BOARD OF SUPERVISORS

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BRUCE GIBSON
SUPERVISOR DISTRICT TWO

July 18, 2016

California Water Commission
Attn: Mr. Joseph Byrne, Chairperson
P.O. Box 942836
Sacramento, CA 94236-0001

Subject: Request Reversal of DWR's Draft Recommendation to Deny the Los Osos Groundwater Basin Boundary Modification Request

Dear Chairperson Byrne:

I write to urge your Commission and the Department of Water Resources (DWR) to help the Los Osos Groundwater Basin (LOGB) be a SGMA success story by approving our request for a basin boundary modification.

DWR has released a draft decision to deny the local modification request. We are asking DWR to reverse its decision, and thus substantiate its commitment to supporting local efforts to achieve sustainability. I believe DWR should support effective local management and technical analysis over state-wide consistency criteria, consistent with the State's policy outlined in SGMA. We believe DWR's approval of our request would also be consistent with the explicit exemption the LOGB was granted in SGMA.

SGMA creates a complete paradigm shift in groundwater management. The law recognizes local management as the best chance for achieving sustainable groundwater management – as is exemplified by local management of the LOGB.

The Los Osos community is already implementing SGMA. Community partners have spent decades developing technical analysis, negotiating governance structures, navigating legal/regulatory processes, and debating key issues. This effort culminated in formation of a new Basin Management Committee (similar to a GSA) comprised of local purveyors, approval of a Basin Management Plan (similar to a GSP), and implementation of solutions.

Most recently, the community has funded the county-led construction of the $183-million Los Osos Water Recycled Facility. This unique coastal wastewater treatment plant employs advanced tertiary treatment so that 100% of its effluent is recycled to beneficial use—there is no ocean outfall.

In addition, the Basin Management Plan formalizes future mitigation actions (totaling approximately $30-million) and provides mechanisms for adaptive management that will secure the long-term sustainability of the LOGB. The Basin Management Committee documents its efforts in annual reports available to DWR (attached), summarizing monitoring data and showing the impacts of the Committee's actions.

We urge DWR to approve our boundary modification request in order to facilitate orderly management of the LOGB. Our technical analysis shows that the fringe areas we ask to be excluded do not have groundwater sustainability issues, nor do they affect the hydrogeology of the LOGB. Thus we firmly believe that our requested boundary is both technically and jurisdictionally justified.

Please note that we believe effective management could also proceed if the fringe areas were designated as sub-basins and re-prioritized in DWR's next steps. Finally, if in future years the required annual reporting does not show substantial progress towards sustainability, SGMA provides the State with mechanisms to intervene and require additional management.

In approving our request, we are asking DWR to give the community an opportunity to prove its ability to achieve sustainability.

Thank you for your consideration.

Sincerely,

Bruce Gibson

BRUCE GIBSON
Supervisor, District 2
San Luis Obispo County

cc: California Water Commissioners (via e-mail, hand-delivered)

Attachments: DRAFT Los Osos Basin Plan Groundwater Monitoring 2015 Annual Report

CF 900.101.01 SGMA

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LOS OSOS BASIN PLAN
GROUNDWATER MONITORING PROGRAM
2015 ANNUAL REPORT

Prepared for the

BASIN MANAGEMENT COMMITTEE

JUNE 2016

CLEATH-HARRIS GEOLOGISTS
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1. INTRODUCTION

This is the first annual report for the Los Osos groundwater basin. The basin was adjudicated in October 2015 and is now managed by the Los Osos Groundwater Basin Management Committee (BMC), consisting of representatives from Los Osos Community Services District (LOCSD), Golden State Water Company (GSWC), S&T Mutual Water Company (S&T), and the County of San Luis Obispo (County).

The 2015 Annual Report describes basin activities related to the Los Osos Basin Plan (LOBP) Groundwater Monitoring Program, and provides results and interpretation of these activities. The LOBP Groundwater Monitoring Program is necessary to accomplish the following continuing goals set forth in Section 2.4 of the Basin Plan (ISJ Group, 2015):

1. *Provide for a continuously updated hydrologic assessment of the Basin, its water resources and sustainable yield.*

2. *Create a water resource accounting which is able to meet the information needs for planning, monitoring, trading, environmental management, utility operations, land development and agricultural operations.*

The LOBP Groundwater Monitoring Program is also necessary to support other goals of the Basin Plan, including prevention of seawater intrusion, establishing a long-term environmentally and economically sustainable and beneficial use of the basin, and the equitable allocation of costs associated with basin management (ISJ Group, 2015). The program will provide significant overlap with several regulatory requirements, including:

- Senate Bill 1168, Senate Bill 1319, and Assembly Bill 1739 which collectively establish the Sustainable Groundwater Management Act (SGMA);
- California Statewide Groundwater Elevation Monitoring (CASGEM);
- State Water Resource Control Board's salt and nutrient monitoring guidelines as adopted in the state Recycled Water Policy;
- and the Recycled Water Management Plan requirements for the Los Osos Wastewater Project (LOWWP).

This report is organized into seven sections, including two sections on introductory and background information, two sections on the conduct of work and analytical results of the monitoring program, two sections on data interpretation and basin status, and a final section on recommendations for the monitoring program.

2. BACKGROUND

In August 2008, the Superior Court of the State of California for the County of San Luis Obispo County (Court) approved an Interlocutory Stipulated Judgment (ISJ) between LOCSD, GSWC, S&T, and the County. Under the ISJ, these parties formed a working group, undertaking technical studies and management discussions that produced the Basin Plan in January 2015. The Basin Plan presents a comprehensive groundwater management strategy and serves as the cornerstone of a physical solution to address the significant problems facing the basin, including seawater intrusion and elevated nitrate concentrations, and for restoration of basin water resources, while respecting existing water rights. The LOBP Groundwater Monitoring Program is a key component of the Basin Plan, providing water level and water quality data that serve as measures of effectiveness for Basin Plan programs and activities with respect to the restoration of basin water resources.

A basin boundary modification application was initiated in 2015 by the County for submittal to the Department of Water Resources (DWR). The proposed scientific boundary modification would adjust the current DWR Bulletin 118 boundary to coincide, with minor adjustments, to the basin boundary used in the Basin Plan. The Basin Plan areas and basin boundary are shown in Figure 1.

2.1 Groundwater Monitoring Program History

Groundwater monitoring has been performed by public agencies, water purveyors, and consultants for various basin studies and programs over several decades. The following lists include historical studies, monitoring reports, and monitoring programs with a major focus on basin water levels and water quality through December 31, 2015, which is the end of the period covered by this Annual Report.

<u>Historical Investigations</u>

- Department of Water Resources, 1973, *Los Osos-Baywood Ground Water Protection Study*;
- Department of Water Resources, 1979, *Morro Bay Sandspit Investigation*;
- Brown & Caldwell, 1983, *Los Osos - Baywood Park Phase I Water Quality Management Study*;
- U. S. Geological Survey, 1988, *Hydrogeology and Water Resources of the Los Osos Valley Ground-Water Basin, San Luis Obispo County, Water-Resources Investigation 88-4081*;
- Metcalf & Eddy, 1995, *Task F - Sanitary Survey and Nitrate Source Study*;
- Cleath & Associates, 2005, *Sea Water Intrusion Assessment and Lower Aquifer Source Investigation of the Los Osos Valley Groundwater Basin*

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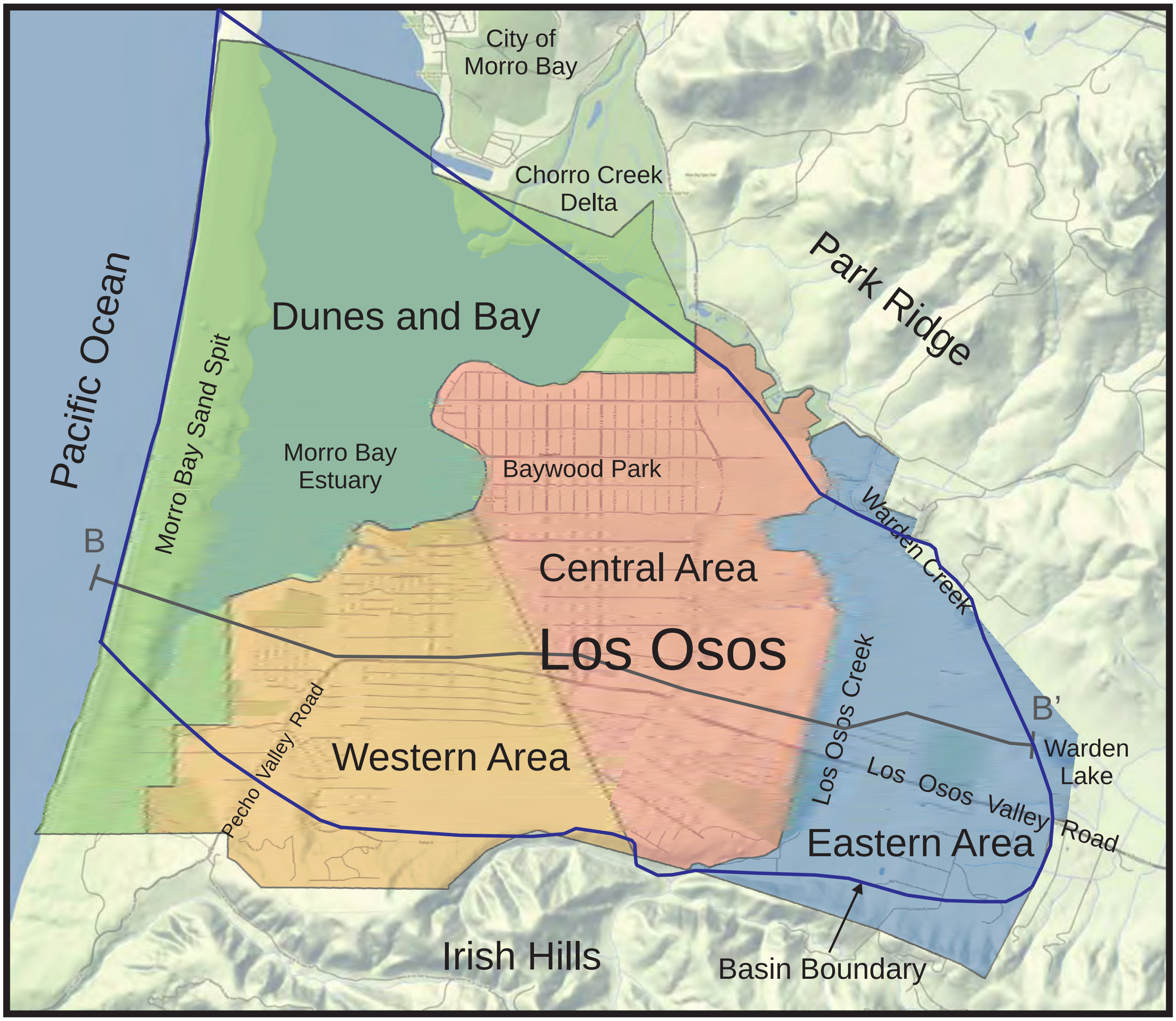

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Scale: 1 inch ≈ 4,000 feet

Explanation

Basin Plan Areas:

- Dunes and Bay Area
- Western Area
- Central Area
- Eastern Area

B—B' Cross-section alignment (Figures 5 and 20). Labeled B-B' to be consistent with Basin Plan.

Basin Boundary from Basin Plan

Figure 1
Basin Location and Plan Areas
Los Osos Groundwater Basin
2015 Annual Report

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- Cleath & Associates, 2006, *Task 3 Upper Aquifer Water Quality Characterization*;

Monitoring Reports:

- San Luis Obispo County Engineering Department, 1999, *Baywood Groundwater Study - Fourth Quarter 1998*;
- Cleath & Associates, 2002-2006, Quarterly and Semi-Annual Groundwater Monitoring Reports for the Los Osos Nitrate Monitoring Program.
- Cleath-Harris Geologists, 2010, *Water Quality Monitoring Results Summary, November 2009-January 2010, Los Osos Valley Groundwater Basin*;
- Cleath-Harris Geologists, 2012-2013, Semi-Annual Groundwater Monitoring Reports for Los Osos Water Recycling Facility Baseline Groundwater Quality Monitoring;
- Rincon Consultants, 2014, Semi-Annual Groundwater Monitoring Reports for Los Osos Water Recycling Facility Baseline Groundwater Quality Monitoring;
- Cleath-Harris Geologists, 2014-2015, Semi-Annual Groundwater Monitoring Reports for Lower Aquifer;
- Cleath-Harris Geologists, 2015, Semi-Annual Groundwater Monitoring Reports for Los Osos Water Recycling Facility Baseline Groundwater Quality Monitoring;
- Consumer Confidence Reports (Water Quality Reports) published annually by the water purveyors.

