. Depth to water during step test at Springfield Well No. 2, December 19, 2017, Pajaro / Sunny Mesa Community Services District, Monterey County, CA

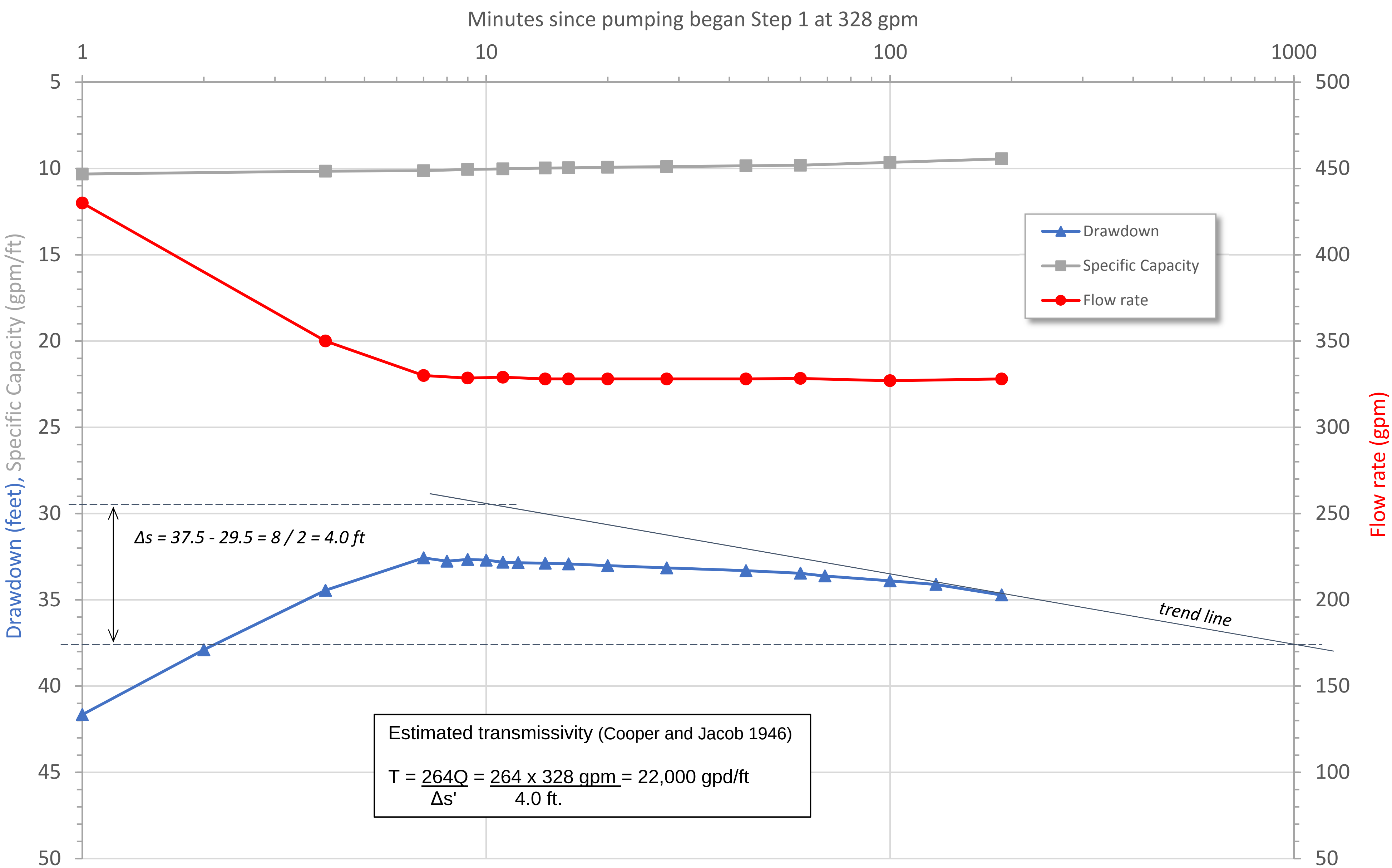

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Figure 16. Time-drawdown graph for first step of step test, 328 gpm at Springfield Well No. 2, December 19, 2017, Pajaro / Sunny Mesa Community Services District, Monterey County, CA

215021 Springfield well test_2-21-18_(20180423).xlsx, step test 328 gpm drawdown

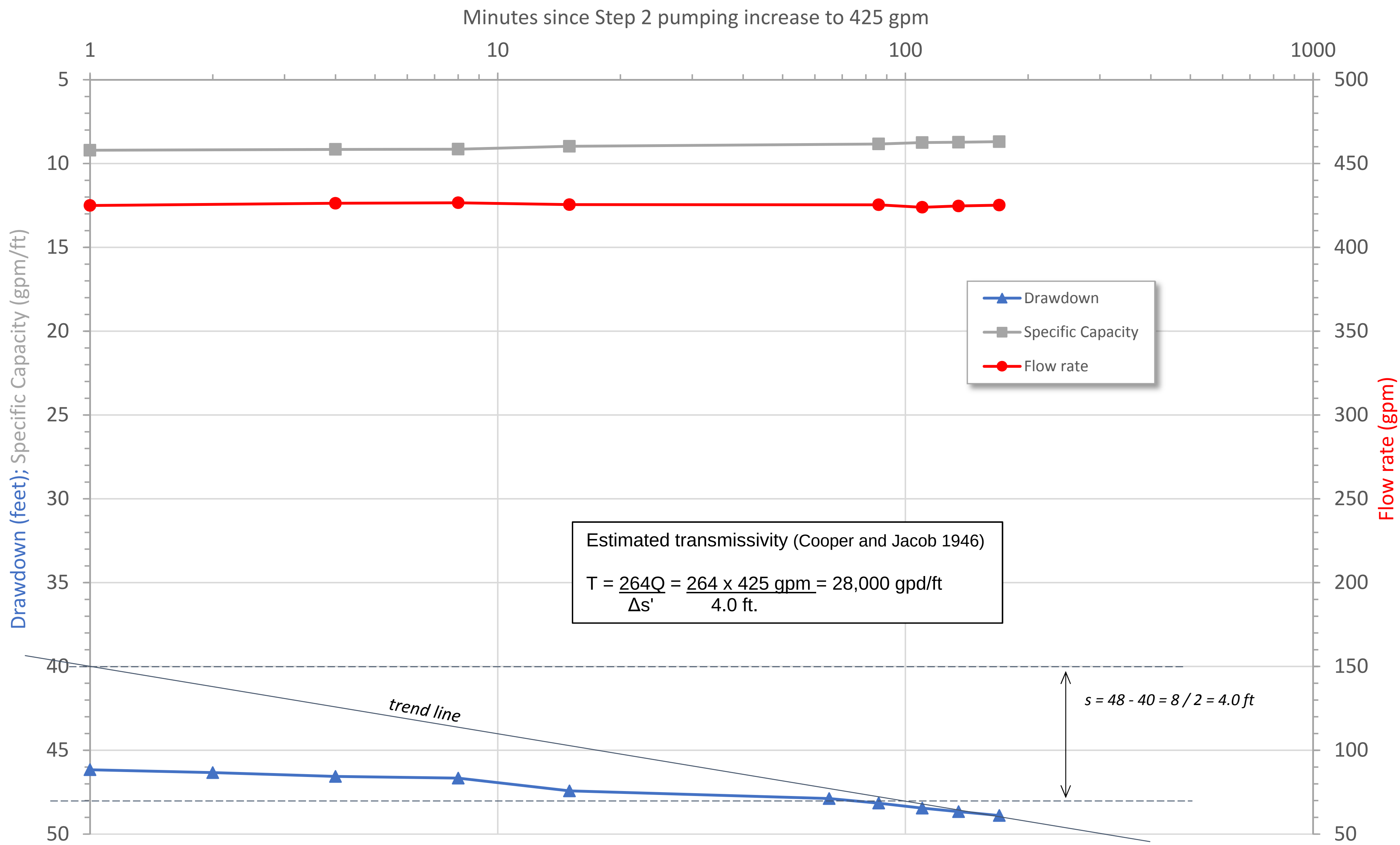

Figure 17. Time-drawdown graph for second step of step test, 425 gpm at Springfield Well No. 2, December 19, 2017, Pajaro / Sunny Mesa Community Services District, Monterey County, CA

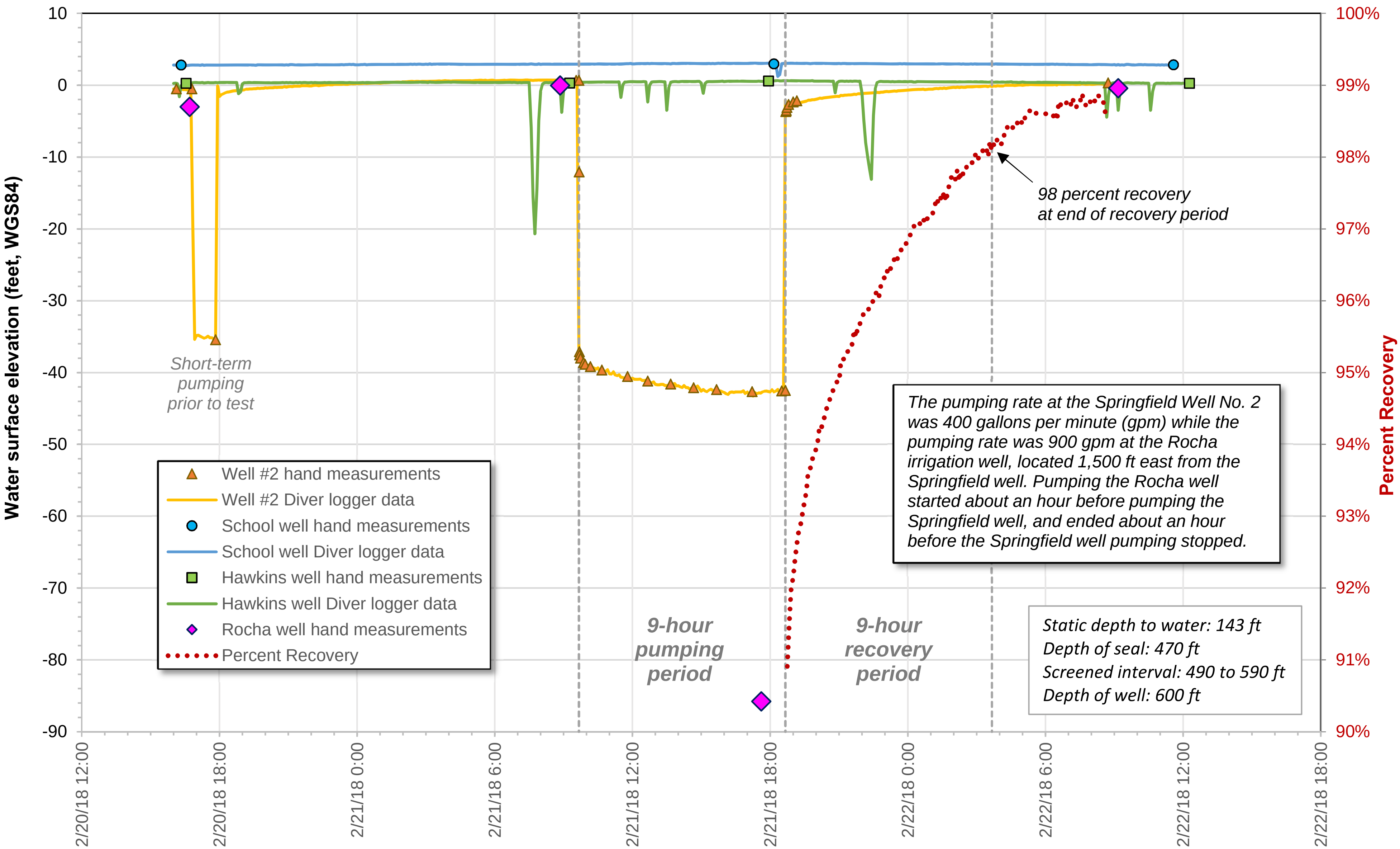

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Figure 18. Water surface elevations during pumping and recovery of 9-hour aquifer test, Springfield Well No. 2, February 21-22, 2018, Pajaro / Sunny Mesa Community Services District, Monterey County, CA

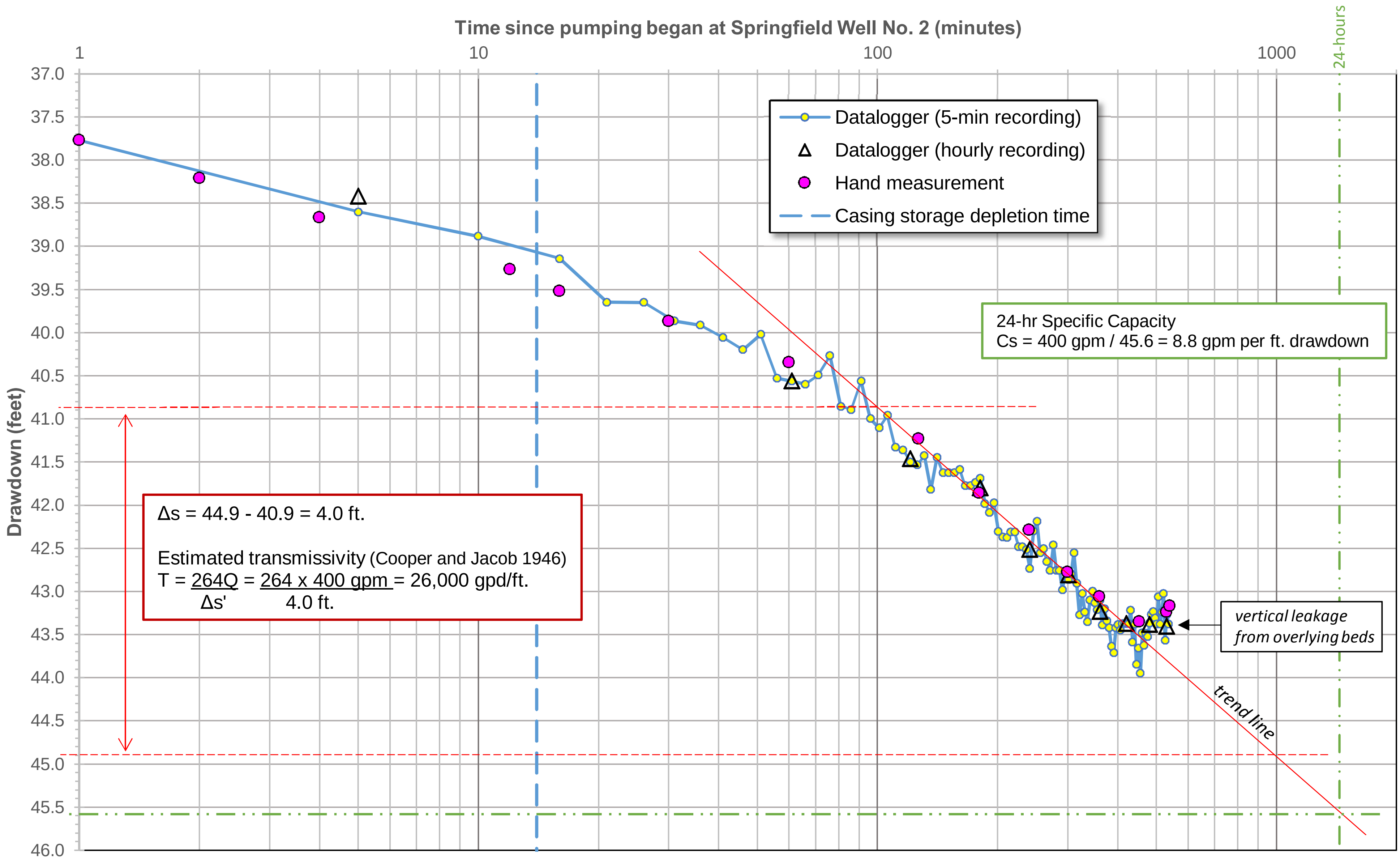

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Figure 19. Time-drawdown graph for 9-hour pumping test at Springfield Well No. 2, February 21-22, 2018, Pajaro / Sunny Mesa Community Services District, Monterey County, California

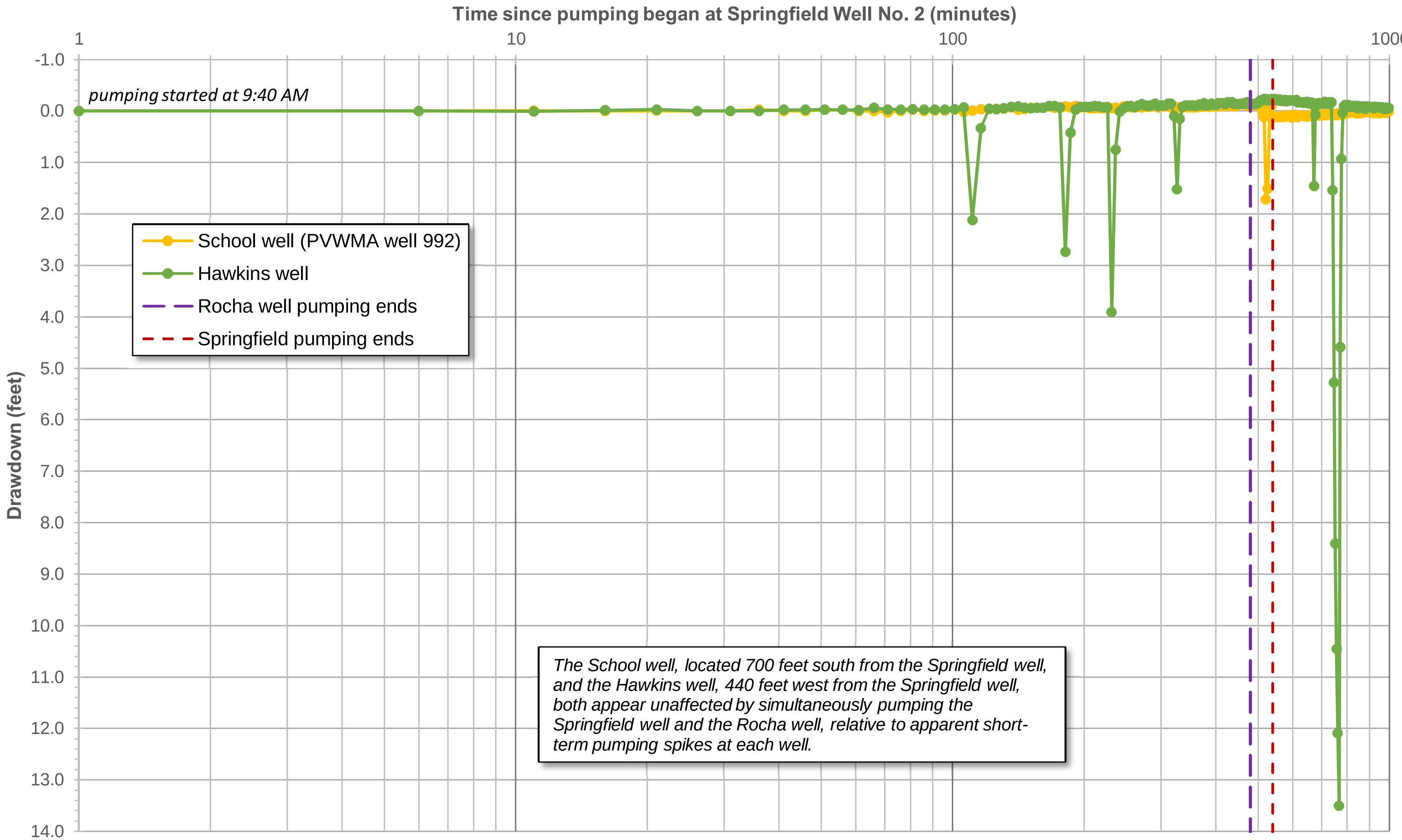

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Figure 20. Time-drawdown graph for observation wells during 9-hour pumping test at Springfield Well No. 2, February 21-22, 2018, Pajaro / Sunny Mesa Community Services District, Monterey County, CA

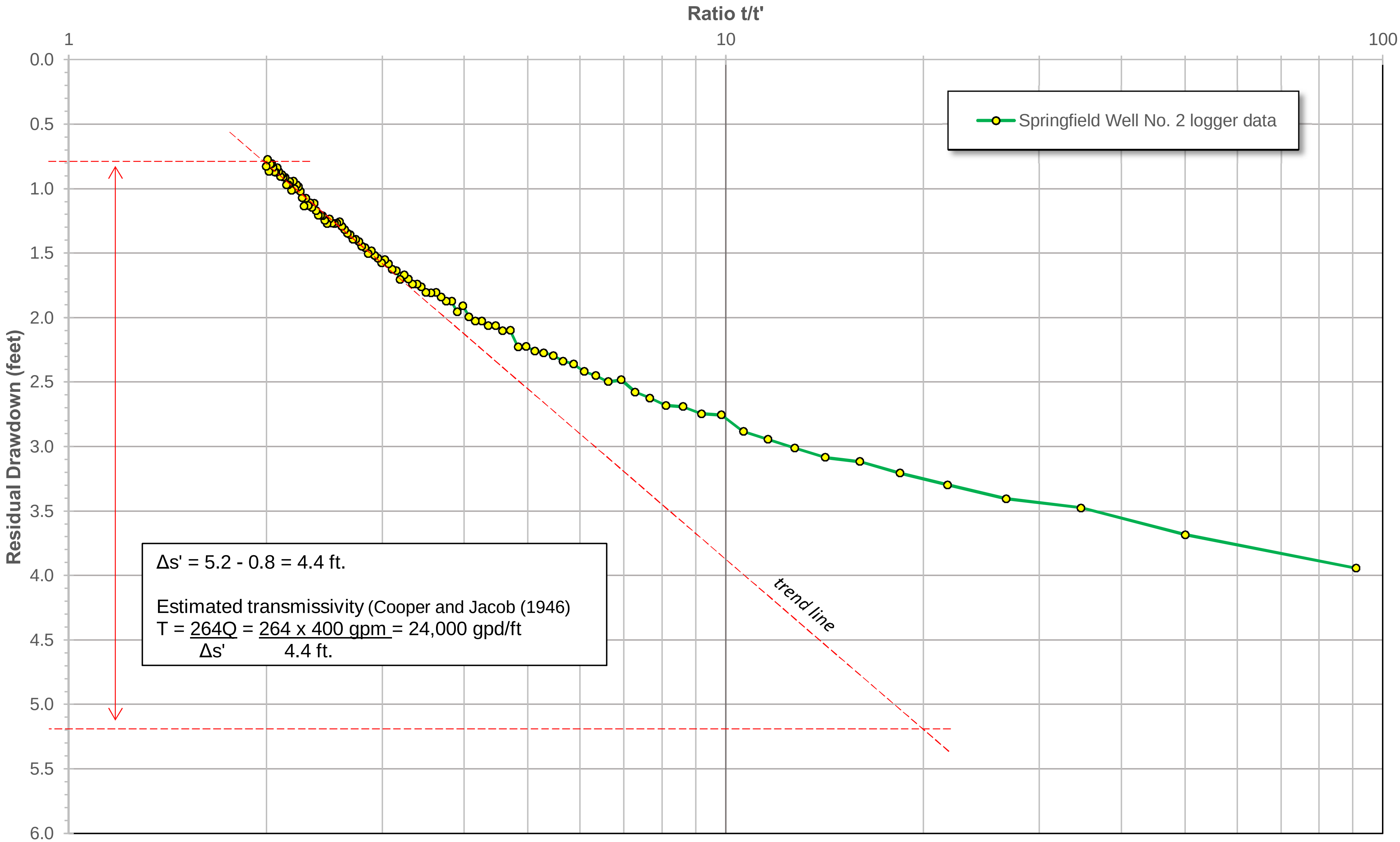

Figure 21. Residual-drawdown graph for recovery test at Springfield Well No. 2, February 21-22, 2018, Pajaro / Sunny Mesa Community Services District, Monterey County, CA

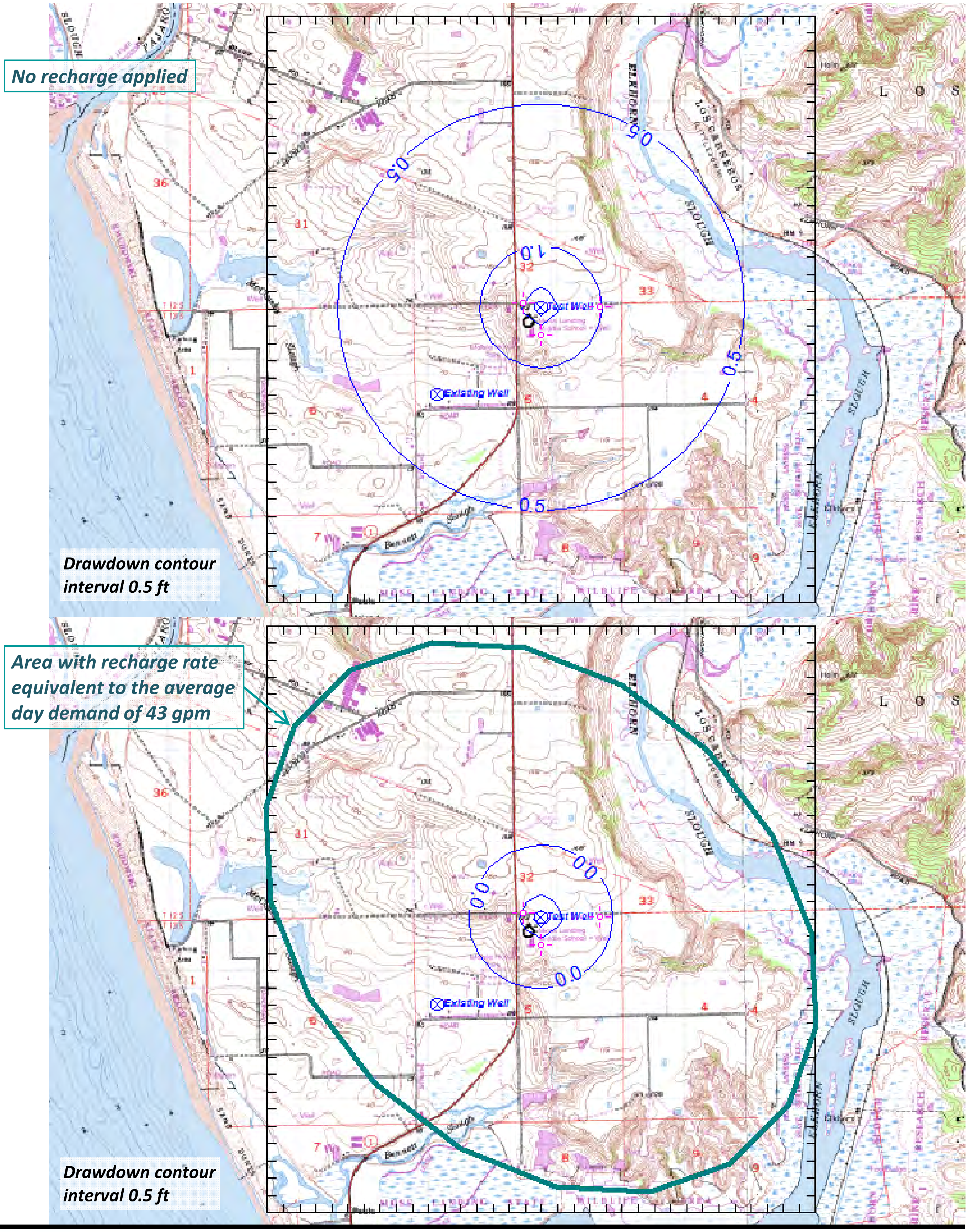

Figure 22. Results of two-dimensional steady-state analytical groundwater model for Springfield Well No. 2 pumping at 43 gpm, Pajaro / Sunny Mesa CSD, Monterey County, CA. The 1-ft drawdown contour is commonly used to estimate a theoretical area of influence. Refer to text for parameters and assumptions of the calculations.

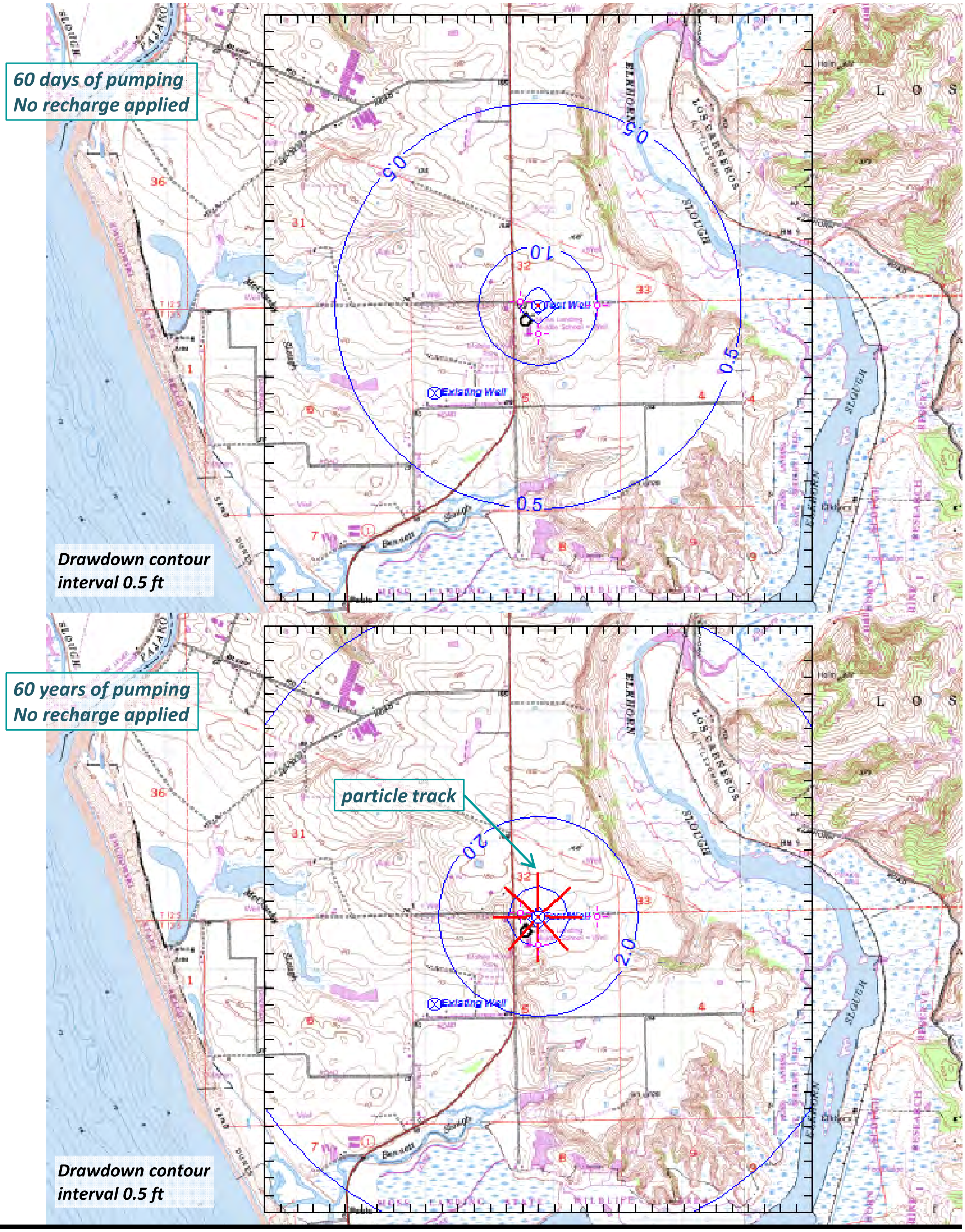

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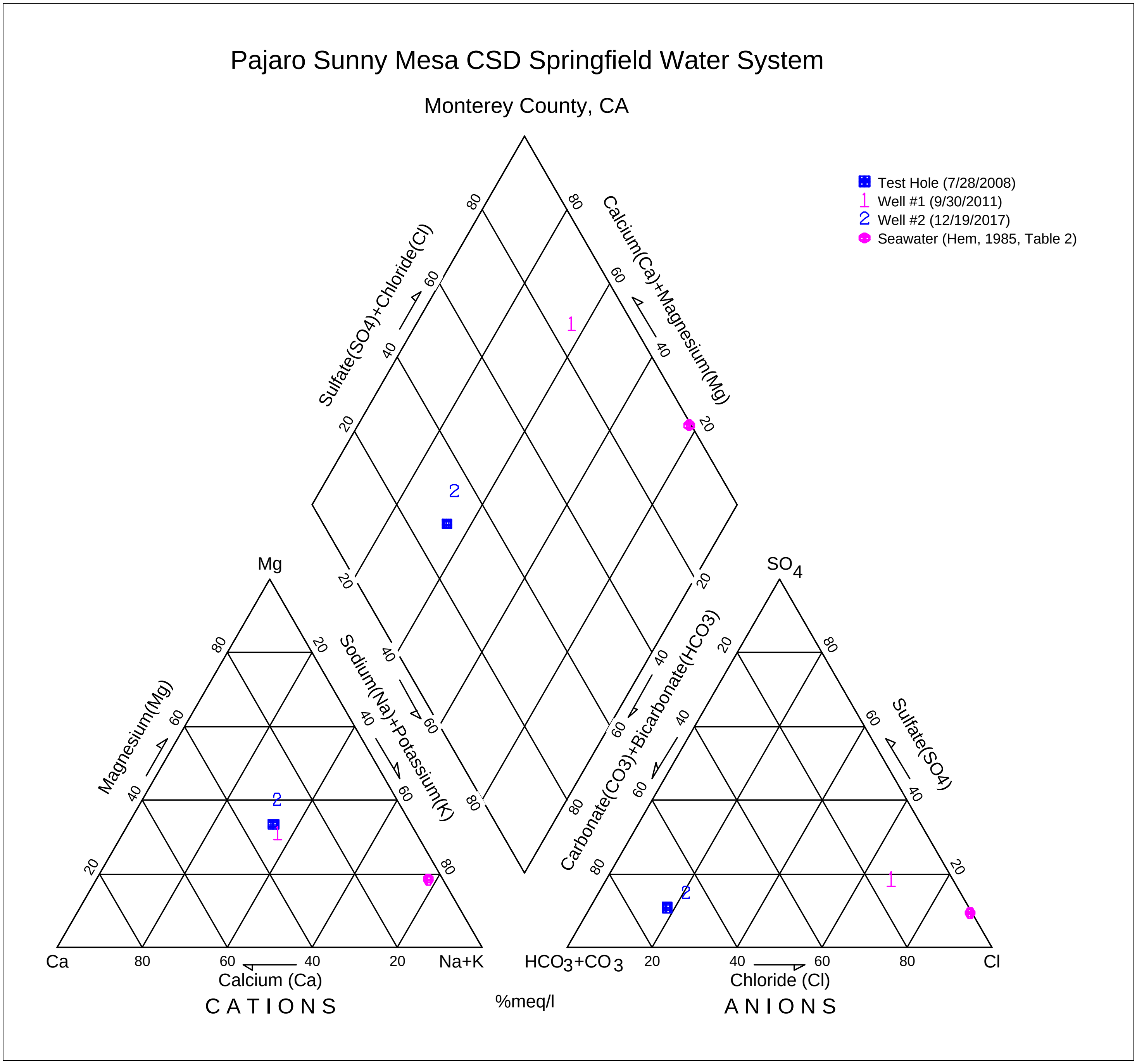
Figure 23. Results of two-dimensional transient analytical groundwater model for Springfield Well No. 2 pumping 43 gpm, Pajaro / Sunny Mesa CSD, Monterey County, CA. Drawdown at 60 days resembles the steady-state model results. The red particle traces identify the aquifer volume equivalent to the total volume of water pumped. Refer to text for parameters and assumptions of the calculations.



This diagram shows cations in the ternary graph on the left and anions on the right graph. The diamond graph in the center illustrates both cations and anions. Hardness dominated (calcium and magnesium) water plots to the left and top of the diamond graph, soft monovalent-salt dominated (primarily sodium) water to the right, and soft alkaline water towards the bottom.

Balance Hydrologics, Inc.®

Figure 24. Piper diagram illustrating ionic signatures of water samples collected from the Springfield water system existing Well 1 and from the test hole and Well 2, Monterey County, California. The two waters are differentiated by their anion composition.

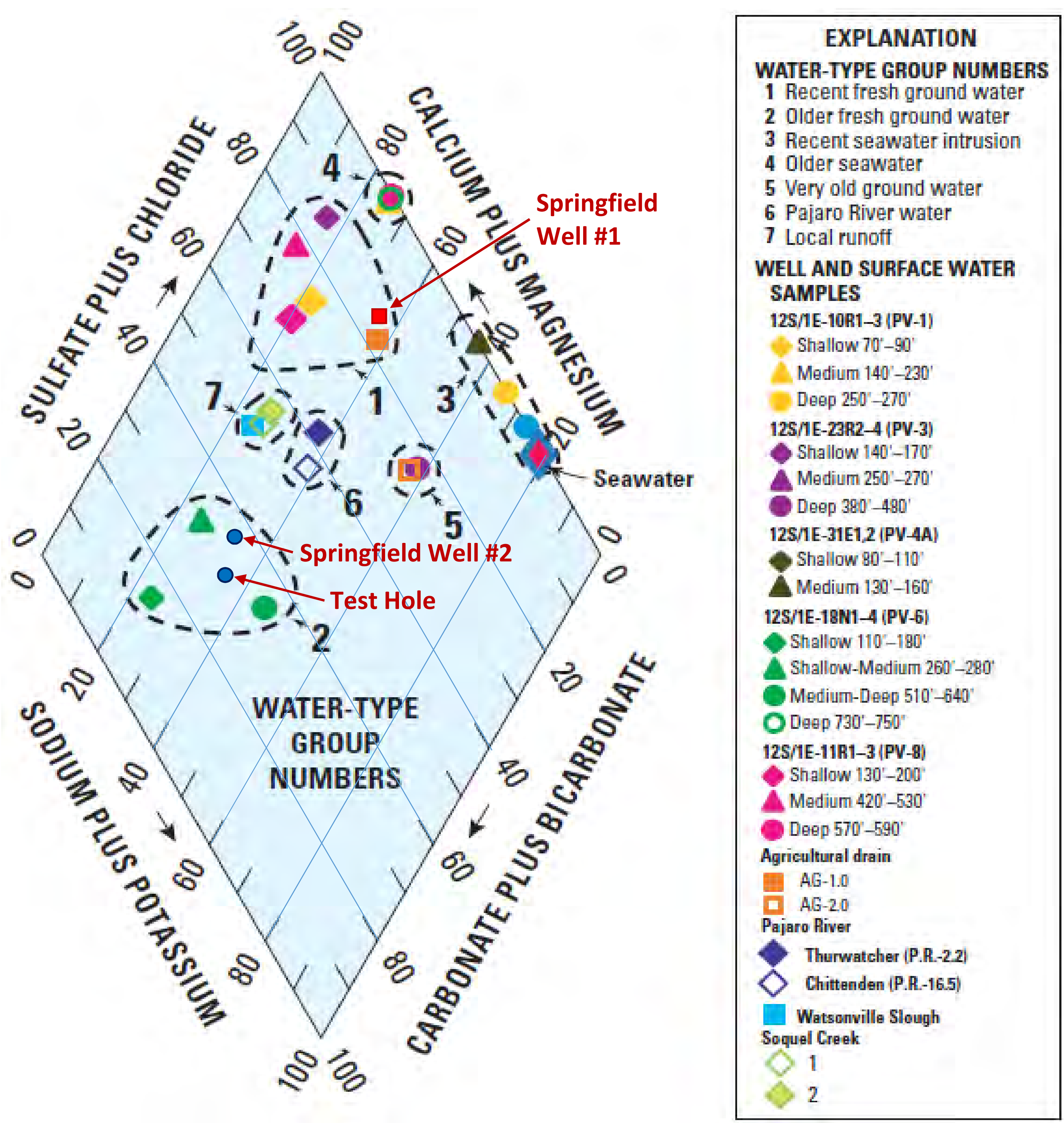
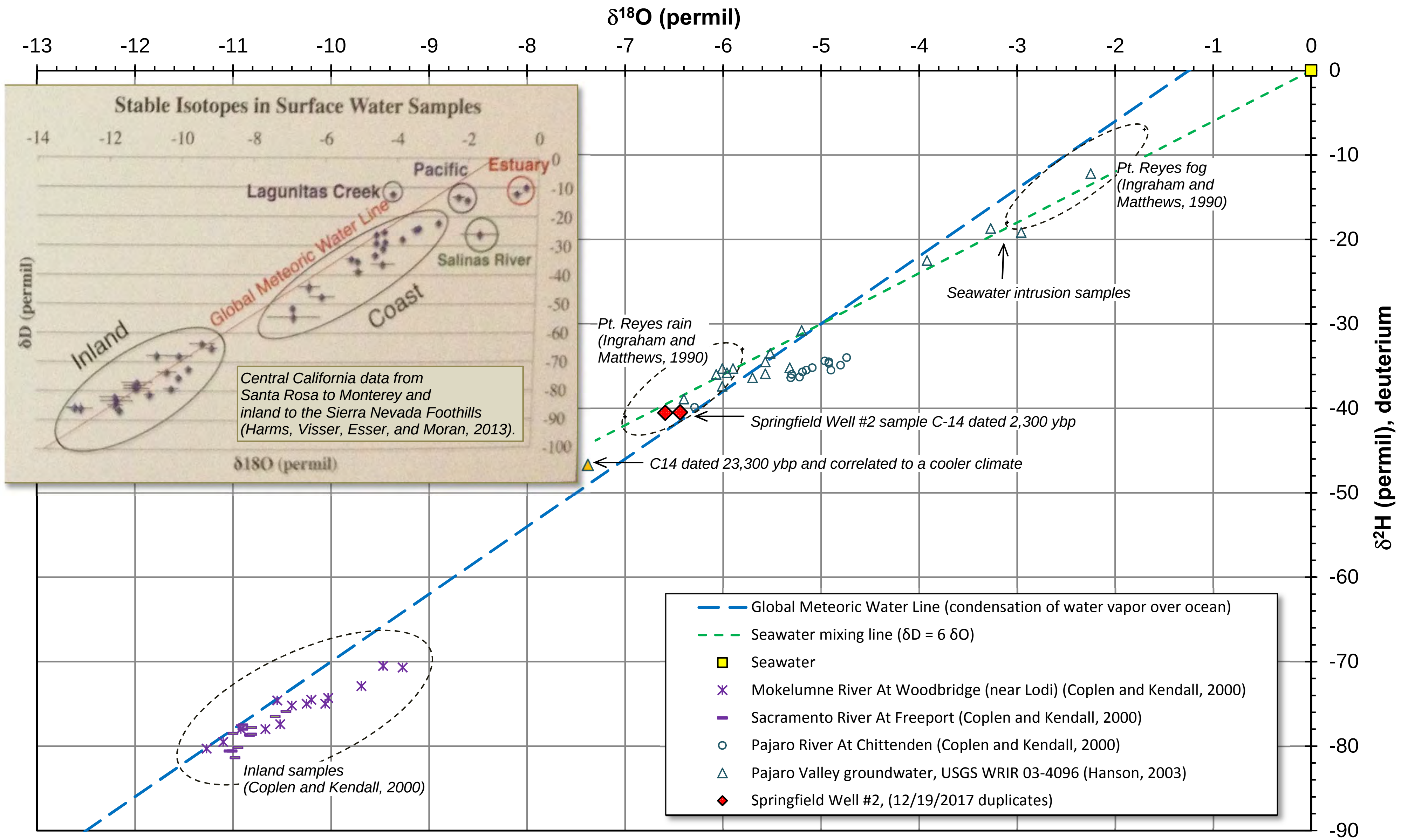


Figure 25. Piper diagram in USGS Fact Sheet 044-03 with data added from the Springfield water system Wells 1 and 2, Monterey County, California.

Well 1 sample is grouped with samples from shallow wells and agricultural drain water, characterized as Recent Fresh Groundwater. The test hole and Well 2 samples are grouped with samples from nested wells (PV-6), located at the corner of W. Beach St. and San Andreas Rd, a similar distance from the coast as the Springfield Well No. 2 site. Up to a depth of 640 ft at PV-6, samples were characterized as Older Fresh Groundwater; below this depth, groundwater was characterized as Old Seawater, indicating seawater intrusion related to the difference in specific gravities between fresh and saline water.

215021_wq_sampling.xlsx, USGS Fact Sheet 044-03, 4/23/2018



Balance Hydrologics, Inc.®

Figure 26. Stable isotopes of oxygen and hydrogen in groundwater from the Springfield Well #2 relative to published results from coastal and inland waters. Water with a higher deuterium content is generally found near the coast, at low elevations, in warm rains, and in water which has undergone partial evaporation. The variation of oxygen-18 content generally follow those of deuterium. Results from the Springfield Well #2 plot within the range of coast waters and other Pajaro Valley samples. Additional differences between coastal and inland waters are shown on the inset chart.

APPENDIX A

Springfield Well No. 1 Drillers Report and Water-Quality Reports

ORIGINAL
File with DWR

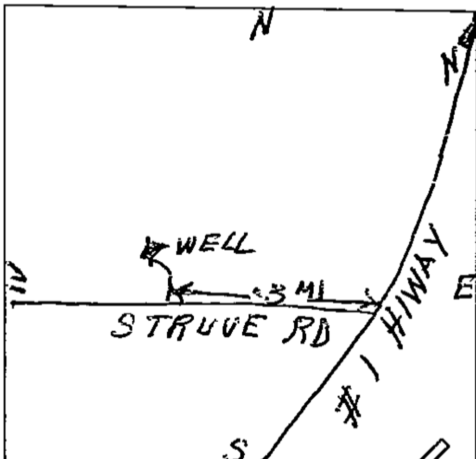
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 076746
State Well No. 13/02-5
Other Well No.

Notice of Intent No. 190633
Local Permit No. or Date 4-6-82

(1) OWNER: Name Springfield Mutual Water Co
Address 18 Struve Road
City Watsonville, CA Zip 95076

(2) LOCATION OF WELL (See instructions):
County Monterey Owner's Well Number
Well address if different from above
Township Range Section
Distance from cities, roads, railroads, fences, etc.



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) EQUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☒ No ☐ Size 8-12
Diameter of bore 20
Packed from 50 to 172 ft.

(7) CASING INSTALLED:
Steel ☐ Plastic ☒ Concrete ☐

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	122	8	160	122	172	3/64 x 4

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 50 ft.
Were strata sealed against pollution? Yes ☒ No ☐ Interval solid ft.
Method of sealing concrete poured through pipe

(10) WATER LEVELS:
Depth of first water, if known 20 ft.
Standing level after well completion 20 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Self
Type of test Pump ☒ Bailer ☐ Air lift ☐
Depth to water at start of test 20 ft. At end of test 21 ft
Discharge 40 gal/min after 6 hours Water temperature cool
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 188 ft. Depth of completed well 172 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	3	Top soil
3	17	Grey clay & sand
17	25	White sand
25	31	Grey clay
31	76	Grey to white sand with streaks of clay
76	186	Red Aromas sand
186	188	Grey clay with large gravel embeded.