Monitoring Programs:

- San Luis Obispo County Public Works, Semi-Annual Water Level Monitoring Program. Period of record for individual wells varies; most begin in 1970's and 1980's, and some end in 1999; program remains active.
- Purveyor Water Supply Well Monitoring per SWRCB-Division of Drinking Water requirements. Period of record for individual wells varies; program remains active.
- 2002-2006 Los Osos Nitrate Monitoring Program. Water levels measured quarterly to semi-annually; program ended October 2006.
- 2012-2015 Los Osos Water Recycling Facility (LOWRF) Baseline Groundwater Monitoring Program. Water levels measured semi-annually; program remains active.

- 2014-2015 Lower Aquifer Monitoring Program. Water levels measured semi-annually; program ended in 2015.

In addition to water quality and water level reporting, this 2015 Annual Report compiles groundwater production, precipitation, and stream flow data from the following sources:

- Community water purveyors (LOCSD, GSWC, and S&T) provide metered production records.

- San Luis Obispo County Department of Public Works provides precipitation at the Los Osos Landfill and stream flow data for Los Osos Creek.

Production from private domestic and agricultural irrigation wells is not metered. Production estimates for these wells are based on water use surveys performed in 2009 with adjustments from aerial photo review.

2.2 Groundwater Monitoring Program Design

The purpose of the LOBP Groundwater Monitoring Program is to collect and organize groundwater data on a regular basis for use in management of the basin. Design of the LOBP Groundwater Monitoring Program is detailed in Chapter 7 of the Basin Plan. The basic elements of the program are as follows:

- Monitor long-term groundwater level trends in a network of wells for three monitoring groups within the basin: First Water (FW), Upper Aquifer (UA), and Lower Aquifer (LA).

- Monitor seasonal fluctuations and long-term water quality trends at selected wells in each of the three monitoring groups.

- Compile hydrologic data pertinent to basin management, including groundwater production from the two principal water supply aquifers (Upper Aquifer and Lower Aquifer), wastewater disposal and recycled water use, local precipitation data and County stream gage records for Los Osos Creek.

- Organize historical and ongoing water production, water level and water quality monitoring data into three comprehensive databases, facilitating access and analysis.

- Collect data sufficient to evaluate the effectiveness of basin management strategies adopted in the Basin Plan via established metrics.

There are a total of 73 wells in the LOBP Groundwater Monitoring Program, including 35 monitoring wells, 15 municipal wells (active and inactive) and 23 private wells (pending well owner participation). Twelve additional existing wells are recommended for inclusion into the monitoring program, for a total of 85 network wells. Existing groundwater monitoring wells were chosen for their specific characteristics and to achieve, to the degree possible, horizontal and vertical coverage throughout the basin. The LOBP Groundwater Monitoring Program coverage within the basin is shown in Figures 2, 3, and 4. Correlation between LOBP Groundwater Monitoring Program well numbers and state well numbers, along with well construction information and monitoring tasks are included in Appendix A. Construction of nested Upper Aquifer and Lower Aquifer monitoring wells near the bay was recommended in the Basin Plan. A budget of $100,000 would be appropriate for new well construction.

2.2.1 Water Level Monitoring

Groundwater elevations in wells are measures of hydraulic head at certain locations in an aquifer. Groundwater moves in the direction of declining head, and groundwater elevation contours can be used to show the general direction of, and hydraulic gradient associated with, groundwater movement. Changes to the amount of groundwater in storage within an aquifer can also be estimated by using changes in the hydraulic head with other parameters. Water level monitoring is a fundamental tool in characterizing basin hydrology, and will be performed at LOBP Groundwater Monitoring Program locations. Eight monitoring locations are scheduled to be equipped with water level transducers, which will provide an efficient and high level of resolution for tracking the dynamic changes in groundwater levels.

Of the 73 wells currently in the groundwater monitoring network, 28 are representative of First Water, 15 are representative of the Upper Aquifer, and 30 are representative of the Lower Aquifer. Spatially, 31 water level monitoring wells are located in the Western Area, 30 are located in the Central Area, and 12 are located in the Eastern Area. The 12 additional wells recommended for the monitoring program include 3 First Water, 3 Upper Aquifer, and 6 Lower Aquifer wells.

First Water

The First Water group refers to wells screened within the first 50 feet of the water table across the basin, regardless of the aquifer (Figure 5). First Water is the interface where percolating waters, including precipitation and return flows from irrigation and wastewater, mix with basin waters. Where First Water rises to the surface, it also impacts drainage and is associated with flooding issues in low-lying areas. First Water extends areally throughout the basin, and may be present in dune sands, Paso Robles Formation deposits, or Los Osos Creek alluvium. Selected First Water wells, including those in downtown Los Osos are used to represent the perched aquifer (Zones A and B) and alluvial aquifer for water level contouring.

Upper Aquifer

The upper aquifer (Zone C) refers to the non-perched aquifer above the regional aquitard (Figure 5). As noted above, the a portion of the upper aquifer may also be considered first water in certain basin areas. Historically, the upper aquifer was developed as the main water supply for the community, and is still the main source of water for rural residential parcels. A significant increase in upper

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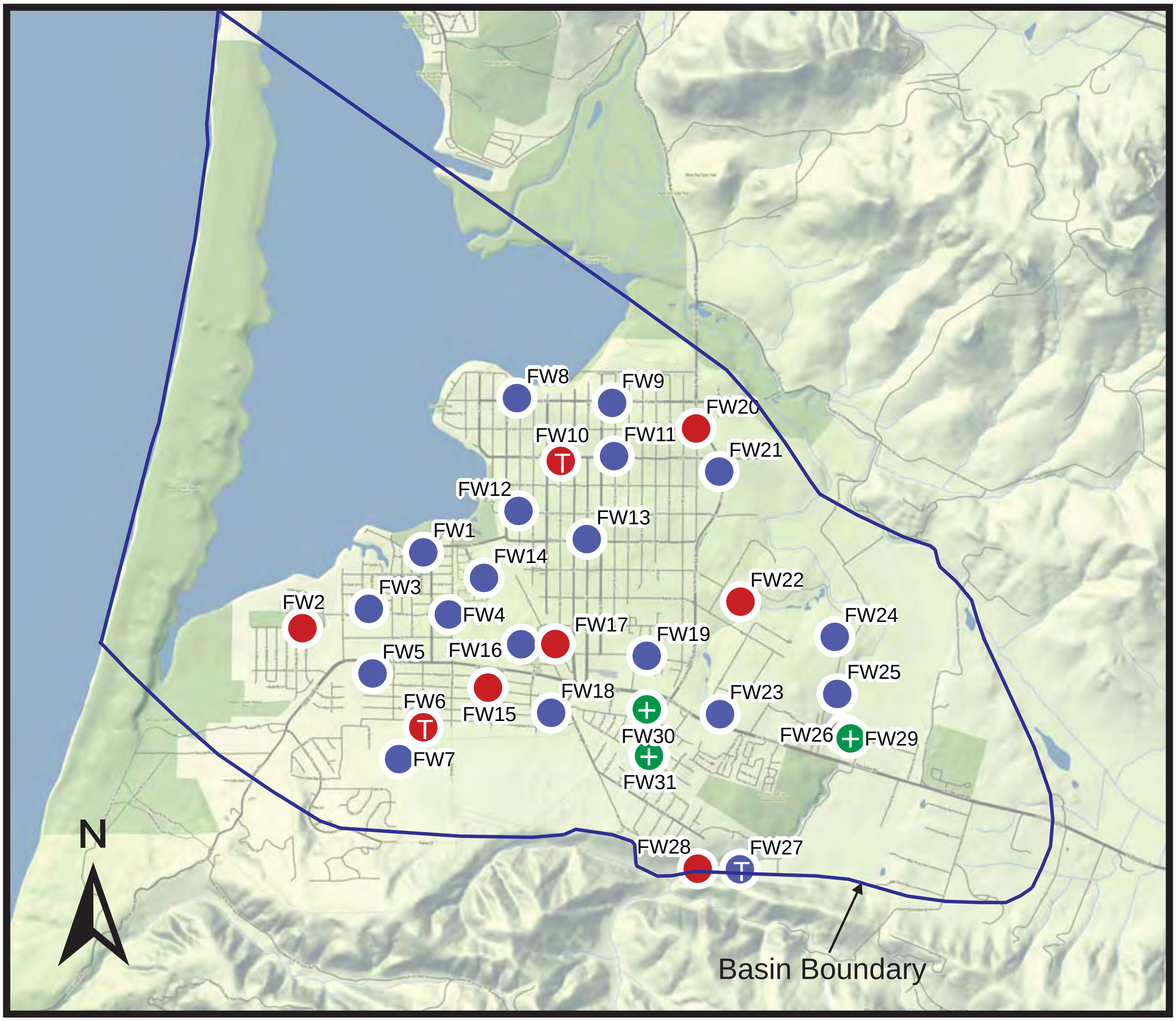

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Scale: 1 inch ≈ 4,000 feet

Explanation

- Water Level Monitoring Well
- Recommended Water Level Monitoring Well Addition (existing well)
- Water Level Transducer
- Water Level and Water Quality Monitoring Well
- Water Level Transducer and Water Quality Monitoring Well

Figure 2
Groundwater Monitoring Program
First Water Wells
Los Osos Groundwater Basin
2015 Annual Report

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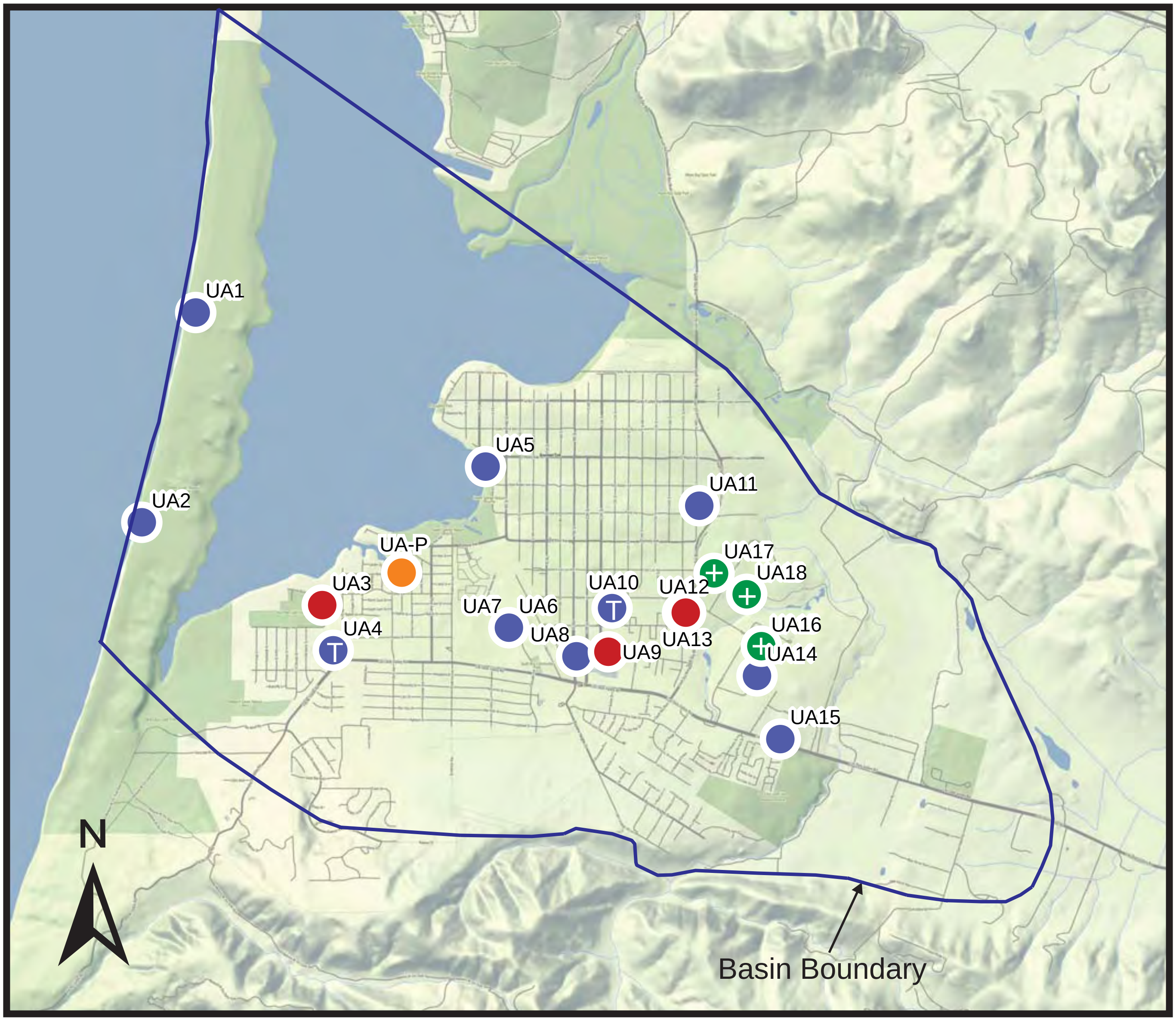

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Explanation

- Water Level Monitoring Well
- Recommended Water Level Monitoring Well Addition (existing well)
- Water Level Transducer
- Water Level and Water Quality Monitoring Well
- Water Level Transducer and Water Quality Monitoring Well
- Planned New Monitoring Well Construction

Figure 3
Groundwater Monitoring Program
Upper Aquifer Wells
Los Osos Groundwater Basin
2015 Annual Report

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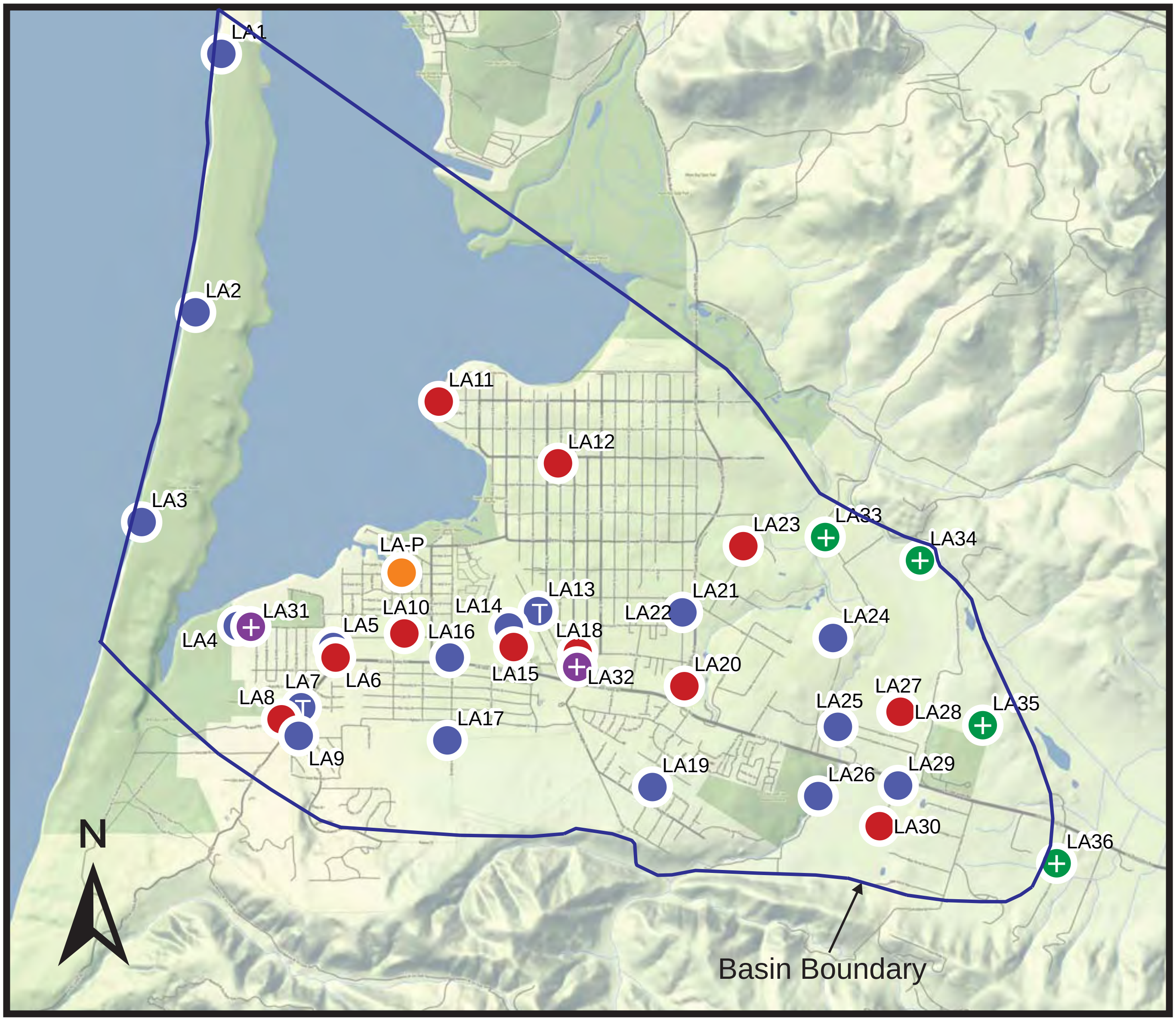

Base Image: Stamen-Terrain

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Scale: 1 inch ≈ 4,000 feet

Explanation

- Water Level Monitoring Well
- Recommended Water Level Monitoring Well Addition (existing well)
- Water Level Transducer
- Water Level and Water Quality Monitoring Well
- Water Level Transducer and Water Quality Monitoring Well
- Recommended Water Quality Monitoring Well Addition (existing well)
- Planned New Monitoring Well Construction

Note: LA24 and FW24 are nested wells (same location)

Figure 4
Groundwater Monitoring Program
Lower Aquifer Wells
Los Osos Groundwater Basin
2015 Annual Report

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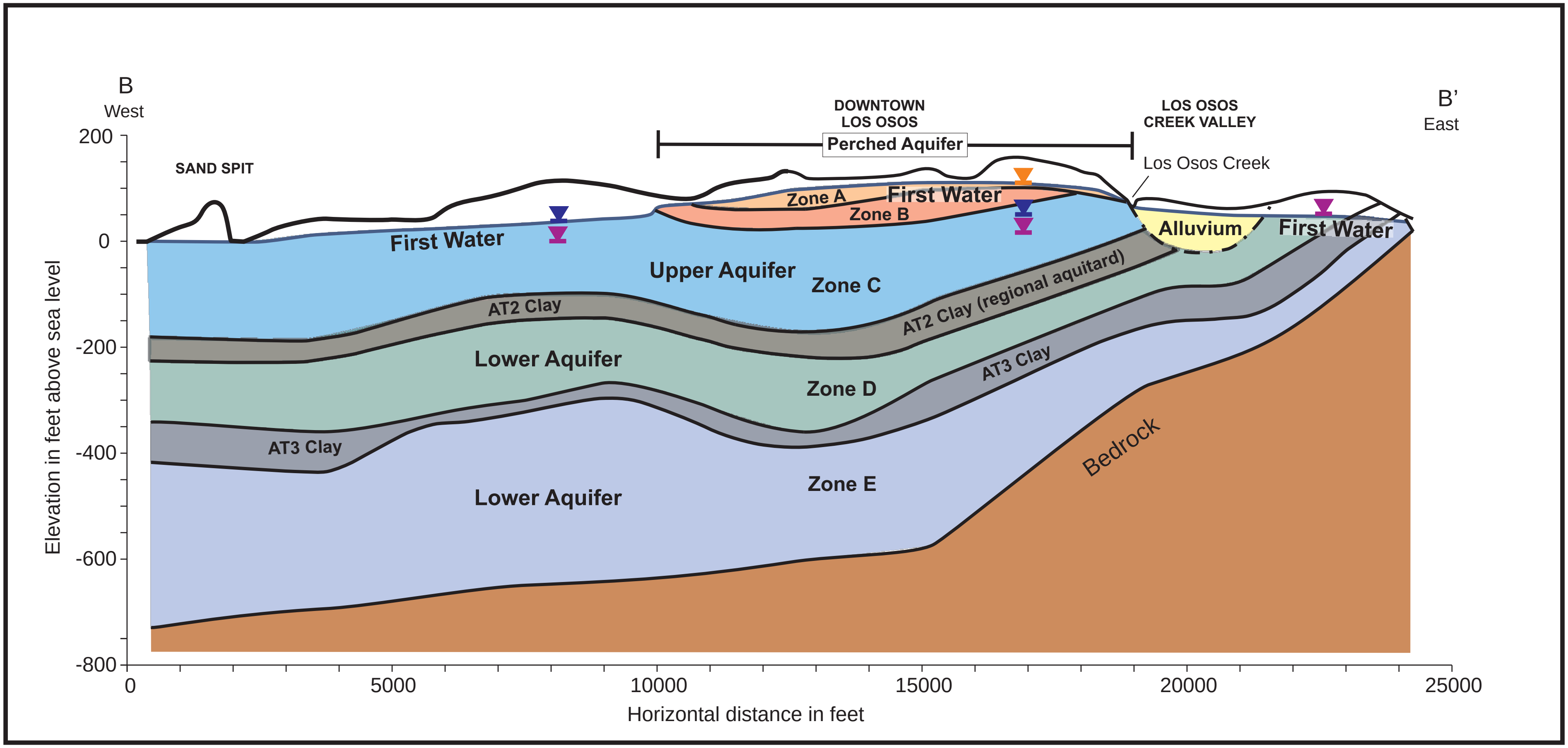

Cross-section alignment shown in Figure 1

Explanation

- Perched Aquifer Water level
- Upper Aquifer Water level
- Lower Aquifer Water level

Figure 5
Basin Aquifers
Los Osos Groundwater Basin
2015 Annual Report

Cleath-Harris Geologists

aquifer production is planned for the future. Monitoring the upper aquifer in the urban area is important to both local purveyors and domestic water users.

Lower Aquifer

The lower aquifer refers to water bearing sediments below the regional aquitard. There are both Paso Robles Formation and Careaga Formation deposits in the lower aquifer. The base of the lower aquifer is claystone and sandstone bedrock, although the effective base of fresh water lies above bedrock at the western edge of the basin. There are two generalized aquifer zones within the lower aquifer. Zone D lies between the regional aquitard (AT2 clay) and a deeper aquitard (AT3 clay). Zone E is below the AT3 clay (Figure 5).

Lower aquifer Zone D is currently the main water supply source for the community. The seawater intrusion front has been advancing inland at increasing rates over time, and a significant reduction in lower aquifer production, together with other Basin Plan programs, is necessary to halt intrusion.

2.2.2 Groundwater Quality Monitoring

Groundwater quality monitoring refers to the periodic collection and analysis of groundwater from wells. The analytical requirements are highly variable, depending on the purpose of monitoring. General minerals and nitrate are common water quality constituents of analysis for groundwater basin investigations. There are many other classes of water quality constituents of concern, however, such as volatile organic compounds, inorganic compounds (metals), petroleum hydrocarbons or emerging contaminants. Many of these are regulated and have drinking water standards. The purveyors monitor many of these constituents and data from those monitoring efforts will be incorporated into the LOBP Groundwater Monitoring Program.

Monitoring Constituents

Constituents of analysis for the LOBP Groundwater Monitoring Program have been selected to evaluate salt loading and associated nitrate impacts, seawater intrusion and wastewater disposal. Table 1 lists the general mineral constituents, including nitrate, which will be monitored as part of the program. Total Dissolved Solids (TDS) and specific conductance are standard measures for groundwater mineralization and salinity. Temperature and pH are parameters that are routinely measured during sampling to confirm that the groundwater samples represent the aquifer. Table 1 presents constituents to be tested in the wells designated for water quality monitoring, which are distributed laterally and vertically across the basin (Figures 2, 3 and 4). Sampling at private wells will be pending private well owner participation in the LOBP Groundwater Monitoring Program.