Work started 4-6- 1982 Completed 4-7-82 19

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED James I. Ash (Well Driller)
James I. Ash
NAME FRED ASH & SONS, INC.
(Person, firm, or corporation) (Typed or printed)
Address 1225 Castroville Blvd.
City Salinas Zip 93907
License No. 391942 Date of this report 4-8-82

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED. USE NEXT CONSECUTIVELY NUMBERED FORM

Pajaro Sunny Mesa Svc District
Donald Rosa
136 San Juan Road
Watsonville, CA 95076-5237

MBAS
MONTEREY BAY ANALYTICAL SERVICES

4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
montereybayanalytical@usa.net

ELAP Certification Number: 2385

Thursday, May 10, 2012

Lab Number: AA85967

Collection Date/Time:	3/21/2012	8:40	Sample Collector:	EVANS, M
Submittal Date/Time:	3/21/2012	15:15	Sample ID	2700771-001

Sample Description: Springfield - Well #1

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed
Nitrate as NO3	EPA300.0	mg/L	293		1	45	3/21/2012

Sample Comments:

Lab Number: AA85968

Collection Date/Time:	3/21/2012	8:40	Sample Collector:	EVANS, M
Submittal Date/Time:	3/21/2012	15:15	Sample ID	2700771-001

Sample Description: Springfield - Well #1

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed
Gross Alpha	EPA900.0	pCi/L	6.06 ± 1.51	E		15	4/25/2012

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter   ug/L : Micrograms per liter   PQL : Practical Quantitation Limit   MCL : Maximum Contamination Level
H = Analyzed ouside of hold time   E = Analysis performed by External Laboratory; See External Laboratory Report attachments.

Pajaro Sunny Mesa Svc District
Donald Rosa
136 San Juan Road
Watsonville, CA 95076-5237

MBAS
MONTEREY BAY ANALYTICAL SERVICES

4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
montereybayanalytical@usa.net

ELAP Certification Number: 2385

Tuesday, July 17, 2012

Lab Number: AA89214

Collection Date/Time:	6/21/2012	13:30	Sample Collector:	EVANS, M
Submittal Date/Time:	6/21/2012	15:20	Sample ID	2700771-001

Sample Description: Springfield System - Well #1

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed
Nitrate as NO3	EPA300.0	mg/L	289		1	45	6/22/2012

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

ME

mg/L: Milligrams per liter ug/L : Micrograms per liter PQL : Practical Quantitation Limit MCL: Maximum Contamination Level
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.

Pajaro Sunny Mesa Svc District
Donald Rosa
136 San Juan Road
Watsonville, CA 95076-5237

MBAS
MONTEREY BAY ANALYTICAL SERVICES

4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
montereybayanalytical@usa.net

ELAP Certification Number: 2385

Thursday, September 20, 2012

Lab Number: **AA91980**

Collection Date/Time:	9/12/2012	8:44	Sample Collector:	EVANS M	
Submittal Date/Time:	9/12/2012	15:16	Sample ID	2700771-001	Coliform Designation:

Sample Description: Springfield System, Well #1

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed
Nitrate as NO3	EPA300.0	mg/L	2[illegible]		1	45	9/13/2012

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter ug/L : Micrograms per liter PQL : Practical Quantitation Limit MCL: Maximum Contamination Level
H = Analyzed outside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.

MBAS
MONTEREY BAY ANALYTICAL SERVICES

4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
montereybayanalytical@usa.net

ELAP Certification Number: 2385

Pajaro Sunny Mesa Svc District
Donald Rosa
136 San Juan Road
Watsonville, CA 95076-5237

Friday, November 30, 2012

Lab Number: AA55018

Collection Date/Time: 11/28/2012 8:30 Sample Collector: EVANS, M
Submittal Date/Time: 11/28/2012 13:40 Sample ID 2700771-001 Coliform Designation:

Sample Description: Springfield System, Well #1

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed
Nitrate as NO3	EPA300.0	mg/L	272		1	45	11/29/2012

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

ME

mg/L: Milligrams per liter ug/L : Micrograms per liter PQL : Practical Quantitation Limit MCL: Maximum Contamination Level
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.

MBAS
MONTEREY BAY ANALYTICAL SERVICES
4 Justin Court Suite D, Monterey, CA 93940
831.375.MBAS
montereybayanalytical@usa.net
ELAP Certification Number: 2385

Pajaro Sunny Mesa Svc District
Donald Rosa
136 San Juan Road
Watsonville, CA 95076-5237

Friday, September 30, 2011

Lab Number: AA80211

Collection Date/Time: 9/15/2011 9:10 Sample Collector: VAZQUEZ-VAREL
Submittal Date/Time: 9/15/2011 13:05 Sample ID 2700771-001

Sample Description: Springfield, Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed
Alkalinity, Total (as CaCO3)	2320B	mg/L	280		2		9/20/2011
Aluminum, Total	EPA200.8	ug/L	Not Detected		10	1000	9/16/2011
Antimony, Total	EPA200.8	ug/L	Not Detected		1	6	9/16/2011
Arsenic, Total	EPA200.8	ug/L	3		1	10	9/16/2011
Barium, Total	EPA200.8	ug/L	68		10	1000	9/16/2011
Beryllium, Total	EPA200.8	ug/L	Not Detected		1	4	9/16/2011
Bicarbonate (as HCO3-)	2320B	mg/L	342		10		9/22/2011
Bromide	EPA300.0	mg/L	0.56		0.05		9/15/2011
Cadmium, Total	EPA200.8	ug/L	Not Detected		0.5	5	9/16/2011
Calcium	EPA200.7	mg/L	281		0.5		9/22/2011
Carbonate as CaCO3	2320B	mg/L	Not Detected		10		9/15/2011
Chloride	EPA300.0	mg/L	822		1	250	9/15/2011
Chromium, Total	EPA200.8	ug/L	12		2	50	9/16/2011
Color, Apparent (Unfiltered)	2120B	Color Units	Not Detected		3	15	9/15/2011
Copper, Total	EPA200.8	ug/L	Not Detected		4	1300	9/16/2011
Cyanide	QuikChem 10-20	ug/L	Not Detected		10	200	9/19/2011
Fluoride	EPA300.0	mg/L	Not Detected		0.10	2.0	9/15/2011
Hardness (as CaCO3)	2340B	mg/L	1451		10		9/23/2011
Hydroxide	2320B	mg/L	Not Detected		5		9/15/2011
Iron	EPA 200.7	ug/L	Not Detected		10		9/22/2011
Langlier Index (15 deg. C)	2330B		0.67				9/23/2011
Langlier Index (60 deg. C)	2330B		1.24				9/23/2011
Lead, Total	EPA200.8	ug/L	Not Detected		5	15	9/16/2011
Magnesium	EPA200.7	mg/L	182		0.5		9/22/2011
Manganese, Total	EPA 200.7	ug/L	Not Detected		10	50	9/22/2011
MBAS (Surfactants)	5540C	mg/L	Not Detected		0.05	0.50	9/21/2011
Mercury, Total	EPA200.8	ug/L	Not Detected		0.5	2	9/16/2011
Nickel, Total	EPA200.8	ug/L	10		10	100	9/16/2011
Nitrate as NO3	EPA300.0	mg/L	194		1	45	9/15/2011
Nitrite as NO2-N	EPA300.0	mg/L	0.18		0.05	1.00	9/15/2011
Odor Threshold at 60 C	2150B	TON	1		1	3	9/15/2011
o-Phosphate-P	EPA300.0	mg/L	Not Detected		0.05		9/15/2011
Perchlorate	314	ug/L	Not Detected	E	4.0	6	9/21/2011
pH (Laboratory)	4500-H+B	STD. Units	7.5				9/15/2011

mg/L: Milligrams per liter ug/L : Micrograms per liter PQL : Practical Quantitation Limit MCL: Maximum Contamination Level
H = Analyzed outside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.

Lab Number: AA80211

Collection Date/Time:	9/15/2011	9:10	Sample Collector:	VAZQUEZ-VAREL
Submittal Date/Time:	9/15/2011	13:05	Sample ID	2700771-001

Sample Description: Springfield, Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed
Potassium	EPA200.7	mg/L	6.2		0.1		9/22/2011
QC Anion Sum x 100	Calculation	%	101%				9/23/2011
QC Anion-Cation Balance	Calculation	%	3				9/23/2011
QC Cation Sum x 100	Calculation	%	108%				9/23/2011
QC Ratio TDS/SEC	Calculation		0.70				9/27/2011
Selenium, Total	EPA200.8	ug/L	12		2	50	9/16/2011
Silver, Total	EPA200.8	ug/L	Not Detected		10	100	9/16/2011
Sodium	EPA200.7	mg/L	356		0.5		9/22/2011
Specific Conductance (E.C)	2510B	umhos/cm	4140		1	900	9/16/2011
Sulfate	EPA300.0	mg/L	349		1	250	9/15/2011
Synthetic Organic Compounds		ug/L	Attached	E			9/20/2011
Thallium, Total	EPA200.8	ug/L	Not Detected		1	2	9/18/2011
Total Diss. Solids	2540C	mg/L	2900		10	500	9/16/2011
Turbidity	180.1	NTU	Not Detected	H	0.05	5.0	9/20/2011
Volatile Org. Compounds (524)	EPA524	ug/L	Attached	E			9/21/2011
Zinc, Total	EPA200.8	ug/L	44		10	5000	9/18/2011

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter ug/L: Micrograms per liter PQL: Practical Quantitation Limit MCL: Maximum Contamination Level
H = Analyzed outside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.

Tel: 408 724-5422
FAX: 408 724-3188

SOIL CONTROL LAB

A Division of Control Laboratories Inc.

In any reference, please quote Certified Analysis Number appearing hereon.

123391-1-74

Christopher & Associates
P.O. Box 161
Capitola CA 95010

[illegible]

CERTIFIED ANALYTICAL REPORT

MATERIAL:	Water sample received 04 November 1997	PUBLIC HEALTH DRINKING WATER LIMITS[1]
IDENTIFICATION:	Springfield MWC, 11/4/97, 10:20	
REPORT:	Quantitative chemical analysis is as follows expressed as milligrams per liter (parts per million):	

Nitrate	(as NO_3)	175	45

[1] California Administrative Code Title 22

The undersigned certifies that the above is a true and accurate report of the findings of this Laboratory.

Analyst

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY

Tel: 831 724-5422
FAX: 831 724-3188

195489-1-2200

Springfield MWC c/o Pajaro Sunny Mesa
136 San Juan Road
Watsonville CA 95076

29 JUL 05

Attn: Struve Road Water System #1

MATERIAL:	Water sample received 27 July 2005	PUBLIC HEALTH DRINKING WATER LIMITS[1]
IDENTIFICATION:	System #2700771, Well, 7/27/05, 1610	
REPORT:	Quantitative chemical analysis is as follows expressed as milligrams per liter (parts per million):	

Nitrate	(as NO_3)	290	45

[1] California Administrative Code
Title 22

cc: MCHD

A Division of Control Laboratories Inc.

SOIL CONTROL LAB

Tel: 408 724-5422
FAX: 408 724-3188

In any reference, please quote Certified Analysis Number appearing hereon.

120099-1-74

A Division of Control Laboratories Inc.

Christopher & Associates
P.O. Box 161
Capitola CA 95010

[illegible] MAY 97

CERTIFIED ANALYTICAL REPORT

MATERIAL: Water sample received 13 May 1997
IDENTIFICATION: Springfield Mutual Water, 5/13/97, 10:00
REPORT: Quantitative chemical analysis is as follows expressed as milligrams per liter (parts per million):

			PUBLIC HEALTH DRINKING WATER LIMITS[1]
Nitrate	(as NO_3)	190	45

[1] California Administrative Code Title 22

The undersigned certifies that the above is a true and accurate report of the findings of this Laboratory.

Analyst

Springfield Mutual WS Nitrate Results

Nitrate MCL = 45 ppm

Date	Result
3/10/2010	283 ppm
6/9/2010	280 ppm
9/23/2010	226 ppm
12/15/2010	280 ppm
3/10/2011	285 ppm
6/8/2011	306 ppm
9/15/2011	194 ppm
12/8/2011	309 ppm
3/21/2012	293 ppm
6/21/2012	269 ppm
9/12/2012	255 ppm
11/28/2012	272 ppm
3/20/2013	253 ppm

APPENDIX B

Test Hole Drillers Report, Geophysical Log, and Water-Quality Report

DWR

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0119536

Page 1 of 1

Owner's Well Number 71081-1

Date Work Began 07/22/2008 Date Work Ended 7/25/2008

Local Permit Agency Monterey County Division of Environmental Health

Permit Number 07-11219 Permit Date 10/18/07

DWR Use Only – Do Not Fill In

13S/02E-03S

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ⦿ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Mud Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	30	Red sand with clay
30	50	White clay
50	70	Gravel and sand
70	90	Red sand
90	110	Sand and Brown silty clay
110	295	Red sand
295	335	Blue clay and sand
335	360	Blue clay
360	450	Red sand
450	470	Red sand and clay
470	630	Red sand

Total Depth of Boring 630 Feet

Total Depth of Completed Well 630 Feet

Well Owner

Name Pajaro Sunny Mesa CSD

Mailing Address 136 San Juan Road

City Royal Oaks State CA Zip 95076

Well Location

Address 1815 Highway 1

City Moss Landing County Monterey

Latitude ___ Deg. ___ Min. ___ Sec. N Longitude ___ Deg. ___ Min. ___ Sec. W

Datum ___ Decimal Lat. ___ Decimal Long. ___

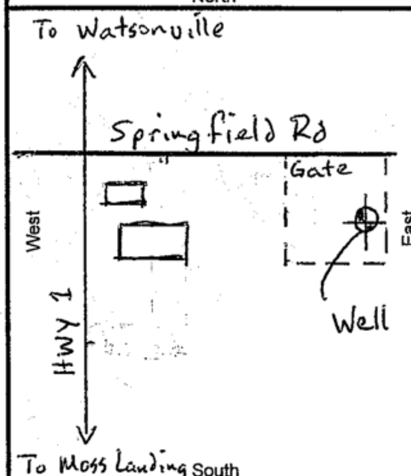
APN Book 413 Page 014 Parcel 001

Township ___ Range ___ Section ___

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North



South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

⦿ New Well
○ Modification/Repair
○ Deepen
○ Other ___
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
⦿ Test Well
○ Vapor Extraction
○ Other ___

Water Level and Yield of Completed Well

Depth to first water ___ (Feet below surface)

Depth to Static Water Level ___ (Feet) Date Measured ___

Estimated Yield * ___ (GPM) Test Type ___

Test Length ___ (Hours) Total Drawdown ___ (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)

Annular Material

Depth from Surface Feet	to Feet	Fill	Description

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other ___

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Maggiora Bros. Drilling, Inc.
Person, Firm or Corporation

595 Airport Blvd. (Address) Watsonville (City) CA (State) 95076 (Zip)

Signed [signature] C-57 Licensed Water Well Contractor

10-27-10 Date Signed

249957 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

N E W M A N   W E L L   S U R V E Y S

ELECTRIC LOG

Job No. 70856	Company	MAGGIORA BROTHERS	
	Well	PAJARO SUNNY MESA	
	Field	SPRINGFIELD	
File No. 710811	County	MONTEREY	State CALIFORNIA

Location:

30 YARDS SOUTH OF EAST END OF SPRINGFIELD RD.

Sec. 5 Twp. 13S Rge. 5E

Other Services:

NONE

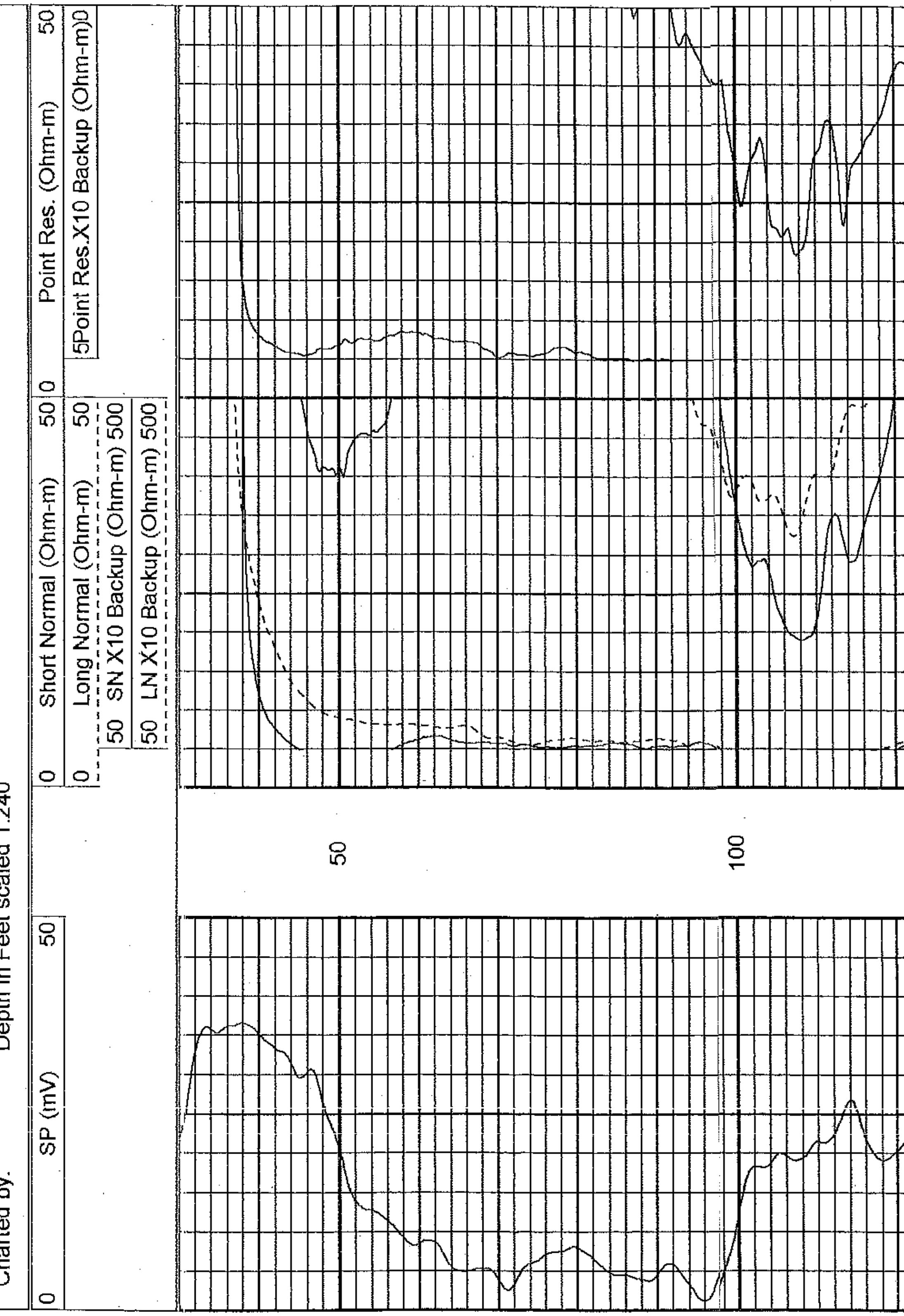
Permanent Datum	GROUND LEVEL	Elevation	Elevation
Log Measured From	GROUND LEVEL	above perm. datum	K.B.
Drilling Measured From	GROUND LEVEL		D.F.
			G.L.

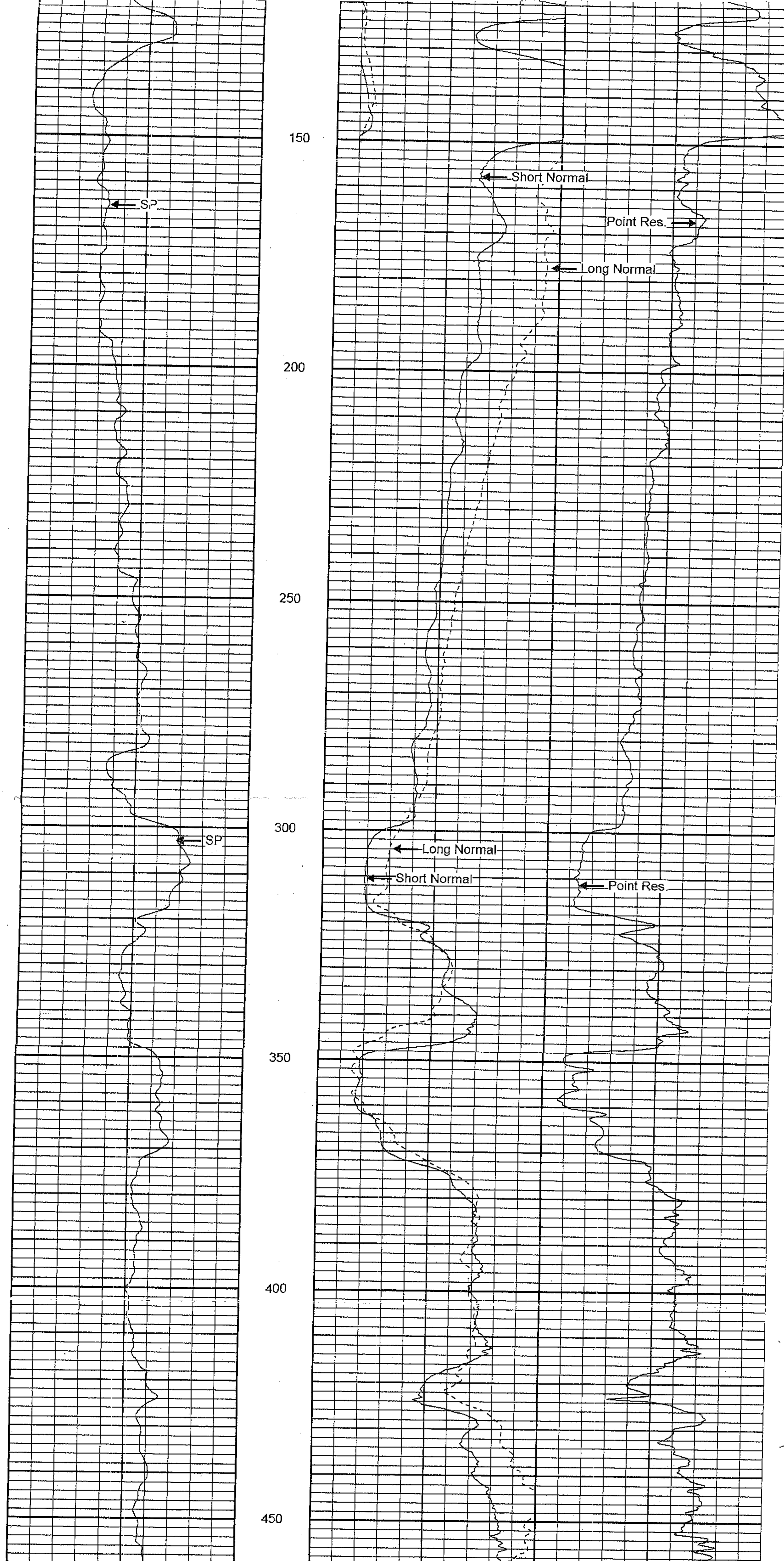
Date	7/24/2008		
Run Number	ONE		
Depth Driller	634'		
Depth Logger	634'		
Bottom Logged Interval	634'		
Top Log Interval	30'		
Casing Driller	NONE		
Casing Logger	NONE		
Bit Size	8 3/4"		
Type Fluid in Hole	BENTONITE		
Density / Viscosity	N/A		
pH / Fluid Loss	N/A		
Source of Sample	CIRC.		
Rm @ Meas. Temp	12.1 @ 72.8 F		
Rmf @ Meas. Temp	10.0 @ 73.2 F		
Rmc @ Meas. Temp	N/A		
Source of Rmf / Rmc	MEAS.		
Rm @ BHT	N/A		
Time Circulation Stopped	1 HOUR		
Time Logger on Bottom	-		
Max. Recorded Temperature	N/A		
Equipment Number	LV-1		
Location	SNS		
Recorded By	C.NEWMAN		
Witnessed By	V.RODRIQUEZ		

<<< Fold Here >>>

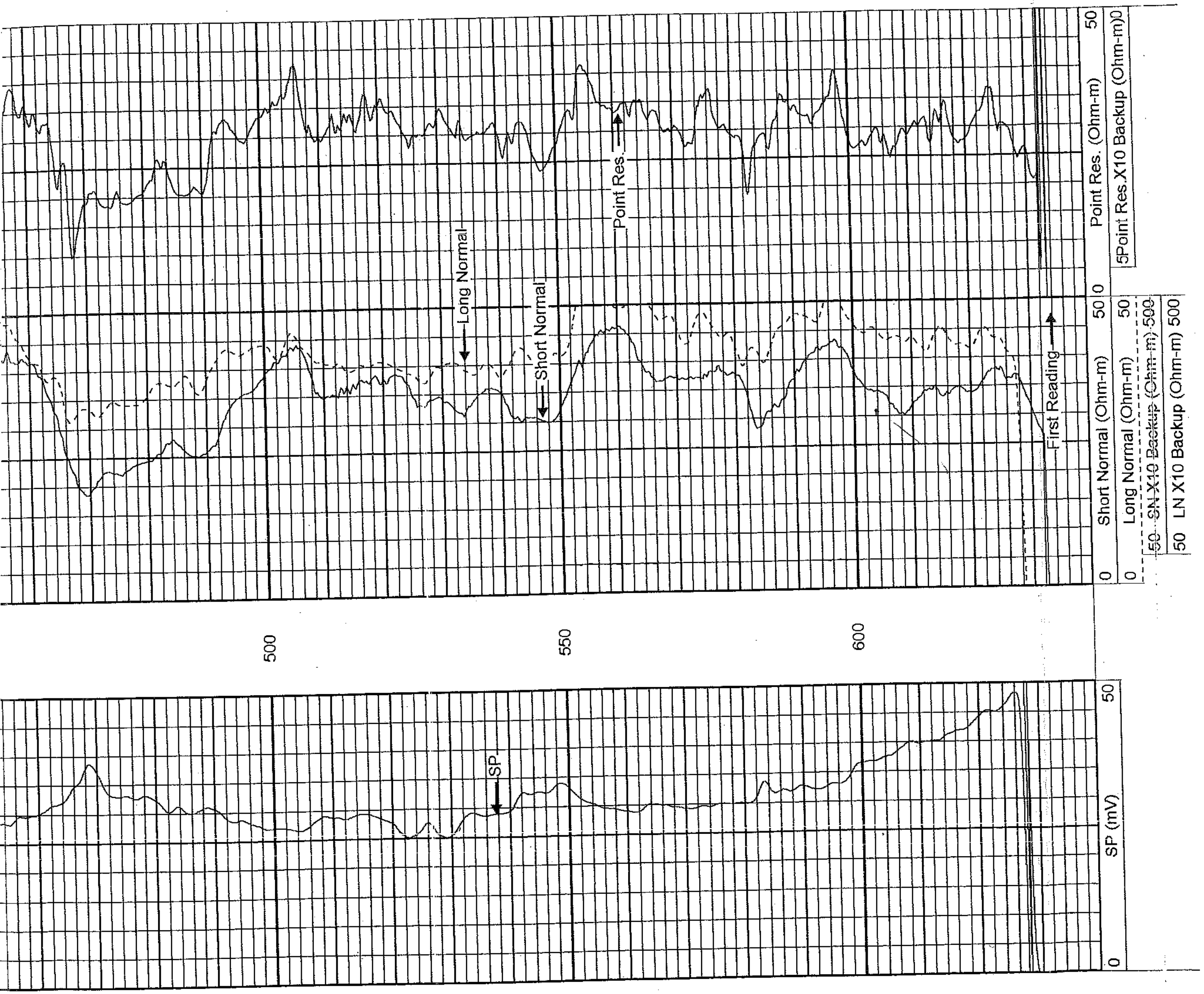
Comments

Database File: 70856.db
Dataset Pathname: pass2.1
Presentation Format: elog2
Dataset Creation: Thu Jul 24 18:53:16 2008 by Calc Warrior Version 6.6
Charted by: Depth in Feet scaled 1:240





150
SP
Short Normal
Point Res.
Long Normal
200
250
300
SP
Long Normal
Short Normal
Point Res.
350
400
450



Water Quality Analy

Rmf @ Temp: 10 **Temp:** 73.2
Corrected Rmf @ 75 degree F: 9.78
Rm @ Temp: 12.8 @ 72.8 F

Depth	S.P. mV	Rwe ohm-m	Rw NaCl ohm-m	Rw NaHCO3 ohm-m	EC NaCl
150 ft to 280 ft	-5.00	8.3	11.1	13.0	901.9
282 ft to 300 ft	-13.00	6.4	8.1	9.5	1241.7
318 ft to 348 ft	-9.00	7.3	9.4	11 1	1058.3
370 ft to 632 ft	-7.00	7.8	10.2	12.0	977.0

Class I : Less than *700* ppm (mg/l) Excellent to Good Quality
Class II : *700* to *2000* ppm (mg/l) Good to Injurious Quality
Class III: More than *2000* ppm (mg/l) Injurious to Unsatisfactory

This interpretation represents our best judgement based on given values. Since all interpr
electrical and other measurements, we can not and do not guarantee the accurancy or co
any cost, damages or expenses that may be incurred from this or any other interpretation

Water Quality Analysis

Rmf @ Temp: 10 **Temp:** 73.2
Corrected Rmf @ 75 degree F: 9.78
Rm @ Temp: 12.8 @ 72.8 F

Depth	S.P. mV	Rwe ohm-m	Rw *NaCl* ohm-m	Rw *NaHCO3* ohm-m	EC umhos *NaCl*	EC umhos *NaHCO3*	T.D.S. *ppm* NaCl	T.D.S. *ppm* NaHCO3	Remarks
150 ft to 280 ft	-5.00	8.3	11.1	13.0	901.9	766.7	478.0	766.7	CLASS I
282 ft to 300 ft	-13.00	6.4	8.1	9.5	1241.7	1055.5	658.1	1055.5	CLASS I
318 ft to 348 ft	-9.00	7.3	9.4	11 1	1058.3	899.5	560.9	899.5	CLASS I
370 ft to 632 ft	-7.00	7.8	10.2	12.0	977.0	830.4	517.8	830.4	CLASS I

Class I : Less than *700* ppm (mg/l) Excellent to Good Quality
Class II : *700* to *2000* ppm (mg/l) Good to Injurious Quality
Class III: More than *2000* ppm (mg/l) Injurious to Unsatisfactory

This interpretation represents our best judgement based on given values. Since all interpretations are opinions based solely on inference from electrical and other measurements, we can not and do not guarantee the accurancy or correctness of this interpretation and shall not be liable for any cost, damages or expenses that may be incurred from this or any other interpretation.

50 LN X10 Backup (Ohm-m) 500

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

TEL: 831-724-5422
FAX: 831-724-3188

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

Springfield MWC c/o Pajaro Sunny Mesa
136 San Juan Road
Royal Oaks, CA 95076
Attn: Joe Rosa

Work Order #: 8070803
Reporting Date: August 6, 2008

TEST HOLE

Date Received: July 28, 2008
Project # / Name: None / None
Water System #: 2700771 SPRINGFIELD MWC
Sample Identification: Springfield Test, sampled 7/28/2008 11:45:00AM
Sampler Name / Co.: Rodney Schmidt / Pajaro Sunny Mesa
Matrix: Water
Laboratory #: 8070803-01

	Results	Units	RL	State Drinking Water Limits 1	Analysis Method	Date Analyzed	Flags
General Mineral							
pH	8.2	pH Units	0.1	-	EPA 150.1	07/29/08	
Specific Conductance (EC)	570	uS/cm	1.0	1600	EPA 120.1	07/29/08	
Hydroxide as OH	ND	mg/L	2.5	-	EPA 310.1	07/29/08	
Carbonate as CO3	ND	mg/L	2.5	-	EPA 310.1	07/29/08	
Bicarbonate as HCO3	270	mg/L	2.5	-	EPA 310.1	07/29/08	
Total Alkalinity as CaCO3	220	mg/L	2.5	-	EPA 310.1	07/29/08	
Hardness	220	mg/L	5.0	-	SM 2340 B	07/30/08	
Total Dissolved Solids	370	mg/L	10	1000	EPA 160.1	07/30/08	
Nitrate as NO3	4.9	mg/L	1.0	45	EPA 300.0	07/29/08	
Chloride	40	mg/L	1.0	500	EPA 300.0	07/29/08	
Sulfate as SO4	33	mg/L	1.0	500	EPA 300.0	07/29/08	
Fluoride	0.14	mg/L	0.10	2	EPA 300.0	07/29/08	
Calcium	43	mg/L	0.50	-	EPA 200.7	07/30/08	
Magnesium	27	mg/L	0.50	-	EPA 200.7	07/30/08	
Potassium	2.5	mg/L	0.50	-	EPA 200.7	07/30/08	
Sodium	51	mg/L	0.50	-	EPA 200.7	07/30/08	
* Iron	7900	ug/L	50	300	EPA 200.7	07/30/08	
* Manganese	180	ug/L	20	50	EPA 200.7	07/30/08	
Copper	ND	ug/L	50	1000	EPA 200.7	07/30/08	
Zinc	130	ug/L	50	5000	EPA 200.7	07/30/08	
Inorganics							
Arsenic	ND	ug/L	2.0	10	EPA 200.8	07/31/08	
Barium	ND	ug/L	100	1000	EPA 200.7	07/30/08	
Boron	170	ug/L	100	-	EPA 200.7	07/30/08	

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.
State Drinking Water Limits1 - as listed by California Administrative Code, Title 22.
* - a * in the left hand margin of the report means that particular constituent is above the California Drinking Water Limits.

Mike Galloway

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Attn: Joe Rosa

Work Order #: 8070803
Reporting Date: August 6, 2008

Date Received: July 28, 2008
Project # / Name: None / None
Water System #: 2700771 SPRINGFIELD MWC
Sample Identification: Springfield Test, sampled 7/28/2008 11:45:00AM
Sampler Name / Co.: Rodney Schmidt / Pajaro Sunny Mesa
Matrix: Water
Laboratory #: 8070803-01

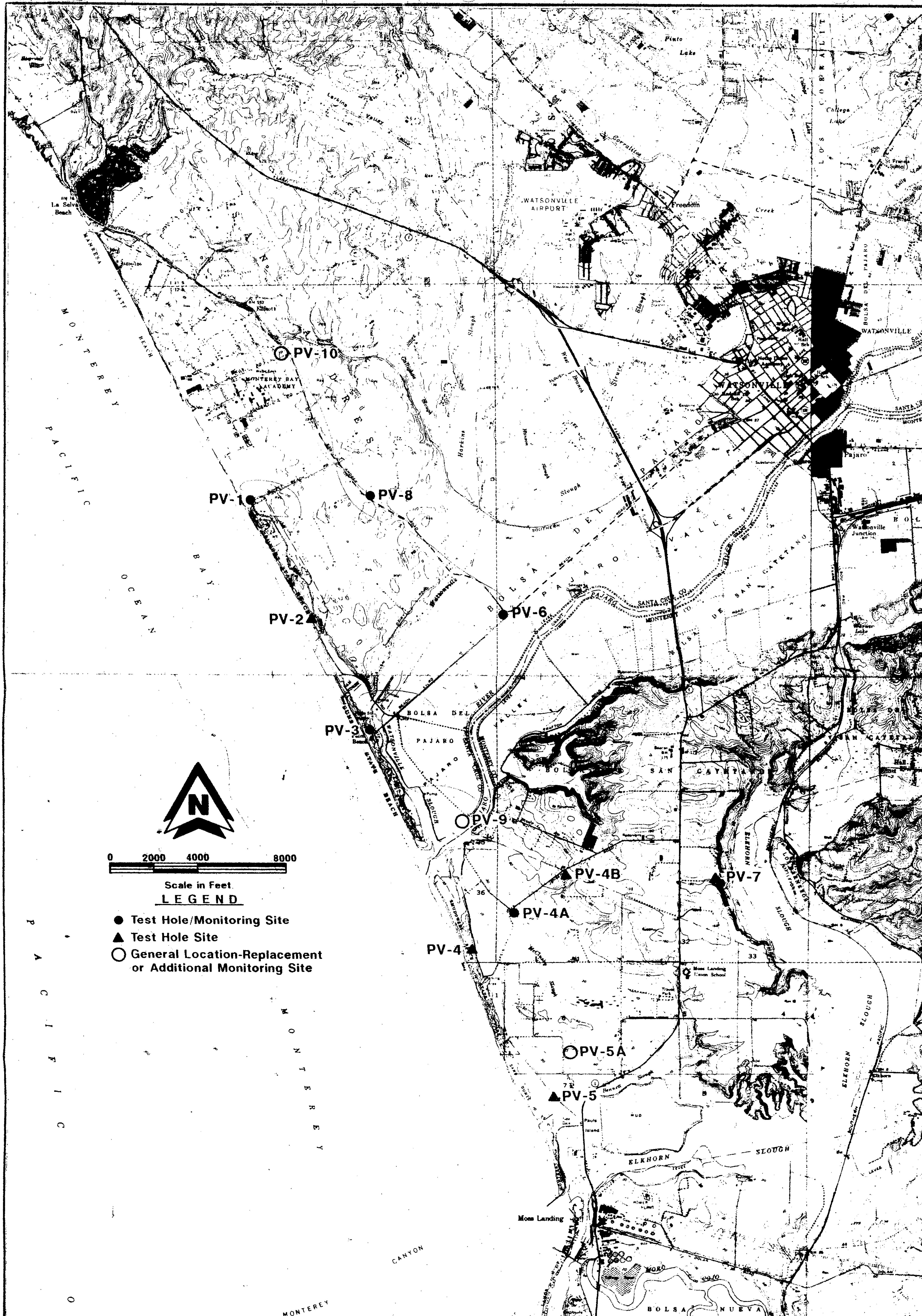
	Results	Units	RL	State Drinking Water Limits 1	Analysis Method	Date Analyzed	Flags
Inorganics							
Cadmium	ND	ug/L	1.0	5	EPA 200.8	07/31/08	
Chromium	16	ug/L	1.0	50	EPA 200.8	07/31/08	
Cyanide (total)	ND	ug/L	100	200	SM 4500-CN F	08/04/08	
Lead	ND	ug/L	5.0	-	EPA 200.8	07/31/08	
Mercury	ND	ug/L	1.0	2	EPA 245.1	07/30/08	
Selenium	ND	ug/L	5.0	50	EPA 200.8	07/31/08	
Silver	ND	ug/L	10	100	EPA 200.7	07/30/08	
MBAS (Surfactants)	ND	mg/L	0.025	0.5	EPA 425.1	07/29/08	
* Aluminum	4600	ug/L	50	1000	EPA 200.7	07/30/08	
Antimony	ND	ug/L	6.0	6	EPA 200.8	07/31/08	
Beryllium	ND	ug/L	1.0	4	EPA 200.7	07/30/08	
Nickel	13	ug/L	10	100	EPA 200.7	07/30/08	
Thallium	ND	ug/L	1.0	2	EPA 200.8	07/31/08	
Nitrite as N	ND	mg/L	0.10	1	EPA 300.0	07/29/08	
General Physical							
Color	12	Color Units	3.0	-	EPA 110.2	07/29/08	
Threshold Odor No.	ND	T.O.N.	1.0	-	EPA 140.1	07/29/08	
Turbidity	94	NTU	0.10	-	EPA 180.1	07/29/08	
Nitrate/Nitrite as N	1.1	mg/L	0.10	10	EPA 300.0	07/29/08	

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.
State Drinking Water Limits1 - as listed by California Administrative Code, Title 22.
* - a * in the left hand margin of the report means that particular constituent is above the California Drinking Water Limits.

Mike Galloway

APPENDIX C

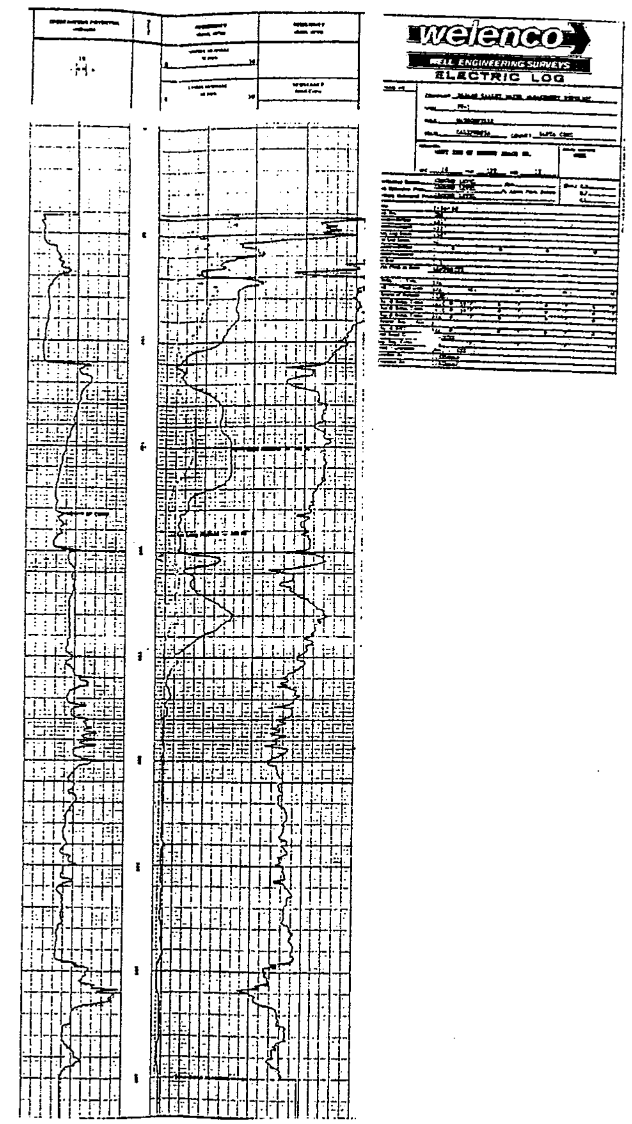
E-logs from Pajaro Valley Groundwater Investigation (Luhdorff and Scalmanini Consulting Engineers, November 1988)



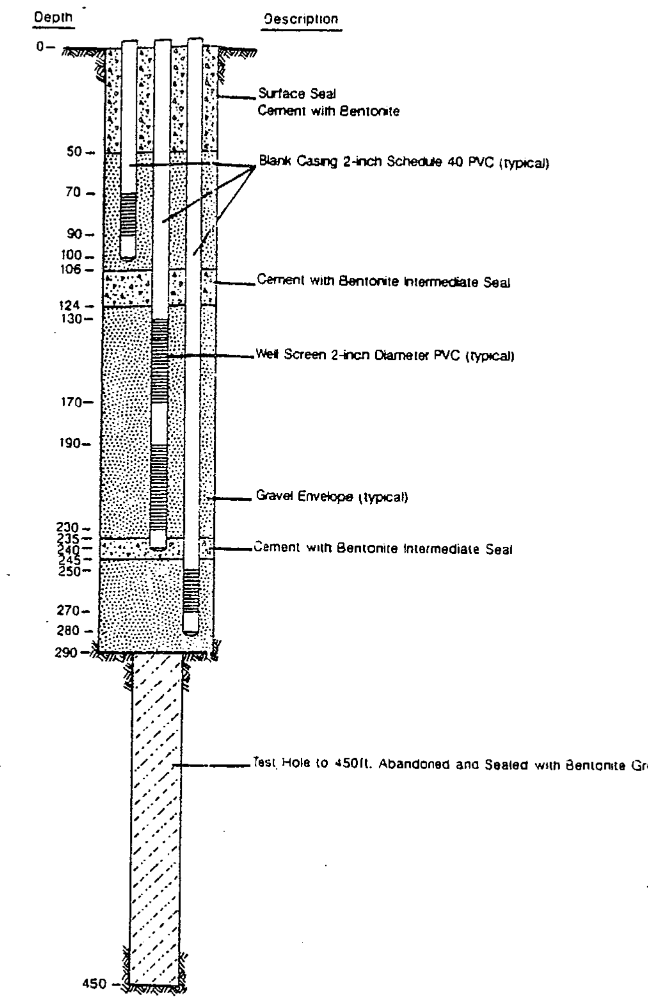
LUHDORFF & SCALMANINI Consulting Engineers Woodland, California 95695	SHEET TITLE Location Map Test Holes and Monitoring Well Sites	PROJECT Pajaro Valley Ground-Water Monitoring	PROJ. NO. 87-1-068 DATE FIGURE 1

LITHOLOGY

Depth	Description
0–39	Sand, medium-coase, reddish brown, moderately sorted, subanglar- subrounded, quartz, lithics, feldsoars, trace mica, some clay in upper 10' from soil forming process
39–54	Gravelly Sand, medium-very coarse, poorly sorted, subangular-subrounded, some fine gravel
54–76 (66)	Gravelly Sand to Gravel w/Sand, medium-very coarse sand, poorly sorted, subangular-suorounded, lithics dominate, thin silty clay interbeds, olive brown at 54ft. & 66ft., medium plastic
76–106	Sand, fine-medium, reddish brown, moderately sorted, subangular-subrounded, quartz, lithcs, feldspars, black & golden mica, some layers of coarse sand
106–122	Clayey Sand, reddish brown, fine-medium, subangular, clay <30%
122–200 (150)	Sand, fine-medium, well sorted, subangular-subrounded, quartz, lithics, feldspars, mica, thin silt(stone), olive gray, low plastic at 150ft., slightly coarser in lower 10ft.
200–220	Sand, medium-coarse, dark gray brown, well sorted, sbangular-subrounded, quartz, lithics
220–250	Sand, medium-coarse, dark brown to yellowish brown, subangular-subrounded, moderately sorted, quartz lithics, trace mica, some thin siltstone layers, unit tends to be slightly coarser grained in lower half
250–300	Sand, medium-coarse, reddish brown, subangular-suorounded, well sorted, quartz, lithics, trace mica, unit tends to be slightly coarser in lower 10ft.
300–350	Sand, medium-coarse, dark reddish brown, moderately sorted, subangular-subrounded, quartz, lithics, trace mica, some thin grayish siltstone layers in upper 10ft., unit tends to be slightly coarser in lower 20ft.
350–396	Sand, medium-coarse, dark brown-dark reddish brown, moderately sorted, subangular-subrounded, some thin grayisn siltstone layers, unit tends to be slightly coarser in lower 20ft., some thin cemented sand layers
396–416 (402)	Clayey Sand-Sandy Clay, reddish brown clayey medium sand, yellowisn to olive brown sandy clay, and thin organic rich (peaty) claystone at 402-404ft.
416–450	Sand, medium-coarse grayish brown, moderately sorted, subangular-subrounded, quartz, lithics, some thin poorly cemented sand layers



WELL PROFILE



Vertical Scale 1" = 40'

NO	DATE	REVISION	BY

MONITORING WELL PROFILE PV-1	87-1-068
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PAJARO VALLEY	mls
GROUND-WATER MONTORING	jcs
	eel
LUHDORFF & SCALMANINI Consulting Engineers Woodland, California 95695	___ OF ___ SHTS

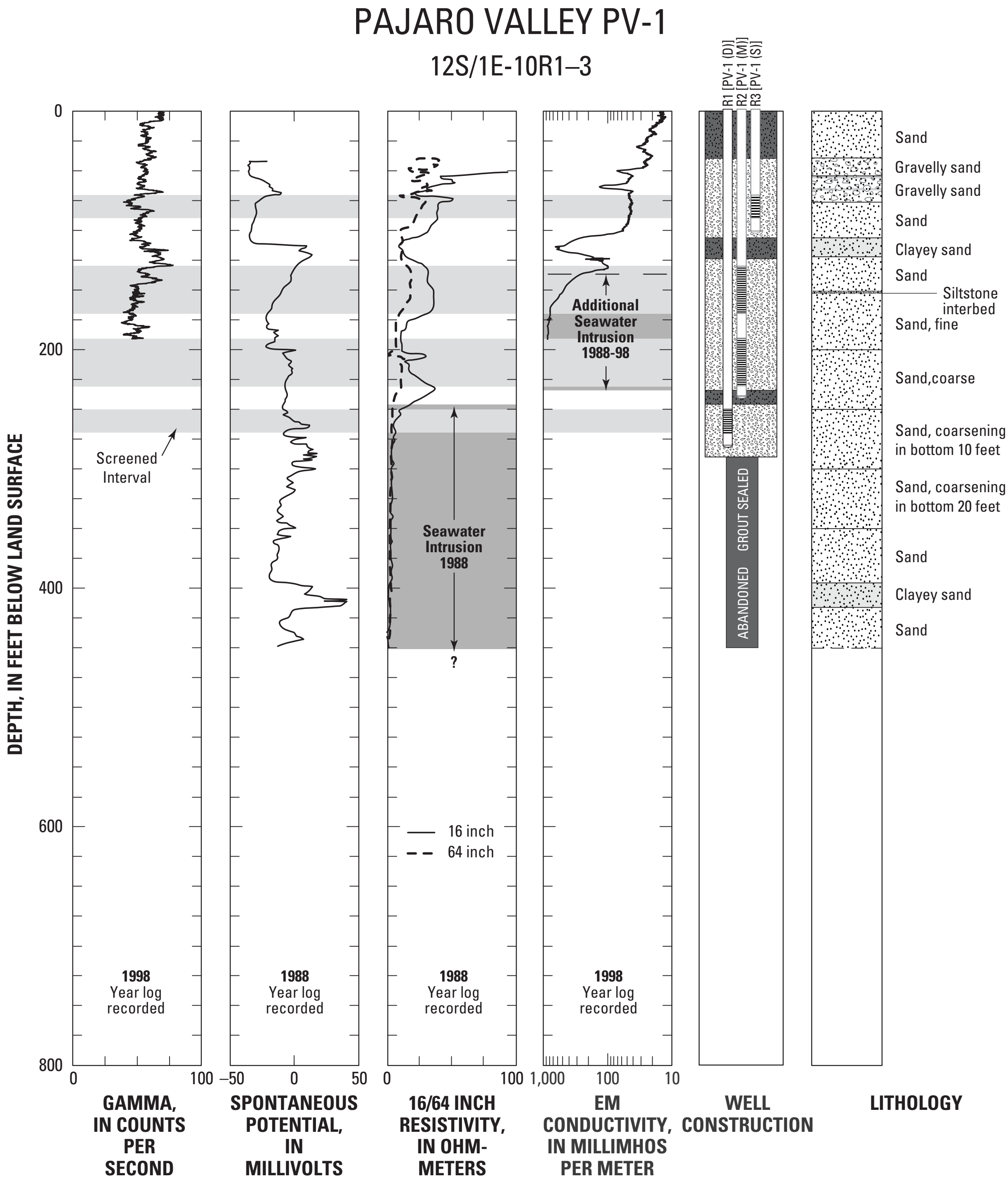
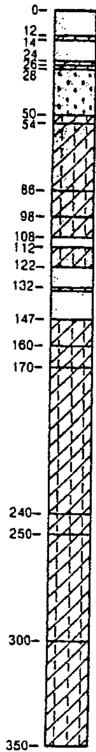


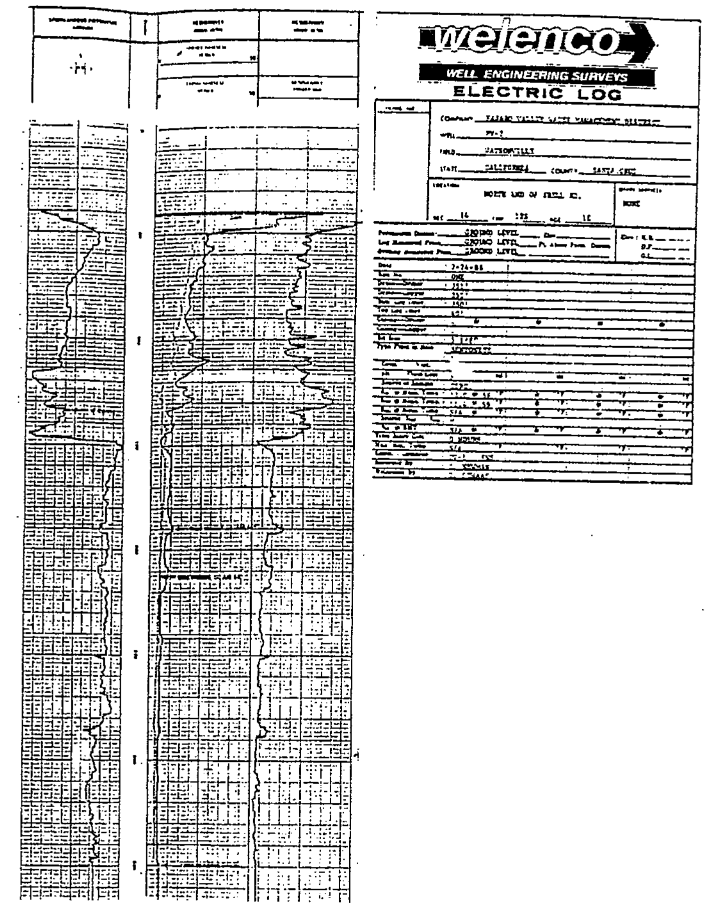
Figure A1.1. Geophysical logs and well construction for selected monitoring wells and test holes in the Pajaro Valley, Santa Cruz County, California.