Table 1. Water Quality Monitoring Constituents[1]		
Constituent	**Reporting Limit**	**Units**
Specific Conductance	1	µs/cm
pH (field)	0.01	pH units
Temperature (field)	0.1	°F
TDS	20	mg/L
Carbonate Alkalinity	10	mg/L
Bicarbonate Alkalinity	10	mg/L
Total Alkalinity	10	mg/L
Chloride	1	mg/L
Nitrate - Nitrogen	0.1	mg/L
Sulfate	2	mg/L
Boron	0.1	mg/L
Calcium	1	mg/L
Magnesium	1	mg/L
Potassium	1	mg/L
Sodium	1	mg/L

[1]From Basin Plan (ISJ Group, 2015)

Additional constituents are analyzed in the general minerals suite performed by the analytical laboratory. The Lower Aquifer (via Well LA4) will also be monitored using down hole geophysics (natural gamma and induction logs) to provide a unique measure of seawater intrusion over time in one location within the basin. The well is located near the Sea Pines Golf Course in the Western Area.

Constituents of Emerging Concern

Monitoring Constituents of Emerging Concern (CECs) is a requirement of salt and nutrient management plans adopted pursuant to the State Water Resources Control Board Recycled Water Policy (SWRCB, 2009). Such monitoring can measure potential dilution and soil-aquifer treatment of recycled water constituents, and travel time and movement of recycled water. As part of the LOWWP, the County is also required by the Regional Water Quality Control Board Monitoring and Reporting Program (MRP) Order No. R3-2011-0001 to monitor recycled water for CECs on an annual basis.

The initial CECs to be monitored are listed in Table 2, and were selected based on the Recycled Water Policy. There are three types of CECs, each of which has a different function. Health-based indicators directly monitor the presence of classes of constituents in groundwater, while performance-based and surrogate indicators measure the effectiveness of the wastewater treatment process. The list of CECs is not intended to be comprehensive, but meant to be representative. CECs may be added to (or removed from) the monitoring list once data has been collected and analyzed, subject to approval by the BMC. CEC monitoring was not performed in 2015, but will begin in 2016.

Table 2. CEC Monitoring Constituents[1]			
Constituent or Parameter	**Type of Constituent**	**Type of Indicator**	**Reporting Limit (μg/L)**
17β-estradiol	Steroid Hormones	Health	0.001
Triclosan	Antimicrobial	Health	0.050
Caffeine	Stimulant	Health	0.050
NDMA	Disinfection Byproduct	Health	0.002
Gemfibrozil	Pharmaceutical Residue	Performance	0.010
DEET	Personal Care Product	Performance	0.050
Iopromide	Pharmaceutical Residue	Performance	0.050
Sucralose	Food additive	Performance	0.100
Ammonia	N/A	Surrogate	N/A
Nitrate-Nitrogen	N/A	Surrogate	N/A
Total Organic Carbon	N/A	Surrogate	N/A
UV Light Absorption	N/A	Surrogate	N/A
Specific Conductance	N/A	Surrogate	N/A

[1]From Basin Plan (ISJ Group, 2015)

2.2.3 Monitoring Frequency

Monitoring frequency is the time interval between data collection. Seasonal fluctuations relating to groundwater levels or quality are typically on semi-annual cycles, correlating with seasonal precipitation, recharge, water levels, and often well production. The monitoring schedule for groundwater levels collected under the LOBP Groundwater Monitoring Program will coincide with seasonal water level fluctuations, with higher levels (i.e. elevations) in April (Spring) and lower levels in October (Fall). Spring water levels collected under the LOWRF Baseline Groundwater Monitoring Program (First Water and Upper Aquifer groups) may extend beyond April into May, and Fall water levels may extend beyond October into November. A semi-annual monitoring frequency provides a measure of these seasonal cycles, which can then be distinguishable from the long-term trends. At the transducer-monitored locations (Appendix A), water level measurements will be recorded automatically on a daily basis and downloaded during the regular semi-annual water level monitoring events.

The monitoring frequency for water quality sampling and analyses performed under the LOBP Groundwater Monitoring Program will generally be once per year in October (Fall), when groundwater levels (i.e. elevations) are seasonally low and many water quality constituents have historically been at a higher concentrations than their corresponding Spring measurement. Lower Aquifer groundwater monitoring will also be performed in April (Spring) as a means of tracking seawater intrusion in greater detail. As previously mentioned, Fall water quality testing performed for the LOWRF Baseline Groundwater Monitoring Program (First Water and Upper Aquifer) may extend beyond October into November.

3. CONDUCT OF WORK

This Groundwater Monitoring Program Annual Report covers monitoring activities performed during the 2015 calendar year. While information from prior years is included in data presentation and interpretation, the conduct of work and detailed groundwater monitoring results are reported for 2015.

3.1 Services Provided

No monitoring services were performed directly for the BMC in 2015. All 2015 groundwater monitoring data compiled for this report, unless described otherwise, comes from other monitoring programs, as follows:

- San Luis Obispo County Public Works, Semi-Annual Water Level Monitoring Program: water level data.
- Purveyor water supply well monitoring: water level, water quality and production data.
- LOWRF Baseline Groundwater Monitoring Program: water level and water quality data.
- Lower Aquifer Monitoring Program: water level, water quality, and geophysical data.

3.2 Field Methods

Groundwater level measurement and groundwater sampling are the primary field activities performed for the LOBP Groundwater Monitoring Program. Field activities include measuring and recording water levels in wells and collecting groundwater samples from wells for laboratory analytical testing. The field methods approved for use in the LOBP Groundwater Monitoring Program are presented in Appendix B. These methods are recommended for services performed directly for the BMC and for other monitoring programs that contribute data to the LOBP Groundwater Monitoring Program.

3.2.1 Elevation Datum

The original survey for wells in the County's Semi-Annual Water Level Monitoring Program was likely based on the National Geodetic Vertical Datum of 1929 (NGVD 29), which has been replaced in land surveying practice by the North American Vertical Datum of 1988 (NAVD 88). Several wells were re-surveyed in 2003 and 2005 using NAVD 88, but there are still wells with elevations based on NGVD 29, along with wells with no known elevation survey. For the 2015 Annual Report, wellhead elevations reported in tables are from the latest available survey or estimated from topographic maps (with datum given). For water level contouring and storage calculations, the NGVD 29 reference point elevation have been adjusted to NAVD 88 datum using a 2.8 feet upward shift, based on North American Vertical Datum Conversion (VERTCON) data reviewed for the Los Osos area, as published by the National Geodetic Society. A review of all reference points by a licensed surveyor is recommended, after which all data may be expressed in the current NAVD 88 standard, including the Water Level Metric.

3.2.2 Water Level Monitoring Procedures

Groundwater level monitoring typically uses an electric sounder or steel tape. If the well is equipped and active, monitoring would take place when the pump is off and the water level is relatively static. Some of the monitoring network wells will be equipped with a pressure transducer, allowing for automatic water level data collection between regular (manual) monitoring events. These devices are placed below water in a well and record changes in pressure that occur in response to changes in the height of the water column above the transducer. Detailed water level monitoring procedures and transducer information are included in Appendix B.

3.2.3 Groundwater Sampling Procedures

Groundwater sampling procedures ensure collection of a representative groundwater sample from an aquifer for water quality analysis. Unused or unequipped wells are purged of standing or stagnant water prior to sampling. Stabilization of field measurements for conductivity, pH, and temperature, along with minimum purge volumes, are included in the approved methods. Active wells can be sampled with alternative purging requirements. Sampling procedures for general mineral and nitrate sampling (with additional procedures for wastewater indicator compounds) are presented in Appendix B.

3.3 Monitoring Staff Affiliations

As indicated above, no services were provided directly for the BMC in 2015. Monitoring services that contributed data to the 2015 Annual Report were performed by staff or consultants affiliated with the following agencies:

- San Luis Obispo County Department of Public Works, Water Resources Division. County staff performed semi-annual water level monitoring, collected and maintained precipitation and stream gage records. Cleath-Harris Geologists performed semi-annual water level monitoring, water quality sampling at private wells, monitoring wells, and municipal supply wells for the LOWRF Baseline Groundwater Monitoring Program.

- Los Osos Water Purveyors (LOCSD, GSWC, S&T). Performed semi-annual water level monitoring and water quality sampling at municipal water supply wells. Cleath-Harris Geologists performed semi-annual water level monitoring, water quality sampling at private wells, monitoring wells, and municipal supply wells for the Lower Aquifer Monitoring Program.

4. MONITORING RESULTS

The results of groundwater monitoring activities performed in 2015 for the various basin monitoring programs are summarized below. Overlap between the LOBP Groundwater Monitoring Program and other ongoing monitoring programs are shown in Appendix A. Laboratory analytical reports of groundwater samples collected for the LOWRF Baseline Groundwater Monitoring Program are contained in their respective Spring and Fall 2015 monitoring program reports (Cleath-Harris Geologists, 2015a, 2015b). Laboratory analytical reports for 2015 Lower Aquifer Monitoring, which were not attached to their respective technical memorandums (Cleath-Harris Geologists 2015c, 2015d), are included in Appendix C.

4.1 Water Level Monitoring Results

Tables 3 through 8 present the results of groundwater level measurements at LOBP Groundwater Monitoring Program wells, as reported by the various monitoring programs. Water levels for private wells are not reported herein, but have been used for aggregated water level contour maps. As previously mentioned, 12 existing wells are recommended for inclusion in the LOBP Groundwater Monitoring Program network to help improve the quality and consistency of basin water level contours, which are used for groundwater storage calculations.

Spring water levels were measured in April 2015 for the County Semi-Annual Water Level Monitoring Program and the Lower Aquifer Monitoring Program, and in May for the LOWRF Baseline Groundwater Monitoring Program. Fall water levels were measured in October 2015 for the County Semi-Annual Water Level Monitoring Program and the Lower Aquifer Monitoring Program, and in November for the LOWRF Baseline Groundwater Monitoring Program.

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Table 3. Spring 2015 Water Levels - First Water					
Well ID	**State Well Number**	**R. P. Elevation and Datum (feet)**	**Date**	**Water Level (Feet)**	
				Depth	**Elevation**
FW1	30S/10E-13A7	PRIVATE			
FW2	30S/10E-13L8	32.63[1]	5/18/2015	23.82	8.8
FW3	30S/10E-13G	50.95[1]	5/18/2015	41.84	9.1
FW4	30S/10E-13H	49.33[1]	5/18/2015	31.29	18
FW5	30S/10E-13Q2	101.27[1]	5/18/2015	86.67	14.6
FW6	30S/10E-24A	193.04[1]	5/20/2015	160.11	32.9
FW7	30S/10E-24Ab	not measured (damaged)			
FW8	30S/11E-7L4	45.76[1]	5/13/2015	38.20	7.6
FW9	30S/11E-7K3	90.71[1]	5/13/2015	54.42	36.3
FW10	30S/11E-7Q1	25.29[1]	5/19/2015	9.20	16.1
FW11	30S/11E-7R2	61.93[1]	5/12/2015	24.61	37.3
FW12	30S/11E-18C2	34.55[1]	5/12/2015	20.20	14.4
FW13	30S/11E-18B2	79.89[1]	5/12/2015	22.82	57.1
FW14	30S/11E-18E1	PRIVATE			
FW15	30S/11E-18N2	125.53[1]	5/14/2015	81.25	44.3
FW16	30S/11E-18L11	88.02[1]	5/18/2015	46.51	41.5
FW17	30S/11E-18L12	103.85[1]	5/14/2015	22.38	81.5
FW18	30S/11E-18P	150[2]	not measured		
FW19	30S/11E-18J7	125.74[1]	5/14/2015	26.45	99.3
FW20	30S/11E-8Mb	95[2]	not measured		
FW21	30S/11E-8N4	95.99[1]	5/14/2015	41.90	54.1
FW22	30S/11E-17F4	PRIVATE			
FW23	30S/11E-17N4	PRIVATE			
FW24	30S/11E-17J2	PRIVATE			
FW25	30S/11E-17R1	PRIVATE			
FW26	30S/11E-20A2	PRIVATE			
FW27	30S/11E-20L1	PRIVATE			
FW28	30S/11E-20M2	PRIVATE			
FW29+	30S/11E-20A1	PRIVATE			
FW30+	30S/11E-18R1	PRIVATE			
FW31+	30S/11E-19A	213[2]	not measured		

NOTES: [1] NAVD 88 elevation as reported by licensed land surveyor
[2] estimated elevation (NAVD 88)
+ indicates recommended addition to monitoring network

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Table 4. Spring 2015 Water Levels - Upper Aquifer					
Well ID	State Well Number	R. P. Elevation and Datum (feet)	Date	Water Level (Feet)	
				Depth	Elevation
UA1	30S/10E-11A1	16.39[1]	3/24/2015	14.00	2.4
UA2	30S/10E-14B1	16.83[1]	3/25/2015	14.66	2.2
UA3	30S/10E-13F1	19[2]	4/13/2015	12	7
UA4	30S/10E-13L1	39[2]	4/21/2015	31	8
UA5	30S/11E-7N1	11[2]	5/14/2015	7.25	3.8
UA6	30S/11E-18L8	75.8[3]	4/15/2015	57.82	18
UA7	30S/11E-18L7	75.4[3]	4/15/2015	66.33	9.1
UA8	30S/11E-18K7	135.65[3]	4/15/2015	119.83	15.8
UA9	30S/11E-18K3	121.18[3]	4/20/2015	117	4.2
UA10	30S/11E-18H1	107.1[3]	not measured		
UA11	30S/11E-17D	PRIVATE			
UA12	30S/11E-17E9	105.85[3]	5/13/2015	94.12	11.7
UA13	30S/11E-17E10	106[2]	not measured		
UA14	30S/11E-17P4	PRIVATE			
UA15	30S/11E-20B7	PRIVATE			
UA16+	30S/11E-17L4	PRIVATE			
UA17+	30S/11E-17E1	PRIVATE			
UA18+	30S/11E-17F2	PRIVATE			

NOTES: [1] NAVD 88 elevation as reported by licensed land surveyor
[2] estimated elevation (assume NAVD 88)
[3] elevation as reported by County records (datum unknown - likely NGVD 29)
+ indicates recommended addition to monitoring network

CHG

Table 5. Spring 2015 Water Levels - Lower Aquifer					
Well ID	State Well Number	R. P. Elevation and Datum (feet)	Date	Water Level (Feet)	
				Depth	Elevation
LA1	30S/10E-2A1	15.83[1]	3/24/2015	8.68	7.2
LA2	30S/10E-11A2	16.39[1]	3/24/2015	12.00	4.4
LA3	30S/10E-14B2	16.83[1]	3/25/2015	13.82	3
LA4	30S/10E-13M1	41.2[3]	4/21/2015	45.32	-4.1
LA5	30S/10E-13L7	37[2]	4/23/2015	33.00	4
LA6	30S/10E-13L4	68[2]	4/13/2015	63.7	4.3
LA7	30S/10E-13P2	PRIVATE			
LA8	30S/10E-13N	138.5[2]	4/23/2015	133	5.5
LA9	30S/10E-24C1	178.32[3]	4/14/2015	176	2.3
LA10	30S/10E-13J1	95.31[3]	4/3/2015	98	-2.7
LA11	30S/10E-12J1	8.43[1]	4/15/2015	6.32	2.1
LA12	30S/11E-7Q3	24.3[3]	4/14/2015	36.70	-12.4
LA13	30S/11E-18F2	100[3]	4/19/2015	105.5	-5.5
LA14	30S/11E-18L6	78.08[3]	4/15/2015	80.78	-2.7
LA15	30S/11E-18L2	85[2]	4/14/2015	92.55	-7.6
LA16	30S/11E-18M1	106.82[3]	4/15/2015	102.18	4.6
LA17	30S/11E-24A2	210.4[3]	not measured		
LA18	30S/11E-18K8	135.74[3]	4/21/2015	146.10	-10.4
LA19	30S/11E-19H2	256.2[3]	4/15/2015	275.02	-18.8
LA20	30S/11E-17N10	140[2]	4/20/2015	144	-4
LA21	30S/11E-17E7	105.85[3]	4/21/2015	115.54	-9.7
LA22	30S/11E-17E8	105.85[3]	4/21/2015	124.62	-18.8
LA23 to LA30		PRIVATE			
LA31+	30S/10E-13M2	(Mixed aquifer - used for water quality only)			
LA32+	30S/11E-18K9	(Mixed aquifer - used for water quality only)			
LA33+	30S/11E-17A1	PRIVATE			
LA34+	30S/11E-8F	26.15[1]	4/20/2015	7	19.2
LA35+	30S/11E-21Bb	96[2]	1/23/15	70	26
LA36+	30S/11E-21Ja	PRIVATE			

NOTES: [1] NAVD 88 elevation as reported by licensed land surveyor
[2] estimated elevation (assume NAVD 88)
[3] elevation as reported by County records (datum unknown - Likely NGVD 29)
+ indicates proposed addition to monitoring network

Table 6. Fall 2015 Water Levels - First Water					
Well ID	State Well Number	R. P. Elevation and Datum (feet)	Date	Water Level (Feet)	
				Depth	Elevation
FW1		PRIVATE			
FW2	30S/10E-13L8	32.63[1]	11/2/2015	23.71	8.9
FW3	30S/10E-13G	50.95[1]	11/2/2015	42.06	8.9
FW4	30S/10E-13H	49.33[1]	11/5/2015	32.32	17
FW5	30S/10E-13Q2	101.27[1]	11/4/2015	86.83	14.4
FW6	30S/10E-24A	193.04[1]	11/5/2015	160.91	32.1
FW7	30S/10E-24Ab	PRIVATE			
FW8	30S/11E-7L4	45.76[1]	11/3/2015	38.30	7.5
FW9	30S/11E-7K3	90.71[1]	11/3/2015	54.90	35.8
FW10	30S/11E-7Q1	25.29[1]	11/9/2015	9.51	15.8
FW11	30S/11E-7R2	61.93[1]	11/3/2015	25.34	36.6
FW12	30S/11E-18C2	34.55[1]	11/2/2015	20.56	14
FW13	30S/11E-18B2	79.89[1]	11/3/2015	23.73	56.2
FW14	30S/11E-18E1	PRIVATE			
FW15	30S/11E-18N2	125.53[1]	11/4/2015	82.51	43
FW16	30S/11E-18L11	88.02[1]	11/2/2015	46.65	41.4
FW17	30S/11E-18L12	103.85[1]	11/2/2015	23.26	80.6
FW18	30S/11E-18P	150[2]	not measured		
FW19	30S/11E-18J7	125.74[1]	11/5/2015	27.44	98.3
FW20	30S/11E-8Mb	95[2]	not measured		
FW21	30S/11E-8N4	95.99[1]	11/3/2015	42.24	53.8
FW22	30S/11E-17F4	PRIVATE			
FW23	30S/11E-17N4	PRIVATE			
FW24	30S/11E-17J2	PRIVATE			
FW25	30S/11E-17R1	PRIVATE			
FW26	30S/11E-20A2	PRIVATE			
FW27	30S/11E-20L1	PRIVATE			
FW28	30S/11E-20M2	PRIVATE			
FW29+	30S/11E-20A1	PRIVATE			
FW30+	30S/11E-18R1	PRIVATE			
FW31+	30S/11E-19A	PRIVATE			

NOTES: [1] NAVD 88 elevation as reported by licensed land surveyor
[2] estimated elevation (NAVD 88)
[3] elevation as reported by County records (datum unknown - Likely NGVD 29)
+ indicates proposed addition to monitoring network

Table 7. Fall 2015 Water Levels - Upper Aquifer					
Well ID	State Well Number	R. P. Elevation and Datum (feet)	Date	Water Level (Feet)	
				Depth	Elevation
UA1	30S/10E-11A1	16.39[1]	10/21/2015	11.82	4.6
UA2	30S/10E-14B1	16.83[1]	10/21/2015	12.68	4.2
UA3	30S/10E-13F1	19[2]	10/19/2015	10	9
UA4	30S/10E-13L1	39[2]	not measured		
UA5	30S/11E-7N1	11[2]	11/10/2015	6.2	4.8
UA6	30S/11E-18L8	75.8[3]	10/26/2015	58.73	17.1
UA7	30S/11E-18L7	75.4[3]	10/26/2015	66.98	8.4
UA8	30S/11E-18K7	135.65[3]	10/27/2015	120.6	15.1
UA9	30S/11E-18K3	121.18[3]	10/19/2015	121	0.2
UA10	30S/11E-18H1	107.1[3]	not measured		
UA11	30S/11E-17D	PRIVATE			
UA12	30S/11E-17E9	105.85[3]	11/5/2015	93.84	12
UA13	30S/11E-17E10	106[2]	not measured		
UA14	30S/11E-17P4	PRIVATE			
UA15	30S/11E-20B7	PRIVATE			
UA16+	30S/11E-17L4	PRIVATE			
UA17+	30S/11E-17E1	PRIVATE			
UA18+	30S/11E-17F2	PRIVATE			

NOTES: [1] NAVD 88 elevation as reported by licensed land surveyor
[2] estimated elevation (NAVD 88)
[3] elevation as reported by County records (datum unknown - Likely NGVD 29)
+ indicates proposed addition to monitoring network

Table 8. Fall 2015 Water Levels - Lower Aquifer					
Well ID	**State Well Number**	**R. P. Elevation and Datum (feet)**	**Date**	**Water Level (Feet)**	
				Depth	**Elevation**
LA1	30S/10E-2A1	15.83[1]	10/21/2015	8.45	7.4
LA2	30S/10E-11A2	16.39[1]	10/21/2015	10.33	6.1
LA3	30S/10E-14B2	16.83[1]	10/21/2015	13.59	3.2
LA4	30S/10E-13M1	41.2[3]	10/24/2015	44.84	-3.6
LA5	30S/10E-13L7	37[2]	not measured		
LA6	30S/10E-13L4	68[2]	not measured		
LA7	30S/10E-13P2	PRIVATE			
LA8	30S/10E-13N	138.5[2]	10/6/2015	134	4.5
LA9	30S/10E-24C1	178.32[3]	10/19/2015	175	3.3
LA10	30S/10E-13J1	95.31[3]	10/19/2015	102	-6.7
LA11	30S/10E-12J1	8.43[1]	10/26/2015	5.22	3.2
LA12	30S/11E-7Q3	24.3[3]	10/15/2015	34.90	-10.6
LA13	30S/11E-18F2	100[3]	not measured		
LA14	30S/11E-18L6	78.08[3]	10/26/2015	83.60	-5.5
LA15	30S/11E-18L2	85[2]	10/15/2015	96	-11
LA16	30S/11E-18M1	106.82[3]	10/27/2015	102.20	4.6
LA17	30S/11E-24A2	210.4[3]	not measured		
LA18	30S/11E-18K8	135.74[3]	10/19/2015	141.27	-5.5
LA19	30S/11E-19H2	256.2[3]	10/27/2015	275.85	-19.7
LA20	30S/11E-17N10	140[2]	10/19/2015	154	-14
LA21	30S/11E-17E7	105.85[3]	10/27/2015	118.51	-12.7
LA22	30S/11E-17E8	105.85[3]	10/1/2015	129.19	-23.3
LA23 to LA30		PRIVATE			
LA31+	30S/10E-13M2	(Mixed aquifer - used for water quality only)			
LA32+	30S/11E-18K9	(Mixed aquifer - used for water quality only)			
LA33+	30S/11E-17A1	PRIVATE			
LA34+	30S/11E-8F	26.15[1]	10/19/2015	9.45	16.7
LA35+	30S/11E-21Bb	96[2]	not measured		
LA36+	30S/11E-21Ja	PRIVATE			

NOTEs: [1] NAVD 88 elevation as reported by licensed land surveyor
[2] estimated elevation (NAVD 88)
[3] elevation as reported by County records (datum unknown - likely NGVD 29)
+ indicates proposed addition to monitoring network

4.2 Water Quality Results

Available Fall 2015 water quality results for First Water and Upper Aquifer monitoring wells designated for water quality reporting in the LOBP Groundwater Monitoring Program are presented in Table 9. The LOBP Groundwater Monitoring Program does not include Spring water quality monitoring at First Water or Upper Aquifer Wells, although this information is collected for the County's LOWRF Baseline Groundwater Monitoring Program. Available Spring and Fall 2015 water quality for Lower Aquifer monitoring wells designated for water quality reporting in the LOBP Groundwater Monitoring Program are presented in Tables 10 and 11.

Available results for First Water wells indicate elevated nitrate concentrations across much of the urban area. A more extensive compilation of shallow water quality, including nitrate and TDS concentration maps, are presented for Spring and Fall 2015 in the County's LOWRF Baseline Groundwater Monitoring Program reports (CHG, 2015a, 2015b).