LITHOLOGY



Depth	Description
0–	Sand, fine-medium, dark brown, well sorted, subrounded; lithic (volcanic, metamorphic, sedimentary), quartz, feldspars, trace micas
12–	Silty Clay, reddish brown, low plastic, trace fine sand
14–	Sand, medium-coarse w/fine gravel, medium brown, poorly sorted, subrounded-subangular, quartz, lithics, feldspars, trace micas
24–	Clayey Sand, medium w/coarse, medium brown, poorly sorted, subrounded-subangular
26–	Silty Clay, brown to gray, low plastic
28–	Gravelly Sand to Gravel, medium-very coarse sand, subangular, poorly sorted, gravel to 1/2", subrounded, lithics, upper 4' has some thin clay interbeds, middle 8' gravelly sand, lower 10' gravel
50–	Silty Clay, yellowish brown, low plastic, trace fine-medium sand
54–	Sandy Silty Clay, very dark gray (bluish), low-medium plastic, stiff, fine-medium sand <20%; some thin sandier stringers
86–	Silty Clay w/Sand, very dark gray, medium plastic, soft
98–	Sandy Silty clay w/thin interbeds of Sand, very dark gray, low plastic, soft, sand beds very fine-fine
108–	Sand, medium w/coarse-very coarse, subangular; coarser, well rounded, some shell fragments
112–	Sandy Silty Clay, very dark gray, low plastic, fine-,medium sand 30-50%
122–	Sand, fine-coarse, poorly sorted, subrounded, abundant shell fragments
132–	Sand, medium-very coarse w/some fine gravel, subrounded-well rounded, quartz, lithics; abundant shell fragments and intact small gastrod (snail) shells, thin 2'thick clay bed at top
147–	Silty Clay w/fine Sand, dark gray, low-medium plastic, sand <15% micaceous
160–	Silty Clay, dark gray, medium plastic
170–	Silty Clay w/trace fine Sand, dark gray, medium-high plastic, stiff
240–	Silty Clay w/trace fine Sand, dark gray, medium plastic, soft
250–	Silty Clay w/trace fine Sand, dark gray, medium-high plastic, stiff
300–	Silty Clay w/trace fine Sand, greenish gray, medium plastic, stiff
350–	

Vertical Scale 1"=40'



NO	DATE	REVISION	BY

Test Hole Lithology PV-2

Pajaro Valley Ground-Water Monitoring

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Woodland, California 95695

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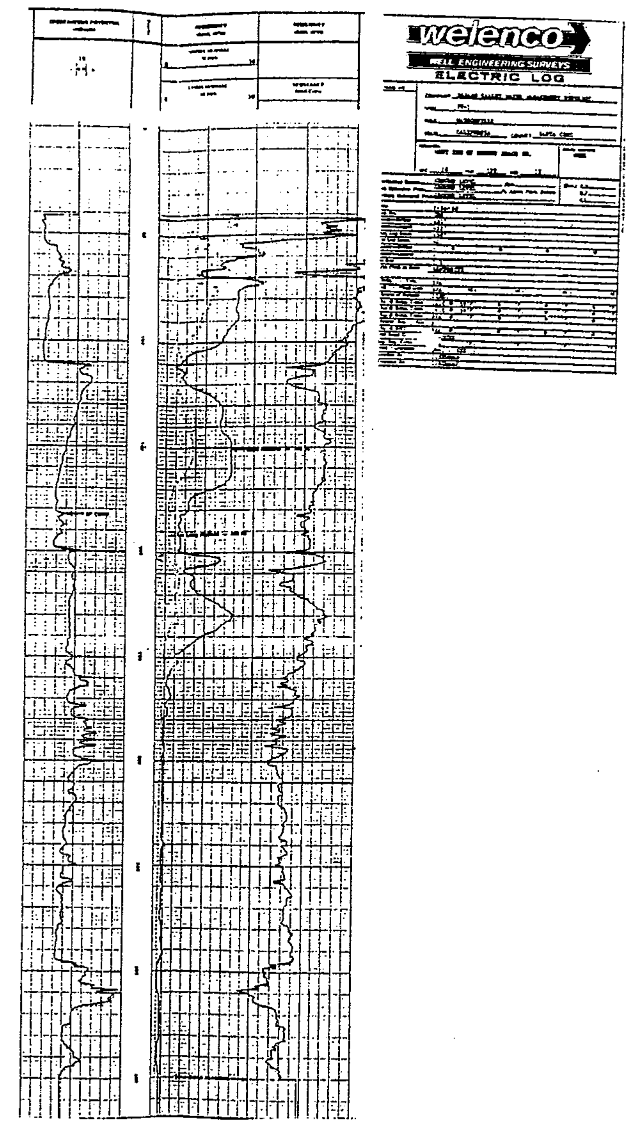
jcs

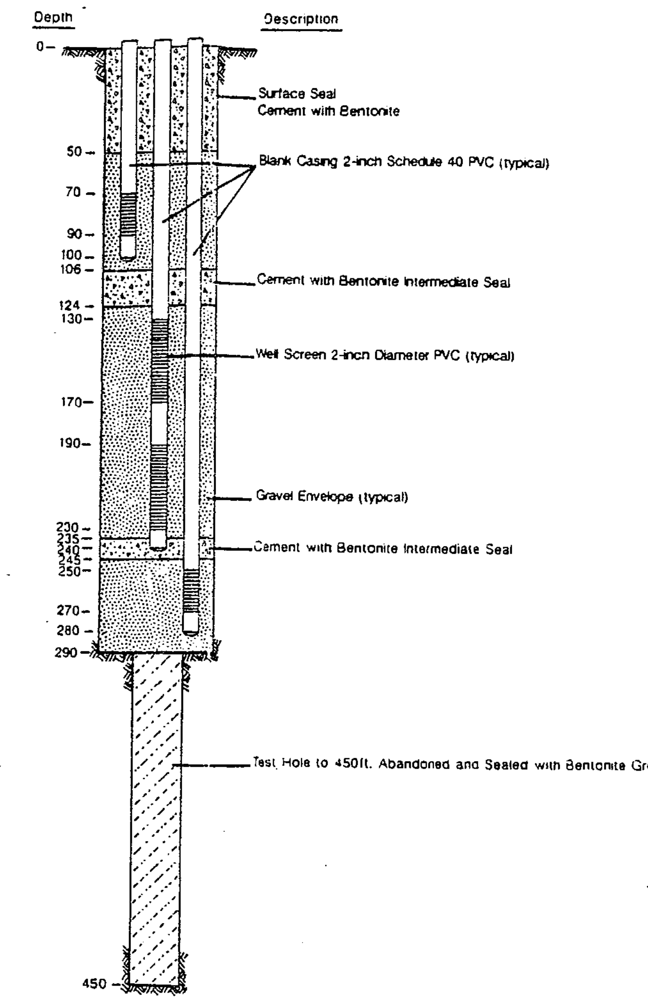
____ OF ____ SHTS

LITHOLOGY

Depth	Description
0–39	Sand, medium-coase, reddish brown, moderately sorted, subanglar- subrounded, quartz, lithics, feldsoars, trace mica, some clay in upper 10' from soil forming process
39–54	Gravelly Sand, medium-very coarse, poorly sorted, subangular-subrounded, some fine gravel
54–66–76	Gravelly Sand to Gravel w/Sand, medium-very coarse sand, poorly sorted, subangular-suorounded, lithics dominate, thin silty clay interbeds, olive brown at 54ft. & 66ft., medium plastic
76–106	Sand, fine-medium, reddish brown, moderately sorted, subangular-subrounded, quartz, lithcs, feldspars, black & golden mica, some layers of coarse sand
106–122	Clayey Sand, reddish brown, fine-medium, subangular, clay <30%
122–150–200	Sand, fine-medium, well sorted, subangular-subrounded, quartz, lithics, feldspars, mica, thin silt(stone), olive gray, low plastic at 150ft., slightly coarser in lower 10ft.
200–220	Sand, medium-coarse, dark gray brown, well sorted, sbangular-subrounded, quartz, lithics
220–250	Sand, medium-coarse, dark brown to yellowish brown, subangular-subrounded, moderately sorted, quartz lithics, trace mica, some thin siltstone layers, unit tends to be slightly coarser grained in lower half
250–300	Sand, medium-coarse, reddish brown, subangular-suorounded, well sorted, quartz, lithics, trace mica, unit tends to be slightly coarser in lower 10ft.
300–350	Sand, medium-coarse, dark reddish brown, moderately sorted, subangular-subrounded, quartz, lithics, trace mica, some thin grayish siltstone layers in upper 10ft., unit tends to be slightly coarser in lower 20ft.
350–396	Sand, medium-coarse, dark brown-dark reddish brown, moderately sorted, subangular-subrounded, some thin grayisn siltstone layers, unit tends to be slightly coarser in lower 20ft., some thin cemented sand layers
396–402–416	Clayey Sand-Sandy Clay, reddish brown clayey medium sand, yellowisn to olive brown sandy clay, and thin organic rich (peaty) claystone at 402-404ft.
416–450	Sand, medium-coarse grayish brown, moderately sorted, subangular-subrounded, quartz, lithics, some thin poorly cemented sand layers



WELL PROFILE



Vertical Scale 1" - 40'

NO	DATE	REVISION	BY

MONITORING WELL PROFILE PV-1

PAJARO VALLEY
GROUND-WATER MONTORING

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Woodland, California 95695

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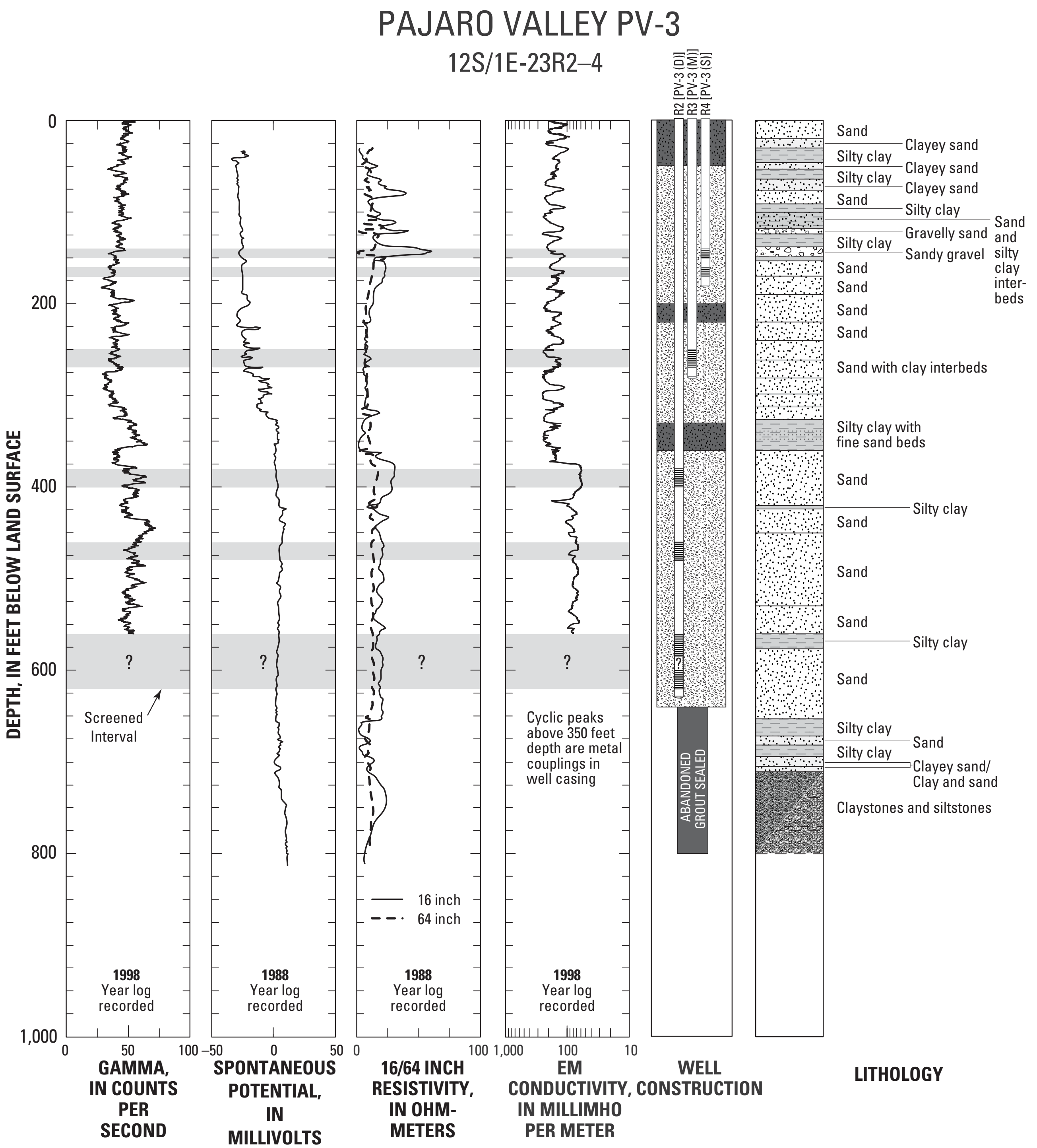
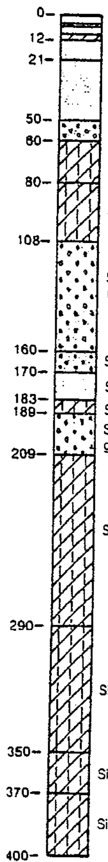


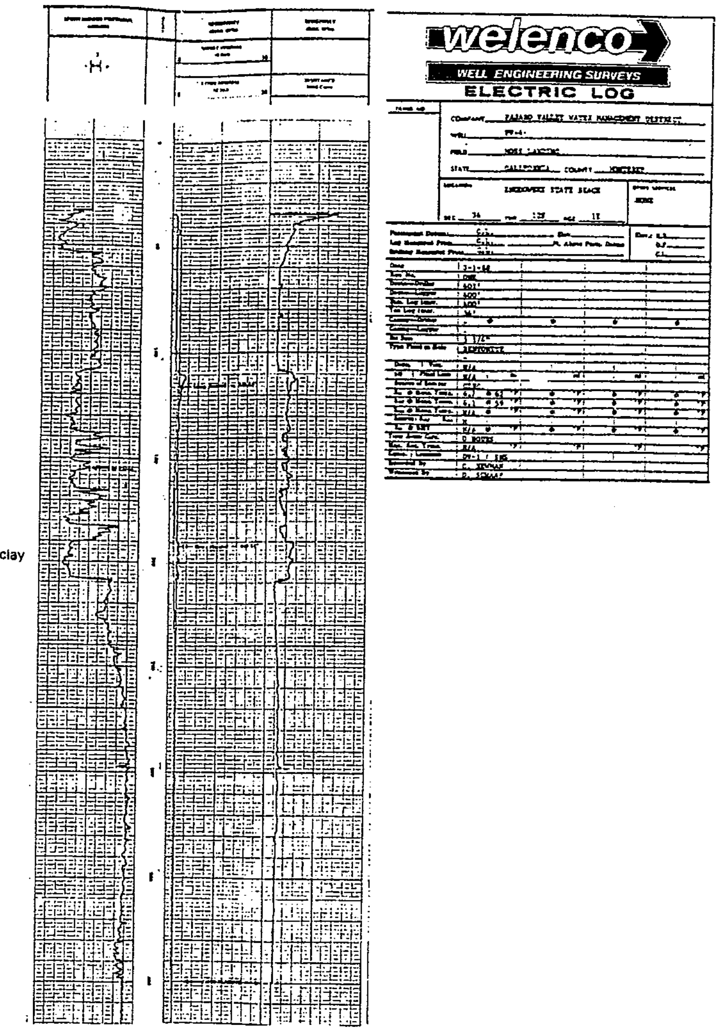
Figure A1.2. Geophysical logs and well construction for selected monitoring wells and test holes in the Pajaro Valley, Santa Cruz County, California.

LITHOLOGY



Depth	Description
0–	Sand and Clay, interbedded, fine-medium sand, silty, subangular-subrounded, clay-dark gray, sandy, low plastic
12–	Sand w/Clay stringers, medium, dark gray brown, subangular-subrounded, quartz, feldspars, lithic, some shell fragments
21–	Sand, medium, dark gray brown, moderately sorted, subangular-subrounded; shell fragments; slightly coarser in lower 10'
50–	Gravelly Sand, medium-very coarse sand, fine gravels, subangular-well rounded, shell fragments, some thin dark gray clay interbeds
60–	Silty Clay, dark gray, soft, medium-high plastic, abundant shell fragments; thin stringers of dark brown peaty material and fine gravels, well rounded
80–	Silty Clay, dark gray, stiff, medium-high plastic; some thin laminate of peaty material, abundant shell fragments above 100'
108–	Sand and Gravel, medium-very coarse sand and fine gravel, subrounded-well rounded, quartz, feldspars, lithics, esp. volcanic clasts; thin stringers of dark gray clay, some shell fragments
160–	Sand and Gravel, coarse-very coarse sand and fine gravel, some thin stringers of silty clay, minor shell fragments
170–	Sand, medium, gray, subrounded-rounded, trace fine gravels; quartz, feldspars, lithics
183–	Silty Clay w/Sand, gray?, low-medium plastic
189–	Sand and Gravel, medium-very coarse sand, fine 2" gravels, poorly sorted, subrounded-well rounded, some thin interbeds of dark brown silty clay gravels dominated by dark lithics; quartz, feldspars and minor sandstone clasts
209–	Silty Clay, dark gray (bluish), soft, medium plastic, trace fine mica sand, some shell fragments
290–	Silty Clay, dark gray (bluish), stiff, slightly compacted, trace fine mica sand, no shells
350–	Silty Clay, dark gray (bluish), soft, low-medium plastic, no shell fragments
370–	Silty Clay, dark gray (bluish), dense, hard, some olive streaks, low-medium plastic
400–	

Vertical Scale 1"=40'



NO	DATE	REVISION	BY

Test Hole Lithology PV-4

Pajaro Valley Ground-Water Monitoring

87-1-068

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6/88

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jcs

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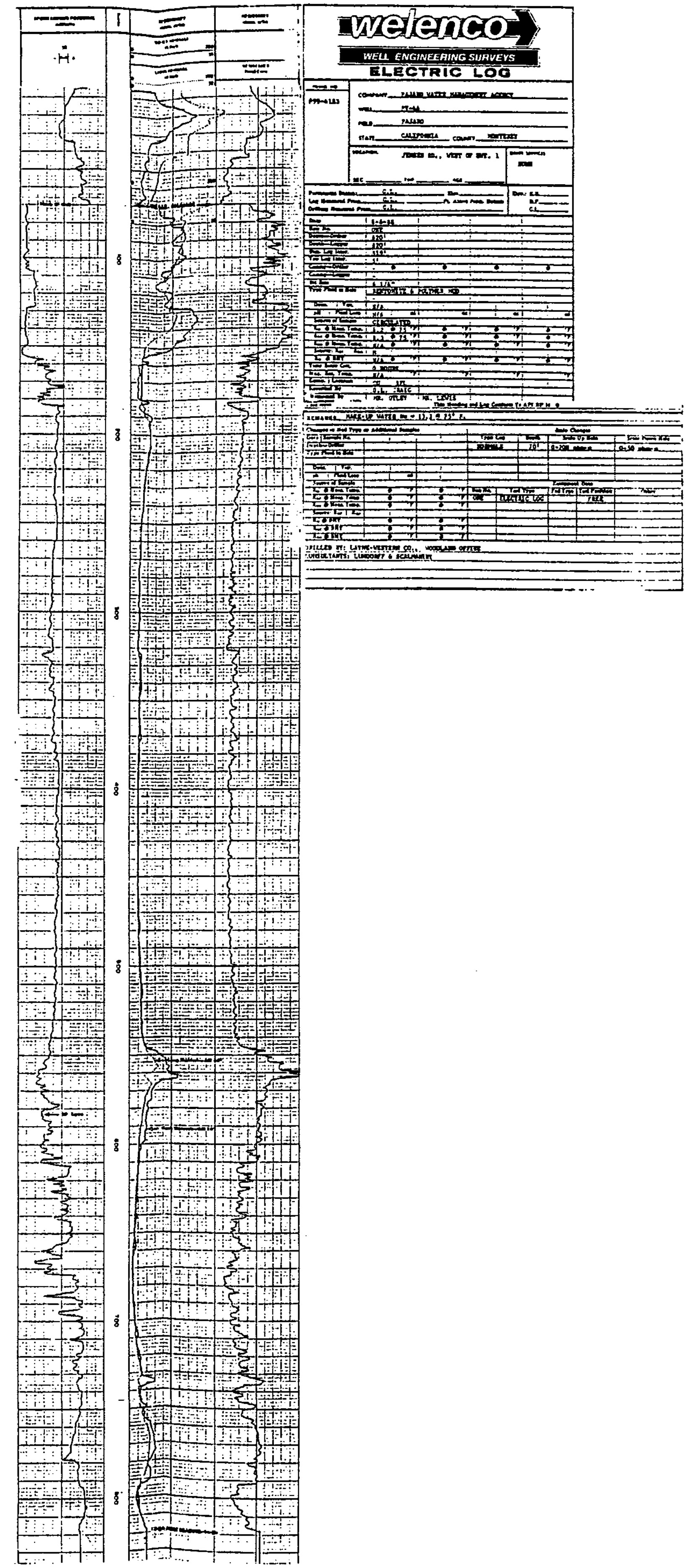
Woodland, California 95695

____ OF ____ SHTS

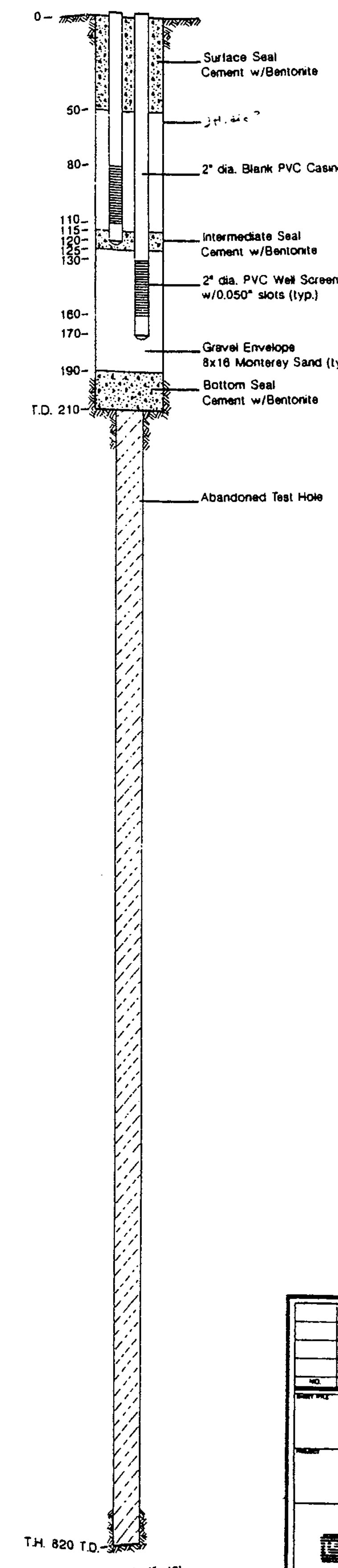
LITHOLOGY

Depth	Description
0–15	Clayey Sand, reddish brown-strong brown, medium-medium coarse, moderately sorted, subrounded; quartz, lithics; topsoil in upper part
15–26	Sand, pale brown, coarse-medium, moderately sorted, subangular-subrounded
26–34	Gravelly Sand, medium-very coarse w/fine gravel, well sorted, subrounded, clots of bluish silty clay
34–74	Silty Clay, light olive brown, medium plastic, some bluish gray clayier zones, small clots of orangish clay, rare shell fragments
74–106	Silty Sand-Sand, pale olive, fine-medium, moderately sorted, matrix of mud; quartz, lithics, trace of mica
106–126	Clay and Sandy Clay, dark greenish gray, soft, low plastic
126–154	Sand, light yellowish brown, fine-medium, well sorted, subrounded; quartz, lithics, trace mica, some coarse-very coarse at base
154–192	Gravelly Sand, medium-very coarse w/fine gravel to 3/4", poorly sorted, subrounded to rounded; quartz, lithics; some shell fragments
192–322	Silty Clay-Clay, greenish-bluish gray, soft to stiff, medium-high plastic, some thin zones of fine sandy clay, massive to thinnly bedded in lower half
322–384	Silty Clay w/Sand, bluish-greenish gray, medium plastic, soft to stiff, fine-very fine sand, trace of coarse to very coarse sand in thin zones
384–546	Clay-Silty Clay, bluish gray, medium-high olastic, stiff, trace fine-very fine sand
546–575	Clayey Sand-Sand, fine-medium, subangular-subrounded, poorly sorted, grades downward into sand, coarse-very coarse, w/shell fragments
575–610	Sand-Gravelly Sand, medium-very coarse w/fine gravel, poorly sorted, subangular-subrounded; lithics, quartz; abundant shell fragments
610, 618, 640, 654, 674	Sand and Clays, interbedded (as shown from E-Log interpretation), sands medium to coarse thinnly bedded, bluish gray-greenish gray mudstones interfingered w/sands; thicker mudstones at top (610) and middle (640)
674, 683, 686, 693, 697, 706, 710, 732, 738, 746, 750, 756, 792, 820	Mudstones and Silty Sandstones, interbedded (as shown from E-Log interpretation), sandstones-fine-very fine, weakly cemented, mudstones-greenish gray, moderately compacted and cemented

Vertical Scale 1"=40'



WELL PROFILE



Vertical Scale 1"=40'

NO.	DATE	REVISION	BY

Monitoring Well Profile-PV-4A

Pajaro Valley
Ground-Water Monitoring

LUHDORFF & SCALMANINI
Consulting Engineers
Woodland, California 95695

Project No.	87-1-066
Scale	Shown
Date	8/88
Drawn by	mfs
Checked by	eel
	jca

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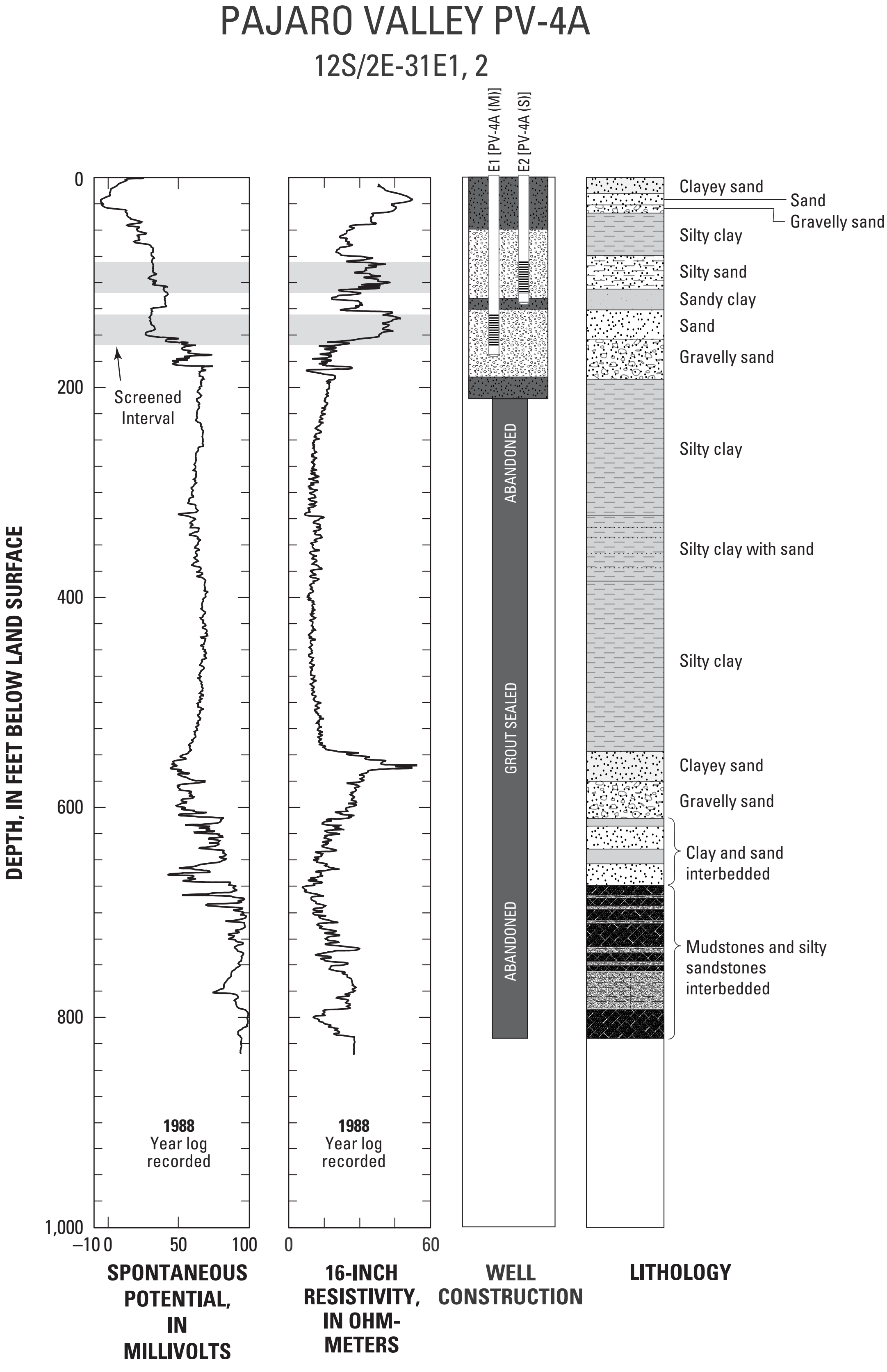
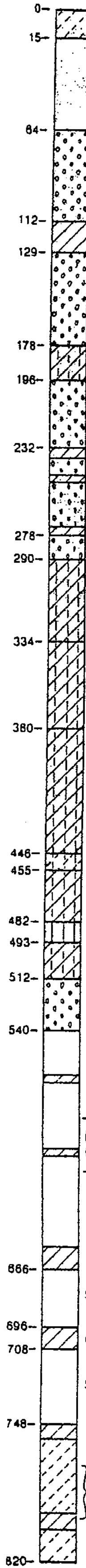


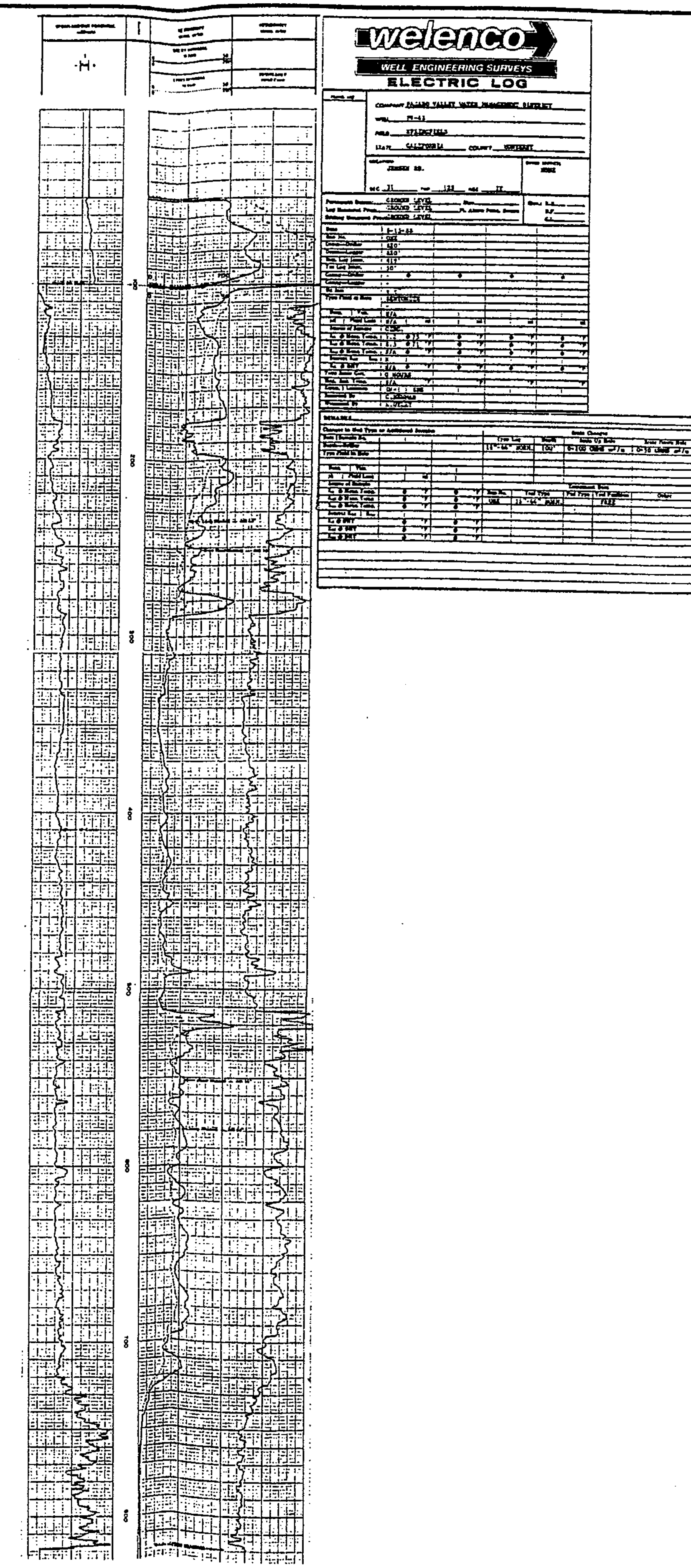
Figure A1.3. Geophysical logs and well construction for selected monitoring wells and test holes in the Pajaro Valley, Monterey County, California.

LITHOLOGY



Depth	Description
0–15	Clayey Sand, strong brown, medium-coarse, subangular-subrounded, poorly sorted; quartz, lithics; topsoil in upper part
15–64	Sand, dark yellow brown, medium, subrounded-subangular, moderately sorted; quartz, lithics; trace of silt; slightly coarser
64–112	Gravelly Sand-Sand and Gravel, grayish brown, medium-very coarse sand, fine gravel to 1/4"; subrounded-subanglar, poorly sorted; lithics, quartz, abundant golden mica
112–129	Sandy Clay, light yellowish brown, low plasticity; fine-very fine sand, some thin sand lenses
129–178	Sand w/Gravel, grayish brown, medium-very coarse, fine gravel, poorly sorted, subrounded-subangular; quartz, lithics; slightly coarser to gravelly sand at bottom; sharp basal contact
178–196	Sandy Silty Clay, tannish to grayish, low plasticity, some orangish weathering mottles; thin sandier layers
196–232	Gravelly Sand, grayish brown, coarse-very coarse, fine gravel, poorly sorted, subrounded-subangular; lithics, quartz; gravel to 1/2"; finer grained in lower half
232–278	Gravelly Sand and Sandy Silty Clay, interbedded, grayish brownish, medium-very coarse, fine gravel, poorly sorted; clay, medium-low plastic w/fine sand
278–290	Gravelly Sand, grayish brown, coarse-very coarse, fine gravel, poorly sorted, sharp base
290–334	Silty Clay-Sandy Silty Clay, bluish gray, low-medium plasticity, fine-very fine sand, some thin fine-very fine sandy layers, thinnly bedded
334–380	Silty Clay, bluish gray, medium plastic, trace fine-very fine sand, some whitish-grayish mudstones, thickly bedded
380–446	Silty Clay-Sandy Silty Clay, bluish gray, medium-low plastic, fine-very fine sand, thin interbeds of sandier layers
446–455	Clayey Silty Sand, bluish grayish, fine-very fine
455–482	Silty Clay, bluish gray, medium plastic, trace fine-very fine sand, some sandier zones
482–493	Clayey Silty Sand, grayish, fine-very fine
493–512	Silty Clay, bluish gray, medium plastic, trace fine-very fine sand
512–540	Sand w/Gravel and Shells, grayish, medium-very coarse, fine gravel; poorly sorted; subrounded, lithic dominated; abundant shell fragments, slightly finer grained in lower half
540–666	Sand w/thin interbeds Clay and Sand, reddish brown-yellowish brown, fine-medium, moderately sorted, subrounded-subangular, quartz, lithics; thin interbeds of reddish brown clay and sand, some tannish-grayish mudstones
666–696	Sand, yellowish brown, medium-coarse, sbangular-subrounded, poorly sorted
696–708	Clayey Sand-Clay and Sand, reddish orangish brown, fine-medium
708–748	Sand, reddish-yellowish brown, fine-medium, moderately sorted, subrounded, quartz, lithics
748–820	Clayey Sand and Sandy Mudstone, thinnly interbedded, reddish-yellowish brown sands, subrounded, quartz, lithics, low plastic mudstones, thicker mudstones as shown, see E-Log for details

Vertical Scale 1"=40'



NO.	DATE	REVISION	BY

Test Hole Lithology
PV-4B

Pajaro Valley
Ground-Water Monitoring

87-1-068
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5/88
mfs
eel
jcs

LUHDORFF & SCALMANINI
Consulting Engineers
Woodland, California 95695

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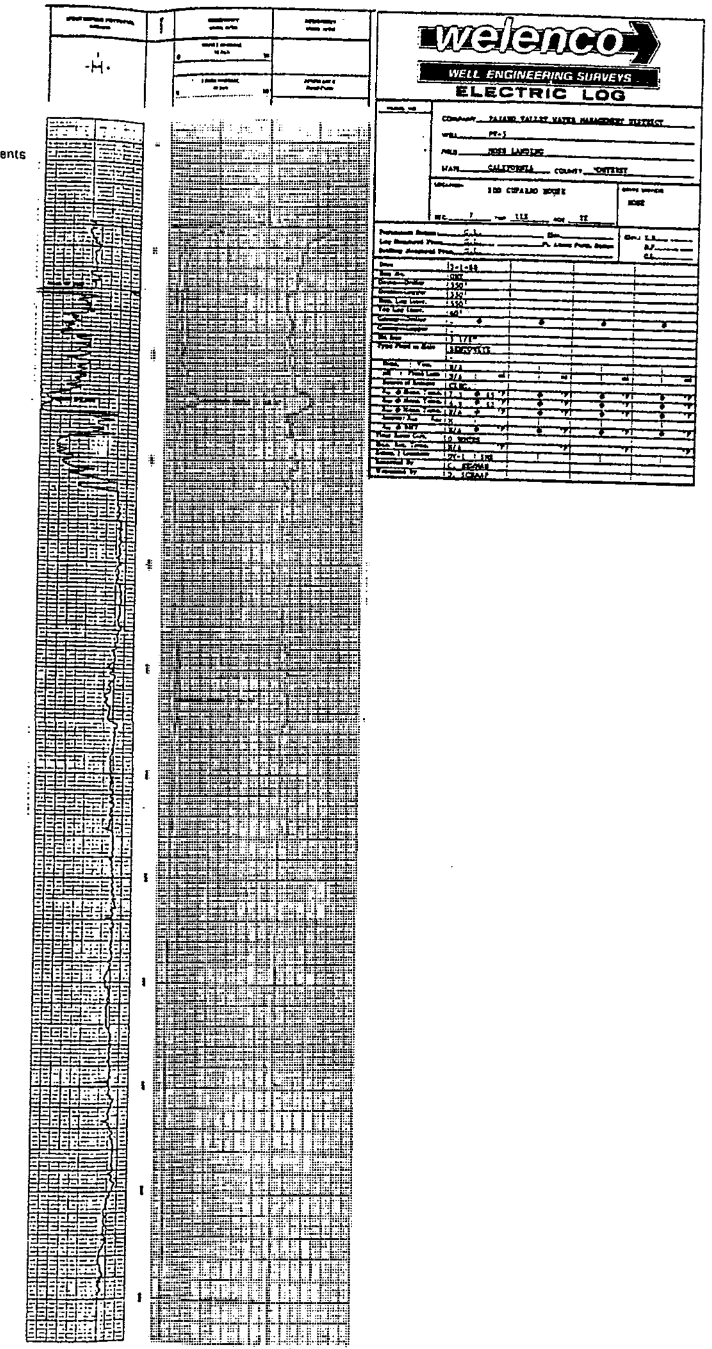
LITHOLOGY

Depth	Description
0–12	Sand, medium, well sorted, subrounded-rounded, yellowish brown, quartz and feldspar; topsoil w/silt and clay in upper 2' w/large shell fragments
12–22	Silty Clay, pale brown w/tan streaks, soft, low plastic, some thin peaty beds
22–40	Sand, medium-coarse, pale brown, well sorted, subrounded-rounded, some coarse sand and fine gravel stringers in lower 4'
40–72	Sand, medium-coarse w/some fine gravel, well sorted, subrounded-rounded, yellowish brown
72–94	Sand w/yellowish brown Silty Clay stringers, medium-coarse sand and fine gravel, subangular-subrounded
94–118	Sandy Silty Clay w/coarse sand stringers, coarse, rounded sands, gray brown sandy clays, stiff, medium-low plastic
118–128	Sand, medium-coarse w/fine gravel, subangular-subrounded, light brown
128–140	Sandy Clay, pale brown, low plastic
140–150	Sand w/Clay, yellowish brown, medium-coarse sand, some fine gravels
150–166	Sand and Clay, interbedded, medium-coarse sand w/fine gravel, clay dark gray (bluish), stiff, medium plastic
166–200	Sandy Silty Clay, bluish gray, medium plastic, fine-medium sand <20%
200–220	Silty Clay, bluish gray, medium-high plastic, trace fine mica sand, trace coarse sand and fine gravel
220–250	Sandy Silty Clay, bluish gray, low-medium plastic, fine mica sand <30%; some dark organic material and shell fragments
250–300	Silty Clay w/Sand, bluish gray, medium-high plastc, fine mica sand <10%
300–320	Sandy Silty Clay, bluish gray, low-medium plastic, fine mica sand <20%, some shell fragments
320–400	Silty Clay w/Sand, bluish gray, medium plastic, fine mica sand <10%, some shell fragments
400–490	Silty Clay w/Sand, dark bluish gray, medium-high plastic, trace fine mica sand <10%, some shell fragments
490–520	Silty Clay, dark bluish gray, high plastic, trace fine mica sand, no shell fragments
520–530	Sandy Silty Clay, bluish gray, low-medium plastic, fine mica sand, some shell fragments
530–550	Silty Clay w/trace fine Sand, dark bluish gray, medium-high plastic, no shell fragments

Vertical Scale 1"=40'



NO.	DATE	REVISION	BY

Test Hole Lithology PV-5

Pajaro Valley Ground-Water Monitoring

87-1-068
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mfs
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jcs

LUHDORFF & SCALMANINI
Consulting Engineers
Woodland, California 95695

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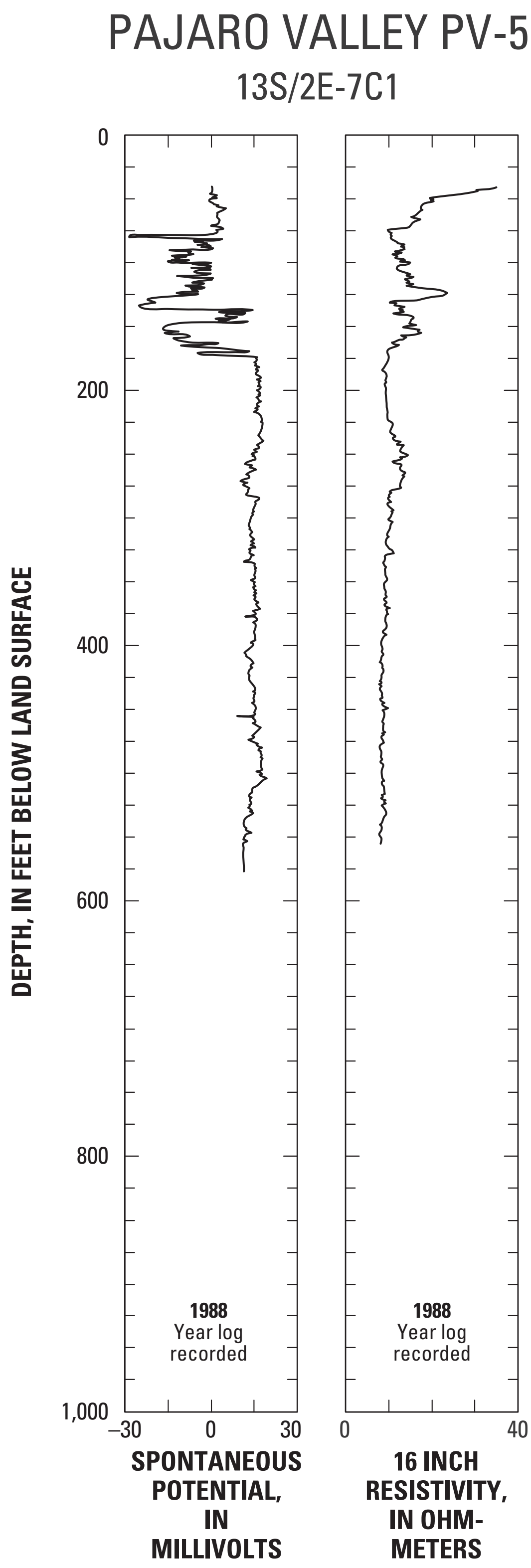
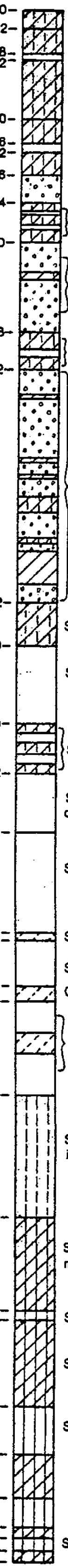
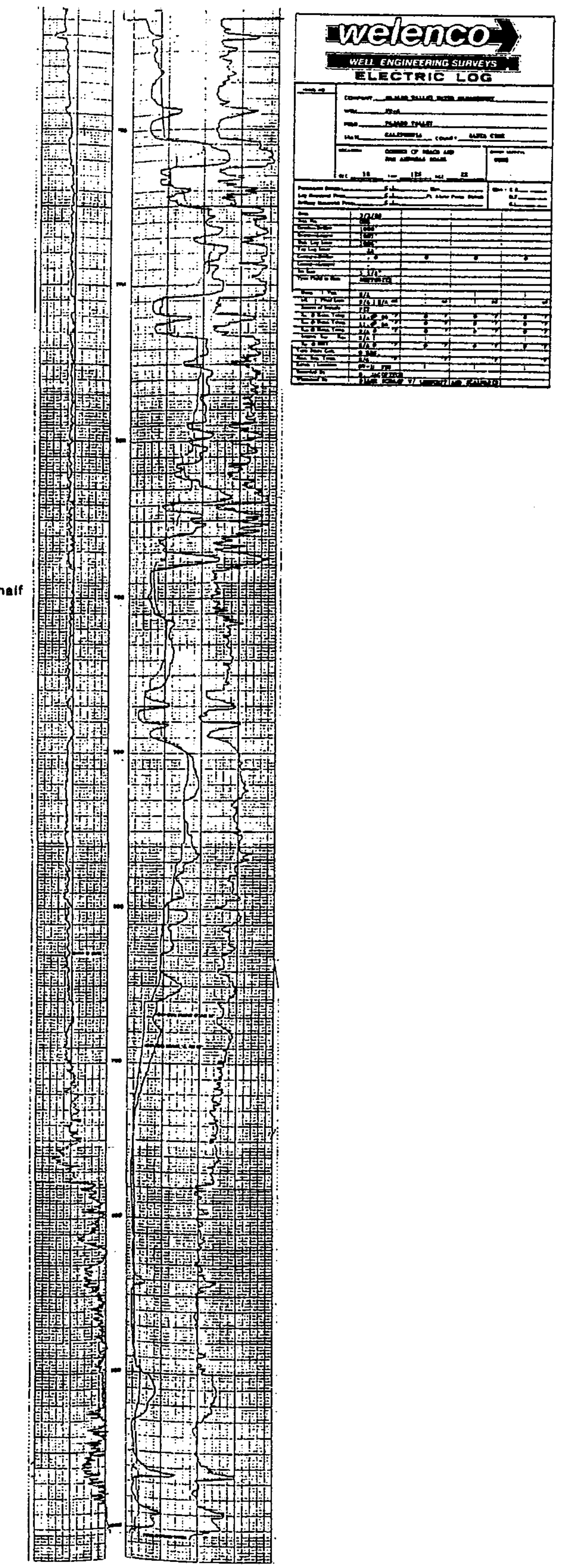


Figure A1.4. Geophysical logs for selected monitoring wells and test holes in the Pajaro Valley, Monterey County, California.