Some of the constituents of analysis that are part of the LOBP Groundwater Monitoring Program listed in Table 1 are not included in the LOWRF Baseline Groundwater Monitoring Program. The missing constituents include specific conductance, alkalinity (bicarbonate, carbonate, and total), calcium, magnesium, and potassium. For efficiency, CHG recommends adding these LOBP Groundwater Monitoring Program constituents to the Fall 2016 LOWRF Baseline Groundwater Monitoring Program monitoring event for wells that are part of both programs. Costs for the additional laboratory analyses may be allocated to the LOBP Groundwater Monitoring Program, as appropriate.

Lower Aquifer water quality results for 2015 show two water supply wells (LA10 and LA31) impacted by seawater intrusion, based on chloride concentrations over 250 mg/L. The overall trend in chloride concentration and seawater intrusion is tracked using the Chloride Metric (Section 7.5.2).

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Table 9. Fall 2015 Water Quality Results - First Water and Upper Aquifer

Basin Plan Well	State Well Number	Date	SC	pH (field)	TDS	Alkalinity			Cl	NO3-N	SO4	B	Ca	Mg	K	Na	T
						CO3	HCO3	Total as CaCO3									
			µS/cm	pH units	mg/L												°F
FW2	30S/10E-13L8	2-Nov	--	6.32	520	--	--	--	107	27.8	20	0.1	--	--	--	122	65.3
FW6	30S/10E-24A	5-Nov	--	6.64	430	--	--	--	140	18.6	7	<0.1	--	--	--	43	61.5
FW10	30S/11E-7Q1	9-Nov	--	6.70	490	--	--	--	119	23.4	45	0.3	--	--	--	79	63.9
FW15	30S/11E-18N2	4-Nov	--	6.32	410	--	--	--	86	24.8	42	0.2	--	--	--	59	66.2
FW17	30S/11E-18L12	2-Nov	--	6.80	510	--	--	--	104	32.6	36	0.2	--	--	--	61	65.8
FW20	30S/11E-8M	(DRY)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FW22	PRIVATE																
FW26	PRIVATE																
FW28	PRIVATE																
UA3	30S/10E-13F1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UA9	30S/11E-18K3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
UA13	30S/11E-17E10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES: "--" = no result available; SC = specific conductance; TDS = total dissolved solids; CO3 = carbonate; HCO3= bicarbonate; CaCO3 = total alkalinity as calcium carbonate; Cl = chloride; NO3-N = nitrate as nitrogen; SO4 = sulfate; B = boron; Ca = calcium; Mg = magnesium; K = potassium; Na = sodium; T = temperature; µS/cm = microsiemens per centimeter; mg/L = milligrams per liter; °F = degrees Fahrenheit

Table 10. Spring 2015 Water Quality Results - Lower Aquifer																		
Basin Plan Well	State Well Number	Date	SC	pH (field)	TDS	Alkalinity			Cl	NO3-N	SO4	B	Ca	Mg	K	Na	T
						CO3	HCO3	Total as CaCO3									
			µS/cm	pH units	-------------------------------------				mg/L	--------------------------------------							°F
LA8	30S/10E-13N	21-Apr	445	--	280	<10	50	40	77	7.7	11	<0.1	16	14	2	38	65.4
LA9	30S/10E24C1	22-Apr	530	--	320	<10	70	60	95	5.5	16	<0.1	19	17	2	45	--
LA10	30S/10E-13J4	22-Apr	1230	--	750	<10	80	70	331	1.9	20	<0.1	69	63	2	39	--
LA11	30S/10E-12J1	22-Apr	1290	7.23	810	<10	360	300	112	<0.2	189	0.3	65	76	5	88	68.9
LA12	30S10E-7Q3	21-Apr	897	--	500	<10	290	240	101	<0.2	55	0.2	48	45	2	59	73.5
LA15	30S/11E-18L2	29-Apr	348	--	230	<10	80	60	43	5.0	10	<0.1	13	11	0	30	65.1
LA18	30S/11E-18K8	21-Apr	634	7.26	400	<10	290	240	33	<0.2	39	<0.1	55	31	2	27	73.2
LA20	30S/11E-17N10	22-Apr	653	--	360	<10	290	240	43	0.6	27	<0.1	36	35	2	42	--
LA22	30S/11E-17E8	21-Apr	481	7.08	270	<10	150	120	49	7.1	13	<0.1	25	23	1	28	67.8
LA23	PRIVATE																
LA28	PRIVATE																
LA31+	30S/10E-13M2	21-Apr	3430	--	1930	<10	60	50	950	0.5	180	0.2	113	111	5	378	64.7
LA32+	30S/11E-18K9	21-Apr	504	--	270	<10	190	160	38	1.6	20	<0.1	17	16	1	27	68.8

NOTES: "--" = no result available; SC = specific conductance; TDS = total dissolved solids; CO3 = carbonate; HCO3= bicarbonate; CaCO3 = total alkalinity as calcium carbonate; Cl = chloride; NO3-N = nitrate as nitrogen; SO4 = sulfate; B = boron; Ca = calcium; Mg = magnesium; K = potassium; Na = sodium; T = temperature; µS/cm = microsiemens per centimeter; mg/L = milligrams per liter; °F = degrees Fahrenheit; + indicates proposed addition to monitoring program.

Table 11. Fall 2015 Water Quality Results - Lower Aquifer Group

Basin Plan Well	State Well Number	Date	SC	pH (field)	TDS	Alkalinity CO3	Alkalinity HCO3	Alkalinity Total as CaCO3	Cl	NO3-N	SO4	B	Ca	Mg	K	Na	T
			µs/cm	pH units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	°F
LA2	30S/10E-11A2	21-Oct	17700	7.44	13100	<10	150	130	6300	<0.1	740	<0.1	1030	990	31	1560	67.1
LA3	30S/10E-14B2	21-Oct	29500	11.55	24700	140	<10	360	10000	<0.1	530	<0.1	2830	20	80	4040	73.8
LA8	30S/10E-13N	6-Oct	422	8.12	310	<10	40	40	75	6.8	10	<0.1	16	14	1	38	65.5
LA9	30S/10E-24C1	5-Oct	349	--	270	<10	50	40	50	7.6	7	<0.1	12	11	1	34	--
LA10	30S/10E-13J4	5-Oct	1280	--	950	<10	70	60	329	1.7	19	<0.1	74	67	2	41	--
LA11	30S/10E-12J1	1-Oct	1280	7.38	840	<10	250	200	117	<0.1	188	0.3	68	77	4	85	70.2
LA12	30S10E-7Q3	6-Oct	828	7.52	490	<10	280	230	91	<0.1	46	0.2	47	44	2	55	70
LA15	30S/11E-18L2	28-Oct	782	7.65	420	<10	230	190	104	0.6	29	<0.1	46	42	<1	30	68.2
LA18	30S/11E-18K8	19-Oct	621	7.39	370	<10	230	190	29	<0.1	33	<0.1	53	30	2	26	74.5
LA20	30S/11E-17N10	5-Oct	614	--	370	<10	280	230	38	0.5	23	0.1	35	34	2	41	--
LA22	30S/11E-17E8	1-Oct	475	7.27	290	<10	120	100	44	6.6	10	<0.1	26	24	1	28	68
LA23	PRIVATE																
LA28	PRIVATE																
LA31+	30S/10E-13M2	6-Oct	3370	7.64	2140	<10	30	30	960	0.5	185	0.2	115	114	5	342	66.6
LA32+	30S/11E-18E9	6-Oct	248	7.49	190	<10	50	40	31	5.9	3	<0.1	10	9	<1	21	72

NOTES: "--" = no result available; SC = Specific Conductance; TDS = total dissolved solids; CO3 = carbonate; HCO3= bicarbonate; CaCO3 = Total alkalinity as calcium carbonate; Cl = chloride; NO3-N = nitrate as nitrogen; SO4 = Sulfate; B = boron; Ca = calcium; Mg = magnesium; K = potassium; Na = sodium; T = Temperature; µS/cm = microsiemens per centimeter; mg/L = milligrams per liter; °F = degrees Fahrenheit; + indicates proposed addition to monitoring program.

Between August 2014 and December 2015, hexavalent chromium was detected in groundwater at concentrations slightly over the Maximum Contaminant level of 10 µg/L at one of the municipal drinking water supply wells (LOCSD Third Street well). Chromite (iron chromium oxide ore) deposits are naturally occurring in San Luis Obispo County, and are associated with serpentinite bodies (Smith and Griggs, 1944). Other sources of chromium in groundwater are associated with contamination from industrial activities such as metal plating and leather tanning, and from paints, dyes, and wood preservatives. There are no known sources of industrial chromium contamination near the Third Street well. Hexavalent chromium concentrations have been detected in groundwater at low levels across the urban area, in both upper and lower aquifer wells, indicating a natural source is present. Figure 6 shows locations and concentrations of hexavalent chromium in groundwater from samples collected in 2014 and 2015.

4.3 Geophysics

Induction and natural gamma logging was performed at Lower Aquifer monitoring well LA4 (30S/10E-13M1) and LA14 (30S/11E-18L6) in October 2015. The log at well LA4 indicates the top of seawater in Zone D has dropped approximately 15 feet in elevation from a high in 2009 (Appendix D). A drop in the seawater elevation in Zone D is consistent with a general reduction in west side lower aquifer pumping since 2009. The top of seawater at LA4 is defined by the deepest point on the log where resistivity increases over the seawater baseline (not defined using specific chloride concentrations). By comparison, the top of seawater at LA4 increased approximately 50 feet between 1985 and 2009, with lower aquifer production reaching historical highs.

Geophysics at deep monitoring well LA14 continues to show no indication of intrusion, despite documented intrusion in Zone E at the nearby LOCSD Palisades well (LA15), approximately 500 feet to the south. This is interpreted as an indication that historical Zone E intrusion toward the Palisades well was through a relatively narrow preferential pathway. Production from Zone E at the Palisades well was permanently eliminated through well modification in 2013.

5. GROUNDWATER PRODUCTION

Annual basin groundwater production between 1970 and 2013 was reported in the Basin Plan (ISJ Group, 2015). Basin production for 2014 and 2015 is estimated at 2,400 acre-feet and 2,170 acre-feet, respectively, continuing a trend of declining water demand since 2007. The data have been compiled by both user type and basin aquifer/area. Tables 12 and 13 present municipal and basin production for calendar year 2013, 2014 and 2015.

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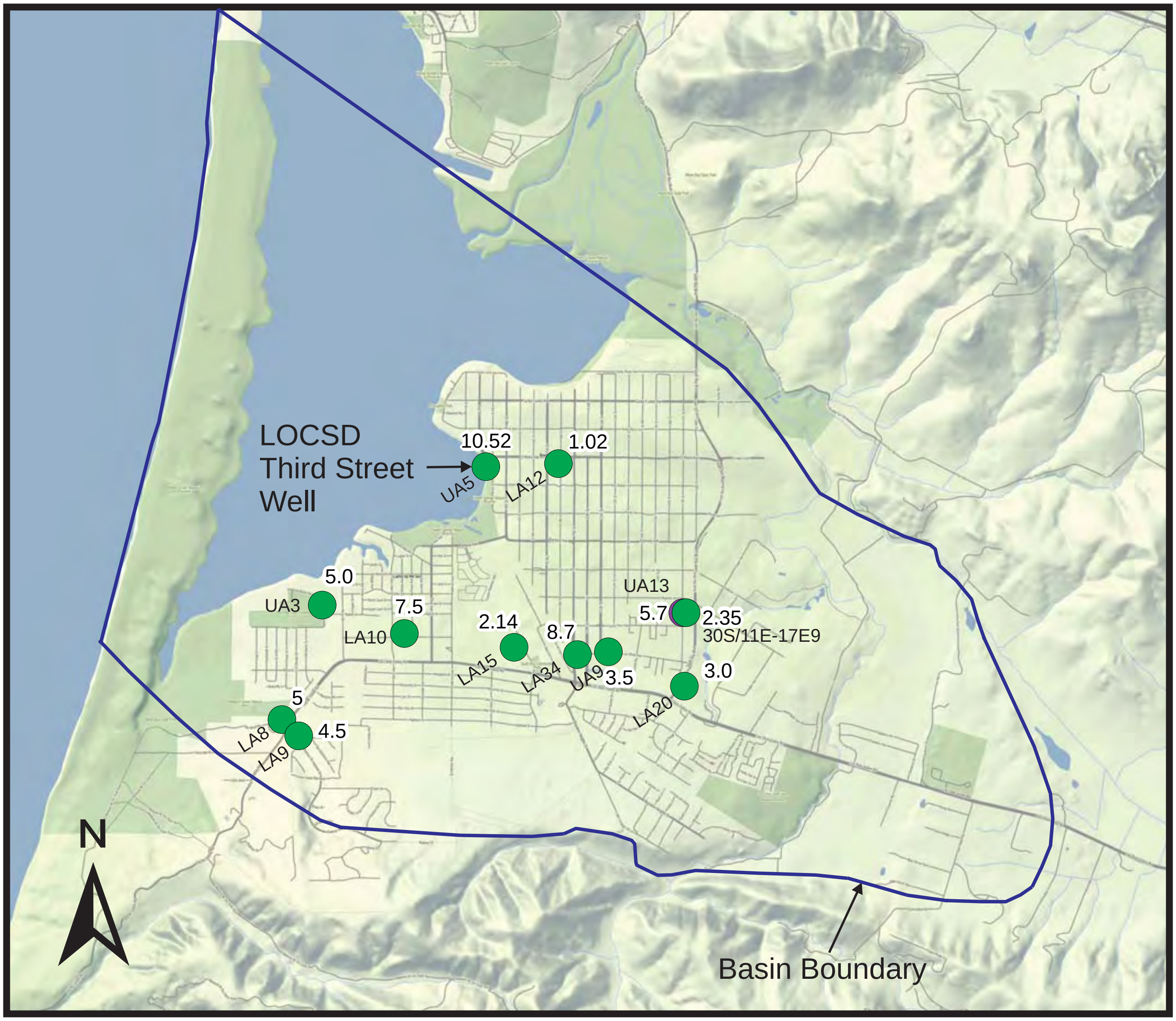

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

UA3 Monitoring program ID
30S/11E-17E9 State Well Number (no monitoring program ID)

3.5 Groundwater with Hexavalent Chromium concentration in micrograms per liter (µg/L). Maximum Contaminant Level = 10 µg/L

Note: Concentrations as reported by water purveyors.

Figure 6
Hexavalent Chromium Concentrations in Groundwater (2014-2015)
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Table 12. Municipal Groundwater Production (2013-2015)				
Year	LOCSD	GSWC	S&T	Total
	Acre-Feet			
2013	730	690	50	1,470
2014	630	560	50	1,240
2015	510	470	30	1,010

Note: All figures rounded to the nearest 10 acre-feet

Table 13. Basin Groundwater Production (2013-2015)					
Year	Purveyors	Domestic	Community	Agriculture	Total
	Acre-Feet				
2013	1,470	200	140	750	2,560
2014	1,240	220	140	800	2,400
2015	1,010	220	140	800	2,170

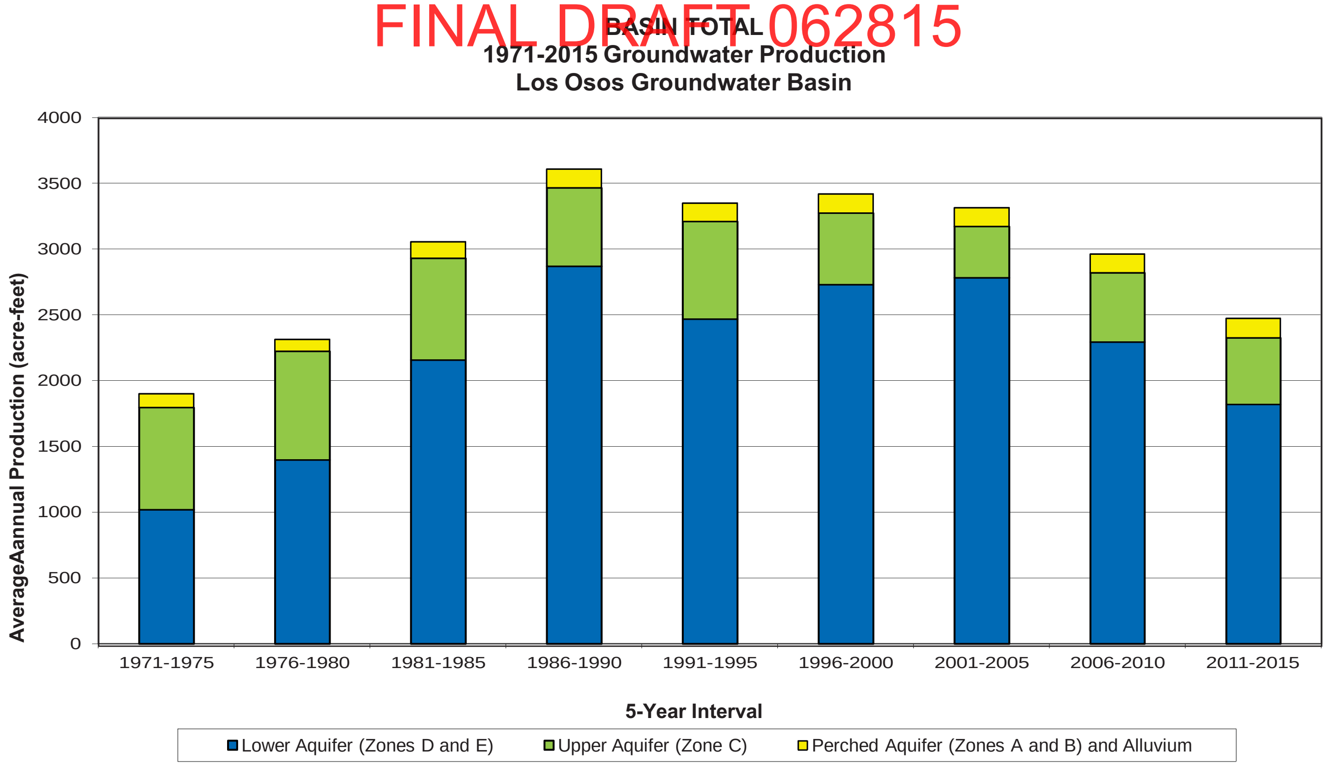
Note: All figures rounded to the nearest 10 acre-feet

Figure 7 shows the historical pumping distribution between basin aquifers since 1970, along with the pumping distribution in the Western Area. Figure 8 show the historical pumping distribution for the Central and Eastern areas. There has been a 30 percent reduction in basin production over the last 10 years, with current production similar to the values reported for the late 1970s. The largest reduction in pumping has occurred in the Lower Aquifer Western Area (Figure 7).

Land use and water use areas overlying the basin, including purveyor service areas, agricultural parcels, domestic parcels, and community facilities are included in Appendix E. Purveyor municipal production data for 2014 and 2015 are based on meter readings, while agricultural, domestic, and community facilities' water production estimates are based on the last reported water use estimates for 2013 from the Basin Plan with minor adjustments due to changes in land use based on aerial photo review. These adjustments include 20 acre-feet per year increased domestic water use, based on adding 19 existing residences located east of the Los Osos Creek Valley that were not previously included in the 2013 estimates. Agricultural water use was increased by 50 acre-feet per year, based on adding 10 acres of peas, 15 acres of truck crops, and 1 acre of pasture east of the Los Osos Creek Valley that were not previously included in the 2013 estimates. Prior estimates for domestic and agricultural water use are detailed in technical memorandums (CHG, 2009a, 2009b).

6. PRECIPITATION AND STREAMFLOW

Precipitation data are currently available from a County gage located at the former Los Osos landfill (Station #727). Precipitation records for Station #727 began in July 2005, and show that rainfall has averaged 14.7 inches, with a minimum of 6.81 inches in the 2014 rainfall year (July 2013 through June 2014) and a maximum of 31.77 inches in the 2011 rainfall year (July 2010 through June 2011). Precipitation for the 2015 rainfall year was reported at 7.68 inches. Records