LITHOLOGY

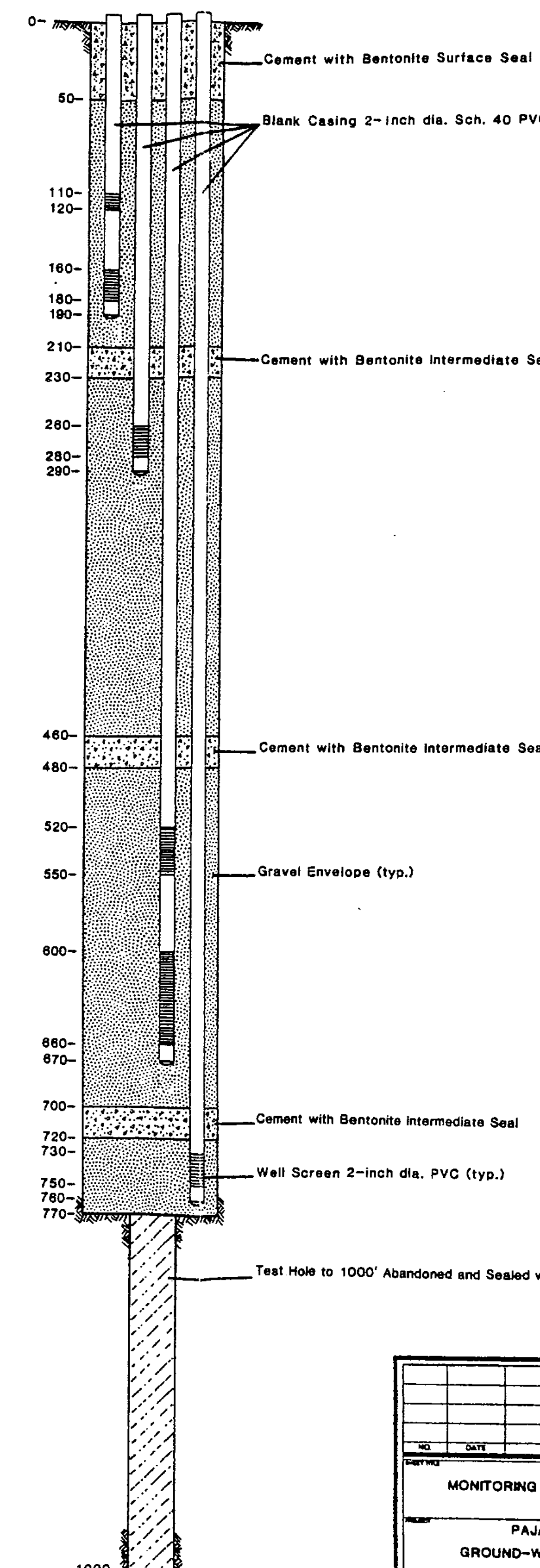


Depth	Description
0–	
12–	Sandy & Silty Clays, dark brown to dark gray, medium plastic
28–	Silty Clay w/Sand, dark gray (bluish), soft, medium-high plastic, fine sand, some layers dark brown peaty material
32–	Silty Sand, medium, subrounded-rounded, quartz, lithics, some shell fragments
	Sandy Silty Clay, dark greenish gray, stiff, medium plastic, zones of sandier clay interbedded, thin, medium-coarse sand layers 60-70ft.
70–	Silty Clay, dark greenish bluish gray, soft, medium-high plastic
86–	
92–	Sand, medium-coarse, well sorted, quartz, lithics, subrounded-well rounded
	Silty Clay w/trace fine Sand, dark bluish gray, medium plastic
106–	Sand-Gravelly Sand, medium, very coarse sand and fine gravel, subangular-well rounded, quartz, lithics, feldspars
124–	Silty Clay & coarse Sand, interbedded, dark gray, clay-medium plastic, medium-coarse sand w/fine gravels
150–	Sand & Gravel, medium-very coarse sand, fine gravel, subrounded-rounded, quartz, lithics, well sorted, some thin dark gray clay layers, thickest at 169ft.
208–	Silty Clay w/Sand, brown-gray, medium plastic, fine-very fine sand, thin fine sand w/gravel 219-224ft.
232–	Sand-Gravelly Sand, medium-very coarse, subangular-subrounded, quartz, feldspars, lithics, gravels fine-pebble, well rounded, lithics dominate, thin interbedded dark gray-brown silty clay & sandy clay at 289-300-314-340-344 & 359ft.
382–	Silty-Sandy Clay, bluish gray, medium-high plastic, trace fine sand, some thin layers fine-medium sand especially in lower half
410–	Sand, medium-coarse, well sorted, gray brown, subrounded-rounded, feldspars, lithics, mica
460–	Silty Clay w/Sand, interbedded, clays-tan, medium plastic, sand fine-medium w/some coarse & fine gravel, subrounded-rounded
492–	Sand, fine-medium, brown, well sorted, subrounded-rounded, quartz, feldspars, lithics, some thin interbedded dark gray silty clay beds
530–	Sand, medium, reddish brown, well sorted, subrounded-rounded, slightly silty in places
594–	
600–	Sandy Clay-Sand & Clay?, gray brown, low plastic?
	Sand, medium, brown, well sorted, sub-well rounded, quartz, feldspars, lithics, slightly silty to finer grained lower 10ft.
630–	
640–	Clayey Sand, reddish brown, medium, subrounded-rounded, quartz, feldspars, lithics
	Sand, fine-medium, reddish brown, well sorted, subrounded-rounded, quartz, feldspars, lithics, thin stringer of light beown-dark gray, silty-clayey 660-674ft.
700–	Sand-Silty Sand, grayish brown, yellowish brown, fine-medium sand, poorly sorted, fines increase, thin interbeds of yellowish brown & grayish siltstones &claystones, sands-quartz,feldspars, lithics
776–	Siltstones & Claystones w/interbedded thin Sandy Siltstone-Silty Sandstones, grayish brown-dark gray, medium-high plastic, dark gray, massive, evenly bedded subunits decribed below
838–	
844–	Silty Sandstone-Sandy Siltstone, grayish brown, fine-medium sand
	Silt & Sandstone?, grayish brown, low plastic, fine sand
900–	Sandy Siltstone-Silty Sandstone?, grayish brown, fine-medium sands
930–	
956–	
977–	
984–	Sandy Siltstone-Silty Sandstone, grayish brown, fine-medium sand
992–	
1000–	



Vertical Scale 1" = 50'

WELL PROFILE



NO.	DATE	REVISION	BY

MONITORING WELL PROFILE PV-6

PAJARO VALLEY
GROUND-WATER MONITORING

LUHDORFF & SCALMANINI
Consulting Engineers
Woodland, California 95695

Project No.	87-1-068
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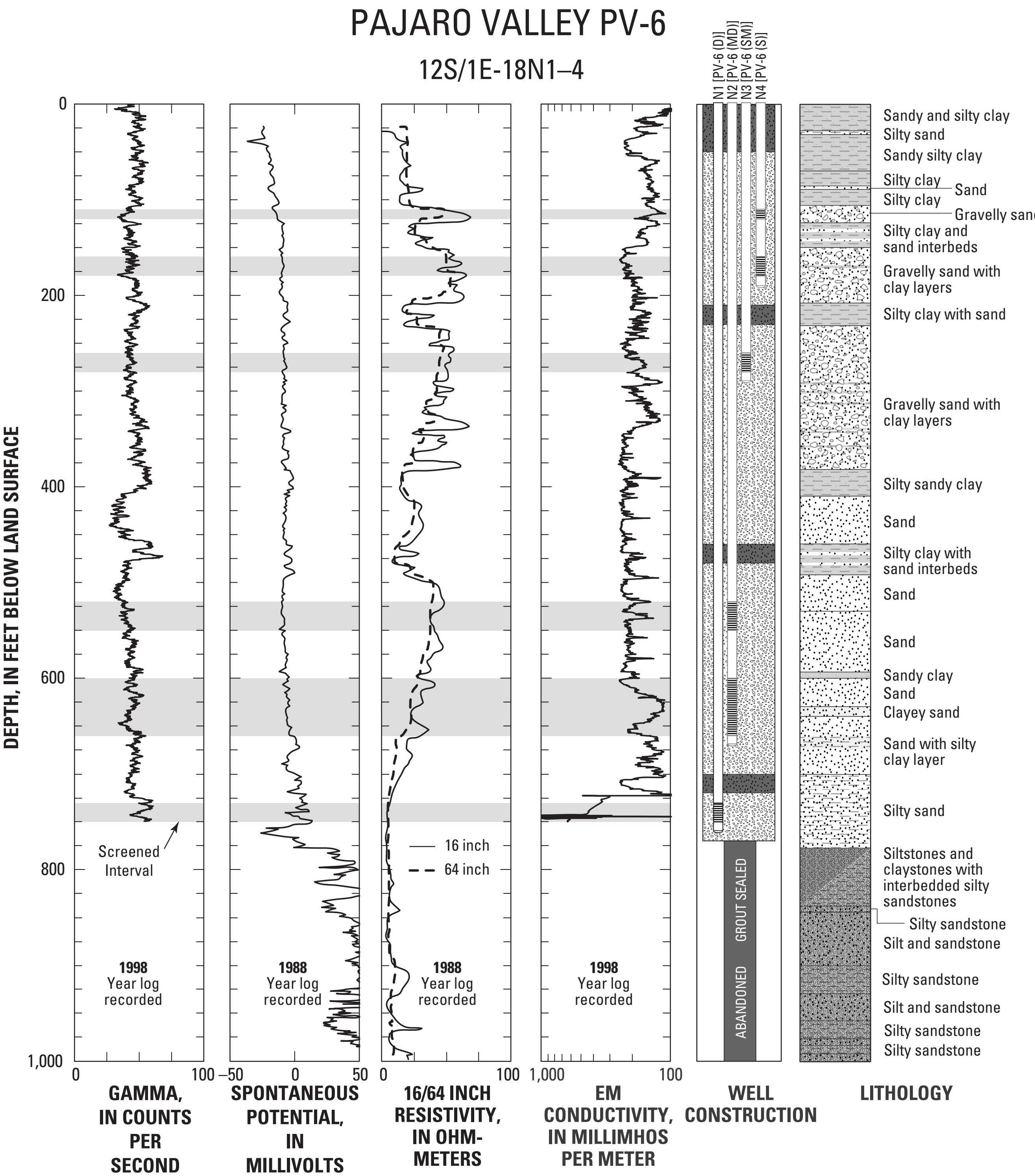
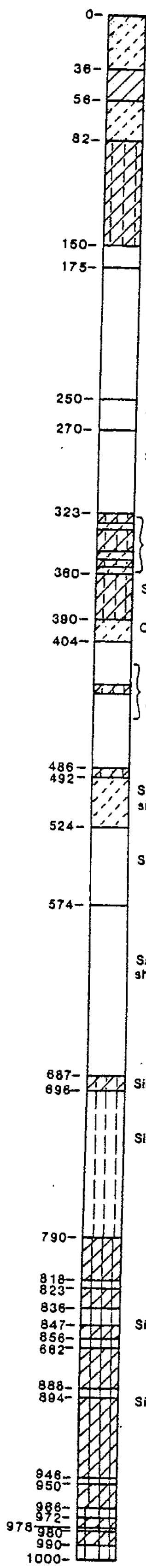


Figure A1.5. Geophysical logs and well construction for selected monitoring wells and test holes in the Pajaro Valley, Santa Cruz County, California.

LITHOLOGY



Description

Clayey Sand, reddish brown, fine-medium, subrounded-rounded, some thin, dark brown organic clay layers

Sandy Clay, reddish brown, soft, low plastic, fine-medium sand, stringers of gray brown clays

Clayey Sand, fine-medium, olive brown & organish, quartz, lithics, mica, thin interbeds of sandy silty clays

Silty Clay w/trace fine mica sand, bluish gray, medium-high plastic, some thin stringers of medium-coarse sand, shell fragments in upper 30ft.

Sand, medium-coarse, subangular, moderately sorted, quartz, feldspars, lithics, trace micas, tends to be coarser downward w/fine gravel in lower 15ft.

Sand, fine-medium w/coarse, well sorted, subrounded-rounded, quartz, lithics, mica, light brown-gray brown, some thin interbeds of dark gray, plastic clays, some thin layers of coarse sand and fine gravel

Sand, medium-coarse, reddish brown, moderately sorted, subrounded-rounded, quartz, lithics

Sand, fine-medium, well sorted, subrounded-rounded, quartz, lithics, mica

Silty Clay, dark gray-olive/bluish gray, medium plastic, trace fine mica sand, stiff, compact, thin interbeds of sand-clayey sand at 328-346 & 356ft.

Silty Clay, olive brown-bluish gray, stiff, medium-high plastic, some thin sand stringers

Clayey Sand, orangish brown, fine-medium sand, subrounded

Sand, fine-medium, well sorted, subrounded-rounded, quartz, lithics, brown-reddish brown, thin interbedded clay(stone), dark gray-olive gray, 432-438 & 486-492ft.

Sand-Clayey Sand, fine-medium, subrounded-rounded, well sorted, some interbeds olive gray silt(stone)-clay(stone), low-medium plastic

Sand w/Silt & Clay, fine-medium, subrounded-rounded, quartz, feldspars, lithics

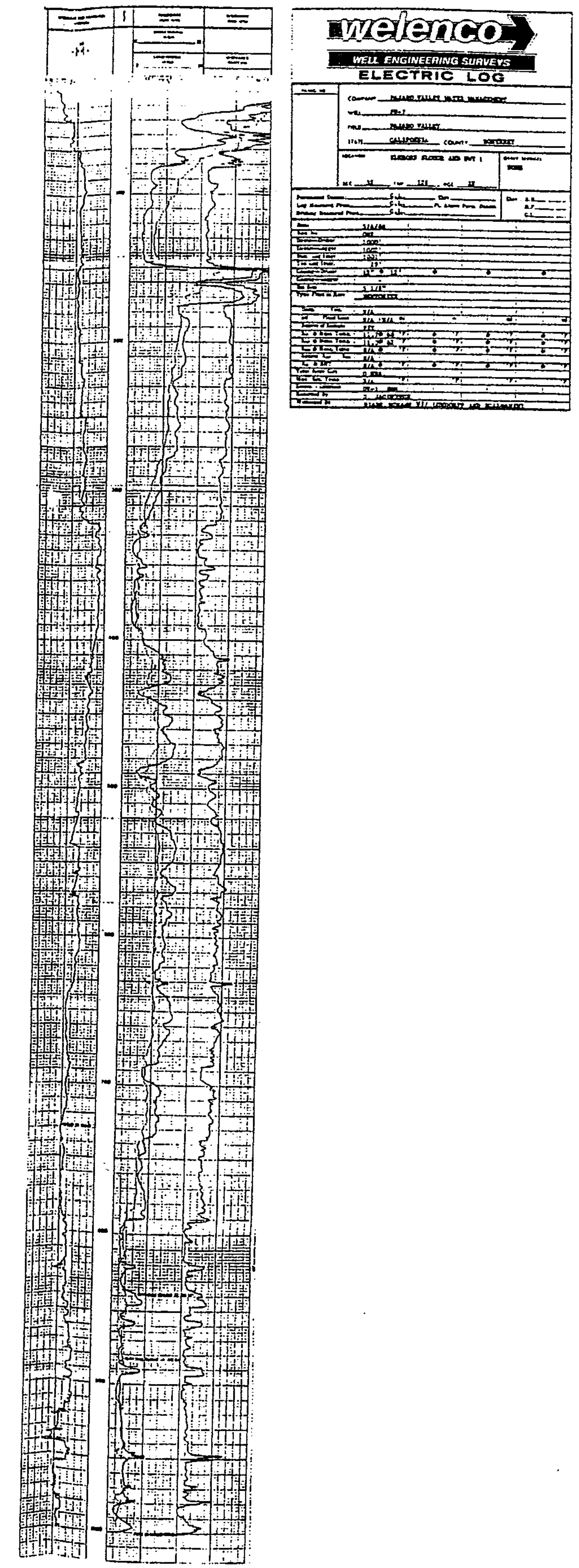
Sand, fine-medium, subrounded-rounded, quartz, lithics, feldspars, some thin grayish siltstone layers, sands locally weakly cemented, shell fragments 630-640ft., thin layers reddish brown clayey sand

Silty Clay, greenish gray, medium plastic

Silty Sand, fine-medium, subrounded-rounded, grayish brown, no-low plastic, some thin interbeds of sandy clays

Silty Claystone-Siltstones, dark gray, stiff, compacted, low-medium plastic, decomposed shell fragments 840-920 & 960-980ft.

Silty Sandstones-Sandy Siltstones, interbedded, dark gray, fine sand, quartz, lithics, subangular-subrounded



Vertical Scale 1" = 50'

NO.	DATE	REVISION	BY

Test Hole Lithology
PV-7

PAJARO VALLEY
GROUND-WATER MONITORING

LUHDORFF & SCALMANINI
Consulting Engineers
Woodland, California 95695

Project No.	87-1-068
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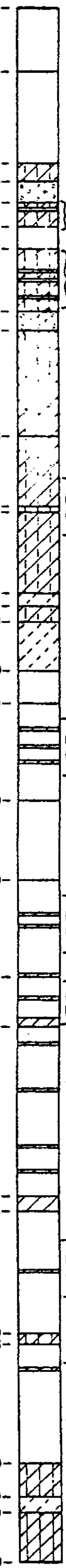
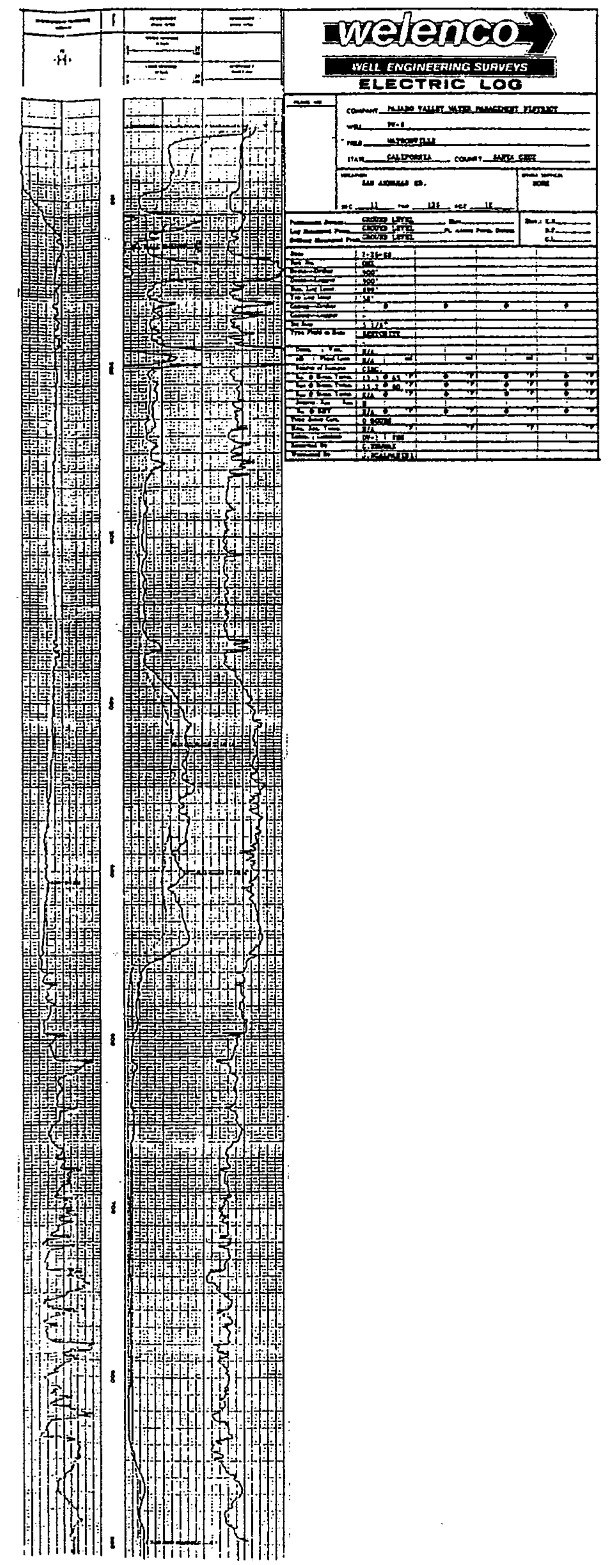
LITHOLOGY

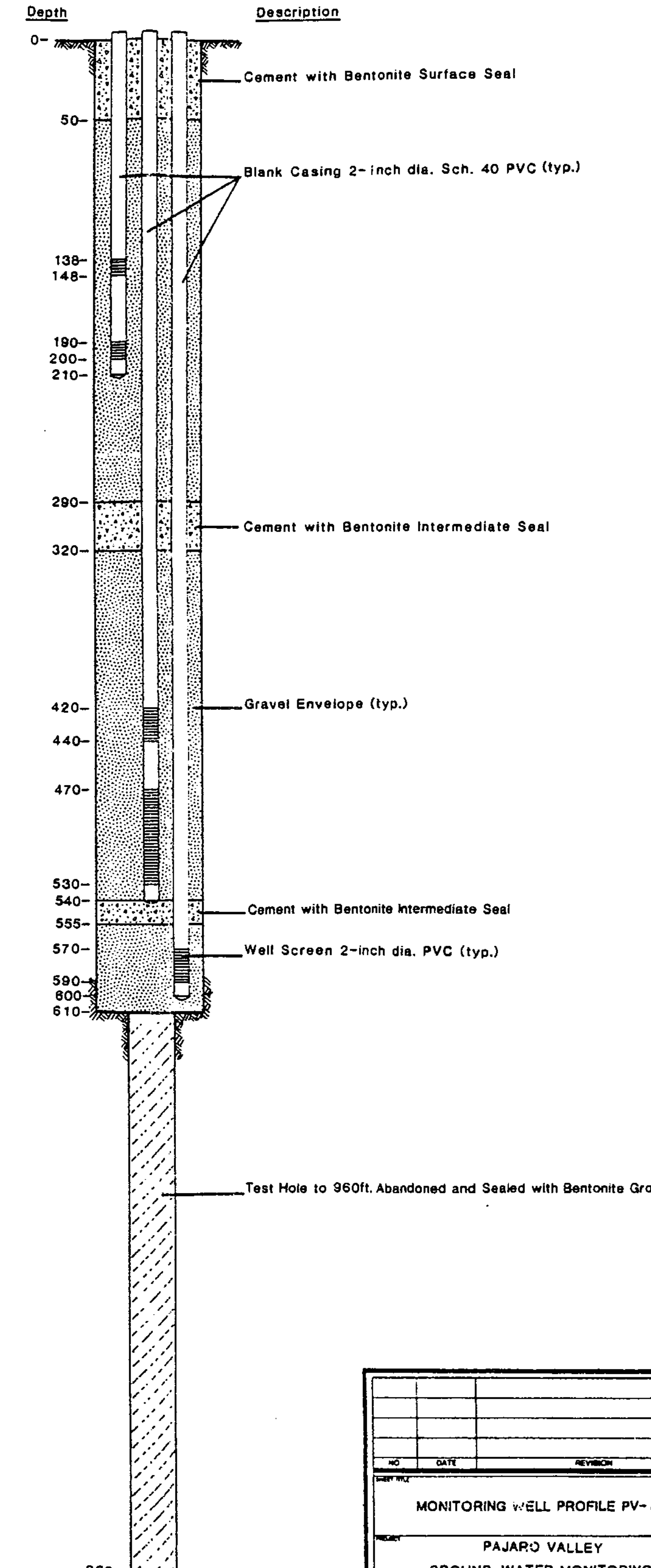


Depth	Description
0–	Sand, fine-medium, w/coarse, reddish brown, moderately sorted, subangular-subrounded, quartz, lithics, topsoil in upper 10ft. w/silt & clay, coarser at base w/fine gravel
40–	Sand, medium-coarse, dark brown-reddish brown, well sorted, subangular-subrounded, quartz, lithics, mica
97–	Silty Clay, w/trace fine Sand, dark gray, medium plastic
108–	Sand-Gravelly Sand, medium-very coarse & fine gravel, moderately sorted, subangular-subrounded, quartz, lithics, some shells
121–	Silty Clay, tannish beown, medium plastic, thin medium-coarse sand at 124ft.
136–	Sand, medium-coarse, well sorted, subangular-subrounded
150–	Silty Clay, bluish gray, medium-high plastic, trace fine mica sands, thin intwrbeds of fine silty sand at 162-168-178ft., and sand-clayey sand at 362-370ft.
188–	Gravelly Sand, medium-very coarse & fine gravels, well sorted, subrounded, quartz, lithics
200–	Silty Clay w/thin interbeds of Silty Sands, greenish bluish gray, medium plastic, thin, fine-very fine sand layers especially in lower 20ft.
265–	
308– 312–	Silty Clay w/trace fine mica Sand, olive greenish gray, medium plastic, thin silty sands
362– 370–	Sand-Clayey Sands, medium-fine, dark gray
380–	Clayey Sand, fine-medium, ver ddark gray, subrounded-rounded, clay <30%
410–	Sand w/Clay, fine-medium, dark grayish brown
430–	Sand, medium, well sorted, subrounded- rounded, quartz, feldspars, lithics weakly cemented, some thin dark clay interbeds at 445-456-& 465-489ft.
490–	Sand, fine-medium, brown, well sorted, subrounded-rounded, thin interbeds of grayish claystones
540–	Sand, medium, brown, well sorted, subrounded-rounded, quartz, feldspars, lithics, thin interbeds of gray claystones at 561-568-598 & 612ft.
598–	Sand, medium, grayish-olive brown, well sorted, subrounded-rounded, quartz, feldspars, lithics
630–	Sand, medium, dark brown, well sorted, subrounded-rounded, quartz, feldspars, lithics, thin interbeds of dark gray claystones at 640-688-704-718 & 722
735– 744–	Sandy Claystone, light olive-black, stiff, compact, peaty in part
	Sand, medium, dark brown,well sorted, subrounded-rounded, some thin interbeds of dark gray claystones
820– 826–	Siltstone-Claystone, grayish, medium plastic
	Sand, medium-coarse, dark brown, well sorted, subangular-subrounded, quartz, lithics, slightly silty-clayey, some thin interbeds of dark gray claystones
900–	Claystone-Siltstone, dark brown-bluish gray, stiff, medium plastic, trace fine mica sand
920–	Clayey Sand, grayish brown, fine-medium
930–	Claystone-Siltstone, dark brown-bluish gray, stiff, medium plastic, trace fine mica sand
960–	



Vertical Scale 1" = 50'

WELL PROFILE



NO	DATE	REVISION	BY

MONITORING WELL PROFILE PV-8	87-1-068
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PAJARO VALLEY GROUND-WATER MONITORING	mfs
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LUHDORFF & SCALMANINI Consulting Engineers Woodland, California 95695	___ OF ___ SHTS

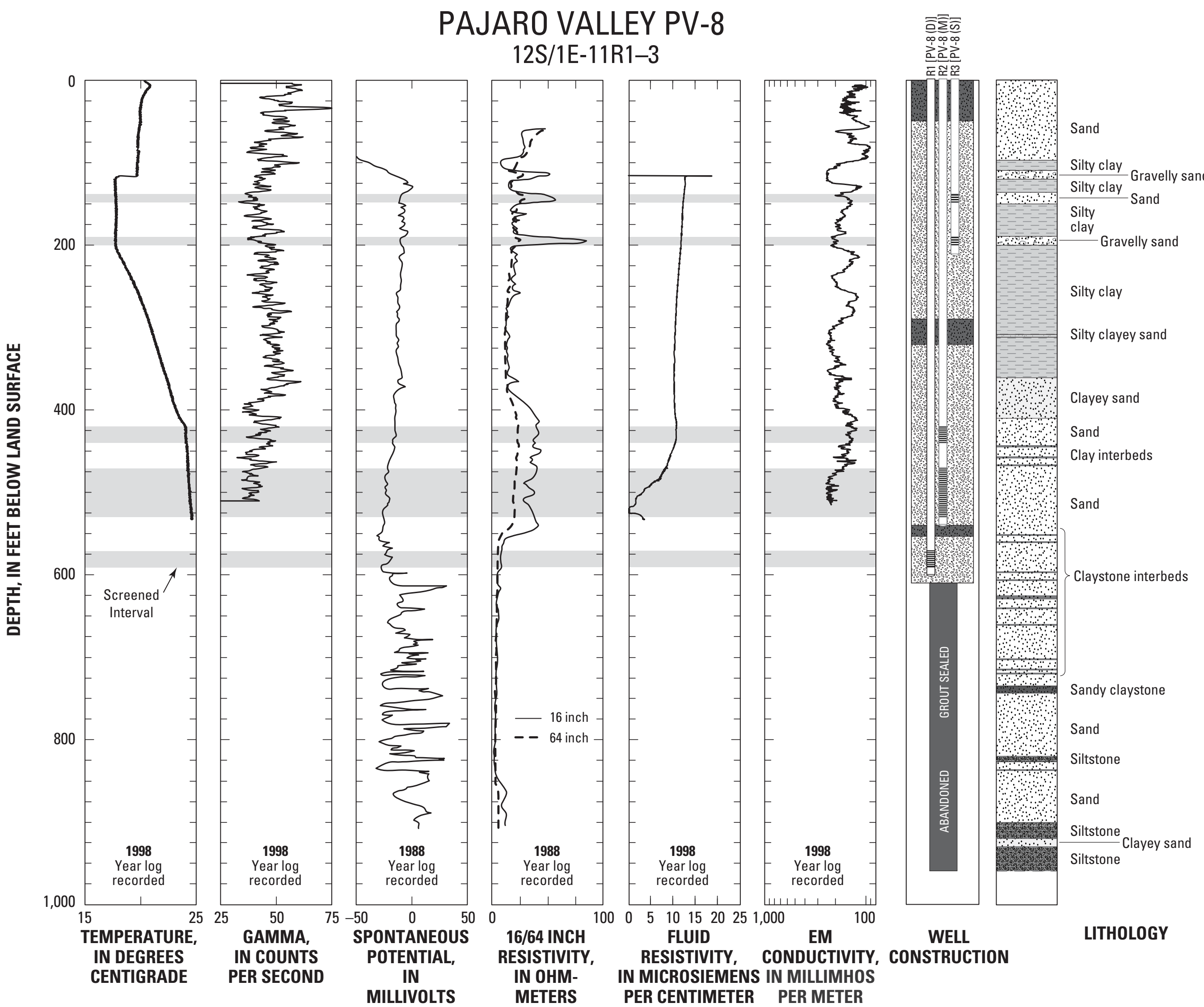
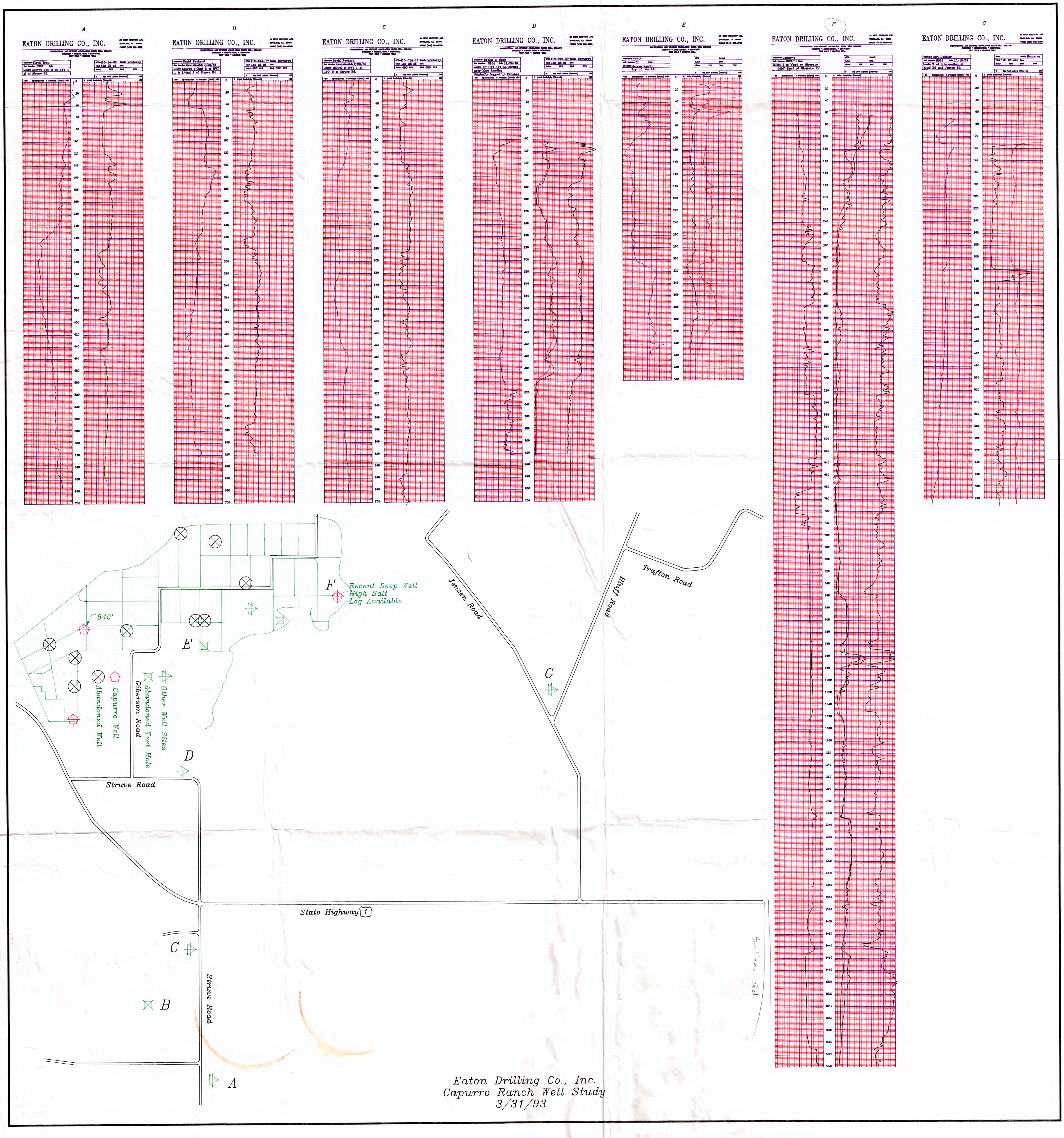


Figure A1.6. Geophysical logs and well construction for selected monitoring wells and test holes in the Pajaro Valley, Santa Cruz County, California.

APPENDIX D

E-logs from the Capurro Ranch well study, Eaton Drilling Co., Inc., March 1993


A
B
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G
EATON DRILLING CO., INC.
EATON DRILLING CO., INC.
EATON DRILLING CO., INC.
EATON DRILLING CO., INC.
EATON DRILLING CO., INC.
EATON DRILLING CO., INC.
EATON DRILLING CO., INC.
Recent Deep Well
High Salt
Log Available
840'
Capurro Well
Abandoned Well
Abandoned Test Hole
Other Well Sites
Giberson Road
Struve Road
Jensen Road
Bluff Road
Trafton Road
State Highway 1
Struve Road
Eaton Drilling Co., Inc.
Capurro Ranch Well Study
3/31/93

APPENDIX E

Springfield Well No. 2 Drilling and Testing Activities Log

Appendix A. Log of drilling and testing activities of Springfield Well #2
Pajaro / Sunny Mesa Community Services District, Monterey County, California

Date	Activity
Monday, November 06, 2017	Drilling at 12:00 noon with 8 3/4-inch bit. Hydraulic system in drilling rig breaks down; stopped drilling after 86 feet (0 to 86 feet)
Tuesday, November 07, 2017	Continued drilling. Stopped for the day at 330 ft. below ground surface (bgs). Driller removed drill pipe from borehole at end of day ("tripped out") (86 to 330feet)
Wednesday, November 08, 2017	Started day by replacing drill pipe back in borehole ("tripping back in"), cleaned out mud shakers as they were getting filled with sand. Continued drilling and stopped at total depth of 615 feet bgs. Tripped out at end of day. Borehole was E-logged by Newman (330 to 615 feet)
Thursday, November 09, 2017	Removed fine sand from system in preparation to ream borehole next week. Balance staff not present.
Friday, November 10, 2017	Removed fine sand from system in preparation to ream borehole next week. Balance staff not present.
Saturday, November 11, 2017	
Sunday, November 12, 2017	
Monday, November 13, 2017	Reamed borehole to 16 inches diameter. Balance staff was not present.
Tuesday, November 14, 2017	Continued reaming borehole. Balance staff was not present.
Wednesday, November 15, 2017	Continued reaming borehole. Balance staff was not present.
Thursday, November 16, 2017	Casing installed in borehole. Drill pipe placed inside casing. Heavy rain intermittently throughout day. Water was circulated through system until mud viscosity was significantly reduced. Attempted placement of sand in annulus was unsuccessful. Truck was not able to reach borehole site due to muddy conditions. Balance staff present.
Friday, November 17, 2017	8/16" gravel pack material was placed in annulus. 14:00 Monterey County inspector observed placement of cement sanitary seal in well. Balance staff present.
Saturday, November 18, 2017	
Sunday, November 19, 2017	
Monday, November 20, 2017	
Tuesday, November 21, 2017	
Wednesday, November 22, 2017	
Thursday, November 23, 2017	Thanksgiving
Friday, November 24, 2017	Holiday
Saturday, November 25, 2017	
Sunday, November 26, 2017	
Monday, November 27, 2017	
Tuesday, November 28, 2017	
Wednesday, November 29, 2017	
Thursday, November 30, 2017	
Friday, December 01, 2017	
Saturday, December 02, 2017	
Sunday, December 03, 2017	
Monday, December 04, 2017	
Tuesday, December 05, 2017	
Wednesday, December 06, 2017	
Thursday, December 07, 2017	
Friday, December 08, 2017	Install dataloggers in Springfield Well No. 2, Hawkins well, and School well (PVWMA 992)
Saturday, December 09, 2017	
Sunday, December 10, 2017	
Monday, December 11, 2017	
Tuesday, December 12, 2017	
Wednesday, December 13, 2017	
Thursday, December 14, 2017	
Friday, December 15, 2017	
Saturday, December 16, 2017	
Sunday, December 17, 2017	
Monday, December 18, 2017	
Tuesday, December 19, 2017	Step test starts at 10:35; Pumping rate is 327 gpm; at 13:45 pumping rate is increased to 425 gpm; water quality samples collected at 18:00; Pumping ends at 18:15; removed all dataloggers
Wednesday, December 20, 2017	
Thursday, December 21, 2017	
Friday, December 22, 2017	

Appendix A. Log of drilling and testing activities of Springfield Well #2
Pajaro / Sunny Mesa Community Services District, Monterey County, California

Date	Activity
Monday, February 12, 2018	
Tuesday, February 13, 2018	
Wednesday, February 14, 2018	
Thursday, February 15, 2018	Re-installed dataloggers in Springfield Well No. 2, Hawkins well, and School well (PVWMA 992), and Rocha's irrigation well
Friday, February 16, 2018	
Saturday, February 17, 2018	
Sunday, February 18, 2018	
Monday, February 19, 2018	
Tuesday, February 20, 2018	Springfield Well No. 2 pumped for 1 hour
Wednesday, February 21, 2018	9-hour constant-rate pumping test starts at 9:40; Pumping rate is 410 gpm; Pumping ends at 18:40
Thursday, February 22, 2018	Recovery ends ast 3:40; equipment demobbed at 9am
Friday, February 23, 2018	

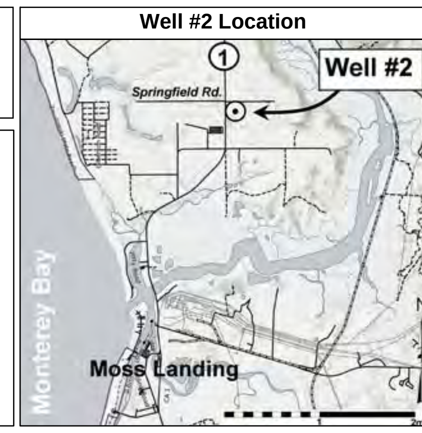
APPENDIX F

Springfield Well No. 2 Geologic and Geophysical Logs

Balance Hydrologics, Inc.

Geologic log for test well #2, Pajaro/Sunny Mesa Community Services District, Monterey County, CA

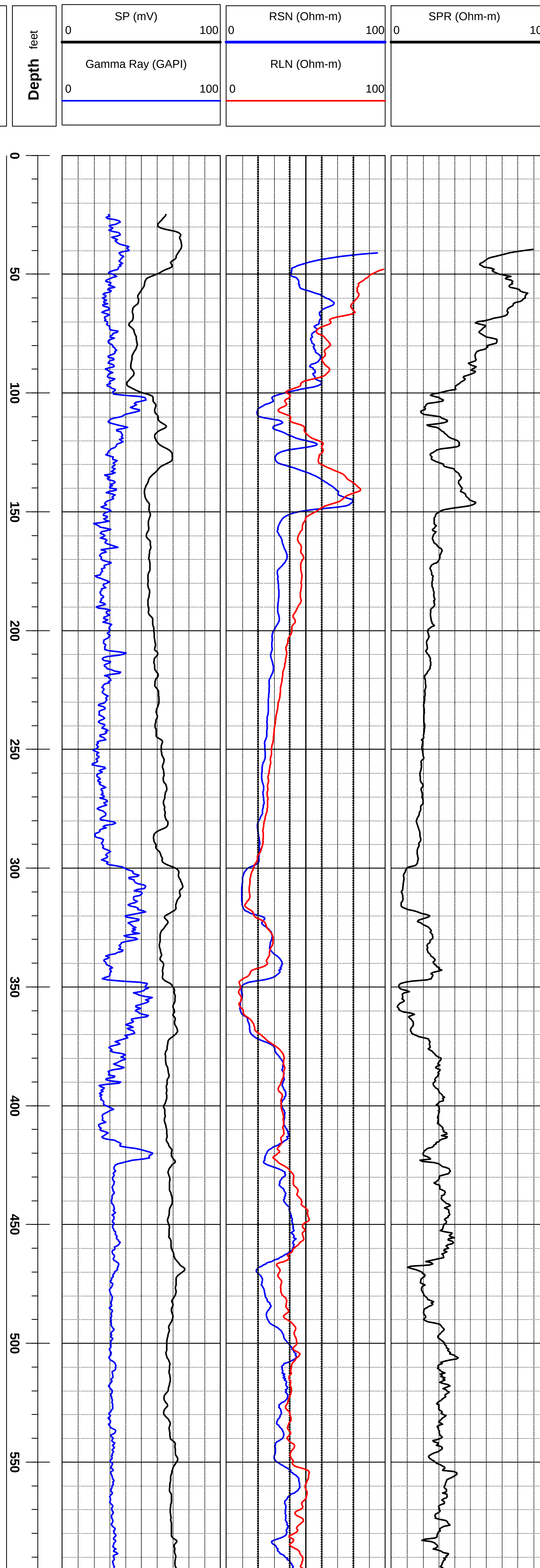
Well #2 Location



Owner:	**Pajaro/Sunny Mesa Community Services District**	Drilling company:	**Maggiora Bros. Drilling Co.**
Well location:	**1812 Springfield Road, Moss Landing CA 95039**	Driller:	**Victor Rodriguez**
APN:	**413-014-001**	Drilling rig:	**Ingersoll Rand TH60**
Latitude, Longitude:	**N 36° 50' 16.59"; W 121° 46' 7.19"**	Driling bits:	**8 ¾ inches, then reamed to 16 inches**
Ground surface elevation:	**142 feet WGS84**	Depth of borehole:	**600 feet**
Start drilling date:	**November 6, 2017**	Depth of casing:	**600 feet**
Well completion date:	**November 17, 2017**	Diameter of casing:	**8-inch PVC**
Borehole geologist:	**Gustavo Porras**	Geophysical log:	**Craig Newman**

Depth (feet)	Lithology	Remarks
0	RED SAND WITH CLAY: Brown (7.5YR 4/2) to reddish brown (5YR 4/4) fine to medium, subangular to subrounded, well sorted loamy, clayey sand	0 to 600 ft.: drilled pilot hole with 8 ¾ -inch bit; cuttings samples were collected as lithology changed; reamed with 16-inch bit.
	WHITE/YELLOW CLAY: Grayish brown (2.5YR 5/2) to (10YR 5/2) silty clay	0 to 490 ft.: 8-inch blank SDR-17 well casing
50	Gravel and Sand: Yellowish brown (10YR 5/4) to brown (10YR 5/3) fine to coarse, subangular to subrounded, poorly sorted sand and small gravels of mixed lithology	0 to 470 ft.: Sanitary seal tremmied with cement slurry
	Thin clay lens	
100	RED SAND: (Gradual change to) reddish brown (5YR 4/3) medium to coarse, rounded to subrounded, predominantly quartz grains, well sorted sand	
150		Static water level = 145 feet bgs on 12/8/17
200	Slightly larger sand grains	
250		
300	BLUE/GREY CLAY: Light brownish gray (10YR 6/2) to gray (10YR 5/1) clay	
	BLUE/GREY CLAY AND SAND: Gray (10YR 5/1) to grayish brown (10YR 5/2) fine to coarse, subangular to subrounded, well sorted sand with clay	
350	RED SAND: Yellowish brown (10YR 5/4) fine to medium, subangular to subrounded, medium sorted sand	
	BLUE/GREY CLAY: Light brownish gray (10YR 6/2) clay	
	Gravel and Sand: Dark yellowish brown (10YR 4/4) to dark gray (10YR 4/1)medium to coarse, angular to subrounded, well sorted, with some shale fragments and diverse lithology, sand	
400	Harder layer with shale fragments	
450	Dark to light grey-green shale pieces interbedded with sand.	
	RED SAND: Yellowish brown (10YR 5/4) fine to medium, subangular to subrounded, medium sorted sand	470 to 600 ft.: Sand pack: 8/16"
500		490 to 590 ft.: 8-inch screened 0.032 inch slot SDR-21 well casing
550	Shale fragments	
		590 to 600 ft.: 5-inch blank SDR-17 well casing
600		Bottom of well capped

Well Construction



ELECTRIC LOG
GAMMA-RAY LOG

Job No. 74380

File No. D00313

Company	MAGGIORA BROS. DRILLING
Well	1815 SPRINGFIELD RD.
Field	SPRINGFIELD TERRACE
County	SANTA CRUZ
State	CALIFORNIA

Location:

lat 36.837935o lon -121.768630o
1815 SPRINGFIELD RD.

Sec. - Twp. - Rge. -

Other Services:

NONE

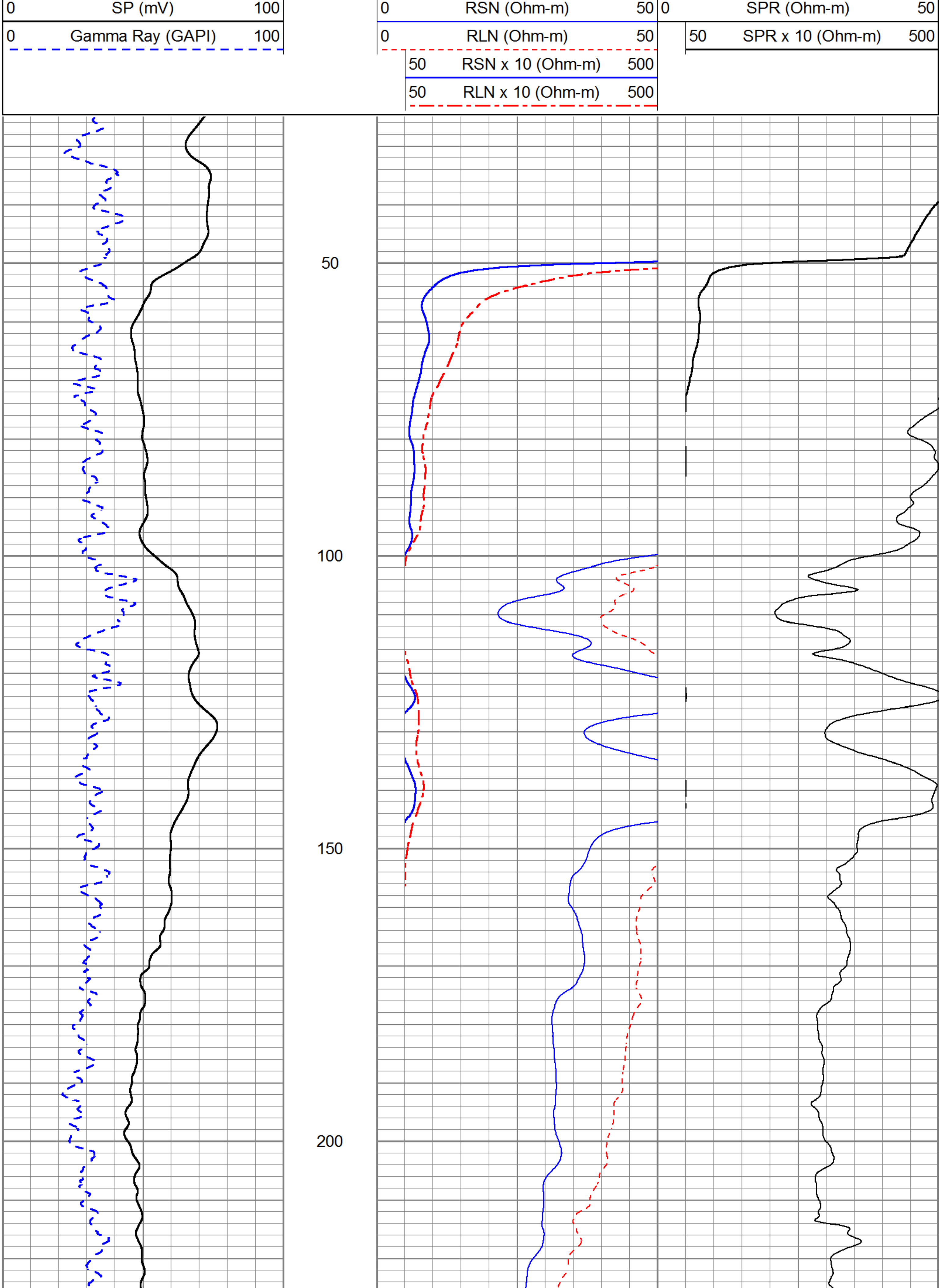
Permanent Datum	GROUND LEVEL	Elevation 142'	Elevation
Log Measured From	GROUND LEVEL	above perm. datum	K.B.
Drilling Measured From	GROUND LEVEL		D.F.
			G.L.

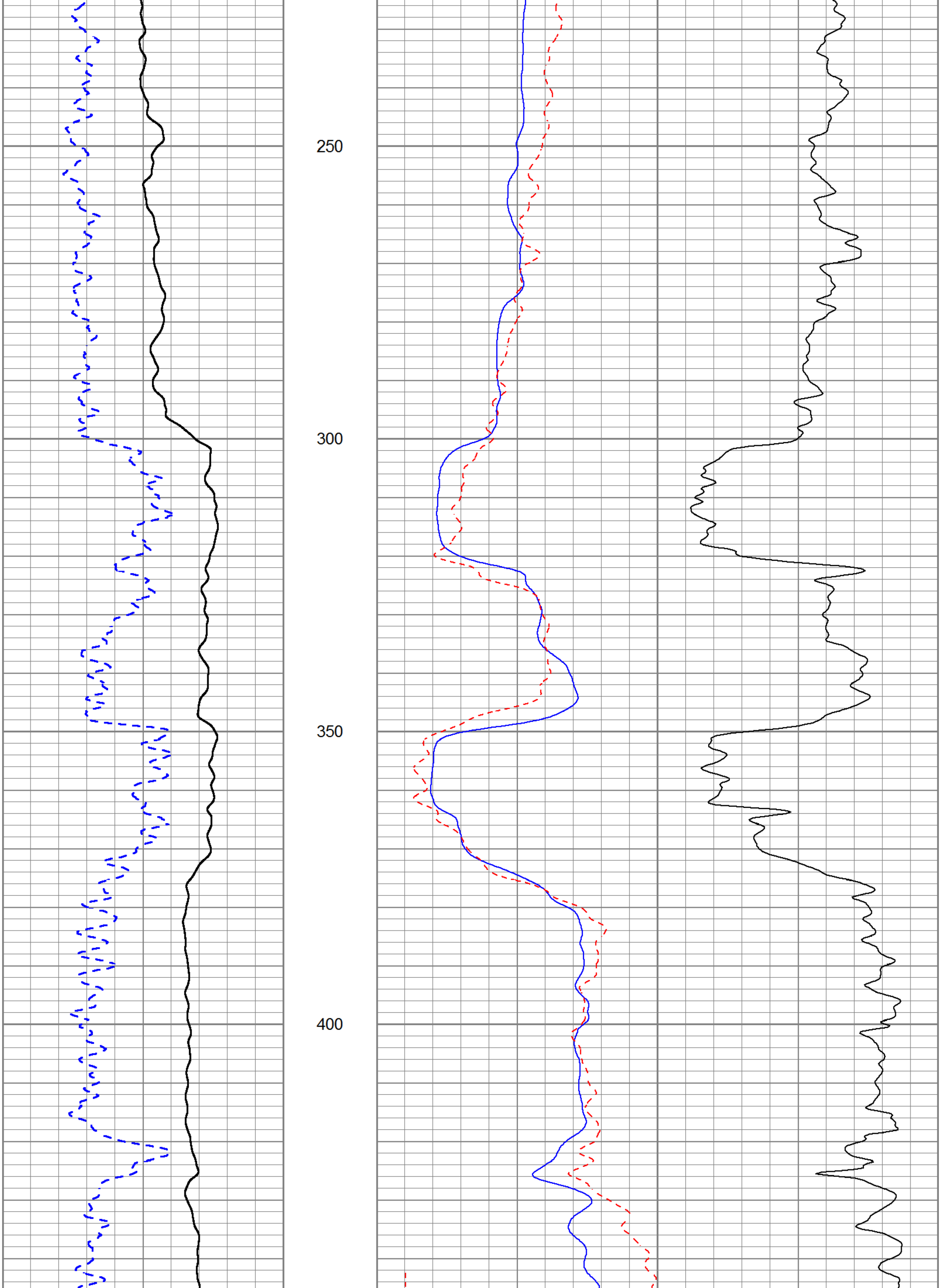
Date	11/8/2017		
Run Number	ONE		
Depth Driller	611'		
Depth Logger	611'		
Bottom Logged Interval	611'		
Top Log Interval	20'		
Casing Driller	NONE		
Casing Logger	NONE		
Bit Size	8 3/4"		
Type Fluid in Hole	BENTONITE		
Density / Viscosity	N/A		
pH / Fluid Loss	N/A		
Source of Sample	PIT		
Rm @ Meas. Temp	8.0 @ 74.3 F		
Rmf @ Meas. Temp	8.6 @ 75.5 F		
Rmc @ Meas. Temp	N/A		
Source of Rmf / Rmc	MEAS.		
Rm @ BHT	N/A		
Time Circulation Stopped	1 HOUR		
Time Logger on Bottom	N/A		
Max. Recorded Temperature	-		
Equipment Number	LV-2		
Location	SNS		
Recorded By	M. NEWMAN		
Witnessed By	V. RODRIQUEZ		

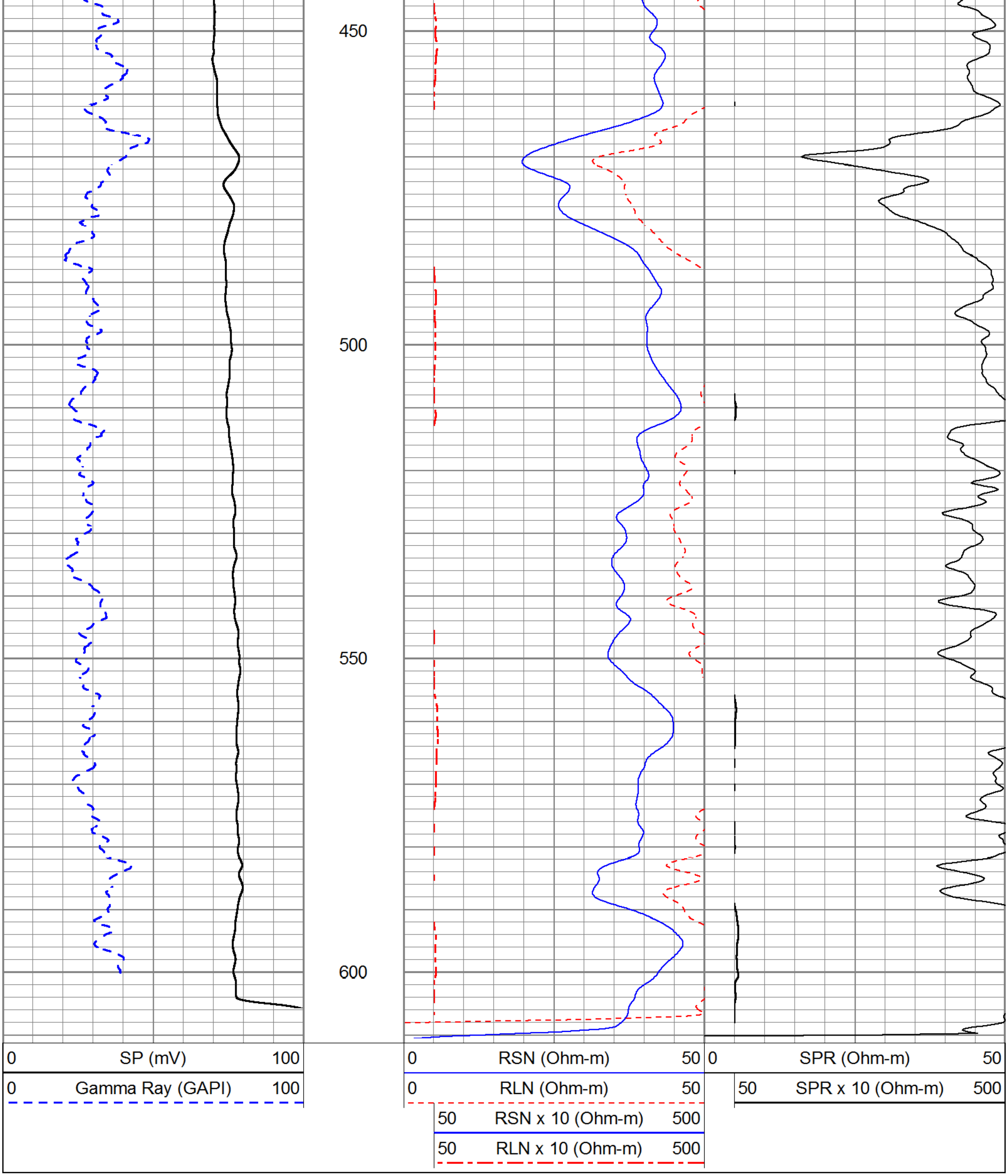
<<< Fold Here >>>

Comments

Database File	74380.db
Dataset Pathname	pass2.1
Presentation Format	elog
Dataset Creation	Thu Nov 09 08:18:22 2017
Charted by	Depth in Feet scaled 1:240


0 SP (mV) 100
0 Gamma Ray (GAPI) 100
0 RSN (Ohm-m) 50
0 RLN (Ohm-m) 50
50 RSN x 10 (Ohm-m) 500
50 RLN x 10 (Ohm-m) 500
0 SPR (Ohm-m) 50
50 SPR x 10 (Ohm-m) 500
50
100
150
200


250
300
350
400


450
500
550
600
0 SP (mV) 100
0 Gamma Ray (GAPI) 100
0 RSN (Ohm-m) 50
0 RLN (Ohm-m) 50
50 RSN x 10 (Ohm-m) 500
50 RLN x 10 (Ohm-m) 500
0 SPR (Ohm-m) 50
50 SPR x 10 (Ohm-m) 500

Newman Well Surveys

a full service geophysical well logging company

Water Quality Analysis

Company:	Maggiora Bros. Drilling	**Date:**	8-Nov-17
Well:	1815 Springfield Rd.	**Run:**	One
Field:	Springfield Terrace	**Job Ticket:**	74380
State:	California	**Total Depth:**	611 ft

Rmf @ Temp: 8.8 **Temp:** 75.5
Corrected Rmf @ 75 degree F: 8.85
Rm @ Temp: 8.0 @ 74.3 F

Depth		S.P. mV	Rwe ohm-m	Rw *NaCl* ohm-m	Rw *NaHCO3* ohm-m	EC umhos		T.D.S *ppm*		Remarks
						NaCl	*NaHCO3*	NaCl	$NaHCO_3$	
145 ft to	302 ft	-5.00	7.5	9.8	11.5	1019.0	866.2	540.1	866.2	Class I
320 ft to	350 ft	-5.00	7.5	9.8	11.5	1019.0	866.2	540.1	866.2	Class I
370 ft to	470 ft	-4.00	7.8	10.2	12.0	979.1	832.3	518.9	832.3	Class I
480 ft to	611 ft	-2.00	8.3	11.1	13.0	903.9	768.3	479.1	768.3	Class I

Class I : Less than *700* ppm (mg/l) Excellent to Good Quality
Class II : *700* to *2000* ppm (mg/l) Good to Injurious Quality
Class III: More than *2000* ppm (mg/l) Injurious to Unsatisfactory

APPENDIX G

Springfield Well No. 2 Water-Quality Reports

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
CALIFORNIA
95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Balance Hydrologics Inc.
800 Bancroft Way, Suite 101
Berkeley, CA 94710-2227
Attn: Mark Woyshner

Work Order #: 7120730
Reporting Date: January 9, 2018

Date Received:	December 20, 2017
Project # / Name:	215021 / Pajaro Sunny Mesa CSD
Water System #:	NA
Sample Identification:	Springfield Well #2, sampled 12/19/2017 5:00:00PM
Sampler Name / Co.:	Gustavo Porras / Balance Hydrologics
Matrix:	Water
Laboratory #:	7120730-01

	Results	Units	RL	State Drinking Water Limits 1	Analysis Method	Date Analyzed	Flags
General Mineral							
pH	7.8	pH Units	0.1	-	SM4500-H+ B	12/20/17	
Specific Conductance (EC)	700	uS/cm	1.0	1600	SM2510B	12/20/17	
Hydroxide as OH	ND	mg/L	2.0	-	SM 2320B	12/20/17	
Carbonate as CO3	ND	mg/L	2.0	-	SM 2320B	12/20/17	
Bicarbonate as HCO3	300	mg/L	2.0	-	SM 2320B	12/20/17	
Total Alkalinity as CaCO3	240	mg/L	2.0	-	SM 2320B	12/20/17	
Hardness	250	mg/L	5.0	-	SM 2340 B	12/22/17	
Total Dissolved Solids	410	mg/L	10	1000	SM2540C	12/20/17	
Chloride	55	mg/L	1.0	500	EPA 300.0	12/22/17	
Sulfate as SO4	54	mg/L	1.0	500	EPA 300.0	12/22/17	
Fluoride	0.15	mg/L	0.10	2	EPA 300.0	12/22/17	
Calcium	41	mg/L	0.50	-	EPA 200.7	12/22/17	
Magnesium	35	mg/L	0.50	-	EPA 200.7	12/22/17	
Potassium	2.5	mg/L	0.50	-	EPA 200.7	12/22/17	
Sodium	51	mg/L	0.50	-	EPA 200.7	12/22/17	
Iron	ND	ug/L	50	300	EPA 200.7	12/22/17	
Manganese	ND	ug/L	20	50	EPA 200.7	12/22/17	
Copper	ND	ug/L	50	1000	EPA 200.7	12/22/17	
Zinc	ND	ug/L	50	5000	EPA 200.7	12/22/17	
Inorganics							
Nitrate+Nitrite as N	0.12	mg/L	0.10	10	EPA 300.0	12/22/17	
Arsenic	ND	ug/L	2.0	10	EPA 200.8	01/04/18	
Barium	ND	ug/L	100	1000	EPA 200.7	12/22/17	
Boron	270	ug/L	100	-	EPA 200.7	12/22/17	

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.
State Drinking Water Limits1 - as listed by California Administrative Code, Title 22.
* - a * in the left hand margin of the report means that particular constituent is above the California Drinking Water Limits.

Mike Galloway

ANALYTICAL CHEMISTS
and
BACTERIOLOGISTS
Approved by State of California

SOIL CONTROL LAB

42 HANGAR WAY
WATSONVILLE
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95076
USA

TEL: 831-724-5422
FAX: 831-724-3188

Balance Hydrologics Inc.
800 Bancroft Way, Suite 101
Berkeley, CA 94710-2227
Attn: Mark Woyshner

Work Order #: 7120730
Reporting Date: January 9, 2018

Date Received: December 20, 2017
Project # / Name: 215021 / Pajaro Sunny Mesa CSD
Water System #: NA
Sample Identification: Springfield Well #2, sampled 12/19/2017 5:00:00PM
Sampler Name / Co.: Gustavo Porras / Balance Hydrologics
Matrix: Water
Laboratory #: 7120730-01

	Results	Units	RL	State Drinking Water Limits 1	Analysis Method	Date Analyzed	Flags
Inorganics							
Cadmium	ND	ug/L	1.0	5	EPA 200.8	01/04/18	
Chromium	7.3	ug/L	1.0	50	EPA 200.8	01/04/18	
Cyanide (total)	ND	ug/L	100	200	SM 4500-CN F	12/20/17	
Lead	ND	ug/L	5.0	15	EPA 200.8	01/04/18	
Mercury	ND	ug/L	1.0	2	EPA 245.1	01/04/18	
Selenium	ND	ug/L	5.0	50	EPA 200.8	01/04/18	
Silver	ND	ug/L	10	100	EPA 200.8	01/04/18	
MBAS (Surfactants)	ND	mg/L	0.025	0.5	SM5540C	12/20/17	
Aluminum	ND	ug/L	50	1000	EPA 200.7	12/22/17	
Antimony	ND	ug/L	6.0	6	EPA 200.8	01/04/18	
Beryllium	ND	ug/L	1.0	4	EPA 200.7	12/22/17	
Nickel	ND	ug/L	10	100	EPA 200.7	12/22/17	
Thallium	ND	ug/L	1.0	2	EPA 200.8	01/04/18	
Nitrite as N	ND	mg/L	0.10	1	EPA 300.0	12/22/17	
General Physical							
Color	ND	Color Units	3.0	-	SM 2120B	12/20/17	
Threshold Odor No.	ND	T.O.N.	1.0	-	SM 2150B	12/20/17	
Turbidity	0.10	NTU	0.10	-	SM 2130B	12/20/17	
Nitrate as N	0.12	mg/L	0.10	10	EPA 300.0	12/22/17	

RL - are levels down to which we can quantify with reliability, a result below this level is reported as "ND" for Not Detected.
State Drinking Water Limits1 - as listed by California Administrative Code, Title 22.
* - a * in the left hand margin of the report means that particular constituent is above the California Drinking Water Limits.

Mike Galloway

BSK Associates Laboratory Fresno
1414 Stanislaus St
Fresno, CA 93706
559-497-2888 (Main)
559-485-6935 (FAX)

A7L2428
1/23/2018
Invoice: A732318

Mark Woyshner
Balance Hydrologics, Inc.
800 Bancroft Way, Suite 101
Berkeley, CA 94710-2227

RE: Report for A7L2428 General Chemistry

Dear Mark Woyshner,

Thank you for using BSK Associates for your analytical testing needs. In the following pages, you will find the test results for the samples submitted to our laboratory on 12/21/2017. The results have been approved for release by our Laboratory Director as indicated by the authorizing signature below.

The samples were analyzed for the test(s) indicated on the Chain of Custody (see attached) and the results relate only to the samples analyzed. BSK certifies that the testing was performed in accordance with the quality system requirements specified in the 2009 TNI Standard. Any deviations from this standard or from the method requirements for each test procedure performed will be annotated alongside the analytical result or noted in the Case Narrative. Unless otherwise noted, the sample results are reported on an "as received" basis.

If additional clarification of any information is required, please contact your Project Manager, True Lee , at 559-497-2888.

Thanks again for using BSK Associates. We value your business and appreciate your loyalty.

Sincerely,

True Lee, Project Manager

Accredited in Accordance with NELAP
ORELAP #4021

Case Narrative

Project and Report Details		Invoice Details	
Client:	Balance Hydrologics, Inc.	**Invoice To:**	Balance Hydrologics, Inc.
Report To:	Mark Woyshner	**Invoice Attn:**	Rachel Boitano
Project #:	Springfield New Well	**Project PO#:**	-
Received:	12/21/2017 - 11:58		
Report Due:	1/23/2018		

Sample Receipt Conditions

Cooler: Default Cooler

Temperature on Receipt °C: 3.5

Containers Intact
COC/Labels Agree
Received On Blue Ice
Packing Material - Bubble Wrap
Sample(s) were received in temperature range.
Initial receipt at BSK-FAL

Detailed Narrative

Chain of Custody Notes

Date: 12/22/2017

Initials: TRL

Note: Received empty bottle for EPA 531. Notified Mark and EPA 531 cancelled.

Data Qualifiers

The following qualifiers have been applied to one or more analytical results:

BS	Blank spike recoveries did not meet acceptance limits.
BS1.0	Blank spike recovery for this analyte was biased high; no material impact on reported result as sample is ND for this parameter.
CV0.0	CCV recovery was above method acceptance limits; no material impact on reported result as sample is ND for this parameter.
MS1.0	Matrix spike recoveries exceed control limits.

Report Distribution

Recipient(s)	Report Format	CC:
Gustavo Porras	FINAL.RPT	
Jason Parke	FINAL.RPT	
Mark Woyshner	FINAL.RPT	

Certificate of Analysis

Sample ID: A7L2428-01
Sampled By: Client
Sample Description: Springfield New Well #2

Sample Date - Time: 12/19/17 - 16:25
Matrix: Water
Sample Type: Grab

BSK Associates Laboratory Fresno

General Chemistry

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Conductivity @ 25C	SM 2510B	**690**	1.0	umhos/cm	1	A716714	12/22/17	12/22/17	
Hexavalent Chromium	EPA 218.7	**6.6**	0.050	ug/L	1	A716766	12/26/17	12/26/17	
Perchlorate	EPA 314.0	ND	2.0	ug/L	1	A716909	12/29/17	12/29/17	

Radiological

Analyte	Method	Result	Units	Batch	Prepared	Analyzed	Qual
Gross Alpha	SM 7110C	**2.52**	pCi/L	A800004	01/02/18	01/03/18	
Gross Alpha 1.65 Sigma Uncertainty	SM 7110C	**0.291**	pCi/L	A800004	01/02/18	01/03/18	
Gross Alpha MDA95	SM 7110C	**1.06**	pCi/L	A800004	01/02/18	01/03/18	

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Chlorinated Acid Herbicides by GC-ECD									
2,4,5-T	EPA 515.4	ND	1.0	ug/L	1	A716839	12/27/17	01/03/18	
2,4,5-TP (Silvex)	EPA 515.4	ND	1.0	ug/L	1	A716839	12/27/17	01/03/18	
2,4-D	EPA 515.4	ND	10	ug/L	1	A716839	12/27/17	01/03/18	
Bentazon	EPA 515.4	ND	2.0	ug/L	1	A716839	12/27/17	01/03/18	
Dalapon	EPA 515.4	ND	10	ug/L	1	A716839	12/27/17	01/03/18	
Dicamba	EPA 515.4	ND	1.5	ug/L	1	A716839	12/27/17	01/03/18	
Dinoseb	EPA 515.4	ND	2.0	ug/L	1	A716839	12/27/17	01/03/18	
Pentachlorophenol	EPA 515.4	ND	0.20	ug/L	1	A716839	12/27/17	01/03/18	
Picloram	EPA 515.4	ND	1.0	ug/L	1	A716839	12/27/17	01/03/18	
Surrogate: DCPAA	EPA 515.4	94 %	*Acceptable range: 70-130 %*						
Volatile Organics by GC-MS									
1,1,1,2-Tetrachloroethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,1,1-Trichloroethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,1,2,2-Tetrachloroethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 524.2	ND	10	ug/L	1	A716740	12/22/17	12/22/17	
1,1,2-Trichloroethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,1-Dichloroethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,1-Dichloroethene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,1-Dichloropropene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,2,3-Trichlorobenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,2,4-Trichlorobenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,2,4-Trimethylbenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,2-Dichlorobenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,2-Dichloroethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,2-Dichloropropane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,3,5-Trimethylbenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,3-Dichlorobenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	

Certificate of Analysis

Sample ID: A7L2428-01
Sampled By: Client
Sample Description: Springfield New Well #2

Sample Date - Time: 12/19/17 - 16:25
Matrix: Water
Sample Type: Grab

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Volatile Organics by GC-MS									
1,3-Dichloropropane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
1,4-Dichlorobenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
2,2-Dichloropropane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
2-Butanone	EPA 524.2	ND	5.0	ug/L	1	A716740	12/22/17	12/22/17	
2-Chlorotoluene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
2-Hexanone	EPA 524.2	ND	10	ug/L	1	A716740	12/22/17	12/22/17	
4-Chlorotoluene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
4-Methyl-2-pentanone	EPA 524.2	ND	5.0	ug/L	1	A716740	12/22/17	12/22/17	
Acetone	EPA 524.2	ND	10	ug/L	1	A716740	12/22/17	12/22/17	
Benzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Bromobenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Bromochloromethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Bromodichloromethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Bromoform	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Bromomethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Carbon Tetrachloride	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Chlorobenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Chloroethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Chloroform	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Chloromethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
cis-1,2-Dichloroethene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
cis-1,3-Dichloropropene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Dibromochloromethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Dibromomethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Dichlorodifluoromethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Dichloromethane	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Di-isopropyl ether (DIPE)	EPA 524.2	ND	3.0	ug/L	1	A716740	12/22/17	12/22/17	
Ethyl tert-Butyl Ether (ETBE)	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Ethylbenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Hexachlorobutadiene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Isopropylbenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
m,p-Xylenes	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Methyl-t-butyl ether	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Naphthalene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
n-Butylbenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
n-Propylbenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
o-Xylene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
p-Isopropyltoluene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
sec-Butylbenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Styrene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
tert-Amyl Methyl Ether (TAME)	EPA 524.2	ND	3.0	ug/L	1	A716740	12/22/17	12/22/17	
tert-Butyl alcohol (TBA)	EPA 524.2	ND	2.0	ug/L	1	A716740	12/22/17	12/22/17	
tert-Butylbenzene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Tetrachloroethene (PCE)	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	

Certificate of Analysis

Sample ID: A7L2428-01
Sampled By: Client
Sample Description: Springfield New Well #2

Sample Date - Time: 12/19/17 - 16:25
Matrix: Water
Sample Type: Grab

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Volatile Organics by GC-MS									
Toluene	EPA 524.2	**0.63**	0.50	ug/L	1	A716740	12/22/17	12/22/17	
trans-1,2-Dichloroethene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
trans-1,3-Dichloropropene	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Trichloroethene (TCE)	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	
Trichlorofluoromethane	EPA 524.2	ND	5.0	ug/L	1	A716740	12/22/17	12/22/17	
Vinyl Chloride	EPA 524.2	ND	0.50	ug/L	1	A716740	12/22/17	12/22/17	BS1.0
Surrogate: 1,2-Dichlorobenzene-d4	EPA 524.2	104 %	*Acceptable range: 70-130 %*						
Surrogate: Bromofluorobenzene	EPA 524.2	105 %	*Acceptable range: 70-130 %*						
Total 1,3-Dichloropropene		ND	0.50	ug/L					
Total Trihalomethanes		ND	0.50	ug/L					
Total Xylenes, EPA 524.2		ND	0.50	ug/L					
Semi-Volatile Organics by GC-MS									
Alachlor	EPA 525.3	ND	1.0	ug/L	1	A716710	12/21/17	12/27/17	
Atrazine	EPA 525.3	ND	0.50	ug/L	1	A716710	12/21/17	12/27/17	
Benzo(a)pyrene	EPA 525.3	ND	0.10	ug/L	1	A716710	12/21/17	12/27/17	
Bis(2-ethylhexyl) adipate	EPA 525.3	ND	3.0	ug/L	1	A716710	12/21/17	12/27/17	
Bis(2-ethylhexyl) phthalate	EPA 525.3	ND	3.0	ug/L	1	A716710	12/21/17	12/27/17	
Bromacil	EPA 525.3	ND	10	ug/L	1	A716710	12/21/17	12/27/17	
Butachlor	EPA 525.3	ND	0.38	ug/L	1	A716710	12/21/17	12/27/17	
Diazinon	EPA 525.3	ND	0.25	ug/L	1	A716710	12/21/17	12/27/17	
Dimethoate	EPA 525.3	ND	10	ug/L	1	A716710	12/21/17	12/27/17	
Metolachlor	EPA 525.3	ND	0.50	ug/L	1	A716710	12/21/17	12/27/17	
Metribuzin	EPA 525.3	ND	0.50	ug/L	1	A716710	12/21/17	12/27/17	
Molinate	EPA 525.3	ND	2.0	ug/L	1	A716710	12/21/17	12/27/17	
Propachlor	EPA 525.3	ND	0.50	ug/L	1	A716710	12/21/17	12/27/17	
Simazine	EPA 525.3	ND	1.0	ug/L	1	A716710	12/21/17	12/27/17	
Thiobencarb	EPA 525.3	ND	1.0	ug/L	1	A716710	12/21/17	12/27/17	
Surrogate: 1,3-Dimethyl-2-nitrobenzene	EPA 525.3	108 %	*Acceptable range: 70-130 %*						
Surrogate: Benzo(a)pyrene-d12	EPA 525.3	123 %	*Acceptable range: 70-130 %*						
Surrogate: Triphenyl Phosphate	EPA 525.3	100 %	*Acceptable range: 70-130 %*						
Diquat by HPLC									
Diquat	EPA 549.2	ND	4.0	ug/L	1	A716758	12/22/17	12/29/17	CV0.0

BSK Associates Laboratory Fresno

General Chemistry Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
EPA 218.7 - Quality Control											
Batch: A716766 Prepared: 12/26/2017											
Prep Method: Method Specific Preparation Analyst: CEG											
Blank (A716766-BLK1)											
Hexavalent Chromium	ND	0.050	ug/L							12/26/17	
Blank Spike (A716766-BS1)											
Hexavalent Chromium	0.035	0.050	ug/L	0.050		70	50-150			12/26/17	
Matrix Spike (A716766-MS1), Source: A7L2496-08											
Hexavalent Chromium	6.4	0.050	ug/L	2.0	4.6	90	85-115			12/26/17	
Matrix Spike Dup (A716766-MSD1), Source: A7L2496-08											
Hexavalent Chromium	6.4	0.050	ug/L	2.0	4.6	88	85-115	1	15	12/26/17	
EPA 314.0 - Quality Control											
Batch: A716909 Prepared: 12/28/2017											
Prep Method: Method Specific Preparation Analyst: RES											
Blank (A716909-BLK1)											
Perchlorate	ND	2.0	ug/L							12/28/17	
Blank Spike (A716909-BS1)											
Perchlorate	16	2.0	ug/L	15		104	85-115			12/28/17	
Matrix Spike (A716909-MS1), Source: A7L2015-01RE1											
Perchlorate	6.6	2.0	ug/L	5.0	ND	99	80-120			12/28/17	
Matrix Spike Dup (A716909-MSD1), Source: A7L2015-01RE1											
Perchlorate	6.7	2.0	ug/L	5.0	ND	101	80-120	2	15	12/28/17	
SM 2510B - Quality Control											
Batch: A716714 Prepared: 12/22/2017											
Prep Method: Method Specific Preparation Analyst: CEG											
Blank Spike (A716714-BS1)											
Conductivity @ 25C	1400	1.0	umhos/cm	1400		99	90-110			12/22/17	
Blank Spike Dup (A716714-BSD1)											
Conductivity @ 25C	1400	1.0	umhos/cm	1400		99	90-110	0	20	12/22/17	
Duplicate (A716714-DUP1), Source: A7L2456-01											
Conductivity @ 25C	590	1.0	umhos/cm		590			1	20	12/22/17	

BSK Associates Laboratory Fresno
Organics Quality Control Report

EPA 515.4 - Quality Control

Batch: A716839 Prepared: 12/27/2017
Prep Method: EPA 515.4 Analyst: YNV

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank (A716839-BLK1)											
2,4,5-T	ND	1.0	ug/L							01/03/18	
2,4,5-TP (Silvex)	ND	1.0	ug/L							01/03/18	
2,4-D	ND	10	ug/L							01/03/18	
Bentazon	ND	2.0	ug/L							01/03/18	
Dalapon	ND	10	ug/L							01/03/18	
Dicamba	ND	1.5	ug/L							01/03/18	
Dinoseb	ND	2.0	ug/L							01/03/18	
Pentachlorophenol	ND	0.20	ug/L							01/03/18	
Picloram	ND	1.0	ug/L							01/03/18	
Surrogate: DCPAA	*35*			*36*		*97*	*70-130*			01/03/18	
Blank Spike (A716839-BS1)											
2,4,5-T	3.9	1.0	ug/L	4.0		98	70-130			01/03/18	
2,4,5-TP (Silvex)	0.83	1.0	ug/L	0.80		104	70-130			01/03/18	
2,4-D	0.41	10	ug/L	0.40		102	70-130			01/03/18	
Bentazon	7.8	2.0	ug/L	8.0		98	70-130			01/03/18	
Dalapon	4.0	10	ug/L	4.0		101	70-130			01/03/18	
Dicamba	0.79	1.5	ug/L	0.80		99	70-130			01/03/18	
Dinoseb	0.80	2.0	ug/L	0.80		100	70-130			01/03/18	
Pentachlorophenol	0.16	0.20	ug/L	0.16		100	70-130			01/03/18	
Picloram	0.37	1.0	ug/L	0.40		93	70-130			01/03/18	
Surrogate: DCPAA	*36*			*36*		*99*	*70-130*			01/03/18	
Blank Spike Dup (A716839-BSD1)											
2,4,5-T	4.0	1.0	ug/L	4.0		100	70-130	2	20	01/03/18	
2,4,5-TP (Silvex)	0.85	1.0	ug/L	0.80		106	70-130	2	20	01/03/18	
2,4-D	0.40	10	ug/L	0.40		99	70-130	3	20	01/03/18	
Bentazon	7.8	2.0	ug/L	8.0		98	70-130	0	20	01/03/18	
Dalapon	4.1	10	ug/L	4.0		103	70-130	2	20	01/03/18	
Dicamba	0.81	1.5	ug/L	0.80		101	70-130	2	20	01/03/18	
Dinoseb	0.82	2.0	ug/L	0.80		102	70-130	2	20	01/03/18	
Pentachlorophenol	0.16	0.20	ug/L	0.16		102	70-130	1	20	01/03/18	
Picloram	0.39	1.0	ug/L	0.40		98	70-130	6	20	01/03/18	
Surrogate: DCPAA	*35*			*36*		*98*	*70-130*			01/03/18	
Matrix Spike (A716839-MS1), Source: A7L2122-01											
2,4,5-T	3.4	1.0	ug/L	4.0	ND	85	70-130			01/03/18	
2,4,5-TP (Silvex)	0.69	1.0	ug/L	0.80	ND	87	70-130			01/03/18	
2,4-D	0.30	10	ug/L	0.40	ND	76	70-130			01/03/18	
Bentazon	ND	2.0	ug/L	8.0	ND	0	70-130			01/03/18	MS1.0 ***Low***
Dalapon	4.0	10	ug/L	4.0	ND	101	70-130			01/03/18	
Dicamba	0.76	1.5	ug/L	0.80	ND	95	70-130			01/03/18	
Dinoseb	0.70	2.0	ug/L	0.80	ND	87	70-130			01/03/18	
Pentachlorophenol	ND	0.20	ug/L	0.16	ND	0	70-130			01/03/18	MS1.0 ***Low***
Picloram	0.37	1.0	ug/L	0.40	ND	93	70-130			01/03/18	
Surrogate: DCPAA	*33*			*36*		*92*	*70-130*			01/03/18	

BSK Associates Laboratory Fresno

Organics Quality Control Report

EPA 515.4 - Quality Control

Batch: A716839 Prepared: 12/27/2017

Prep Method: EPA 515.4 Analyst: YNV

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Matrix Spike Dup (A716839-MSD1), Source: A7L2122-01											
2,4,5-T	3.4	1.0	ug/L	4.0	ND	84	70-130	1	30	01/03/18	
2,4,5-TP (Silvex)	0.67	1.0	ug/L	0.80	ND	84	70-130	3	30	01/03/18	
2,4-D	0.29	10	ug/L	0.40	ND	72	70-130	5	30	01/03/18	
Bentazon	ND	2.0	ug/L	8.0	ND	0	70-130		30	01/03/18	MS1.0 ***Low***
Dalapon	4.0	10	ug/L	4.0	ND	100	70-130	1	30	01/03/18	
Dicamba	0.75	1.5	ug/L	0.80	ND	93	70-130	2	30	01/03/18	
Dinoseb	0.69	2.0	ug/L	0.80	ND	86	70-130	2	30	01/03/18	
Pentachlorophenol	ND	0.20	ug/L	0.16	ND	0	70-130		30	01/03/18	MS1.0 ***Low***
Picloram	0.38	1.0	ug/L	0.40	ND	96	70-130	3	30	01/03/18	
Surrogate: DCPAA	*33*			*36*		*91*	*70-130*			01/03/18	

EPA 524.2 - Quality Control

Batch: A716740 Prepared: 12/22/2017

Prep Method: EPA 524.2 Analyst: ANM

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank (A716740-BLK1)											
1,1,1,2-Tetrachloroethane	ND	0.50	ug/L							12/22/17	
1,1,1-Trichloroethane	ND	0.50	ug/L							12/22/17	
1,1,2,2-Tetrachloroethane	ND	0.50	ug/L							12/22/17	
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	10	ug/L							12/22/17	
1,1,2-Trichloroethane	ND	0.50	ug/L							12/22/17	
1,1-Dichloroethane	ND	0.50	ug/L							12/22/17	
1,1-Dichloroethene	ND	0.50	ug/L							12/22/17	
1,1-Dichloropropene	ND	0.50	ug/L							12/22/17	
1,2,3-Trichlorobenzene	ND	0.50	ug/L							12/22/17	
1,2,4-Trichlorobenzene	ND	0.50	ug/L							12/22/17	
1,2,4-Trimethylbenzene	ND	0.50	ug/L							12/22/17	
1,2-Dichlorobenzene	ND	0.50	ug/L							12/22/17	
1,2-Dichloroethane	ND	0.50	ug/L							12/22/17	
1,2-Dichloropropane	ND	0.50	ug/L							12/22/17	
1,3,5-Trimethylbenzene	ND	0.50	ug/L							12/22/17	
1,3-Dichlorobenzene	ND	0.50	ug/L							12/22/17	
1,3-Dichloropropane	ND	0.50	ug/L							12/22/17	
1,4-Dichlorobenzene	ND	0.50	ug/L							12/22/17	
2,2-Dichloropropane	ND	0.50	ug/L							12/22/17	
2-Butanone	ND	5.0	ug/L							12/22/17	
2-Chlorotoluene	ND	0.50	ug/L							12/22/17	
2-Hexanone	ND	10	ug/L							12/22/17	
4-Chlorotoluene	ND	0.50	ug/L							12/22/17	
4-Methyl-2-pentanone	ND	5.0	ug/L							12/22/17	
Acetone	ND	10	ug/L							12/22/17	
Benzene	ND	0.50	ug/L							12/22/17	
Bromobenzene	ND	0.50	ug/L							12/22/17	
Bromochloromethane	ND	0.50	ug/L							12/22/17	
Bromodichloromethane	ND	0.50	ug/L							12/22/17	
Bromoform	ND	0.50	ug/L							12/22/17	

BSK Associates Laboratory Fresno

Organics Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual

EPA 524.2 - Quality Control

Batch: A716740 Prepared: 12/22/2017

Prep Method: EPA 524.2 Analyst: ANM

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank (A716740-BLK1)											
Bromomethane	ND	0.50	ug/L							12/22/17	
Carbon Tetrachloride	ND	0.50	ug/L							12/22/17	
Chlorobenzene	ND	0.50	ug/L							12/22/17	
Chloroethane	ND	0.50	ug/L							12/22/17	
Chloroform	ND	0.50	ug/L							12/22/17	
Chloromethane	ND	0.50	ug/L							12/22/17	
cis-1,2-Dichloroethene	ND	0.50	ug/L							12/22/17	
cis-1,3-Dichloropropene	ND	0.50	ug/L							12/22/17	
Dibromochloromethane	ND	0.50	ug/L							12/22/17	
Dibromomethane	ND	0.50	ug/L							12/22/17	
Dichlorodifluoromethane	ND	0.50	ug/L							12/22/17	
Dichloromethane	ND	0.50	ug/L							12/22/17	
Di-isopropyl ether (DIPE)	ND	3.0	ug/L							12/22/17	
Ethyl tert-Butyl Ether (ETBE)	ND	0.50	ug/L							12/22/17	
Ethylbenzene	ND	0.50	ug/L							12/22/17	
Hexachlorobutadiene	ND	0.50	ug/L							12/22/17	
Isopropylbenzene	ND	0.50	ug/L							12/22/17	
m,p-Xylenes	ND	0.50	ug/L							12/22/17	
Methyl-t-butyl ether	ND	0.50	ug/L							12/22/17	
Naphthalene	ND	0.50	ug/L							12/22/17	
n-Butylbenzene	ND	0.50	ug/L							12/22/17	
n-Propylbenzene	ND	0.50	ug/L							12/22/17	
o-Xylene	ND	0.50	ug/L							12/22/17	
p-Isopropyltoluene	ND	0.50	ug/L							12/22/17	
sec-Butylbenzene	ND	0.50	ug/L							12/22/17	
Styrene	ND	0.50	ug/L							12/22/17	
tert-Amyl Methyl Ether (TAME)	ND	3.0	ug/L							12/22/17	
tert-Butyl alcohol (TBA)	ND	2.0	ug/L							12/22/17	
tert-Butylbenzene	ND	0.50	ug/L							12/22/17	
Tetrachloroethene (PCE)	ND	0.50	ug/L							12/22/17	
Toluene	ND	0.50	ug/L							12/22/17	
trans-1,2-Dichloroethene	ND	0.50	ug/L							12/22/17	
trans-1,3-Dichloropropene	ND	0.50	ug/L							12/22/17	
Trichloroethene (TCE)	ND	0.50	ug/L							12/22/17	
Trichlorofluoromethane	ND	5.0	ug/L							12/22/17	
Vinyl Chloride	ND	0.50	ug/L							12/22/17	
Surrogate: 1,2-Dichlorobenzene-d4	*49*			*50*		*98*	*70-130*			12/22/17	
Surrogate: Bromofluorobenzene	*50*			*50*		*100*	*70-130*			12/22/17	
Blank Spike (A716740-BS1)											
1,1,1,2-Tetrachloroethane	11	0.50	ug/L	10		109	70-130			12/22/17	
1,1,1-Trichloroethane	11	0.50	ug/L	10		112	70-130			12/22/17	
1,1,2,2-Tetrachloroethane	11	0.50	ug/L	10		109	70-130			12/22/17	
1,1,2-Trichloro-1,2,2-trifluoroethane	11	10	ug/L	10		112	70-130			12/22/17	
1,1,2-Trichloroethane	11	0.50	ug/L	10		110	70-130			12/22/17	
1,1-Dichloroethane	11	0.50	ug/L	10		110	70-130			12/22/17	

BSK Associates Laboratory Fresno

Organics Quality Control Report

EPA 524.2 - Quality Control

Batch: A716740 Prepared: 12/22/2017

Prep Method: EPA 524.2 Analyst: ANM

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank Spike (A716740-BS1)											
1,1-Dichloroethene	11	0.50	ug/L	10		111	70-130			12/22/17	
1,1-Dichloropropene	11	0.50	ug/L	10		110	70-130			12/22/17	
1,2,3-Trichlorobenzene	10	0.50	ug/L	10		101	70-130			12/22/17	
1,2,4-Trichlorobenzene	9.9	0.50	ug/L	10		99	70-130			12/22/17	
1,2,4-Trimethylbenzene	11	0.50	ug/L	10		107	70-130			12/22/17	
1,2-Dichlorobenzene	11	0.50	ug/L	10		110	70-130			12/22/17	
1,2-Dichloroethane	11	0.50	ug/L	10		108	70-130			12/22/17	
1,2-Dichloropropane	11	0.50	ug/L	10		108	70-130			12/22/17	
1,3,5-Trimethylbenzene	11	0.50	ug/L	10		108	70-130			12/22/17	
1,3-Dichlorobenzene	11	0.50	ug/L	10		109	70-130			12/22/17	
1,3-Dichloropropane	11	0.50	ug/L	10		108	70-130			12/22/17	
1,4-Dichlorobenzene	11	0.50	ug/L	10		111	70-130			12/22/17	
2,2-Dichloropropane	12	0.50	ug/L	10		119	70-130			12/22/17	
2-Butanone	11	5.0	ug/L	10		106	70-130			12/22/17	
2-Chlorotoluene	11	0.50	ug/L	10		106	70-130			12/22/17	
2-Hexanone	11	10	ug/L	10		107	70-130			12/22/17	
4-Chlorotoluene	11	0.50	ug/L	10		108	70-130			12/22/17	
4-Methyl-2-pentanone	10	5.0	ug/L	10		104	70-130			12/22/17	
Acetone	11	10	ug/L	10		106	70-130			12/22/17	
Benzene	11	0.50	ug/L	10		109	70-130			12/22/17	
Bromobenzene	11	0.50	ug/L	10		108	70-130			12/22/17	
Bromochloromethane	11	0.50	ug/L	10		107	70-130			12/22/17	
Bromodichloromethane	11	0.50	ug/L	10		109	70-130			12/22/17	
Bromoform	11	0.50	ug/L	10		109	70-130			12/22/17	
Bromomethane	11	0.50	ug/L	10		111	70-130			12/22/17	
Carbon disulfide	12	10	ug/L	10		115	70-130			12/22/17	
Carbon Tetrachloride	11	0.50	ug/L	10		114	70-130			12/22/17	
Chlorobenzene	11	0.50	ug/L	10		109	70-130			12/22/17	
Chloroethane	11	0.50	ug/L	10		109	70-130			12/22/17	
Chloroform	11	0.50	ug/L	10		110	70-130			12/22/17	
Chloromethane	11	0.50	ug/L	10		106	70-130			12/22/17	
cis-1,2-Dichloroethene	11	0.50	ug/L	10		109	70-130			12/22/17	
cis-1,3-Dichloropropene	11	0.50	ug/L	10		107	70-130			12/22/17	
Dibromochloromethane	11	0.50	ug/L	10		110	70-130			12/22/17	
Dibromomethane	11	0.50	ug/L	10		109	70-130			12/22/17	
Dichlorodifluoromethane	11	0.50	ug/L	10		113	70-130			12/22/17	
Dichloromethane	11	0.50	ug/L	10		113	70-130			12/22/17	
Di-isopropyl ether (DIPE)	10	3.0	ug/L	10		100	70-130			12/22/17	
Ethyl tert-Butyl Ether (ETBE)	9.7	0.50	ug/L	10		97	70-130			12/22/17	
Ethylbenzene	11	0.50	ug/L	10		108	70-130			12/22/17	
Hexachlorobutadiene	11	0.50	ug/L	10		111	70-130			12/22/17	
Isopropylbenzene	11	0.50	ug/L	10		109	70-130			12/22/17	
m,p-Xylenes	22	0.50	ug/L	20		110	70-130			12/22/17	
Methyl-t-butyl ether	21	0.50	ug/L	20		104	70-130			12/22/17	
Naphthalene	9.4	0.50	ug/L	10		94	70-130			12/22/17	
n-Butylbenzene	11	0.50	ug/L	10		108	70-130			12/22/17	

BSK Associates Laboratory Fresno

Organics Quality Control Report

EPA 524.2 - Quality Control

Batch: A716740 Prepared: 12/22/2017

Prep Method: EPA 524.2 Analyst: ANM

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank Spike (A716740-BS1)											
n-Propylbenzene	11	0.50	ug/L	10		110	70-130			12/22/17	
o-Xylene	11	0.50	ug/L	10		114	70-130			12/22/17	
p-Isopropyltoluene	11	0.50	ug/L	10		109	70-130			12/22/17	
sec-Butylbenzene	11	0.50	ug/L	10		109	70-130			12/22/17	
Styrene	11	0.50	ug/L	10		107	70-130			12/22/17	
tert-Amyl Methyl Ether (TAME)	10	3.0	ug/L	10		101	70-130			12/22/17	
tert-Butyl alcohol (TBA)	10	2.0	ug/L	10		103	70-130			12/22/17	
tert-Butylbenzene	11	0.50	ug/L	10		109	70-130			12/22/17	
Tetrachloroethene (PCE)	11	0.50	ug/L	10		112	70-130			12/22/17	
Toluene	11	0.50	ug/L	10		108	70-130			12/22/17	
trans-1,2-Dichloroethene	11	0.50	ug/L	10		110	70-130			12/22/17	
trans-1,3-Dichloropropene	11	0.50	ug/L	10		106	70-130			12/22/17	
Trichloroethene (TCE)	11	0.50	ug/L	10		113	70-130			12/22/17	
Trichlorofluoromethane	11	5.0	ug/L	10		109	70-130			12/22/17	
Vinyl Chloride	14	0.50	ug/L	10		135	70-130			12/22/17	BS ***High***
Surrogate: 1,2-Dichlorobenzene-d4	*51*			*50*		*102*	*70-130*			12/22/17	
Surrogate: Bromofluorobenzene	*51*			*50*		*101*	*70-130*			12/22/17	
Blank Spike Dup (A716740-BSD1)											
1,1,1,2-Tetrachloroethane	11	0.50	ug/L	10		108	70-130	1	30	12/22/17	
1,1,1-Trichloroethane	11	0.50	ug/L	10		110	70-130	1	30	12/22/17	
1,1,2,2-Tetrachloroethane	11	0.50	ug/L	10		111	70-130	2	30	12/22/17	
1,1,2-Trichloro-1,2,2-trifluoroethane	11	10	ug/L	10		110	70-130	2	30	12/22/17	
1,1,2-Trichloroethane	11	0.50	ug/L	10		110	70-130	1	30	12/22/17	
1,1-Dichloroethane	11	0.50	ug/L	10		109	70-130	1	30	12/22/17	
1,1-Dichloroethene	11	0.50	ug/L	10		109	70-130	1	30	12/22/17	
1,1-Dichloropropene	11	0.50	ug/L	10		108	70-130	2	30	12/22/17	
1,2,3-Trichlorobenzene	10	0.50	ug/L	10		102	70-130	2	30	12/22/17	
1,2,4-Trichlorobenzene	10	0.50	ug/L	10		104	70-130	5	30	12/22/17	
1,2,4-Trimethylbenzene	11	0.50	ug/L	10		106	70-130	1	30	12/22/17	
1,2-Dichlorobenzene	11	0.50	ug/L	10		110	70-130	0	30	12/22/17	
1,2-Dichloroethane	11	0.50	ug/L	10		108	70-130	0	30	12/22/17	
1,2-Dichloropropane	11	0.50	ug/L	10		109	70-130	0	30	12/22/17	
1,3,5-Trimethylbenzene	11	0.50	ug/L	10		108	70-130	1	30	12/22/17	
1,3-Dichlorobenzene	11	0.50	ug/L	10		109	70-130	1	30	12/22/17	
1,3-Dichloropropane	11	0.50	ug/L	10		110	70-130	2	30	12/22/17	
1,4-Dichlorobenzene	11	0.50	ug/L	10		110	70-130	1	30	12/22/17	
2,2-Dichloropropane	12	0.50	ug/L	10		116	70-130	2	30	12/22/17	
2-Butanone	11	5.0	ug/L	10		106	70-130	0	30	12/22/17	
2-Chlorotoluene	11	0.50	ug/L	10		108	70-130	1	30	12/22/17	
2-Hexanone	11	10	ug/L	10		111	70-130	4	30	12/22/17	
4-Chlorotoluene	11	0.50	ug/L	10		108	70-130	0	30	12/22/17	
4-Methyl-2-pentanone	11	5.0	ug/L	10		107	70-130	3	30	12/22/17	
Acetone	11	10	ug/L	10		107	70-130	1	30	12/22/17	
Benzene	11	0.50	ug/L	10		109	70-130	0	30	12/22/17	
Bromobenzene	11	0.50	ug/L	10		109	70-130	1	30	12/22/17	

BSK Associates Laboratory Fresno
Organics Quality Control Report

EPA 524.2 - Quality Control

Batch: A716740 Prepared: 12/22/2017
Prep Method: EPA 524.2 Analyst: ANM

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank Spike Dup (A716740-BSD1)											
Bromochloromethane	10	0.50	ug/L	10		102	70-130	4	30	12/22/17	
Bromodichloromethane	11	0.50	ug/L	10		109	70-130	1	30	12/22/17	
Bromoform	11	0.50	ug/L	10		109	70-130	1	30	12/22/17	
Bromomethane	11	0.50	ug/L	10		113	70-130	2	30	12/22/17	
Carbon disulfide	11	10	ug/L	10		112	70-130	2	30	12/22/17	
Carbon Tetrachloride	11	0.50	ug/L	10		112	70-130	2	30	12/22/17	
Chlorobenzene	11	0.50	ug/L	10		109	70-130	0	30	12/22/17	
Chloroethane	11	0.50	ug/L	10		108	70-130	1	30	12/22/17	
Chloroform	11	0.50	ug/L	10		109	70-130	1	30	12/22/17	
Chloromethane	11	0.50	ug/L	10		106	70-130	0	30	12/22/17	
cis-1,2-Dichloroethene	11	0.50	ug/L	10		108	70-130	1	30	12/22/17	
cis-1,3-Dichloropropene	11	0.50	ug/L	10		106	70-130	1	30	12/22/17	
Dibromochloromethane	11	0.50	ug/L	10		108	70-130	1	30	12/22/17	
Dibromomethane	11	0.50	ug/L	10		110	70-130	1	30	12/22/17	
Dichlorodifluoromethane	11	0.50	ug/L	10		111	70-130	2	30	12/22/17	
Dichloromethane	11	0.50	ug/L	10		111	70-130	2	30	12/22/17	
Di-isopropyl ether (DIPE)	9.9	3.0	ug/L	10		99	70-130	1	30	12/22/17	
Ethyl tert-Butyl Ether (ETBE)	9.9	0.50	ug/L	10		99	70-130	3	30	12/22/17	
Ethylbenzene	11	0.50	ug/L	10		107	70-130	1	30	12/22/17	
Hexachlorobutadiene	11	0.50	ug/L	10		112	70-130	1	30	12/22/17	
Isopropylbenzene	11	0.50	ug/L	10		107	70-130	2	30	12/22/17	
m,p-Xylenes	22	0.50	ug/L	20		109	70-130	1	30	12/22/17	
Methyl-t-butyl ether	21	0.50	ug/L	20		104	70-130	0	30	12/22/17	
Naphthalene	10	0.50	ug/L	10		100	70-130	6	30	12/22/17	
n-Butylbenzene	11	0.50	ug/L	10		108	70-130	0	30	12/22/17	
n-Propylbenzene	11	0.50	ug/L	10		108	70-130	2	30	12/22/17	
o-Xylene	11	0.50	ug/L	10		113	70-130	1	30	12/22/17	
p-Isopropyltoluene	11	0.50	ug/L	10		106	70-130	3	30	12/22/17	
sec-Butylbenzene	11	0.50	ug/L	10		106	70-130	2	30	12/22/17	
Styrene	11	0.50	ug/L	10		107	70-130	0	30	12/22/17	
tert-Amyl Methyl Ether (TAME)	10	3.0	ug/L	10		102	70-130	1	30	12/22/17	
tert-Butyl alcohol (TBA)	10	2.0	ug/L	10		103	70-130	0	30	12/22/17	
tert-Butylbenzene	10	0.50	ug/L	10		103	70-130	6	30	12/22/17	
Tetrachloroethene (PCE)	11	0.50	ug/L	10		110	70-130	2	30	12/22/17	
Toluene	11	0.50	ug/L	10		107	70-130	1	30	12/22/17	
trans-1,2-Dichloroethene	11	0.50	ug/L	10		109	70-130	2	30	12/22/17	
trans-1,3-Dichloropropene	11	0.50	ug/L	10		107	70-130	1	30	12/22/17	
Trichloroethene (TCE)	11	0.50	ug/L	10		115	70-130	2	30	12/22/17	
Trichlorofluoromethane	11	5.0	ug/L	10		107	70-130	1	30	12/22/17	
Vinyl Chloride	11	0.50	ug/L	10		111	70-130	20	30	12/22/17	
Surrogate: 1,2-Dichlorobenzene-d4	*51*			*50*		*102*	*70-130*			12/22/17	
Surrogate: Bromofluorobenzene	*51*			*50*		*103*	*70-130*			12/22/17	
Matrix Spike (A716740-MS1), Source: A7L2423-01											
1,1,1,2-Tetrachloroethane	10	0.50	ug/L	10	ND	103	41-156			12/23/17	
1,1,1-Trichloroethane	12	0.50	ug/L	10	ND	117	48-160			12/23/17	

BSK Associates Laboratory Fresno

Organics Quality Control Report

EPA 524.2 - Quality Control

Batch: A716740 Prepared: 12/22/2017

Prep Method: EPA 524.2 Analyst: ANM

Matrix Spike (A716740-MS1), Source: A7L2423-01

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
1,1,2,2-Tetrachloroethane	11	0.50	ug/L	10	ND	106	42-151			12/23/17	
1,1,2-Trichloro-1,2,2-trifluoroethane	15	10	ug/L	10	ND	146	47-164			12/23/17	
1,1,2-Trichloroethane	11	0.50	ug/L	10	ND	107	45-152			12/23/17	
1,1-Dichloroethane	11	0.50	ug/L	10	ND	112	48-157			12/23/17	
1,1-Dichloroethene	12	0.50	ug/L	10	ND	125	51-158			12/23/17	
1,1-Dichloropropene	12	0.50	ug/L	10	ND	123	46-162			12/23/17	
1,2,3-Trichlorobenzene	9.6	0.50	ug/L	10	ND	96	37-145			12/23/17	
1,2,4-Trichlorobenzene	9.8	0.50	ug/L	10	ND	98	33-149			12/23/17	
1,2,4-Trimethylbenzene	11	0.50	ug/L	10	ND	107	44-146			12/23/17	
1,2-Dichlorobenzene	11	0.50	ug/L	10	ND	107	44-146			12/23/17	
1,2-Dichloroethane	11	0.50	ug/L	10	ND	106	47-151			12/23/17	
1,2-Dichloropropane	11	0.50	ug/L	10	ND	108	47-155			12/23/17	
1,3,5-Trimethylbenzene	11	0.50	ug/L	10	ND	110	45-154			12/23/17	
1,3-Dichlorobenzene	11	0.50	ug/L	10	ND	108	44-146			12/23/17	
1,3-Dichloropropane	11	0.50	ug/L	10	ND	106	45-151			12/23/17	
1,4-Dichlorobenzene	11	0.50	ug/L	10	ND	109	43-146			12/23/17	
2,2-Dichloropropane	9.6	0.50	ug/L	10	ND	96	24-182			12/23/17	
2-Butanone	9.9	5.0	ug/L	10	ND	99	55-144			12/23/17	
2-Chlorotoluene	11	0.50	ug/L	10	ND	110	48-150			12/23/17	
2-Hexanone	10	10	ug/L	10	ND	103	40-159			12/23/17	
4-Chlorotoluene	11	0.50	ug/L	10	ND	111	43-150			12/23/17	
4-Methyl-2-pentanone	9.8	5.0	ug/L	10	ND	98	30-171			12/23/17	
Acetone	9.9	10	ug/L	10	ND	99	27-181			12/23/17	
Benzene	11	0.50	ug/L	10	ND	113	48-155			12/23/17	
Bromobenzene	11	0.50	ug/L	10	ND	110	43-151			12/23/17	
Bromochloromethane	9.3	0.50	ug/L	10	ND	93	48-161			12/23/17	
Bromodichloromethane	11	0.50	ug/L	10	ND	105	47-151			12/23/17	
Bromoform	9.9	0.50	ug/L	10	ND	99	29-162			12/23/17	
Bromomethane	12	0.50	ug/L	10	ND	116	10-200			12/23/17	
Carbon disulfide	13	10	ug/L	10	ND	126	57-161			12/23/17	
Carbon Tetrachloride	12	0.50	ug/L	10	ND	124	47-163			12/23/17	
Chlorobenzene	11	0.50	ug/L	10	ND	109	46-152			12/23/17	
Chloroethane	12	0.50	ug/L	10	ND	121	28-189			12/23/17	
Chloroform	11	0.50	ug/L	10	ND	113	52-148			12/23/17	
Chloromethane	11	0.50	ug/L	10	ND	115	53-159			12/23/17	
cis-1,2-Dichloroethene	11	0.50	ug/L	10	ND	111	50-152			12/23/17	
cis-1,3-Dichloropropene	9.7	0.50	ug/L	10	ND	97	34-156			12/23/17	
Dibromochloromethane	10	0.50	ug/L	10	ND	101	44-149			12/23/17	
Dibromomethane	11	0.50	ug/L	10	ND	108	46-150			12/23/17	
Dichlorodifluoromethane	15	0.50	ug/L	10	ND	149	33-170			12/23/17	
Dichloromethane	12	0.50	ug/L	10	ND	117	47-156			12/23/17	
Di-isopropyl ether (DIPE)	9.6	3.0	ug/L	10	ND	96	41-159			12/23/17	
Ethyl tert-Butyl Ether (ETBE)	9.1	0.50	ug/L	10	ND	91	32-160			12/23/17	
Ethylbenzene	11	0.50	ug/L	10	ND	112	40-157			12/23/17	
Hexachlorobutadiene	12	0.50	ug/L	10	ND	116	38-151			12/23/17	
Isopropylbenzene	11	0.50	ug/L	10	ND	114	41-156			12/23/17	

BSK Associates Laboratory Fresno

Organics Quality Control Report

EPA 524.2 - Quality Control

Batch: A716740 Prepared: 12/22/2017

Prep Method: EPA 524.2 Analyst: ANM

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Matrix Spike (A716740-MS1), Source: A7L2423-01											
m,p-Xylenes	23	0.50	ug/L	20	ND	113	49-154			12/23/17	
Methyl-t-butyl ether	19	0.50	ug/L	20	ND	96	41-156			12/23/17	
Naphthalene	9.0	0.50	ug/L	10	ND	90	35-154			12/23/17	
n-Butylbenzene	11	0.50	ug/L	10	ND	114	31-153			12/23/17	
n-Propylbenzene	11	0.50	ug/L	10	ND	115	39-156			12/23/17	
o-Xylene	12	0.50	ug/L	10	ND	116	27-164			12/23/17	
p-Isopropyltoluene	11	0.50	ug/L	10	ND	115	26-161			12/23/17	
sec-Butylbenzene	12	0.50	ug/L	10	ND	116	39-154			12/23/17	
Styrene	11	0.50	ug/L	10	ND	114	10-200			12/23/17	
tert-Amyl Methyl Ether (TAME)	10	3.0	ug/L	10	ND	100	24-161			12/23/17	
tert-Butyl alcohol (TBA)	8.3	2.0	ug/L	10	ND	83	22-174			12/23/17	
tert-Butylbenzene	11	0.50	ug/L	10	ND	110	40-153			12/23/17	
Tetrachloroethene (PCE)	12	0.50	ug/L	10	ND	120	48-155			12/23/17	
Toluene	11	0.50	ug/L	10	ND	110	40-159			12/23/17	
trans-1,2-Dichloroethene	12	0.50	ug/L	10	ND	116	52-157			12/23/17	
trans-1,3-Dichloropropene	9.4	0.50	ug/L	10	ND	94	28-160			12/23/17	
Trichloroethene (TCE)	11	0.50	ug/L	10	ND	114	49-155			12/23/17	
Trichlorofluoromethane	13	5.0	ug/L	10	ND	135	47-169			12/23/17	
Vinyl Chloride	15	0.50	ug/L	10	ND	154	21-183			12/23/17	
Surrogate: 1,2-Dichlorobenzene-d4	*51*			*50*		*102*	*70-130*			12/23/17	
Surrogate: Bromofluorobenzene	*51*			*50*		*101*	*70-130*			12/23/17	

EPA 525.3 - Quality Control

Batch: A716710 Prepared: 12/21/2017

Prep Method: EPA 525.3 Analyst: JKH

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank (A716710-BLK1)											
Alachlor	ND	1.0	ug/L							12/26/17	
Atrazine	ND	0.50	ug/L							12/26/17	
Benzo(a)pyrene	ND	0.10	ug/L							12/26/17	
Bis(2-ethylhexyl) adipate	ND	3.0	ug/L							12/26/17	
Bis(2-ethylhexyl) phthalate	ND	3.0	ug/L							12/26/17	
Bromacil	ND	10	ug/L							12/26/17	
Butachlor	ND	0.38	ug/L							12/26/17	
Diazinon	ND	0.25	ug/L							12/26/17	
Dimethoate	ND	10	ug/L							12/26/17	
Metolachlor	ND	0.50	ug/L							12/26/17	
Metribuzin	ND	0.50	ug/L							12/26/17	
Molinate	ND	2.0	ug/L							12/26/17	
Propachlor	ND	0.50	ug/L							12/26/17	
Simazine	ND	1.0	ug/L							12/26/17	
Thiobencarb	ND	1.0	ug/L							12/26/17	
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*1.0*			*1.0*		*104*	*70-130*			12/26/17	
Surrogate: Benzo(a)pyrene-d12	*1.2*			*1.0*		*117*	*70-130*			12/26/17	
Surrogate: Triphenyl Phosphate	*1.1*			*1.0*		*110*	*70-130*			12/26/17	

BSK Associates Laboratory Fresno
Organics Quality Control Report

EPA 525.3 - Quality Control

Batch: A716710 Prepared: 12/21/2017
Prep Method: EPA 525.3 Analyst: JKH

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank Spike (A716710-BS1)											
Alachlor	0.98	1.0	ug/L	1.0		98	70-130			12/26/17	
Atrazine	0.52	0.50	ug/L	0.50		103	70-130			12/26/17	
Benzo(a)pyrene	0.11	0.10	ug/L	0.10		113	70-130			12/26/17	
Bis(2-ethylhexyl) adipate	1.9	3.0	ug/L	2.0		97	70-130			12/26/17	
Bis(2-ethylhexyl) phthalate	2.9	3.0	ug/L	3.0		96	70-130			12/26/17	
Bromacil	1.2	10	ug/L	1.0		116	70-130			12/26/17	
Butachlor	1.1	0.38	ug/L	1.0		108	70-130			12/26/17	
Diazinon	1.3	0.25	ug/L	1.3		103	70-130			12/26/17	
Dimethoate	1.8	10	ug/L	2.0		90	70-130			12/26/17	
Metolachlor	1.3	0.50	ug/L	1.3		106	70-130			12/26/17	
Metribuzin	1.0	0.50	ug/L	1.0		101	70-130			12/26/17	
Molinate	2.0	2.0	ug/L	2.0		102	70-130			12/26/17	
Propachlor	0.51	0.50	ug/L	0.50		101	70-130			12/26/17	
Simazine	0.38	1.0	ug/L	0.35		107	70-130			12/26/17	
Thiobencarb	0.97	1.0	ug/L	1.0		97	70-130			12/26/17	
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*1.0*			*1.0*		*102*	*70-130*			12/26/17	
Surrogate: Benzo(a)pyrene-d12	*1.2*			*1.0*		*120*	*70-130*			12/26/17	
Surrogate: Triphenyl Phosphate	*1.0*			*1.0*		*103*	*70-130*			12/26/17	
Blank Spike Dup (A716710-BSD1)											
Alachlor	0.98	1.0	ug/L	1.0		98	70-130	1	30	12/26/17	
Atrazine	0.48	0.50	ug/L	0.50		96	70-130	7	30	12/26/17	
Benzo(a)pyrene	0.12	0.10	ug/L	0.10		119	70-130	5	30	12/26/17	
Bis(2-ethylhexyl) adipate	2.1	3.0	ug/L	2.0		105	70-130	8	30	12/26/17	
Bis(2-ethylhexyl) phthalate	3.3	3.0	ug/L	3.0		111	70-130	14	30	12/26/17	
Bromacil	1.1	10	ug/L	1.0		111	70-130	5	30	12/26/17	
Butachlor	1.0	0.38	ug/L	1.0		104	70-130	4	30	12/26/17	
Diazinon	1.3	0.25	ug/L	1.3		102	70-130	1	30	12/26/17	
Dimethoate	1.9	10	ug/L	2.0		94	70-130	4	30	12/26/17	
Metolachlor	1.3	0.50	ug/L	1.3		104	70-130	1	30	12/26/17	
Metribuzin	0.98	0.50	ug/L	1.0		98	70-130	3	30	12/26/17	
Molinate	2.2	2.0	ug/L	2.0		112	70-130	9	30	12/26/17	
Propachlor	0.52	0.50	ug/L	0.50		105	70-130	3	30	12/26/17	
Simazine	0.33	1.0	ug/L	0.35		94	70-130	13	30	12/26/17	
Thiobencarb	0.97	1.0	ug/L	1.0		97	70-130	1	30	12/26/17	
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*1.1*			*1.0*		*110*	*70-130*			12/26/17	
Surrogate: Benzo(a)pyrene-d12	*1.3*			*1.0*		*129*	*70-130*			12/26/17	
Surrogate: Triphenyl Phosphate	*1.2*			*1.0*		*123*	*70-130*			12/26/17	
Matrix Spike (A716710-MS1), Source: A7L2241-01											
Alachlor	1.3	1.0	ug/L	1.3	ND	101	70-130			12/26/17	
Atrazine	0.66	0.50	ug/L	0.66	ND	101	70-130			12/26/17	
Benzo(a)pyrene	0.14	0.10	ug/L	0.13	ND	103	70-130			12/26/17	
Bis(2-ethylhexyl) adipate	2.3	3.0	ug/L	2.6	ND	88	70-130			12/26/17	
Bis(2-ethylhexyl) phthalate	3.6	3.0	ug/L	3.9	ND	93	70-130			12/26/17	
Bromacil	1.4	10	ug/L	1.3	ND	110	70-130			12/26/17	

BSK Associates Laboratory Fresno
Organics Quality Control Report

EPA 525.3 - Quality Control

Batch: A716710 Prepared: 12/21/2017
Prep Method: EPA 525.3 Analyst: JKH

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Matrix Spike (A716710-MS1), Source: A7L2241-01											
Butachlor	1.4	0.38	ug/L	1.3	ND	104	70-130			12/26/17	
Diazinon	1.6	0.25	ug/L	1.6	ND	98	70-130			12/26/17	
Dimethoate	2.3	10	ug/L	2.6	ND	86	70-130			12/26/17	
Metolachlor	1.7	0.50	ug/L	1.6	ND	102	70-130			12/26/17	
Metribuzin	1.3	0.50	ug/L	1.3	ND	97	70-130			12/26/17	
Molinate	2.7	2.0	ug/L	2.6	ND	101	70-130			12/26/17	
Propachlor	0.67	0.50	ug/L	0.66	ND	102	70-130			12/26/17	
Simazine	0.42	1.0	ug/L	0.46	ND	91	70-130			12/26/17	
Thiobencarb	1.3	1.0	ug/L	1.3	ND	96	70-130			12/26/17	
Surrogate: 1,3-Dimethyl-2-nitrobenzene	*0.88*			*0.94*		*94*	*70-130*			12/26/17	
Surrogate: Benzo(a)pyrene-d12	*1.1*			*0.94*		*120*	*70-130*			12/26/17	
Surrogate: Triphenyl Phosphate	*0.91*			*0.94*		*97*	*70-130*			12/26/17	

EPA 549.2 - Quality Control

Batch: A716758 Prepared: 12/22/2017
Prep Method: EPA 549.2 Analyst: ANM

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank (A716758-BLK1)											
Diquat	ND	4.0	ug/L							12/29/17	
Blank Spike (A716758-BS1)											
Diquat	4.0	4.0	ug/L	4.0		101	70-130			12/29/17	
Blank Spike Dup (A716758-BSD1)											
Diquat	4.4	4.0	ug/L	4.0		111	70-130	9	30	12/29/17	
Matrix Spike (A716758-MS1), Source: A7L2241-01											
Diquat	4.6	4.0	ug/L	4.0	ND	115	70-130			12/29/17	
Matrix Spike (A716758-MS2), Source: A7L2254-01											
Diquat	4.4	4.0	ug/L	4.0	ND	110	70-130			12/29/17	

BSK Associates Laboratory Fresno

Radiological Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual

SM 7110C - Quality Control

Batch: A800004 Prepared: 1/2/2018

Prep Method: EPA 00-02 Analyst: SAB

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank (A800004-BLK1)											
Gross Alpha	ND	3	pCi/L							01/03/18	
Gross Alpha 1.65 Sigma Uncertainty	ND	0.00	pCi/L							01/03/18	
Gross Alpha MDA95	ND	0.00	pCi/L							01/03/18	
Blank Spike (A800004-BS1)											
Gross Alpha	27.7	3	pCi/L	30		92	73-127			01/03/18	
Blank Spike Dup (A800004-BSD1)											
Gross Alpha	24.2	3	pCi/L	30		81	73-127	14	50	01/03/18	
Matrix Spike (A800004-MS1), Source: A7L2300-01											
Gross Alpha	104	3	pCi/L	120	ND	86	70-130			01/03/18	
Matrix Spike Dup (A800004-MSD1), Source: A7L2300-01											
Gross Alpha	106	3	pCi/L	120	ND	88	70-130	2	50	01/03/18	

Certificate of Analysis

Notes:

- The Chain of Custody document and Sample Integrity Sheet are part of the analytical report.
- Any remaining sample(s) for testing will be disposed of according to BSK's sample retention policy unless other arrangements are made in advance.
- All positive results for EPA Methods 504.1 and 524.2 require the analysis of a Field Reagent Blank (FRB) to confirm that the results are not a contamination error from field sampling steps. If Field Reagent Blanks were not submitted with the samples, this method requirement has not been performed.
- Samples collected by BSK Analytical Laboratories were collected in accordance with the BSK Sampling and Collection Standard Operating Procedures.
- J-value is equivalent to DNQ (Detected, not quantified) which is a trace value. A trace value is an analyte detected between the MDL and the laboratory reporting limit. This result is of an unknown data quality and is only qualitative (estimated). Baseline noise, calibration curve extrapolation below the lowest calibrator, method blank detections, and integration artifacts can all produce apparent DNQ values, which contribute to the un-reliability of these values.
- (1) - Residual chlorine and pH analysis have a 15 minute holding time for both drinking and waste water samples as defined by the EPA and 40 CFR 136. Waste water and ground water (monitoring well) samples must be field filtered to meet the 15 minute holding time for dissolved metals.
- Summations of analytes (i.e. Total Trihalomethanes) may appear to add individual amounts incorrectly, due to rounding of analyte values occurring before or after the total value is calculated, as well as rounding of the total value.
- RL Multiplier is the factor used to adjust the reporting limit (RL) due to variations in sample preparation procedures and dilutions required for matrix interferences.
- Due to the subjective nature of the Threshold Odor Method, all characterizations of the detected odor are the opinion of the panel of analysts. The characterizations can be found in Standard Methods 2170B Figure 2170:1.
- The MCLs provided in this report (if applicable) represent the primary MCLs for that analyte.

Definitions

mg/L:	Milligrams/Liter (ppm)	MDL:	Method Detection Limit	MDA95:	Min. Detected Activity
mg/Kg:	Milligrams/Kilogram (ppm)	RL:	Reporting Limit: DL x Dilution	MPN:	Most Probable Number
µg/L:	Micrograms/Liter (ppb)	ND:	None Detected at RL	CFU:	Colony Forming Unit
µg/Kg:	Micrograms/Kilogram (ppb)	pCi/L:	Picocuries per Liter	Absent:	Less than 1 CFU/100mLs
%:	Percent Recovered (surrogates)	RL Mult:	RL Multiplier	Present:	1 or more CFU/100mLs
NR:	Non-Reportable	MCL:	Maximum Contaminant Limit		

Please see the individual Subcontract Lab's report for applicable certifications.

BSK is not accredited under the NELAP program for the following parameters:

Chlorothalonil	Trifluralin

Certifications: **Please refer to our website for a copy of our Accredited Fields of Testing under each certification.**

Fresno			
State of California - ELAP	1180	State of Hawaii	4021
State of Nevada	CA000792018-1	State of Oregon - NELAP	4021-009
EPA - UCMR4	CA00079	State of Washington	C997-17B
State of New York	12073		
Sacramento			
State of California - ELAP	2435		
San Bernardino			
State of California - ELAP	2993	State of Oregon - NELAP	4119-002
Vancouver			
State of Oregon - NELAP	WA100008-010	State of Washington	C824-17

A7L2428

12212017

Balan1000

Turnaround: Standard
Due Date: 1/8/2018

Balance Hydrologics, Inc.

Printed: 12/21/2017 2:51:20PM
Page 1 of 1

BSK ASSOCIATES

1414 Stanislaus St., Fresno, CA 93706
(559) 497-2888 · Fax (559) 497-2893
www.bskassociates.com

Turnaround Time Request
[X] Standard - 10 business days
[ ] Rush (Surcharge may apply)
Date needed:

A7L2428 12/21/2017
Balan1000 10

Y

*Required Fields Temp: 3.5° #45

Company/Client Name*: Balance Hyrdologics, Inc.	Report Attention*: Mark Woyshner Additional cc's: see project	Invoice To*: Rachel Boitano PO#:	Phone*: 510-704-1000 E-mail*: mwoyshner@balancehydro.com	Fax:
Address*: 800 Bancroft Way Suite 101	City*: Berkeley	State*: CA Zip*: 94710-2227		
Project: Springfield New Well	Project #:	How would you like to receive your completed results?* [X] E-Mail [ ] Fax [ ] Mail		
Reporting Options: [ ] Trace (J-Flag) [ ] Swamp [ ] EDD Type: ______	Regulatory Carbon Copies: [ ] SWRCB (Drinking Water) [ ] Merced Co [ ] Fresno Co [ ] Madera Co [ ] Tulare Co [ ] Other: ______	Regulatory Compliance: [ ] EDT to California SWRCB (Drinking Water) System Number*: ______ [ ] Geotracker #: ______		
Sampler Name (Printed/Signature)*:				

Matrix Types: SW=Surface Water BW=Bottled Water GW=Ground Water WW=Waste Water STW=Storm Water DW=Drinking Water SO=Solid

#	Sample Description*	Sampled* Date	Time	Matrix*	Comments / Station Code / WTRAX	Perchlorate Package, Hexavalent Chromium (Cr6)	Gross Alpha	EPA 515.4, 524.2, 525.3, 531, 549	Uranium Decision		EXT - Radium 228	Hold Analysis: Rad 226		
	Springfield New Well #2	12/19/17	16:25	WATER		X	X	X	X		X	X		
	12-21-17 SL													
	Project created - trl 11/27/17													

Relinquished by: (Signature and Printed Name)	Company	Date	Time	Received by: (Signature and Printed Name)	Company
[signature] GUSTAVO PORRAS	BALANCE HYDRO	12/20/17	13:30	12/21/17 SL	
Relinquished by: (Signature and Printed Name)	Company	Date	Time	Received by: (Signature and Printed Name)	Company
Received for Lab by: (Signature and Printed Name)		Date	Time	Payment Received at Delivery: Date: Amount: PIA#:	Check / Cash Init.
[signature] Steven Lytum		12-21-17	11:58		

Shipping Method: ONTRAC UPS GSO WALK-IN FED EX Courier: ______ Custody Seal Y N
Cooling Method: Wet Blue None Chilling Process Begun: Y N B/W

Payment for services rendered as noted herein are due in full within 30 days from the date invoiced. If not so paid, account balances are deemed delinquent. Delinquent balances are subject to monthly service charges and interest specified in BSK's current Standard Terms and Conditions for Laboratory Services. The person signing for the Client/Company acknowledges that they are either the Client or an authorized agent to the Client, that the Client agrees to be responsible for payment for the services on this Chain of Custody, and agrees to BSK's terms and conditions for laboratory services unless contractually bound otherwise. BSK's current terms and conditions can be found at www.bskassociates.com/BSKLabTermsConditions.pdf

SR-FL-0012-07

3.5° #TS

A7L2428 12/21/2017
Balan1000 10

BSK Associates SR-FL-0002-18

Sample Integrity

BSK Bottles: (Yes) No   Page 1 of 1

COC Info

Was temperature within range? Chemistry ≤ 6°C Micro < 8°C	(Yes) No NA	Were correct containers and preservatives received for the tests requested?	(Yes) No NA
If samples were taken today, is there evidence that chilling has begun?	Yes No (NA)	Were there bubbles in the VOA vials? **(Volatiles Only)**	Yes (No) NA
Did all bottles arrive unbroken and intact?	(Yes) No	Was a sufficient amount of sample received?	Yes (No)
Did all bottle labels agree with COC?	(Yes) No	Do samples have a hold time <72 hours?	Yes (No)
Was sodium thiosulfate added to CN sample(s) until chlorine was no longer present?	Yes No (NA)	Was PM notified of discrepancies? PM: Adam By/Time: Steve 12:15	(Yes) No NA

Bottles Received ("—" means preservation/chlorine checks are either N/A or are performed in the lab)

250ml(A) 500ml(B) 1Liter(C) 40ml VOA(V)	Checks	Passed?	1				
Bacti $Na_2S_2O_3$	—	—					
None (P) White Cap	—	—	1B				
Cr6 (P) Lt. Green Label/Blue Cap NH4OH(NH4)2SO4 DW	Cl, pH > 8	(Y) N	1A				
Cr6 (P) Pink Label/Blue Cap NH4OH(NH4)2SO4 WW	pH 9.3-9.7	Y N	~~1A~~ SL				
Cr6 (P) Black Label/Blue Cap NH4OH(NH4)2SO4 7199 ***24 HOUR HOLD TIME***	pH 9.0-9.5	Y N					
HNO_3 (P) Red Cap or HCl (P) Purple Cap/Lt. Blue Label	—	—	4C, 1B				
H_2SO_4 (P) or (AG) Yellow Cap/Label	pH < 2	Y N					
NaOH (P) Green Cap	Cl, pH >10	Y N			12/21/17		
NaOH + ZnAc (P)	pH > 9	Y N			SL		
Dissolved Oxygen 300ml (g)	—	—					
None (AG) 608/8081/8082, 625, 632/8321, 8151, 8270	—	—					
HCl (AG) Lt. Blue Label O&G, Diesel	—	—					
Ascorbic, EDTA, KH_2Ct (AG) Pink Label 525	—	—	2C				
Na_2SO_3 250mL (AG) Neon Green Label 515	—	—	1A				
$Na_2S_2O_3$ 1 Liter (Brown P) 549	—	—	1C				
$Na_2S_2O_3$ (AG) Blue Label 548, THM, 524	—	—					
$Na_2S_2O_3$ (CG) Blue Label 504, 505, 547	—	—					
$Na_2S_2O_3$ + MCAA (CG) Orange Label 531	pH < 3	Y N	~~1V~~ SL				
NH_4Cl (AG) Purple Label 552	—	—					
EDA (AG) Brown Label DBPs	—	—					
HCL (CG) 524.2, BTEX, Gas, MTBE, 8260/624	—	—	3V				
Buffer pH 4 (CG)	—	—					
H_3PO_4 (CG) Salmon Label	—	—					
Other:							
Asbestos 1Liter Plastic w/ Foil	—	—					
Low Level Hg / Metals Double Baggie	—	—					
Bottled Water	—	—					
Clear Glass 250mL / 500mL / 1 Liter	—	—					
Soil Tube Brass / Steel / Plastic	—	—					
Tedlar Bag / Plastic Bag	—	—					

Split

	Container	Preservative	Date/Time/Initials		Container	Preservative	Date/Time/Initials
S P				S P			
S P				S P			

Comments

531 bottle V received empty

* Cancel EPA 531 vial due to no volume. Mark Woysher notified and will resample. MM 12-21-17

Labeled by: [signature] @ 1322   Labels checked by: MP @ 1337   RUSH Paged by:________@_______

External

A7L2428

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

January 22, 2018

True Lee
BSK Associates
1414 Stanislaus Street
Fresno, CA 93706

RE: Project: A7L2428
Pace Project No.: 30240447

Dear True Lee:

Enclosed are the analytical results for sample(s) received by the laboratory on January 09, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Revision 1: This report replaces the January 10, 2018 report. Report reissued January 21, 2018 to reflect the correction of the WO and Sample ID.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jacquelyn Collins
jacquelyn.collins@pacelabs.com
(724)850-5612
Project Manager

Enclosures

cc: Ms. Brittney Cornejo, BSK Associates

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

CERTIFICATIONS

Project: A7L2428
Pace Project No.: 30240447

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

SAMPLE SUMMARY

Project: A7L2428
Pace Project No.: 30240447

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30240447001	**A7L2428-01**	Drinking Water	12/19/17 16:25	01/09/18 10:45

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

SAMPLE ANALYTE COUNT

Project: A7L2428
Pace Project No.: 30240447

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
30240447001	**A7L2428-01**	EPA 904.0	JLW	1	PASI-PA

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

PROJECT NARRATIVE

Project: A7L2428
Pace Project No.: 30240447

Method: **EPA 904.0**
Description: 904.0 Radium 228
Client: BSK Associates
Date: January 22, 2018

General Information:
1 sample was analyzed for EPA 904.0. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2 3,4
Greensburg, PA 15601
(724)850-5600

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: A7L2428
Pace Project No.: 30240447

Sample: A7L2428-01 **Lab ID: 30240447001** Collected: 12/19/17 16:25 Received: 01/09/18 10:45 Matrix: Drinking Water
PWS: Site ID: Sample Type:

Comments: • The sampler's name and signature were not listed on the COC.

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 904.0	**0.549 ± 0.322 (0.616)** **C:81% T:82%**	pCi/L	01/17/18 11:55	15262-20-1	

REPORT OF LABORATORY ANALYSIS

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL - RADIOCHEMISTRY

Project: A7L2428
Pace Project No.: 30240447

QC Batch: 284604 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 30240447001

METHOD BLANK: 1396192 Matrix: Water
Associated Lab Samples: 30240447001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.107 ± 0.296 (0.663) C:80% T:86%	pCi/L	01/17/18 11:54	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical
www.pacelabs.com

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALIFIERS

Project: A7L2428
Pace Project No.: 30240447

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-PA Pace Analytical Services - Greensburg

WO# : 30240447

30240447

BSK ASSOCIATES

SUBCONTRACT ORDER

A7L2428

SENDING LABORATORY:

BSK Associates Laboratory Fresno
1414 Stanislaus St
Fresno, CA 93706
Phone: 559-497-2888
Fax: 559-485-6935
Project Manager: True Lee
E-mail: tlee@bskassociates.com

RECEIVING LABORATORY:

Pace Analytical-Radiochem
1638 Roseytown Rd Ste 2,3,4
Greensburg, PA 15601
Phone :(724) 850-5600
Fax: (724) 722-5208
Turnaround (Days): Standard
QC Deliverables: I Std III IV

Sample ID	Samp Desc	Comments	Sample Date
A7L2428-01	Springfield New Well #2	Client Matrix Water	12/19/2017 16:25 001
Lab Matrix:	Water		
	Analysis: (2) 1 L P HNO3		
	EXT-Radium 226-DW Matrix	Please HOLD RAD 226 until further notice.	
	EXT-Radium 228-DW Matrix		

Analyze Radium 228 only.
* Please Contact True with Preliminary results.
* Hold for Radium 226. —True 12/22/17

Released By	Date	Received By	Date
[signature]	1-2-18	Michael L [signature]	1-9-18 1045
Released By	Date	Received By	Date

Page 1 of 1

Pittsburgh Lab Sample Condition Upon Receipt

Pace Analytical

Client Name: BSK   Project #: 30240447

Label	7U
LIMS Login	BLM

Courier: ☐ Fed Ex ☒ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other ________

Tracking #: 1Z93X9210370491548

Custody Seal on Cooler/Box Present: ☐ yes ☒ no   Seals intact: ☐ yes ☐ no

Thermometer Used: 6   Type of Ice: (Wet) Blue None

Cooler Temperature   Observed Temp: 1.6 °C   Correction Factor: 0.0 °C   Final Temp: 1.6 °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: MC 1-9-18

Comments:	Yes	No	N/A	
Chain of Custody Present:	X			1.
Chain of Custody Filled Out:	X			2.
Chain of Custody Relinquished:	X			3.
Sampler Name & Signature on COC:		X		4.
Sample Labels match COC:	X			5.
-Includes date/time/ID Matrix: WT				
Samples Arrived within Hold Time:	X			6.
Short Hold Time Analysis (<72hr remaining):		X		7.
Rush Turn Around Time Requested:		X		8.
Sufficient Volume:	X			9.
Correct Containers Used:	X			10.
-Pace Containers Used:	X			
Containers Intact:	X			11.
Orthophosphate field filtered			X	12.
Hex Cr Aqueous Compliance/NPDES sample field filtered			X	13.
Organic Samples checked for dechlorination:			X	14.
Filtered volume received for Dissolved tests			X	15.
All containers have been checked for preservation.	X			16. PH < 2
All containers needing preservation are found to be in compliance with EPA recommendation.	X			
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed: MC Date/time of preservation: Lot # of added preservative:
Headspace in VOA Vials (>6mm):			X	17.
Trip Blank Present:		X		18.
Trip Blank Custody Seals Present			X	
Rad Aqueous Samples Screened > 0.5 mrem/hr		X		Initial when completed: ML Date: 1-9-18

Client Notification/ Resolution:

Person Contacted: ________________ Date/Time: ____________ Contacted By: ____________

Comments/ Resolution: ________________________________

☐ A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen

BSK Associates Laboratory Fresno
1414 Stanislaus St
Fresno, CA 93706
559-497-2888 (Main)
559-485-6935 (FAX)

A8B2807
3/12/2018
Invoice: A805351

Mark Woyshner
Balance Hydrologics, Inc.
800 Bancroft Way, Suite 101
Berkeley, CA 94710-2227

RE: Report for A8B2807 General Chemistry

Dear Mark Woyshner,

Thank you for using BSK Associates for your analytical testing needs. In the following pages, you will find the test results for the samples submitted to our laboratory on 2/26/2018. The results have been approved for release by our Laboratory Director as indicated by the authorizing signature below.

The samples were analyzed for the test(s) indicated on the Chain of Custody (see attached) and the results relate only to the samples analyzed. BSK certifies that the testing was performed in accordance with the quality system requirements specified in the 2009 TNI Standard. Any deviations from this standard or from the method requirements for each test procedure performed will be annotated alongside the analytical result or noted in the Case Narrative. Unless otherwise noted, the sample results are reported on an "as received" basis.

If additional clarification of any information is required, please contact your Project Manager, True Lee , at 559-497-2888.

Thank you again for using BSK Associates. We value your business and appreciate your loyalty.

Sincerely,

True Lee, Project Manager

Accredited in Accordance with NELAP
ORELAP #4021-009

BSK ASSOCIATES

Case Narrative

Project and Report Details		Invoice Details	
Client:	Balance Hydrologics, Inc.	**Invoice To:**	Balance Hydrologics, Inc.
Report To:	Mark Woyshner	**Invoice Attn:**	Rachel Boitano
Project #:	Springfield New Well - #215021	**Project PO#:**	-
Received:	2/26/2018 - 13:02		
Report Due:	3/12/2018		

Sample Receipt Conditions

Cooler: Default Cooler

Temperature on Receipt °C: 5.8

Containers Intact
COC/Labels Agree
Preservation Confirmed
Received On Blue Ice
Packing Material - Other
Sample(s) were received in temperature range.
Initial receipt at BSK-FAL

Data Qualifiers

The following qualifiers have been applied to one or more analytical results:

None applied

Report Distribution

Recipient(s)	Report Format	CC:
Gustavo Porras	FINAL.RPT	
Jason Parke	FINAL.RPT	
Mark Woyshner	FINAL.RPT	

ASSOCIATES

A8B2807

General Chemistry

Springfield New Well - #215021

Certificate of Analysis

Sample ID: A8B2807-01
Sampled By: Gustavo Porras
Sample Description: Springfield New Well

Sample Date - Time: 02/21/18 - 18:37
Matrix: Ground Water
Sample Type: Grab

BSK Associates Laboratory Fresno

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Carbamates by HPLC									
3-Hydroxycarbofuran	EPA 531.1	ND	3.0	ug/L	1	A802824	03/01/18	03/02/18	
Aldicarb	EPA 531.1	ND	3.0	ug/L	1	A802824	03/01/18	03/02/18	
Aldicarb Sulfone	EPA 531.1	ND	2.0	ug/L	1	A802824	03/01/18	03/02/18	
Aldicarb Sulfoxide	EPA 531.1	ND	3.0	ug/L	1	A802824	03/01/18	03/02/18	
Carbaryl	EPA 531.1	ND	5.0	ug/L	1	A802824	03/01/18	03/02/18	
Carbofuran	EPA 531.1	ND	5.0	ug/L	1	A802824	03/01/18	03/02/18	
Methomyl	EPA 531.1	ND	2.0	ug/L	1	A802824	03/01/18	03/02/18	
Oxamyl	EPA 531.1	ND	20	ug/L	1	A802824	03/01/18	03/02/18	

BSK Associates Laboratory Fresno

Organics Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual

EPA 531.1 - Quality Control

Batch: A802824 Prepared: 3/1/2018

Prep Method: EPA 531.1 Analyst: PNN

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
Blank (A802824-BLK1)											
3-Hydroxycarbofuran	ND	3.0	ug/L							03/02/18	
Aldicarb	ND	3.0	ug/L							03/02/18	
Aldicarb Sulfone	ND	2.0	ug/L							03/02/18	
Aldicarb Sulfoxide	ND	3.0	ug/L							03/02/18	
Carbaryl	ND	5.0	ug/L							03/02/18	
Carbofuran	ND	5.0	ug/L							03/02/18	
Methomyl	ND	2.0	ug/L							03/02/18	
Oxamyl	ND	20	ug/L							03/02/18	
Blank Spike (A802824-BS1)											
3-Hydroxycarbofuran	4.3	3.0	ug/L	4.3		99	80-120			03/02/18	
Aldicarb	4.7	3.0	ug/L	4.3		107	80-120			03/02/18	
Aldicarb Sulfone	4.2	2.0	ug/L	4.3		97	80-120			03/02/18	
Aldicarb Sulfoxide	4.3	3.0	ug/L	4.3		98	80-120			03/02/18	
Carbaryl	4.4	5.0	ug/L	4.3		101	80-120			03/02/18	
Carbofuran	4.4	5.0	ug/L	4.3		100	80-120			03/02/18	
Methomyl	4.2	2.0	ug/L	4.3		97	80-120			03/02/18	
Oxamyl	4.2	20	ug/L	4.3		98	80-120			03/02/18	
Blank Spike Dup (A802824-BSD1)											
3-Hydroxycarbofuran	4.5	3.0	ug/L	4.3		104	80-120	5	20	03/02/18	
Aldicarb	4.6	3.0	ug/L	4.3		106	80-120	1	20	03/02/18	
Aldicarb Sulfone	4.4	2.0	ug/L	4.3		102	80-120	5	20	03/02/18	
Aldicarb Sulfoxide	4.5	3.0	ug/L	4.3		102	80-120	5	20	03/02/18	
Carbaryl	4.4	5.0	ug/L	4.3		101	80-120	0	20	03/02/18	
Carbofuran	4.4	5.0	ug/L	4.3		102	80-120	1	20	03/02/18	
Methomyl	4.4	2.0	ug/L	4.3		101	80-120	4	20	03/02/18	
Oxamyl	4.4	20	ug/L	4.3		101	80-120	3	20	03/02/18	
Matrix Spike (A802824-MS1), Source: A8B2577-08											
3-Hydroxycarbofuran	4.3	3.0	ug/L	4.3	ND	99	65-135			03/02/18	
Aldicarb	4.3	3.0	ug/L	4.3	ND	100	65-135			03/02/18	
Aldicarb Sulfone	4.4	2.0	ug/L	4.3	ND	101	65-135			03/02/18	
Aldicarb Sulfoxide	4.4	3.0	ug/L	4.3	ND	101	65-135			03/02/18	
Carbaryl	4.3	5.0	ug/L	4.3	ND	99	65-135			03/02/18	
Carbofuran	4.4	5.0	ug/L	4.3	ND	101	65-135			03/02/18	
Methomyl	4.2	2.0	ug/L	4.3	ND	96	65-135			03/02/18	
Oxamyl	4.4	20	ug/L	4.3	ND	101	65-135			03/02/18	

BSK ASSOCIATES

Certificate of Analysis

Notes:

- The Chain of Custody document and Sample Integrity Sheet are part of the analytical report.
- Any remaining sample(s) for testing will be disposed of according to BSK's sample retention policy unless other arrangements are made in advance.
- All positive results for EPA Methods 504.1 and 524.2 require the analysis of a Field Reagent Blank (FRB) to confirm that the results are not a contamination error from field sampling steps. If Field Reagent Blanks were not submitted with the samples, this method requirement has not been performed.
- Samples collected by BSK Analytical Laboratories were collected in accordance with the BSK Sampling and Collection Standard Operating Procedures.
- J-value is equivalent to DNQ (Detected, not quantified) which is a trace value. A trace value is an analyte detected between the MDL and the laboratory reporting limit. This result is of an unknown data quality and is only qualitative (estimated). Baseline noise, calibration curve extrapolation below the lowest calibrator, method blank detections, and integration artifacts can all produce apparent DNQ values, which contribute to the un-reliability of these values.
- (1) - Residual chlorine and pH analysis have a 15 minute holding time for both drinking and waste water samples as defined by the EPA and 40 CFR 136. Waste water and ground water (monitoring well) samples must be field filtered to meet the 15 minute holding time for dissolved metals.
- Summations of analytes (i.e. Total Trihalomethanes) may appear to add individual amounts incorrectly, due to rounding of analyte values occurring before or after the total value is calculated, as well as rounding of the total value.
- RL Multiplier is the factor used to adjust the reporting limit (RL) due to variations in sample preparation procedures and dilutions required for matrix interferences.
- Due to the subjective nature of the Threshold Odor Method, all characterizations of the detected odor are the opinion of the panel of analysts. The characterizations can be found in Standard Methods 2170B Figure 2170:1.
- The MCLs provided in this report (if applicable) represent the primary MCLs for that analyte.

Definitions

mg/L:	Milligrams/Liter (ppm)	MDL:	Method Detection Limit	MDA95:	Min. Detected Activity
mg/Kg:	Milligrams/Kilogram (ppm)	RL:	Reporting Limit: DL x Dilution	MPN:	Most Probable Number
µg/L:	Micrograms/Liter (ppb)	ND:	None Detected at RL	CFU:	Colony Forming Unit
µg/Kg:	Micrograms/Kilogram (ppb)	pCi/L:	PicoCuries per Liter	Absent:	Less than 1 CFU/100mLs
%:	Percent	RL Mult:	RL Multiplier	Present:	1 or more CFU/100mLs
NR:	Non-Reportable	MCL:	Maximum Contaminant Limit		

Please see the individual Subcontract Lab's report for applicable certifications.

BSK is not accredited under the NELAP program for the following parameters: **NA**

Certifications: **Please refer to our website for a copy of our Accredited Fields of Testing under each certification.**

Fresno

EPA - UCMR4	CA00079	NELAP certified	4021-010	State of California - ELAP	1180
State of Hawaii	4021	State of Nevada	CA000792018-1	State of New York	12073
State of Oregon - NELAP	4021-010	State of Washington	C997-17b		

Sacramento

State of California - ELAP	2435

San Bernardino

NELAP certified	4119-002	State of California - ELAP	2993	State of Oregon - NELAP	4119-002

Vancouver

NELAP certified	WA100008-010	State of Oregon - NELAP	WA100008-010	State of Washington	C824-17

A8B2807

02262018

Balan1000

Turnaround: Standard

Due Date: 3/12/2018

Balance Hydrologics, Inc.

BSK ASSOCIATES

1414 Stanislaus St., Fresno, CA 93706
(559) 497-2888 · Fax (559) 497-2893
www.bskassociates.com

Turnaround Time Request
- [X] Standard - 10 business days
- [ ] Rush (Surcharge may apply)

Date needed:

Balan1000 02/26/2018 10

*Required Fields Temp: 5.8° #4

Company/Client Name*: Balance Hydrologics, Inc.	Report Attention*: Mark Woyshner; Additional cc's: see project	Invoice To*: Rachel Boitano; PO#:	Phone*: (510) 704-1000 x 209; Fax:; E-mail*: mwoyshner@balancehydro.com
Address*: 800 Bancroft Way, Suite 101	City*: Berkeley	State*: CA; Zip*: 94710-2227	
Project: Springfield New Well	Project #: 215021	How would you like to receive your completed results?* [X] E-Mail [ ] Fax [ ] Mail	
Reporting Options: [ ] Trace (J-Flag) [ ] Swamp [ ] EDD Type: ______	Regulatory Carbon Copies: [ ] SWRCB (Drinking Water) [ ] Merced Co [ ] Fresno Co [ ] Madera Co [ ] Tulare Co [ ] Other:	Regulatory Compliance: [ ] EDT to California SWRCB (Drinking Water) System Number*: ______ [ ] Geotracker #: ______	
Sampler Name (Printed/Signature)*: Gustavo Porras [signature]			

Matrix Types: SW=Surface Water BW=Bottled Water GW=Ground Water WW=Waste Water STW=Storm Water DW=Drinking Water SO=Solid

#	Sample Description*	Sampled* Date	Time	Matrix*	Comments / Station Code / WTRAX	EPA 531
1	Springfield New Well	2/21/18	18:37	GW		X
	2/26/18 SC					

Relinquished by: (Signature and Printed Name)	Company	Date	Time	Received by: (Signature and Printed Name)	Company
Gustavo Porras [signature]	Balance Hydrologics	2/23/18	12:00	2/26/18	SC

Received for Lab by: (Signature and Printed Name) [signature] Date 2/26/18 Time 1332 Payment Received at Delivery: Date: Amount: PIA#: Check / Cash Init.

Shipping Method: ONTRAC UPS GSO WALK-IN **FED EX** Courier: ______ Custody Seal: Y/N

Cooling Method: Wet **Blue** None Chilling Process Begun: Y / N

A8B2807 02/26/2018
Balan1000 10

BSK Associates SR-FL-0002-18

Sample Integrity

BSK Bottles: (Yes) No Page 1 of 1

COC Info

Was temperature within range? Chemistry **≤ 6°C** Micro **< 8°C**	(Yes) No NA	Were correct containers and preservatives received for the tests requested?	(Yes) No NA
If samples were taken today, is there evidence that chilling has begun?	Yes No (NA)	Were there bubbles in the VOA vials? **(Volatiles Only)**	Yes No (NA)
Did all bottles arrive unbroken and intact?	(Yes) No	Was a sufficient amount of sample received?	(Yes) No
Did all bottle labels agree with COC?	(Yes) No	Do samples have a hold time <72 hours?	Yes (No)
Was sodium thiosulfate added to CN sample(s) until chlorine was no longer present?	Yes No (NA)	Was PM notified of discrepancies? PM: By/Time:	Yes No (NA)

Bottles Received

"—" means preservation/chlorine checks are either N/A or are performed in the lab

250ml(A) 500ml(B) 1Liter(C) 40ml VOA(V)	Checks	Passed?	1				
Bacti $Na_2S_2O_3$	—	—					
None (P) White Cap	—	—					
Cr6 (P) Lt. Green Label/Blue Cap NH4OH(NH4)2SO4 **DW**	Cl, pH > 8	Y N					
Cr6 (P) Pink Label/Blue Cap NH4OH(NH4)2SO4 **WW**	pH 9.3-9.7	Y N					
Cr6 (P) Black Label/Blue Cap NH4OH(NH4)2SO4 **7199** ******24 HOUR HOLD TIME******	pH 9.0-9.5	Y N					
HNO_3 (P) Red Cap or HCl (P) Purple Cap/Lt. Blue Label	—	—					
H_2SO_4 (P) or (AG) Yellow Cap/Label	pH < 2	Y N					
NaOH (P) Green Cap	Cl, pH >10	Y N					
NaOH + ZnAc (P)	pH > 9	Y N					
Dissolved Oxygen 300ml (g)	—	—					
None (AG) 608/8081/8082, 625, 632/8321, 8151, 8270	—	—					
HCl (AG) Lt. Blue Label O&G, Diesel	—	—					
Ascorbic, EDTA, KH_2Ct (AG) Pink Label 525	—	—					
Na_2SO_3 250mL (AG) Neon Green Label 515	—	—					
$Na_2S_2O_3$ 1 Liter (Brown P) 549	—	—					
$Na_2S_2O_3$ (AG) Blue Label 548, THM, 524	—	—					
$Na_2S_2O_3$ (CG) Blue Label 504, 505, 547	—	—					
$Na_2S_2O_3$ + MCAA (CG) Orange Label 531	pH < 3	(Y) N	1V		2/26/18 SC		
NH_4Cl (AG) Purple Label 552	—	—					
EDA (AG) Brown Label DBPs	—	—					
HCL (CG) 524.2,BTEX,Gas, MTBE, 8260/624	—	—					
Buffer pH 4 (CG)	—	—					
H_3PO_4 (CG) Salmon Label	—	—					
Other:							
Asbestos 1Liter Plastic w/ Foil	—	—					
Low Level Hg / Metals Double Baggie	—	—					
Bottled Water	—	—					
Clear Glass 250mL / 500mL / 1 Liter	—	—					
Soil Tube Brass / Steel / Plastic	—	—					
Tedlar Bag / Plastic Bag	—	—					

Split

	Container	Preservative	Date/Time/Initials		Container	Preservative	Date/Time/Initials
S P				S P			
S P				S P			

Comments

Labeled by: SC @ 1418 Labels checked by: [initials] @ 1513 RUSH Paged by: ____ @ ____

APPENDIX H

Observers' Log

Appendix H. Groundwater monitoring observations, Springfield Well No. 2, Pajaro / Sunny Mesa CSD, Monterey County, CA

Site Conditions			Water Level		Water Quality Observations				Remarks
Time Zone (PST/PDT)	Date/Time (2004-4)	Observer(s) (see notes)	Depth to Water (feet)	WSE (ft amsl)	Water Temperature (°C)	Specific Conductance at field temp. (µmhos/cm)	Specific Conductance at 25C (at 25 °C)	Samples (see notes)	

Springfield Well No. 2

Reference point elevation (ft amsl) = 143.80
Stickup (feet) = 1.80
Ground surface elevation (ft amsl) = 142.00
Depth of well from ground surface (feet) = 600.00

Latitude (WGS84) = N 36°50'16.59"
Longitude (WGS84) = W 121°46'7.19"
Depth to 60HP pump (feet) = 380

Time Zone	Date/Time	Observer(s)	Depth to Water	WSE	Water Temperature	Specific Conductance at field temp.	Specific Conductance at 25C	Samples	Remarks
PST	11/6/17 12:00	gp							Drilling of Springfield well No. 2 begins with mud-rotary rig.
PST	11/8/17 16:00	gp							Total depth of well is reached. Borehole was E-logged by Newman (330 to 615 feet)
PST	11/16/17 12:00	gp							Casing installed in borehole.
PST	11/17/18 14:00	gp							Monterey County inspector observed placement of cement sanitary seal in well.
PST	12/8/17 10:42	mw	146.60	-2.80					Diver 100m BSN 3019 installed at a depth of 400 ft
PST	12/8/17 11:05	mw	146.90	-3.10					
PST	12/19/17 9:00	gp	148.20	-4.40					
PST	12/19/17 10:24	gp	146.30	-2.50					Static water level
PST	12/19/17 10:35	gp	146.30	-2.50					Pumping begins
PST	12/19/17 10:35	gp	182.00	-38.20					
PST	12/19/17 10:36	gp	187.95	-44.15					Flow rate: 430 gpm
PST	12/19/17 10:37	gp	184.20	-40.40					
PST	12/19/17 10:39	gp	180.75	-36.95					Flow rate: 350 gpm
PST	12/19/17 10:42	gp	178.87	-35.07					Flow rate: 330 gpm
PST	12/19/17 10:45	gp	179.00	-35.20					Flow rate: 328.5 gpm
PST	12/19/17 10:55	gp	179.32	-35.52					Flow rate: 328 gpm
PST	12/19/17 11:03	gp	179.45	-35.65					Flow rate: 328 gpm
PST	12/19/17 11:19	gp	179.61	-35.81					Flow rate: 328 gpm
PST	12/19/17 11:35	gp	179.76	-35.96					Flow rate: 328.3 gpm
PST	12/19/17 11:44	gp	179.92	-36.12					
PST	12/19/17 12:15	gp	180.20	-36.40					Flow rate: 327 gpm
PST	12/19/17 12:45	gp	180.41	-36.61					
PST	12/19/17 13:44	gp	181.02	-37.22					
PST	12/19/17 13:45	gp	181.02	-37.22					
PST	12/19/17 13:45	gp	191.70	-47.90					
PST	12/19/17 13:46	gp	192.46	-48.66					Flow rate: 425 gpm
PST	12/19/17 13:47	gp	192.63	-48.83					
PST	12/19/17 13:49	gp	192.86	-49.06					Flow rate: 426.3 gpm
PST	12/19/17 13:53	gp	192.96	-49.16					Flow rate: 426.6 gpm

PST	12/19/17 14:00	gp	193.72	-49.92					Flow rate: 425.5 gpm
PST	12/19/17 14:50	gp	194.18	-50.38					
PST	12/19/17 15:11	gp	194.45	-50.65					Flow rate: 425.4 gpm
PST	12/19/17 15:35	gp	194.75	-50.95	22.0	657	695		Flow rate: 423.9 gpm
PST	12/19/17 16:00	gp	194.96	-51.16					Flow rate: 424.7 gpm
PST	12/19/17 16:35	gp	195.19	-51.39					Flow rate: 425.2 gpm
PST	12/19/17 18:00	gp						yes	Water quality/age dating samples collected
PST	12/19/17 18:15	gp							Pumping stops
PST	12/20/17 10:40	gp	145.50	-1.70					Diver logger demobed
PST	2/15/18 19:48	gp	144.67	-0.87					Diver logger re-installed
PST	2/20/18 16:07	gp	144.52	-0.72					
PST	2/20/18 16:48	gp	144.52	-0.72					Start pumping
PST	2/20/18 17:50	gp	179.45	-35.65					Pumping ends
PST	2/21/18 9:33	gp	143.33	0.47					Static WL
PST	2/21/18 9:40	gp	143.33	0.47					Static WL. Pumping starts. Flow meter 95571800 gal
PST	2/21/18 9:40	gp	156.10	-12.30					
PST	2/21/18 9:41	gp	181.10	-37.30					
PST	2/21/18 9:42	gp	181.54	-37.74					
PST	2/21/18 9:44	gp	182.00	-38.20					
PST	2/21/18 9:52	gp	182.60	-38.80					
PST	2/21/18 9:56	gp	182.85	-39.05					
PST	2/21/18 10:10	gp	183.20	-39.40					
PST	2/21/18 10:40	gp	183.68	-39.88					
PST	2/21/18 11:47	gp	184.56	-40.76	22.3	651	688		
PST	2/21/18 12:40	gp	185.19	-41.39	22.5	659	693		
PST	2/21/18 13:40	gp	185.62	-41.82	22.5	659	691		
PST	2/21/18 14:40	gp	186.11	-42.31					
PST	2/21/18 15:40	gp	186.39	-42.59					
PST	2/21/18 17:13	gp	186.68	-42.88					
PST	2/21/18 18:30	gp	186.57	-42.77	22.1	648	686		WQ sample taken at 18:37
PST	2/21/18 18:40	gp	186.50	-42.70					Pumping stops; Recovery begins; Flow meter 95784700 gal
PST	2/21/18 18:40	gp	143.18	0.62					
PST	2/21/18 18:41	gp	147.68	-3.88					
PST	2/21/18 18:42	gp	147.52	-3.72					
PST	2/21/18 18:44	gp	147.12	-3.32					
PST	2/21/18 18:48	gp	146.70	-2.90					
PST	2/21/18 19:00	gp	146.35	-2.55					
PST	2/21/18 19:10	gp	146.18	-2.38					
PST	2/22/18 8:44	gp	143.69	0.11					Diver logger demobed

School Well (PVWMA 992)

Reference point elevation (ft amsl) = 137.00
Stickup (feet) = 1.00
Ground surface elevation (ft amsl) = 136.00
Depth of well from ground surface (feet) =

Latitude (WGS84) = N 36°50'9.63"
Longitude (WGS84) = W 121°46'6.68"

PST	12/8/17 8:40	mw	136.55	0.45					Diver 50m BSN 3123 installed
PST	12/8/17 11:20	mw	136.50	0.50					
PST	12/19/17 10:10	gp	136.40	0.60					Diver logger demobed
PST	2/15/18 17:48	gp	134.19	2.81					Diver logger re-installed
PST	2/20/18 16:20	gp	134.21	2.79					
PST	2/21/18 18:10	gp	134.05	2.95					
PST	2/22/18 11:35	gp	134.18	2.82					Diver logger demobed

Hawkins Well

Reference point elevation (ft amsl) = 137.69
Stickup (feet) = 0.69
Ground surface elevation (ft amsl) = 137.00
Depth of well from ground surface (feet) =

Latitude (WGS84) = N 36° 50' 18.18"
Longitude (WGS84) = W 121° 46' 12.26"

PST	12/19/17 9:39	gp	140.00	-2.31					Diver logger installed and demobed at the end of the day
PST	2/15/18 16:25	gp	137.80	-0.11					Diver logger installed
PST	2/20/18 16:33	gp	137.75	-0.06					
PST	2/21/18 9:16	gp	137.71	-0.02					
PST	2/21/18 17:56	gp	137.45	0.24					
PST	2/22/18 12:17	gp	137.76	-0.07					Diver logger demobed

Rocha Well ("Mini Joto" well)

Reference point elevation (ft amsl) = 125.00
Stickup (feet) = 0.00
Ground surface elevation (ft amsl) = 125.00
Depth of well from ground surface (feet) = unknown
Depth to Diver from RP (feet) = 300.00

Latitude (WGS84) = N 36° 50' 17.5"
Longitude (WGS84) = W 121° 45' 48.7"

PST	2/15/18 15:42	gp	208.30	-83.30					Diver logger installed
PST	2/20/18 16:42	gp	128.00	-3.00					
PST	2/21/18 8:51	gp	125.05	-0.05					
PST	2/21/18 8:55	gp							Rocha well starts pumping; Q~900 gpm
PST	2/21/18 17:37	gp	210.77	-85.77					
PST	2/21/18 17:40	gp							
PST	2/22/18 9:10	gp	125.41	-0.41					Rocha well stops pumping; Diver logger demobed

Notes:
1) gp = Gustavo Porras, mw = Mark Woyshner
2) NR is not recorded
3) NA or "-" is not applicable
4) Abbreviations: SCT = specific conductance and temperature; DL = datalogger; PT = pressure transducer;

APPENDIX I

Groundwater Contours
(Fugro, 1995, Hanson and Others, 2014, and Feeney, 2016)

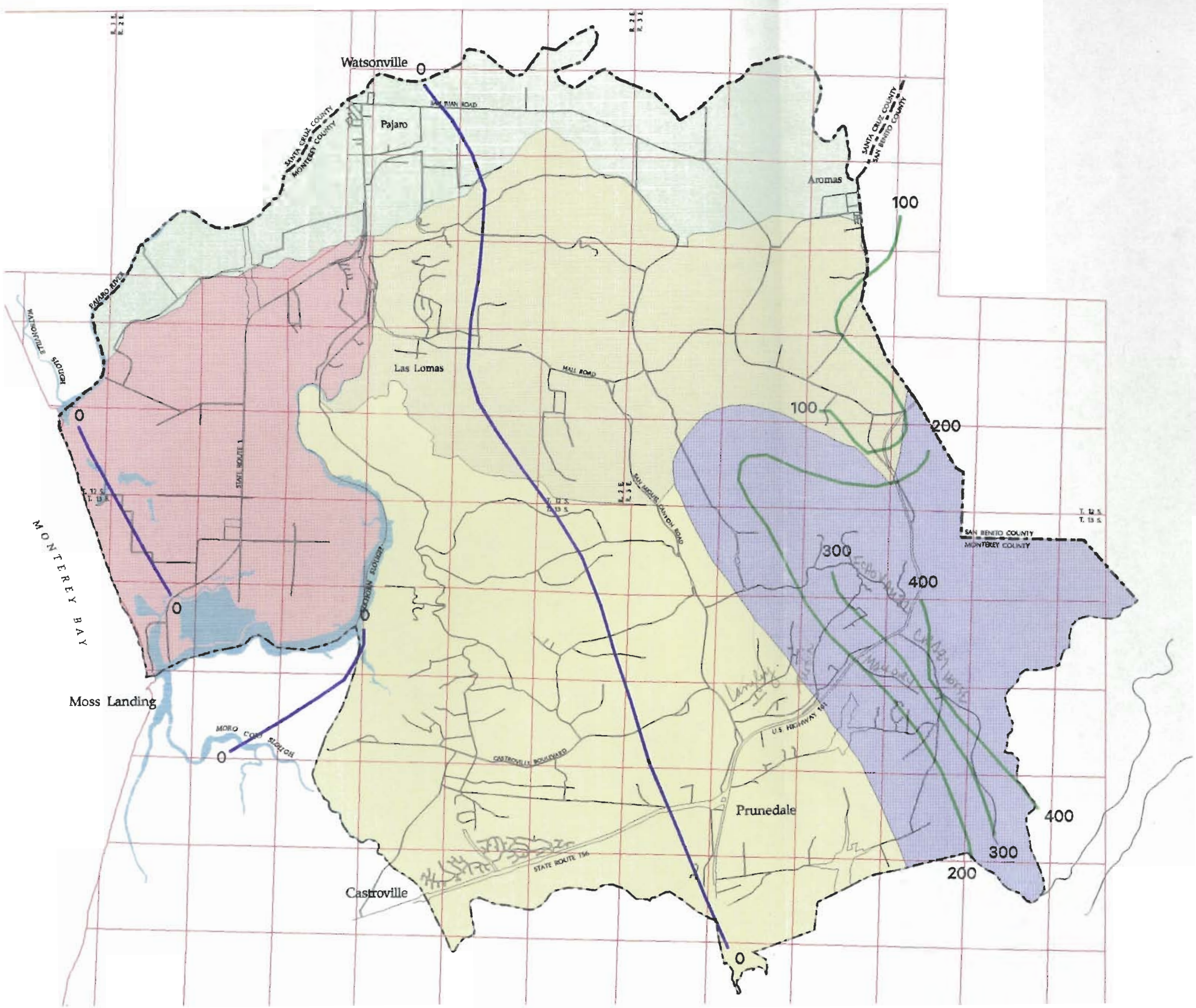


Figure 13

1979 WATER LEVELS

- Pajaro
- Springfield Terrace
- Granite Ridge
- Highlands North
- Highlands South
- Water Surface - Below Sea Level
- Water Surface - Sea Level
- Water Surface - Above Sea Level
- Study Area Boundary
- County Line
- Township and Range Grid

MILES

0 1.25 2.5

Source: USGS

North Monterey County Hydrogeologic Study

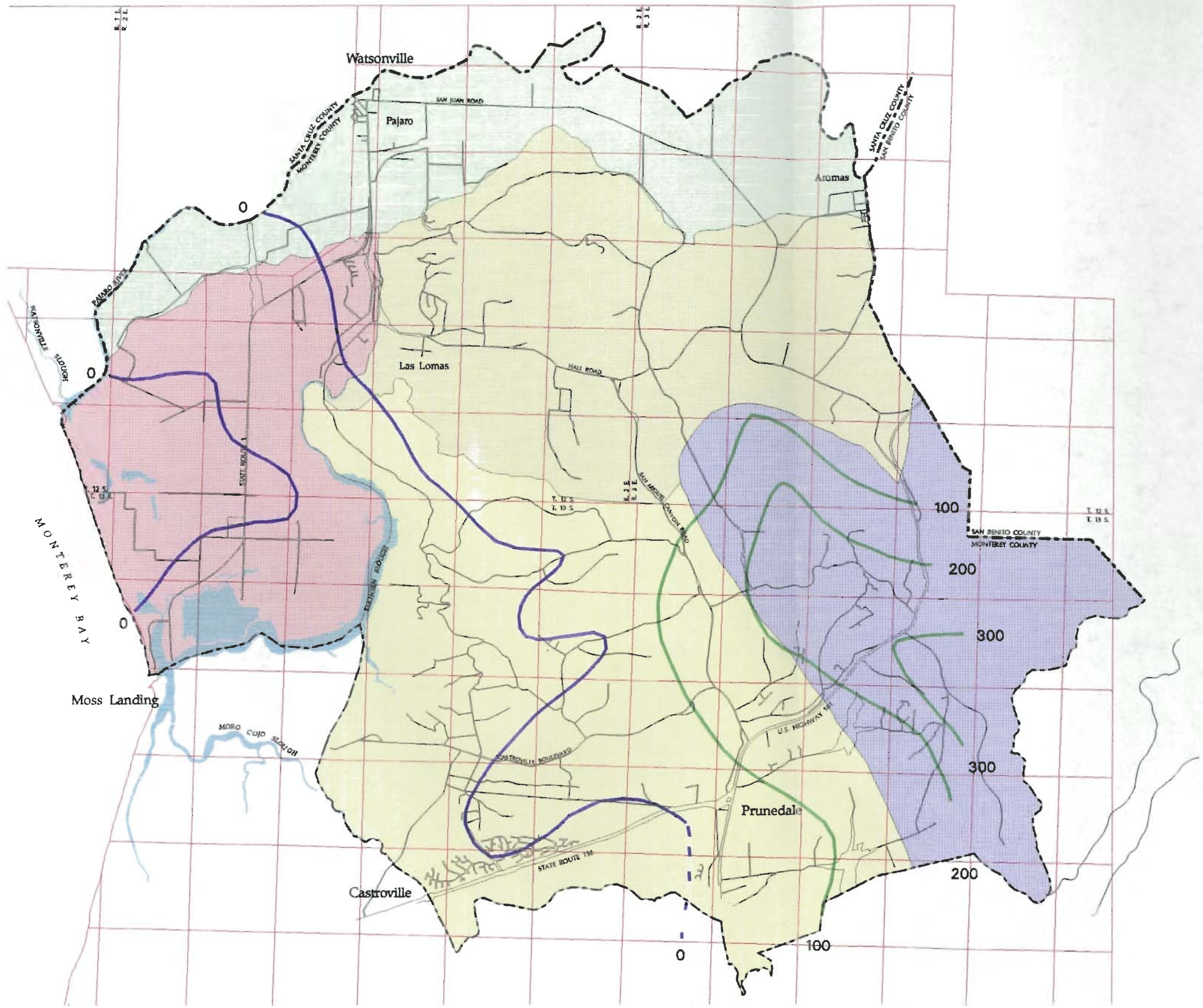


Figure 11

1983 WATER LEVELS

- Pajaro
- Springfield Terrace
- Granite Ridge
- Highlands North
- Highlands South
- Water Surface - Below Sea Level
- Water Surface - Sea Level
- Water Surface - Above Sea Level
- Study Area Boundary
- County Line
- Township and Range Grid

MILES

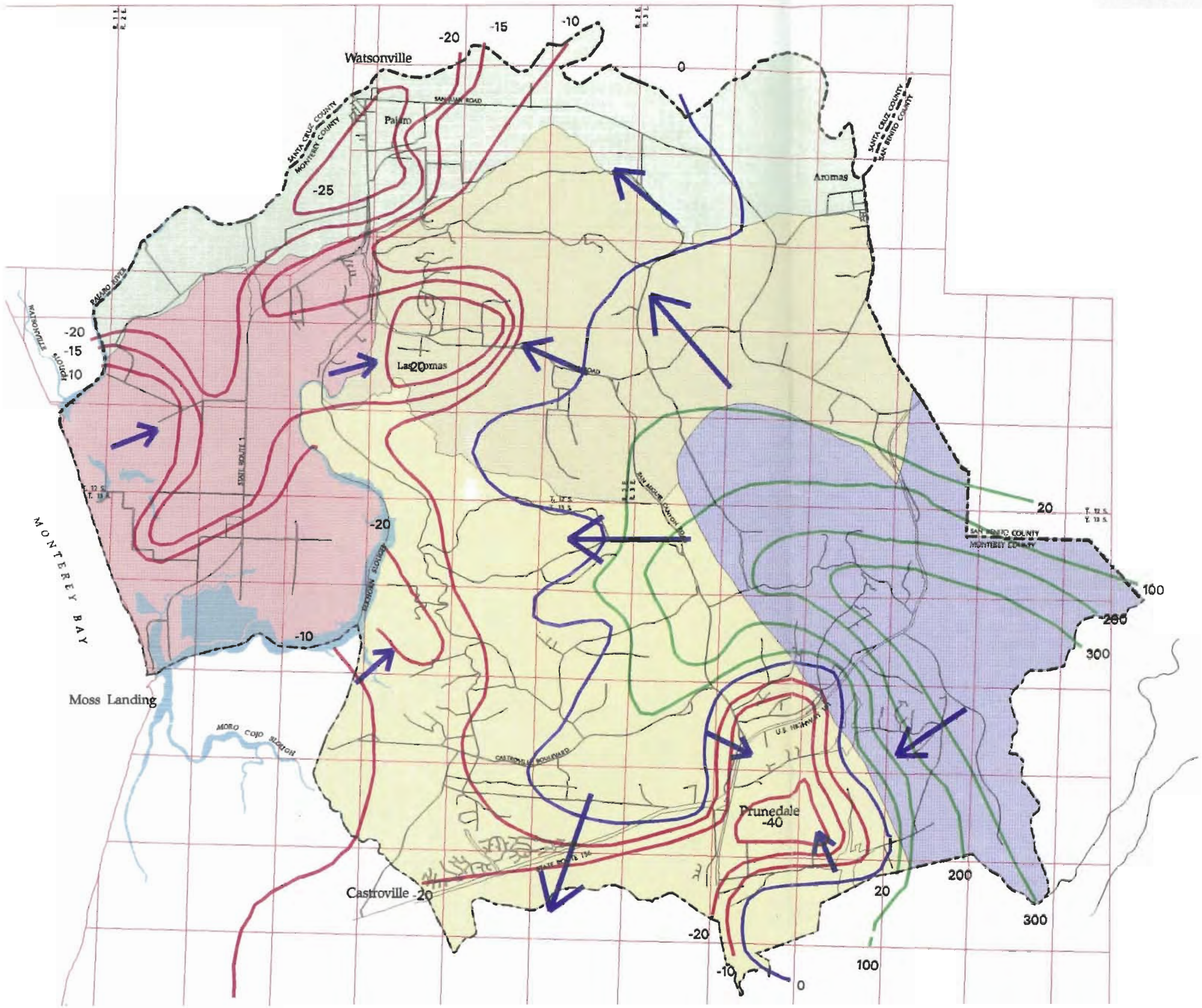
0 1.25 2.5

Sources: MCWRA, PVMVA, and Fugro

North Monterey County Hydrogeologic Study

Figure 12

1994 WATER LEVELS



Sources: MCWRA, PVMVA, and Fugro

North Monterey County Hydrogeologic Study

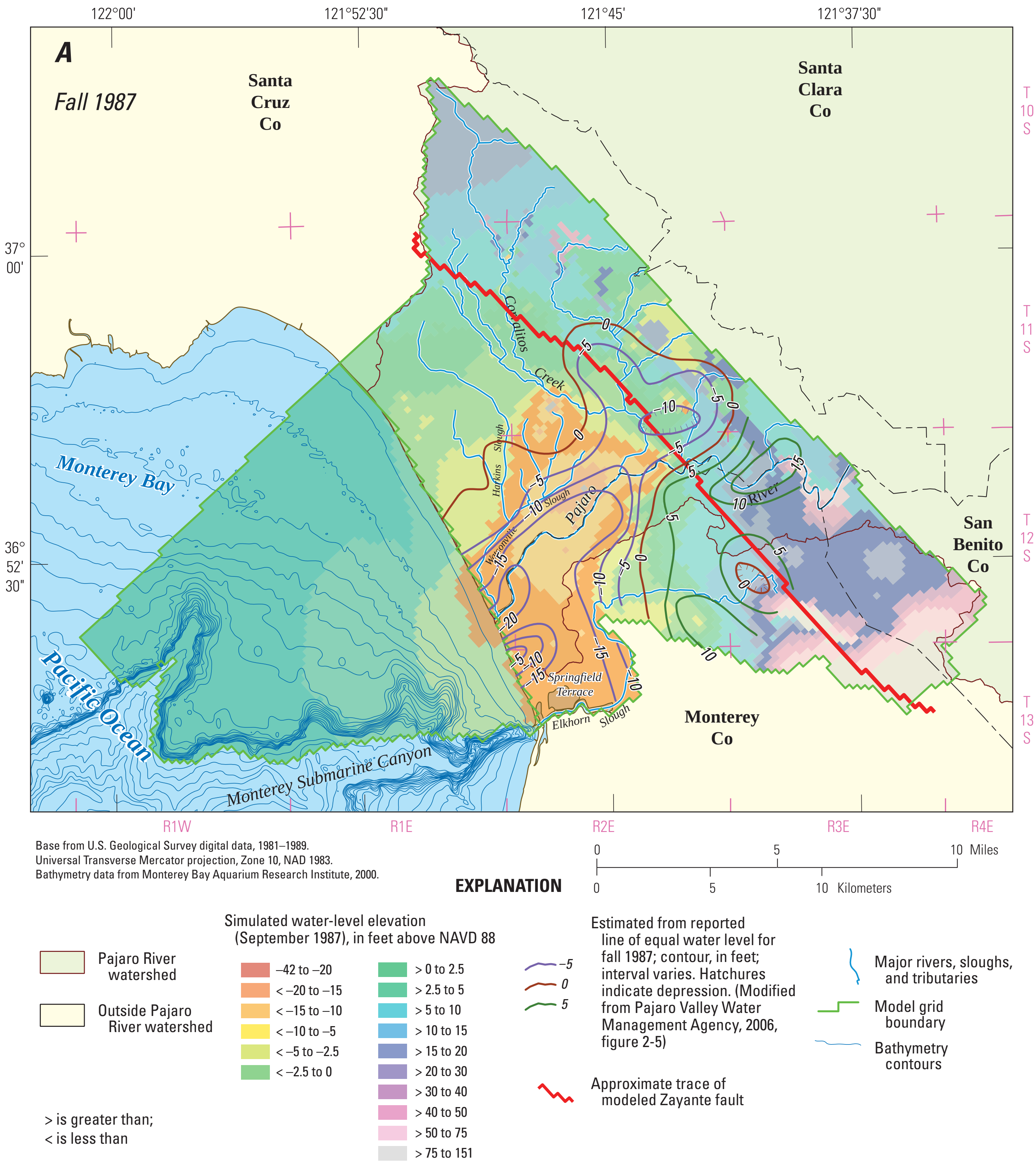


Figure 33. Comparison of the contoured measured with simulated water levels *A*, in 1987; *B*, in 1992; *C*, in 1998; and *D*, in September 2006 for the calibrated hydrologic flow model, Pajaro Valley, California.

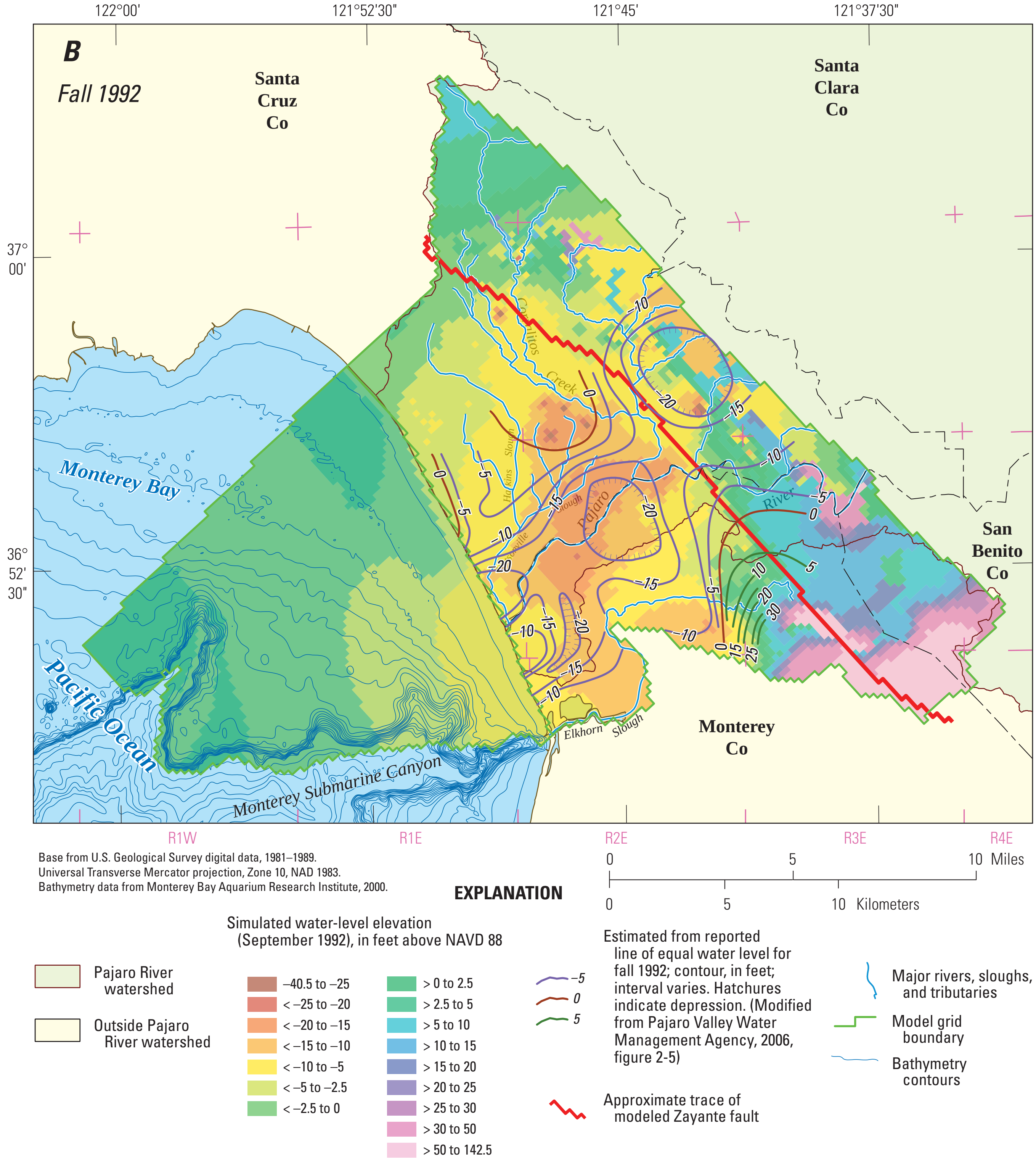


Figure 33. —Continued

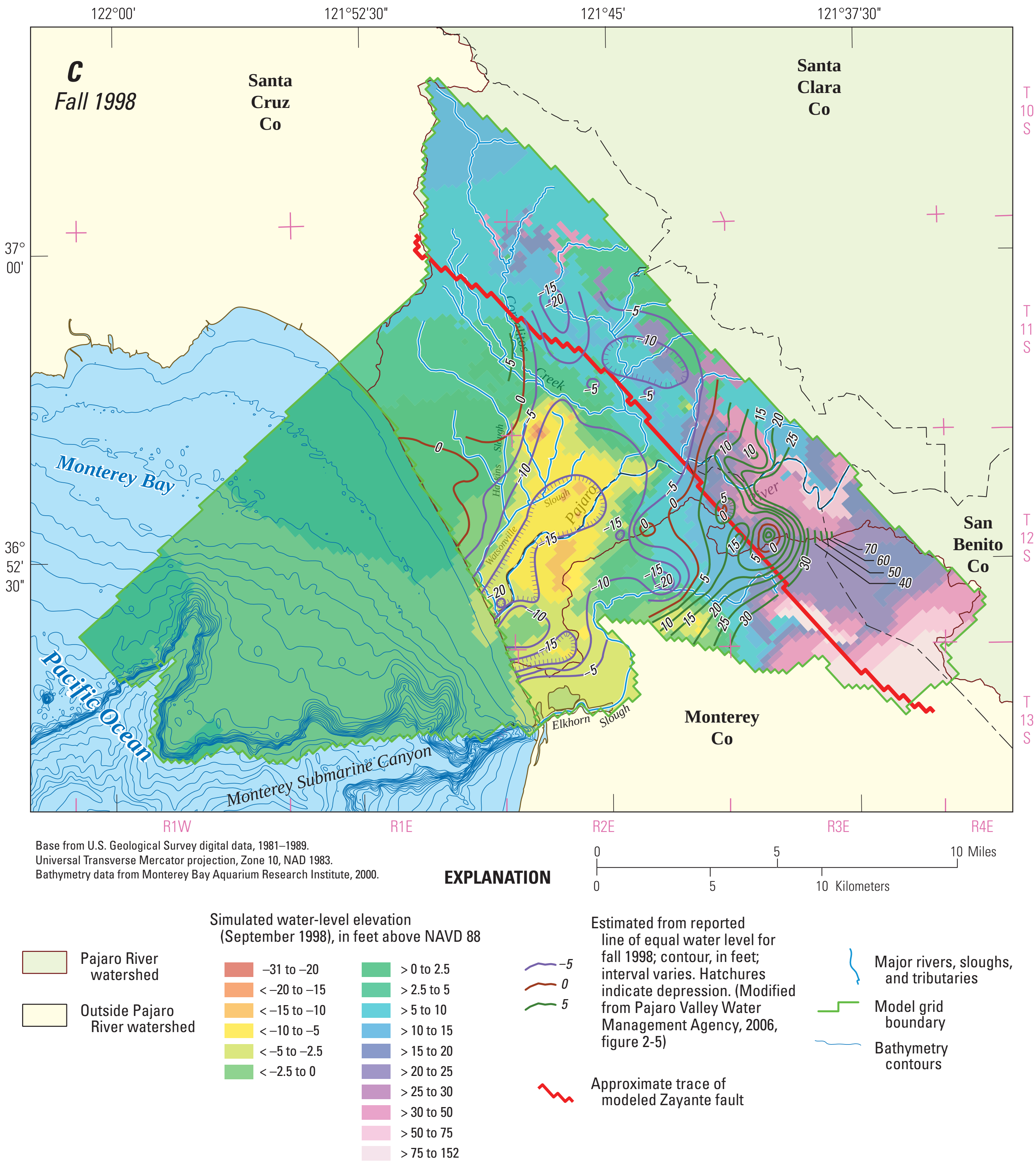
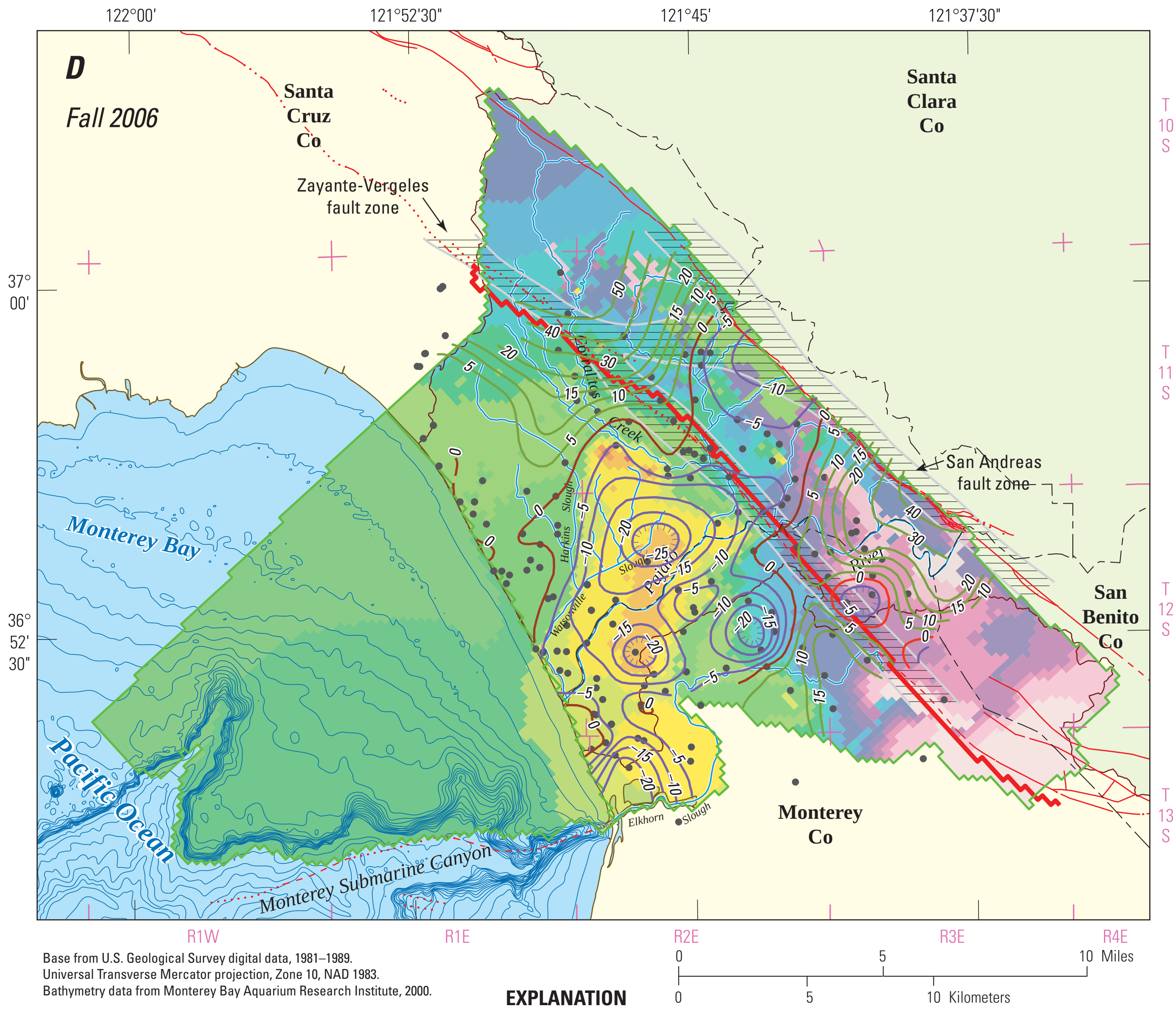


Figure 33. —Continued



Base from U.S. Geological Survey digital data, 1981–1989.
Universal Transverse Mercator projection, Zone 10, NAD 1983.
Bathymetry data from Monterey Bay Aquarium Research Institute, 2000.

EXPLANATION

Pajaro River watershed

Outside Pajaro River watershed

Simulated water-level elevation (September 2006), in feet above NAVD 88

- –36.9 to –25
- < –25 to –20
- < –20 to –15
- < –15 to –10
- < –10 to –5
- < –5 to –2.5
- < –2.5 to 0
- > 0 to 2.5
- > 2.5 to 5
- > 5 to 7.5
- > 7.5 to 10
- > 10 to 15
- > 15 to 20
- > 20 to 25
- > 25 to 30
- > 30 to 50
- > 50 to 155

–5, 0, 5 — Estimated from reported line of equal water level for fall 2006; contour, in feet; interval varies. Hatchures indicate depression. (Modified from Pajaro Valley Water Management Agency, 2006, figure 2-5)

Major rivers, sloughs, and tributaries

Model grid boundary

Bathymetry contours

Faults—
From USGS (Brabb and others, 1997), and CDMG (Wagner and others, 2000)

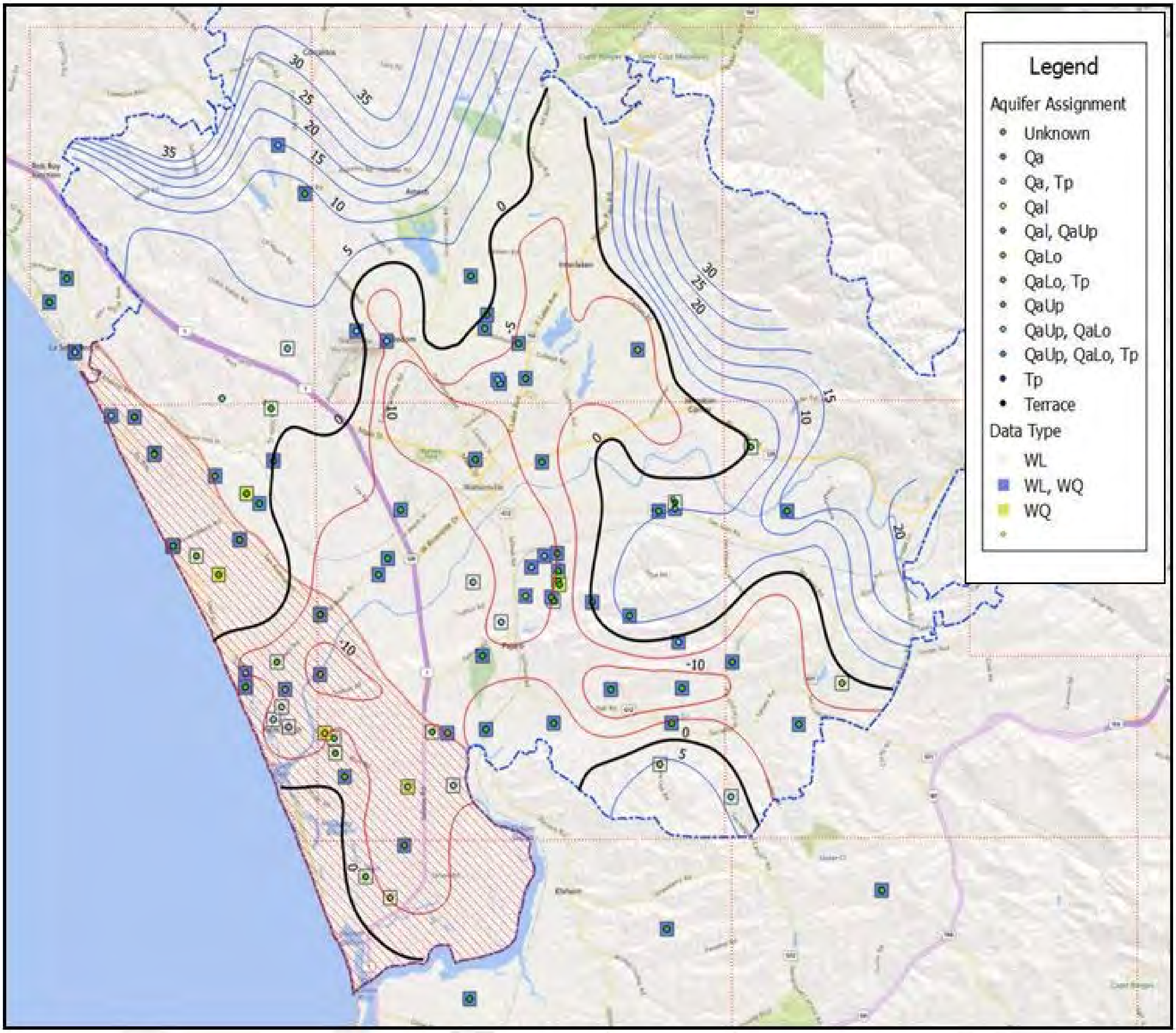
- Known
- Concealed
- Inferred

Approximate trace of modeled Zayante fault

Data points used to generate water-level contours

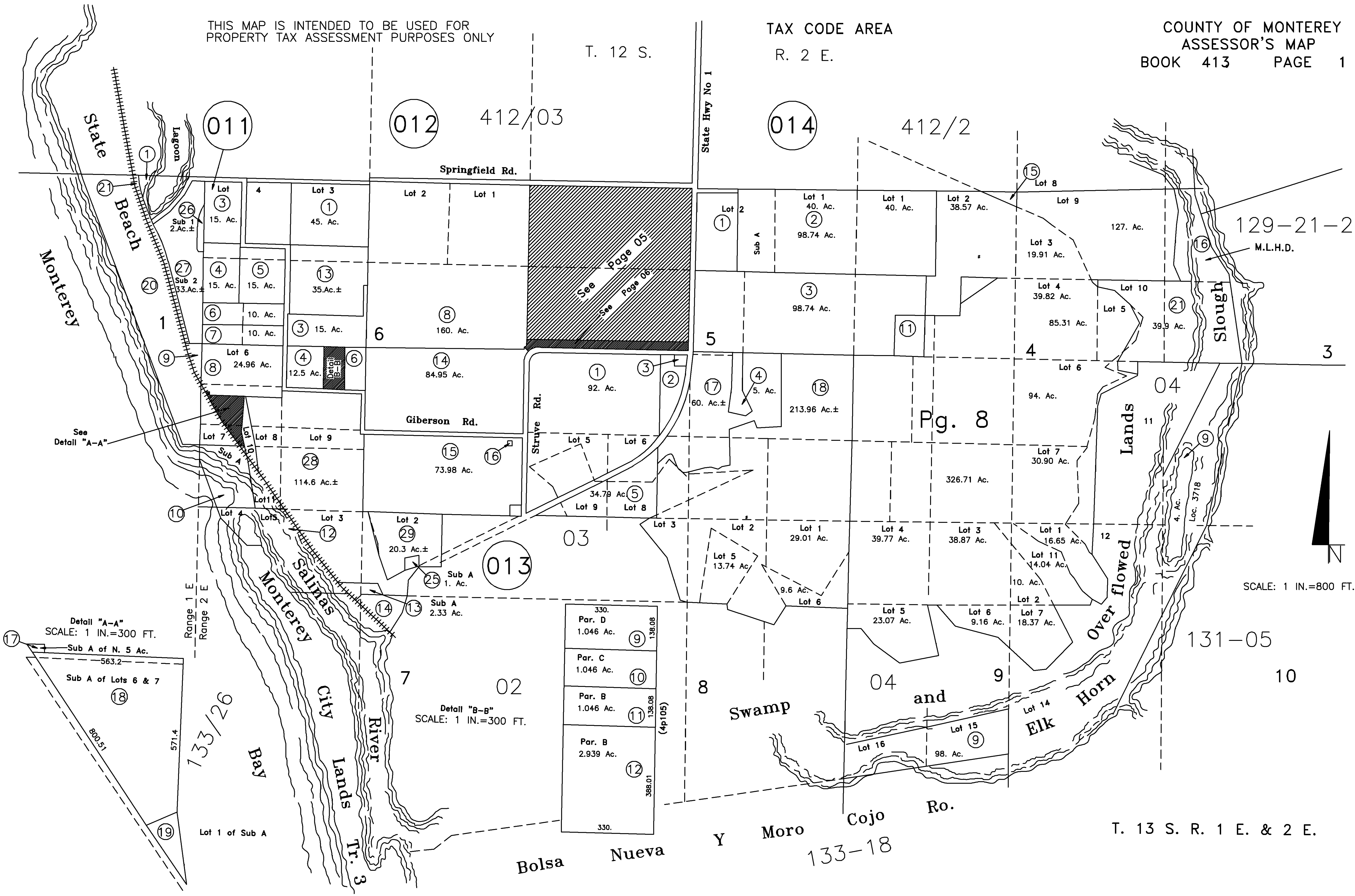
Figure 33. —Continued

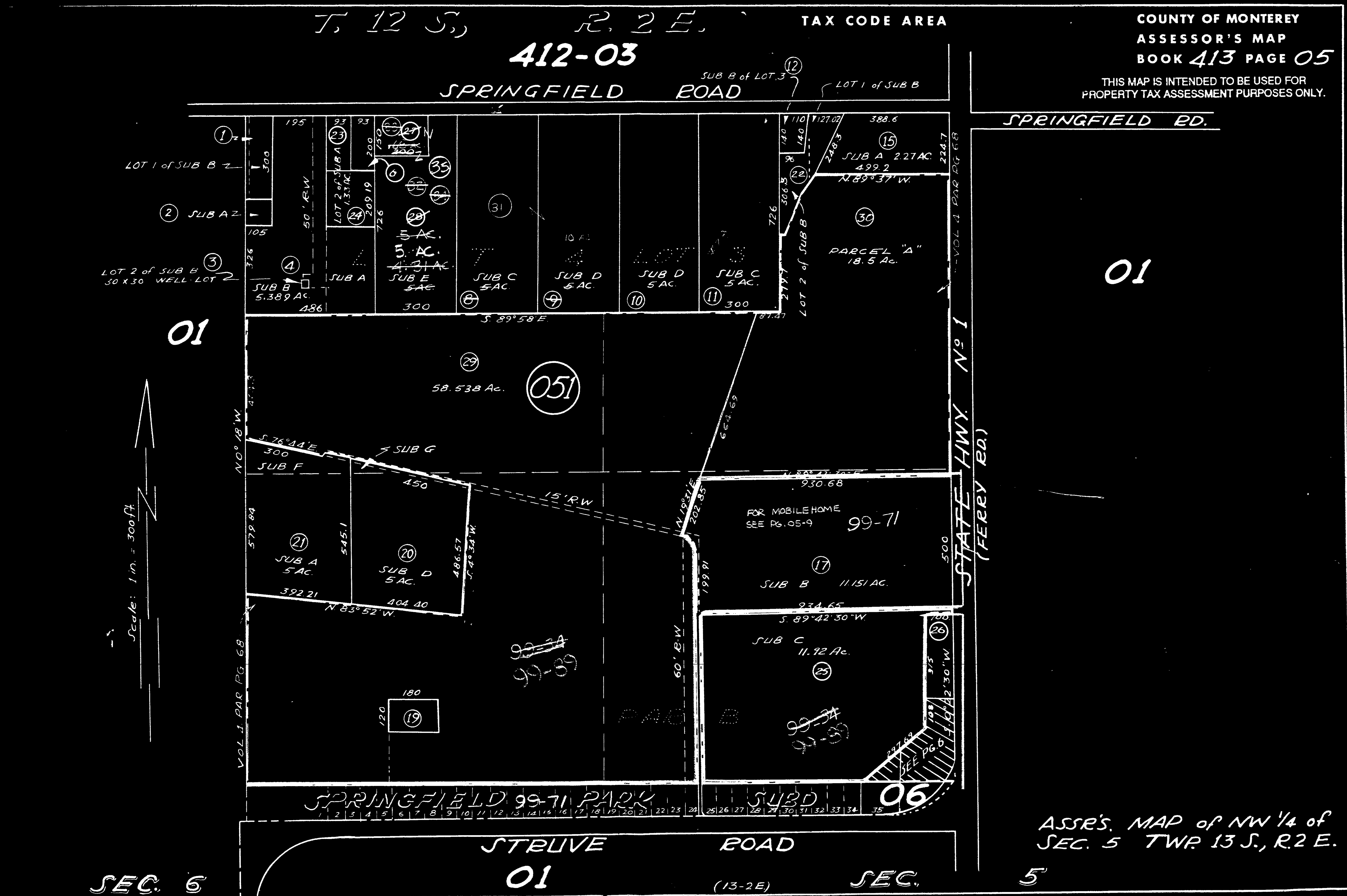
Network Wells Perforated in Upper and Lower Aromas



Feeney, M., 2016, Groundwater monitoring network review, modifictions, and recommended improvements: Technical memorandum to Pajaro Valley Water Management Agency (PVWMA), May 8, 2016

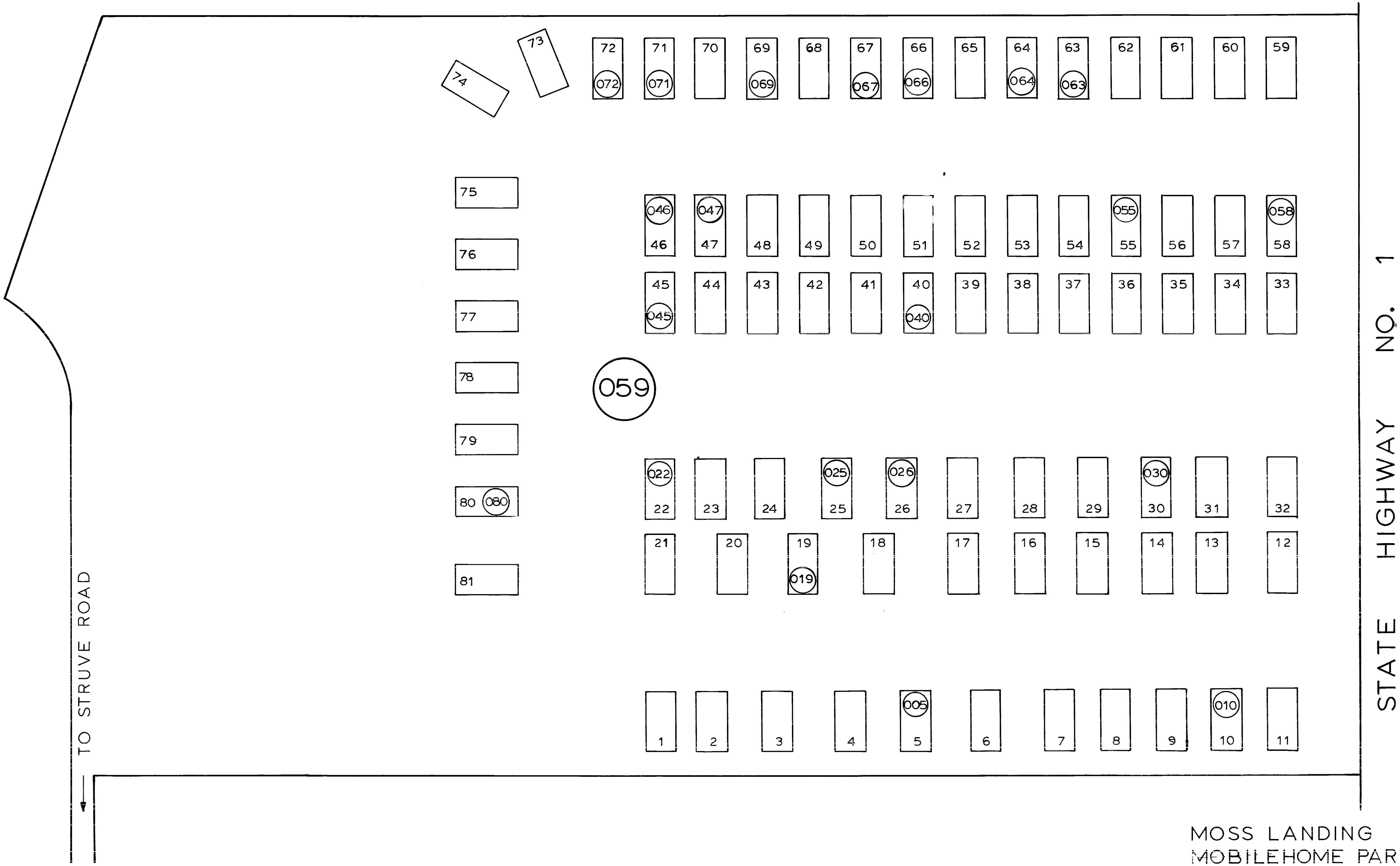
Appendix E – Parcel Maps


THIS MAP IS INTENDED TO BE USED FOR
PROPERTY TAX ASSESSMENT PURPOSES ONLY
TAX CODE AREA
COUNTY OF MONTEREY
ASSESSOR'S MAP
BOOK 413 PAGE 1
T. 12 S.
R. 2 E.
011
012
013
014
412/03
412/2
129-21-2
131-05
133/26
133-18
Springfield Rd.
Giberson Rd.
Struve Rd.
State Hwy No 1
See Page 05
See Page 06
Pg. 8
Monterey State Beach
Lagoon
Monterey Bay
Monterey City Lands Tr. 3
Salinas River
Bolsa Nueva Y Moro Cojo Ro.
Swamp and Over flowed Lands
Elk Horn Slough
M.L.H.D.
Range 1 E
Range 2 E
Detail "A-A"
SCALE: 1 IN.=300 FT.
Sub A of N. 5 Ac.
Sub A of Lots 6 & 7
Lot 1 of Sub A
Detail "B-B"
SCALE: 1 IN.=300 FT.
See Detail "A-A"
SCALE: 1 IN.=800 FT.
T. 13 S. R. 1 E. & 2 E.


COUNTY OF MONTEREY
ASSESSOR'S MAP
BOOK 413 PAGE 05
THIS MAP IS INTENDED TO BE USED FOR PROPERTY TAX ASSESSMENT PURPOSES ONLY.
TAX CODE AREA
T. 12 S., R. 2 E.
412-03
SPRINGFIELD ROAD
SPRINGFIELD RD.
SUB B of LOT 3
LOT 1 of SUB B
LOT 1 of SUB B
SUB A
LOT 2 of SUB B
50 X 30 WELL LOT
SUB B 5.389 Ac.
SUB A
SUB E
SUB C 5 AC.
SUB D 5 AC.
SUB D 5 AC.
SUB C 5 AC.
SUB A 2.27 AC.
N. 89° 37' W.
PARCEL "A" 18.5 Ac.
LOT 2 of SUB B
58.538 Ac.
051
S. 89° 58' E.
S. 76° 44' E.
SUB G
SUB F
15' R.W.
SUB A 5 AC.
SUB D 5 AC.
N. 83° 52' W.
FOR MOBILE HOME SEE PG. 05-9
99-71
SUB B 11.151 AC.
S. 89° 42' 30" W.
SUB C 11.92 Ac.
60' R.W.
50' R.W.
SEE PG. 6
99-89
STATE HWY. No 1
(FERRY RD.)
VOL. 1 PAR PG. 68
Scale: 1 in. = 300 ft.
SPRINGFIELD 99-71 PARK SUBD
STRUVE ROAD
01
06
SEC. 6
SEC. 5
(13-2E)
ASSR'S. MAP of NW 1/4 of SEC. 5 TWP. 13 S., R. 2 E.

TAX RATE AREA

COUNTY OF MONTEREY
ASSESSOR'S MAP
BOOK 413 **PAGE** 05-9



MOSS LANDING
MOBILEHOME PARK
LOCATED ON
413-051-17

Appendix F – Construction Cost Estimate

OPINION OF PROBABLE CONSTRUCTION COST

MNS ENGINEERS INC

Project: Springfield Water Supply Improvements, Pajaro Sunny Mesa Community Services District

Prepared By: NEP
Date Prepared: 11/21/2019
MNS Proj. No. PSMCS.150024

Building, Area: Moss Landing Middle School Well Site

Estimate Type:
- ☐ Conceptual
- ☑ Preliminary (w/o plans)
- ☐ Design Development @ ____ % complete
- ☐ Construction
- ☐ Change Order

Months to Midpoint of Construction: 36

				Materials		Installation		Sub-Contractor		
Item No.	**Description**	**Qty.**	**Units**	**$/Unit**	**Total**	**$/Unit**	**Total**	**$/Unit**	**Total**	**Total**
1	Mobilization	1	LS	$5,000.00	$5,000.00	$50,000.00	$50,000.00			$55,000.00
2	Site Clearing and Grubbing	1	LS	$1,000.00	$1,000.00	$5,000.00	$5,000.00			$6,000.00
3	8' High Chain Link Fence	440	LF	$15.00	$6,600.00	$15.00	$6,600.00			$13,200.00
4	20' Wide Double Swing Manual Gate	1	LS	$1,500.00	$1,500.00	$1,500.00	$1,500.00			$3,000.00
5	40,000-Gal Infiltration Basin w/ Two Pre-Cast Catch Basins	1	LS	$7,500.00	$7,500.00	$12,500.00	$12,500.00			$20,000.00
6	Site Grading	1	LS	$1,000.00	$1,000.00	$5,000.00	$5,000.00			$6,000.00
7	Gravel Surfacing	1	LS	$10,000.00	$10,000.00	$5,000.00	$5,000.00			$15,000.00
8	Miscellaneous Site Improvements	1	LS	$10,000.00	$10,000.00	$15,000.00	$15,000.00			$25,000.00
9	PG&E Service and Transformer	1	LS					$50,000.00	$50,000.00	$50,000.00
10	Generator	1	LS	$50,000.00	$50,000.00	$15,000.00	$15,000.00			$65,000.00
11	Well Pump	1	LS	$3,000.00	$3,000.00	$5,000.00	$5,000.00			$8,000.00
12	Wellhead Slab and Pedestal	1	LS	$2,500.00	$2,500.00	$2,500.00	$2,500.00			$5,000.00
13	1" Air release Valve	1	EA	$1,500.00	$1,500.00	$500.00	$500.00			$2,000.00
14	4" Gate Valve	5	EA	$1,000.00	$5,000.00	$250.00	$1,250.00			$6,250.00
15	4" Check Valve	1	EA	$1,000.00	$1,000.00	$250.00	$250.00			$1,250.00
16	4" Flow Meter	1	EA	$2,500.00	$2,500.00	$500.00	$500.00			$3,000.00
17	4" D.I. Fitting	7	EA	$250.00	$1,750.00	$150.00	$1,050.00			$2,800.00
18	4" D.I. Piping	30	LF	$40.00	$1,200.00	$40.00	$1,200.00			$2,400.00
19	4" Back Pressure Sustaining Valve	1	EA	$5,000.00	$5,000.00	$1,000.00	$1,000.00			$6,000.00
20	Back Pressure Sustaining Valve/Bypass Vault	1	LS	$5,000.00	$5,000.00	$2,500.00	$2,500.00			$7,500.00
21	Pipe and Valve Coatings	1	LS	$3,500.00	$3,500.00	$5,000.00	$5,000.00			$8,500.00
22	Tank Ringwall Foundation	2	EA	$20,000.00	$40,000.00	$20,000.00	$40,000.00			$80,000.00
23	110,000-Gal 32'-4" Bolted Steel Water Storage Tank and Appurtenances	2	EA	$55,000.00	$110,000.00	$55,000.00	$110,000.00			$220,000.00
24	Internal Tank Mixing System	2	EA	$10,000.00	$20,000.00	$2,500.00	$5,000.00			$25,000.00
25	8" Flexible Expansion Joint	2	EA	$5,000.00	$10,000.00	$750.00	$1,500.00			$11,500.00
26	8" Gate Valve	15	EA	$2,500.00	$37,500.00	$500.00	$7,500.00			$45,000.00
27	8" Check Valve	4	EA	$2,500.00	$10,000.00	$500.00	$2,000.00			$12,000.00
28	8" D.I. Fitting	29	EA	$500.00	$14,500.00	$250.00	$7,250.00			$21,750.00
29	8" PVC Piping	150	LF	$50.00	$7,500.00	$50.00	$7,500.00			$15,000.00
30	200-GPM Duty Pump	2	EA	$58,000.00	$116,000.00	$10,000.00	$20,000.00			$136,000.00
31	1,150-GPM Fire Pump	2	EA	$72,000.00	$144,000.00	$20,000.00	$40,000.00			$184,000.00
32	3,000-Gal Hydropneumatic Tank and Surge System	1	LS	$100,000.00	$100,000.00	$40,000.00	$40,000.00			$140,000.00
33	12' x 35' Electrical/Chlorination FRP Building	420	SF	$100.00	$42,000.00	$50.00	$21,000.00			$63,000.00
34	Electrical Equipment and Controls	1	LS	$75,000.00	$75,000.00	$50,000.00	$50,000.00			$125,000.00
35	Site Lighting Improvements	1	LS	$5,000.00	$5,000.00	$5,000.00	$5,000.00			$10,000.00

36	Chlorine Pump, Piping, Injection Quill, Storage Tank	1	LS	$5,000.00	$5,000.00	$2,500.00	$2,500.00			$7,500.00
37	Site Cleanup/Punchlist	1	LS	$2,500.00	$2,500.00	$2,500.00	$2,500.00			$5,000.00
	Subtotals				$863,550.00		$498,100.00		$50,000.00	$1,411,650.00
	Division 1 Costs	@	2.00%		$17,271.00		$9,962.00		$1,000.00	$28,233.00
	Subtotals				$880,821.00		$508,062.00		$51,000.00	$1,439,883.00
	Taxes - Materials Costs	@	7.75%		$68,263.63					$68,263.63
	Subtotals				$949,084.63		$508,062.00		$51,000.00	$1,508,146.63
	Contractor Markup for Sub	@	12.00%						$6,120.00	$6,120.00
	Subtotals				$949,084.63		$508,062.00		$57,120.00	$1,514,266.63
	Contractor OH&P	@	15.00%		$142,362.69		$76,209.30		$8,568.00	$227,139.99
	Subtotals				$1,091,447.32		$584,271.30		$65,688.00	$1,741,406.62
	Estimate Contingency	@	20.00%		$218,289.46		$116,854.26		$13,137.60	$348,281.32
	Subtotals				$1,309,736.79		$701,125.56		$78,825.60	$2,089,687.95
	Escalate to Midpoint of Construct (4% per Year)	@	12.5%		$163,538.97		$87,545.34		$9,842.48	$260,926.80
	Estimated Bid Cost				$1,473,275.76		$788,670.90		$88,668.08	$2,350,614.74
	Total Estimate									**$2,350,000.00**

OPINION OF PROBABLE CONSTRUCTION COST

MNS ENGINEERS INC

Project: Springfield Water Supply Improvements, Pajaro Sunny Mesa Community Services District

Prepared By: NEP
Date Prepared: 11/21/2019
MNS Proj. No. PSMCS.150024

Building, Area: Water Distribution System - Option D

Estimate Type:
- [ ] Conceptual
- [x] Preliminary (w/o plans)
- [ ] Design Development @
- [ ] Construction
- [ ] Change Order

______ % complete

Months to Midpoint of Construction 36

				Materials		Installation		Sub-Contractor		
Item No.	**Description**	**Qty.**	**Units**	**$/Unit**	**Total**	**$/Unit**	**Total**	**$/Unit**	**Total**	**Total**
1	Mobilization	1	LS	$5,000.00	$5,000.00	$50,000.00	$50,000.00			$55,000.00
2	6" PVC C900, Paved Road (Struve Road)	2250	LF	$60.00	$135,000.00	$60.00	$135,000.00			$270,000.00
3	6" PVC C900, Paved Road (Struve Road to MH Park)	880	LF	$60.00	$52,800.00	$60.00	$52,800.00			$105,600.00
4	8" PVC C900, Unpaved Road (Springfield Road to MH Park)	1430	LF	$50.00	$71,500.00	$50.00	$71,500.00			$143,000.00
5	8" PVC C900, Paved Road (Springfield Road to MH Park)	1620	LF	$70.00	$113,400.00	$70.00	$113,400.00			$226,800.00
6	6" PVC C900, Mobile Home Park	2950	LF	$60.00	$177,000.00	$60.00	$177,000.00			$354,000.00
7	8" PVC C900, Paved Road (Springfield Road)	3280	LF	$70.00	$229,600.00	$70.00	$229,600.00			$459,200.00
8	8" PVC C900 in Steel Casing by Jack and Bore (Highway 1 Crossing)	100	LF	$300.00	$30,000.00	$500.00	$50,000.00			$80,000.00
9	6" D.I. Fitting	10	EA	$350.00	$3,500.00	$200.00	$2,000.00			$5,500.00
10	8" D.I. Fitting	10	EA	$500.00	$5,000.00	$250.00	$2,500.00			$7,500.00
11	6" In-Line Gate Valve	7	EA	$1,500.00	$10,500.00	$500.00	$3,500.00			$14,000.00
12	8" In-Line Gate Valve	9	EA	$2,500.00	$22,500.00	$750.00	$6,750.00			$29,250.00
13	Fire Hydrant, Bury, Lateral, and Gate Valve	19	EA	$7,500.00	$142,500.00	$2,500.00	$47,500.00			$190,000.00
14	Water Sampling Station	2	EA	$5,000.00	$10,000.00	$2,500.00	$5,000.00			$15,000.00
15	Water Service Connection and Meter	163	EA	$2,000.00	$326,000.00	$1,500.00	$244,500.00			$570,500.00
16	Blowoff Valve	3	EA	$3,000.00	$9,000.00	$2,000.00	$6,000.00			$15,000.00
17	Air Release Valve	4	EA	$3,000.00	$12,000.00	$2,000.00	$8,000.00			$20,000.00
18	Road Repair	1	LS	$100,000.00	$100,000.00	$150,000.00	$150,000.00			$250,000.00
	Subtotals				$1,455,300.00		$1,355,050.00			$2,810,350.00
	Division 1 Costs	@	2.00%		$29,106.00		$27,101.00			$56,207.00
	Subtotals				$1,484,406.00		$1,382,151.00			$2,866,557.00
	Taxes - Materials Costs	@	7.75%		$115,041.47					$115,041.47
	Subtotals				$1,599,447.47		$1,382,151.00			$2,981,598.47
	Contractor OH&P	@	15.00%		$239,917.12		$207,322.65			$447,239.77
	Subtotals				$1,839,364.58		$1,589,473.65			$3,428,838.23
	Estimate Contingency	@	20.00%							$685,767.65
	Subtotals									$4,114,605.88
	Escalate to Midpoint of Construct	@	12.5%							$513,766.15
	Estimated Bid Cost									$4,628,372.03
	Total Estimate									**$4,630,000.00**

OPINION OF PROBABLE CONSTRUCTION COST

Project: Springfield Water Supply Improvements, Pajaro Sunny Mesa Community Services District

Prepared By: NEP

Date Prepared: 11/21/2019

Building, Area: Existing Springfield Well Site

MNS Proj. No. PSMCS.150024

Estimate Type:
- ☐ Conceptual
- ☑ Preliminary (w/o plans)
- ☐ Design Development @ ____ % complete
- ☐ Construction
- ☐ Change Order

Months to Midpoint of Construction 36

Item No.	Description	Qty.	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-Contractor $/Unit	Sub-Contractor Total	Total
1	Mobilization	1	LS	$5,000.00	$5,000.00	$25,000.00	$25,000.00			$30,000.00
2	Demolition of Existing Structure and Facilities	1	LS	$5,000.00	$5,000.00	$10,000.00	$10,000.00			$15,000.00
3	Site Clearing and Grubbing	1	LS	$1,000.00	$1,000.00	$1,000.00	$1,000.00			$2,000.00
4	12' Wide Gravel Access Road	550	LF	$50.00	$27,500.00	$100.00	$55,000.00			$82,500.00
5	8' High Chain Link Fence	264	LF	$15.00	$3,960.00	$15.00	$3,960.00			$7,920.00
6	16' Wide Double Swing Manual Gate	1	LS	$1,500.00	$1,500.00	$1,500.00	$1,500.00			$3,000.00
7	20,000-Gal Infiltration Basin	1	LS	$5,000.00	$5,000.00	$7,500.00	$7,500.00			$12,500.00
8	Site Grading	1	LS	$500.00	$500.00	$2,500.00	$2,500.00			$3,000.00
9	Gravel Surfacing	1	LS	$5,000.00	$5,000.00	$2,500.00	$2,500.00			$7,500.00
10	Miscellaneous Site Improvements	1	LS	$10,000.00	$10,000.00	$10,000.00	$10,000.00			$20,000.00
11	Well	1	LS					$100,000.00	$100,000.00	$100,000.00
12	Well Pump	1	LS	$3,000.00	$3,000.00	$5,000.00	$5,000.00			$8,000.00
13	Wellhead Pad and Pedestal	1	LS	$2,500.00	$2,500.00	$2,500.00	$2,500.00			$5,000.00
14	1" Air Release Valve	1	EA	$1,500.00	$1,500.00	$500.00	$500.00			$2,000.00
15	4" Gate Valve	2	EA	$1,000.00	$2,000.00	$250.00	$500.00			$2,500.00
16	4" Check Valve	1	EA	$1,000.00	$1,000.00	$250.00	$250.00			$1,250.00
17	4" Flow Meter	1	EA	$2,500.00	$2,500.00	$500.00	$500.00			$3,000.00
18	4" D.I. Fitting	4	EA	$250.00	$1,000.00	$150.00	$600.00			$1,600.00
19	4" D.I. Piping	10	LF	$40.00	$400.00	$40.00	$400.00			$800.00
20	4" PVC Piping	60	LF	$30.00	$1,800.00	$30.00	$1,800.00			$3,600.00
21	10' x 18' Electrical/Chlorination FRP Building	180	SF	$120.00	$21,600.00	$60.00	$10,800.00			$32,400.00
22	Electrical Equipment and Controls	1	LS	$40,000.00	$40,000.00	$20,000.00	$20,000.00			$60,000.00
23	Site Lighting Improvements	2	LS	$2,500.00	$5,000.00	$2,500.00	$5,000.00			$10,000.00
24	Chlorine Pump, Piping, Injection Quill, Storage Tank	1	LS	$5,000.00	$5,000.00	$2,500.00	$2,500.00			$7,500.00
25	Existing Well Destruction	1	LS					$20,000.00	$20,000.00	$20,000.00
26	Site Cleanup/Punchlist	1	LS	$2,500.00	$2,500.00	$2,500.00	$2,500.00			$5,000.00
	Subtotals				$154,260.00		$171,810.00		$120,000.00	$446,070.00
	Division 1 Costs	@	2.00%		$3,085.20		$3,436.20		$2,400.00	$8,921.40
	Subtotals				$157,345.20		$175,246.20		$122,400.00	$454,991.40
	Taxes - Materials Costs	@	7.75%		$12,194.25					$12,194.25
	Subtotals				$169,539.45		$175,246.20		$122,400.00	$467,185.65
	Contractor Markup for Sub	@	12.00%						$14,688.00	$14,688.00
	Subtotals				$169,539.45		$175,246.20		$137,088.00	$481,873.65
	Contractor OH&P	@	15.00%		$25,430.92		$26,286.93		$20,563.20	$72,281.05
	Subtotals				$194,970.37		$201,533.13		$157,651.20	$554,154.70

Estimate Contingency	@	20.00%				$110,830.94
Subtotals						$664,985.64
Escalate to Midpoint of Construct	@	12.5%				$83,032.77
Estimated Bid Cost						$748,018.41
Total Estimate						**$750,000.00**

OPINION OF PROBABLE CONSTRUCTION COST

MNS ENGINEERS INC

Project: Springfield Water Supply Improvements, Pajaro Sunny Mesa Community Services District

Prepared By: NEP
Date Prepared: 11/21/2019
MNS Proj. No. PSMCS.150024

Building, Area: Water Distribution System - Option D

Estimate Type:
- ☐ Conceptual
- ☑ Preliminary (w/o plans)
- ☐ Design Development @ ______ % complete
- ☐ Construction
- ☐ Change Order

Months to Midpoint of Construction: 36

				Materials		Installation		Sub-Contractor		
Item No.	**Description**	**Qty.**	**Units**	**$/Unit**	**Total**	**$/Unit**	**Total**	**$/Unit**	**Total**	**Total**
1	Mobilization	1	LS	$5,000.00	$5,000.00	$50,000.00	$50,000.00			$55,000.00
2	4" PVC C900 (SW-3 to Struve Road)	600	LF	$30.00	$18,000.00	$30.00	$18,000.00			$36,000.00
3	6" PVC C900, Unpaved Road	2000	LF	$40.00	$80,000.00	$30.00	$60,000.00			$140,000.00
4	6" PVC C900, Crossing Under McClusky Slough	300	LF	$41.00	$12,300.00	$31.00	$9,300.00			$21,600.00
5	6" PVC C900, Paved Road	10100	LF	$40.00	$404,000.00	$40.00	$404,000.00			$808,000.00
6	4" D.I. Fitting	3	EA	$250.00	$750.00	$150.00	$450.00			$1,200.00
7	6" D.I. Fitting	8	EA	$350.00	$2,800.00	$200.00	$1,600.00			$4,400.00
8	6" In-Line Gate Valve	17	EA	$1,500.00	$25,500.00	$500.00	$8,500.00			$34,000.00
9	Fire Hydrant, Bury, Lateral, and Gate Valve	6	EA	$7,500.00	$45,000.00	$2,500.00	$15,000.00			$60,000.00
10	Water Sampling Station	2	EA	$5,000.00	$10,000.00	$2,500.00	$5,000.00			$15,000.00
11	Water Service Connection and Meter	163	EA	$2,000.00	$326,000.00	$1,500.00	$244,500.00			$570,500.00
12	Air Release Valve	4	EA	$3,000.00	$12,000.00	$2,000.00	$8,000.00			$20,000.00
13	Road Repair	1	LS	$100,000.00	$100,000.00	$150,000.00	$150,000.00			$250,000.00
	Subtotals				$1,041,350.00		$974,350.00			$2,015,700.00
	Division 1 Costs	@	2.00%		$20,827.00		$19,487.00			$40,314.00
	Subtotals				$1,062,177.00		$993,837.00			$2,056,014.00
	Taxes - Materials Costs	@	7.75%		$82,318.72					$82,318.72
	Subtotals				$1,144,495.72		$993,837.00			$2,138,332.72
	Contractor OH&P	@	15.00%		$171,674.36		$149,075.55			$320,749.91
	Subtotals				$1,316,170.08		$1,142,912.55			$2,459,082.63
	Estimate Contingency	@	20.00%		$263,234.02		$228,582.51			$491,816.53
	Subtotals				$1,579,404.09		$1,371,495.06			$2,950,899.15
	Escalate to Midpoint of Construct	@	12.5%		$197,210.71		$171,250.36			$368,461.07
	Estimated Bid Cost				$1,776,614.80		$1,542,745.42			$3,319,360.22
	Total Estimate									**$3,320,000.00**

OPINION OF PROBABLE CONSTRUCTION COST

Project: Springfield Water Supply Improvements, Pajaro Sunny Mesa Community Services District

Prepared By: NEP
Date Prepared: 11/21/2019
MNS Proj. No. PSMCS.150024

Building, Area: Moss Landing Middle School Well Site

Estimate Type:
- ☐ Conceptual
- ☑ Preliminary (w/o plans)
- ☐ Design Development @ ____ % complete
- ☐ Construction
- ☐ Change Order

Months to Midpoint of Construction: 36

Item No.	Description	Qty.	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-Contractor $/Unit	Sub-Contractor Total	Total
1	Mobilization	1	LS	$5,000.00	$5,000.00					$5,000.00
2	Communications and Controls Improvements	1	LS	$25,000.00	$25,000.00	$25,000.00	$25,000.00			$50,000.00
3	Backpressure Sustaining Valve	1	LS	$6,000.00	$6,000.00	$1,000.00	$1,000.00			$7,000.00
	Subtotals				$36,000.00		$26,000.00			$62,000.00
	Division 1 Costs	@	2.00%		$720.00		$520.00			$1,240.00
	Subtotals				$36,720.00		$26,520.00			$63,240.00
	Taxes - Materials Costs	@	7.75%		$2,845.80					$2,845.80
	Subtotals				$39,565.80		$26,520.00			$66,085.80
	Contractor Markup for Sub	@	12.00%							
	Subtotals				$39,565.80		$26,520.00			$66,085.80
	Contractor OH&P	@	15.00%		$5,934.87		$3,978.00			$9,912.87
	Subtotals				$45,500.67		$30,498.00			$75,998.67
	Estimate Contingency	@	20.00%							$15,199.73
	Subtotals									$91,198.40
	Escalate to Midpoint of Construct (4% per Year)	@	12.5%							$11,387.40
	Estimated Bid Cost									$102,585.80
	Total Estimate									**$100,000.00**