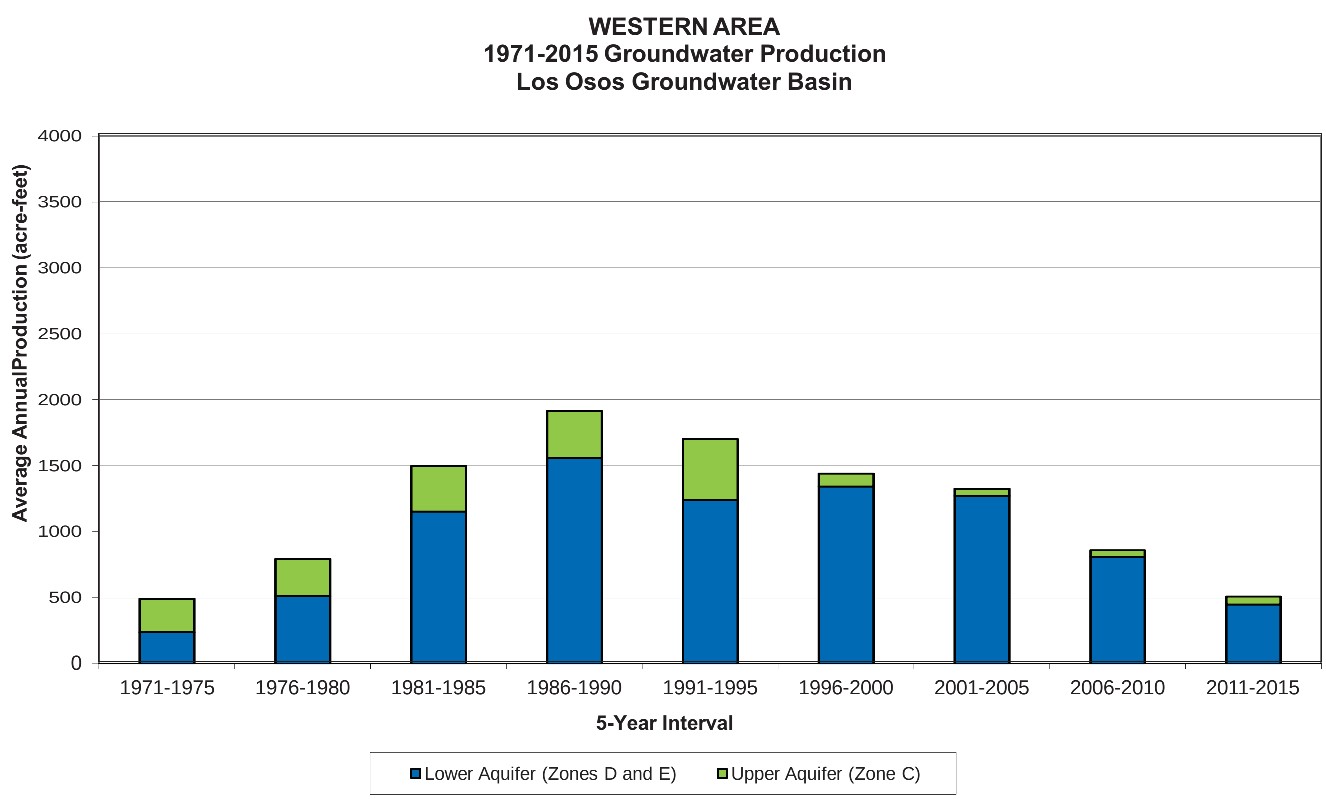


Figure 7
Basin Production 1971-2015
Basin Total and Western Area
Los Osos Goundwater Basin
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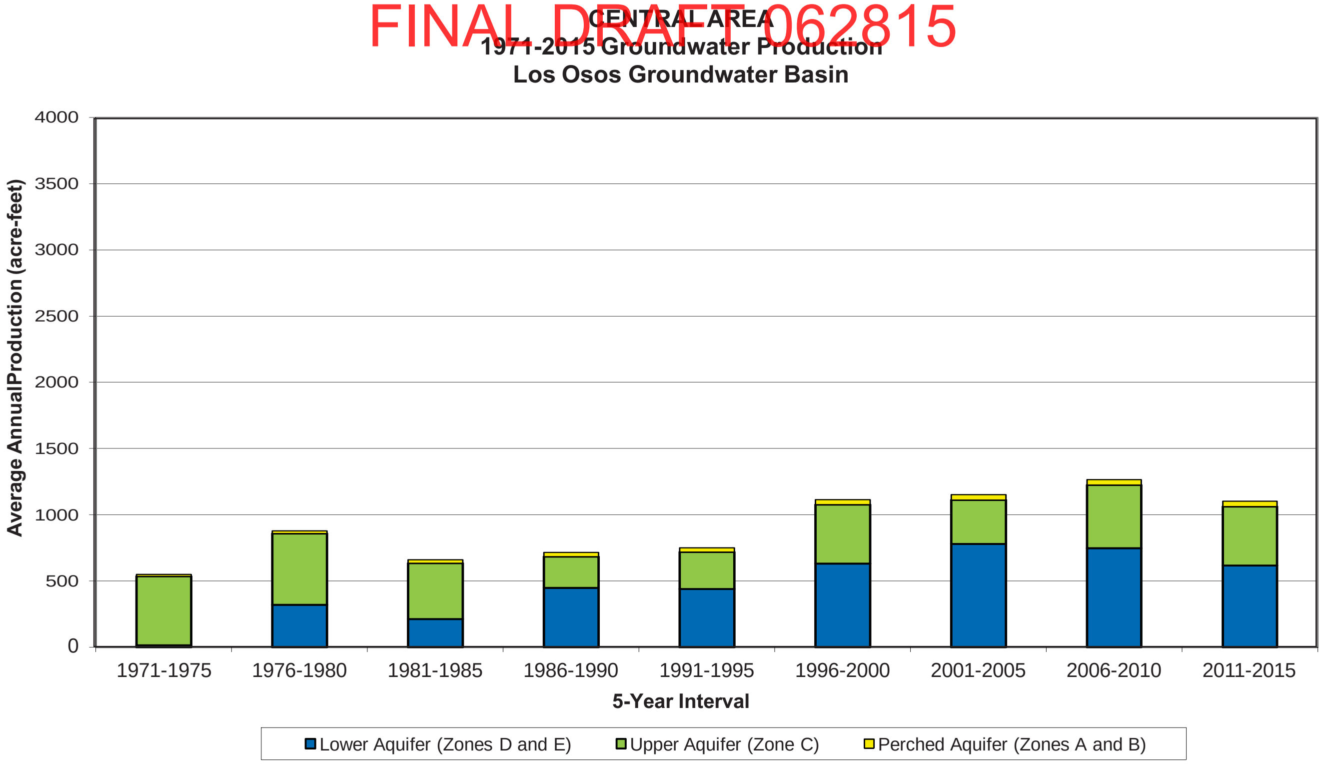

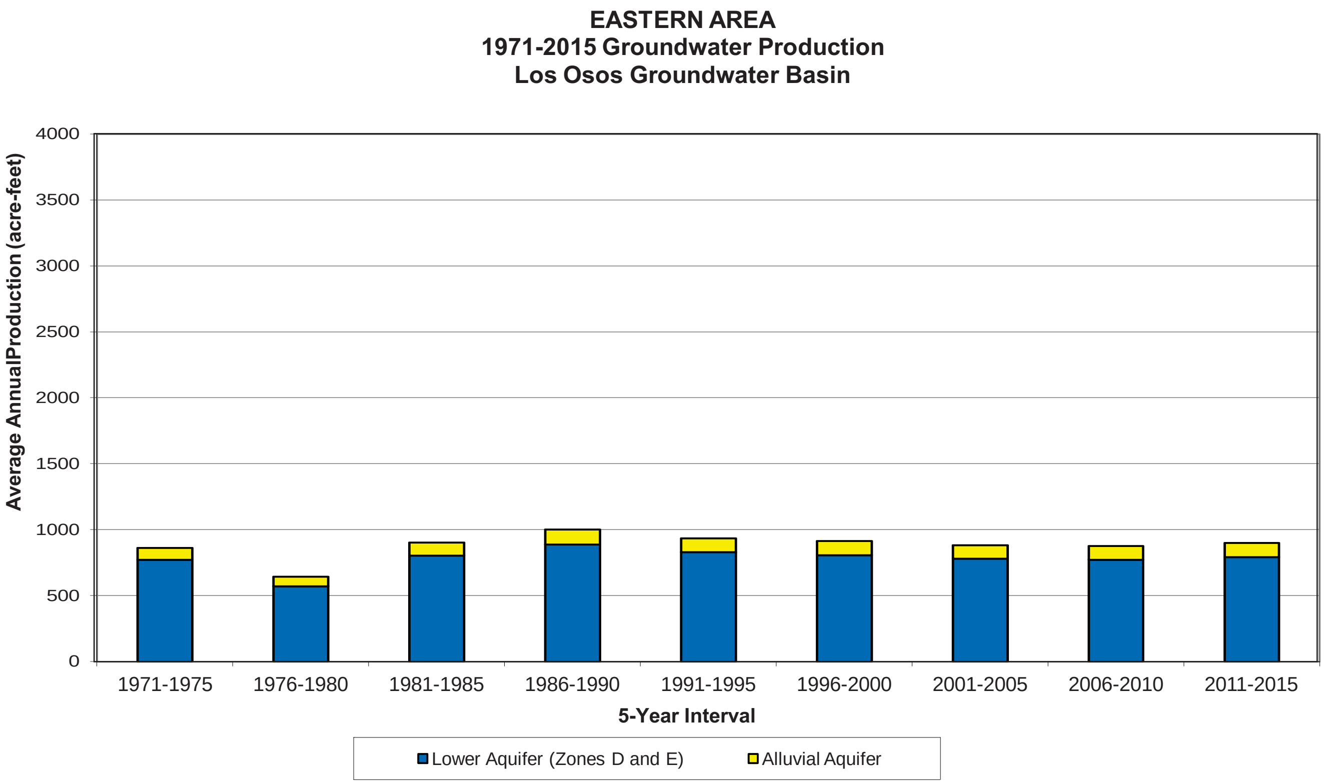

Figure 8
Basin Production 1971-2015
Central and Eastern Areas
Los Osos Groundwater Basin
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for Station #727 through the calendar year 2015 are included in Appendix F. The average rainfall at Station #727 is lower compared to other local rain gages due to a short period of record that includes six years of below average rainfall.

Historically, precipitation records at rain gage stations were compiled by the County for the LOCSD maintenance yard on 8th Street (Station #177), at the South Bay fire station on 9th Street (Station #197), and at two private volunteer stations (Station #144.1 in the Los Osos Creek Valley and Station #201.1 on Broderson Avenue). The longest active period of record in the vicinity is at the Morro Bay fire department (Station #152). A summary of precipitation data for these stations is presented in Table 14.

Table 14. Active and Former Precipitation Stations

Station No.	Name	Period of Record (rainfall years)	Average Annual Precipitation (inches)
144.1	Bender	1955-1987	19.17
152	Morro Bay Fire Dept.	1959-2015 (active)	16.14
177	CSA9 Baywood Park	1967-1980	17.49
197	South Bay Fire	1975-2001	19.52
201.1	Simas	1976-1983	21.16
727	Los Osos Landfill	2006-2015 (active)	14.67*

NOTE: *lower average due to short period of record that includes six years of below normal rainfall.

Figure 9 shows the long term cumulative departure from mean precipitation at Station #152. Once data for Los Osos Landfill Station #727 becomes representative of long-term climatic conditions, it would be appropriate to use the gage in the cumulative departure from mean precipitation graph.

There have been four consecutive years of below normal rainfall from 2012 through 2015. Rainfall for 2015 was 8.6 inches below average at Station #152 and 7.0 inches below average at Station #727. San Luis Obispo County was in exceptional drought conditions (the greatest intensity level) during 2015, based on information from the U.S. Drought Monitor, a partnership of federal agencies (NDMC/USDA/NOAA, 2015).

Los Osos Creek drains the Clark Valley watershed. Streamflow on Los Osos Creek is monitored by a County gage (formerly Gage #6, now Sensor 751) at the Los Osos Valley Road bridge. The location has been gaged intermittently since 1976, with 18 years of flow records through 2001. The average measured flow on Los Osos Creek at the gage (drainage area of 7.6 square miles) was 3,769 acre-feet per year between 1976 and 2001 (San Luis Obispo County, 2005). A summary of the available annual streamflow data is in Appendix F.

Streamflow was recorded at the gage on eight days during the 2015 water year (October 1, 2014 through September 30, 2015). The dates, maximum stage, and corresponding daily precipitation value from Station #727 are listed below in Table 15.

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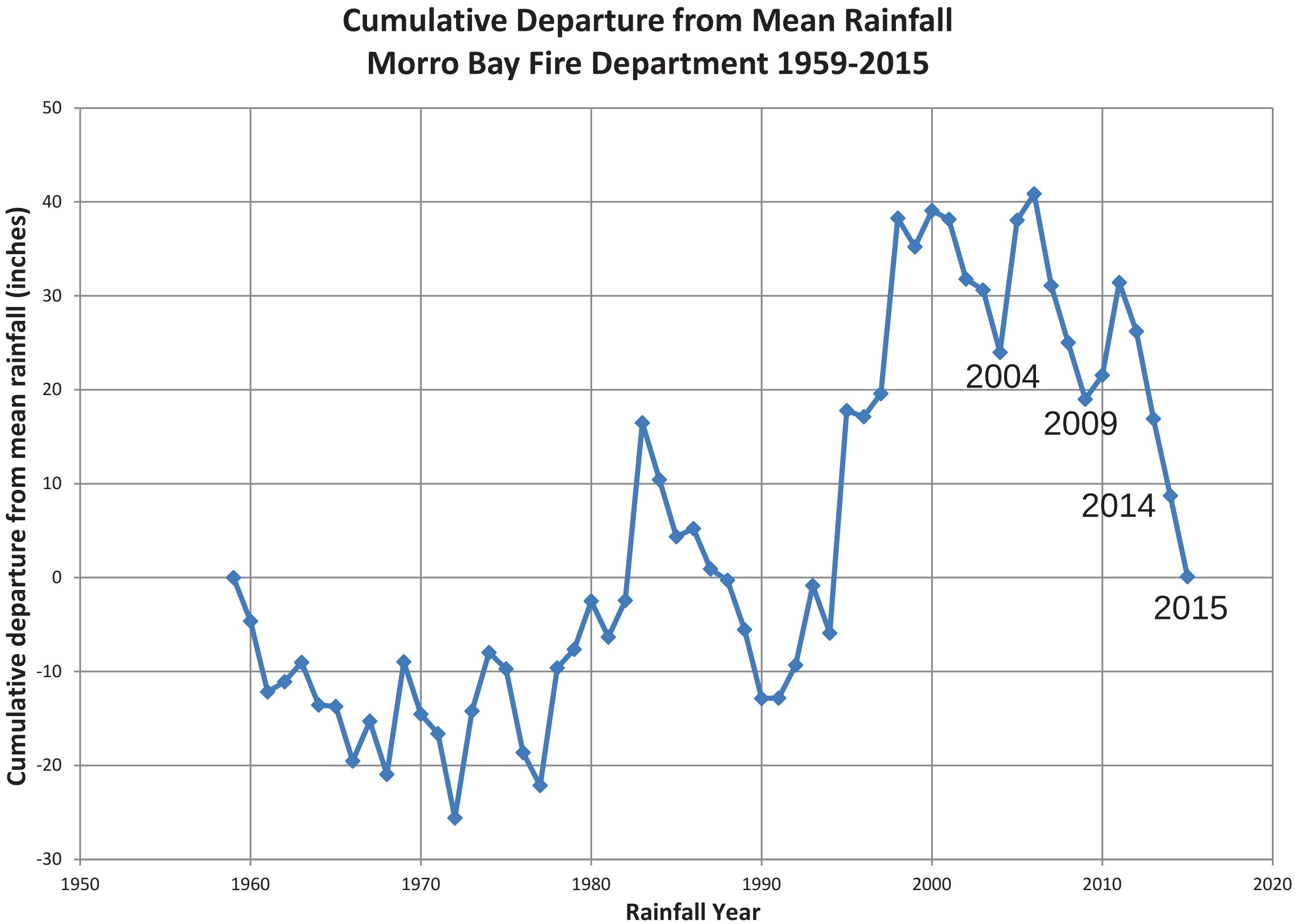

Figure 9
Cumulative Departure from
Mean Rainfall at Morro Bay Fire Department
Los Osos Groundwater Basin
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Table 15. Maximum Stream Stage for Los Osos Creek, 2015 Water Year		
Date	**Maximum Stream Stage County Sensor 751 (feet)**	**Daily Precipitation County Station #727 (inches)**
12/11/14	2.25	1.22
12/12/14	0.69	1.22
12/15/14	0.40	0.71
12/16/14	2.68	0.71
12/17/14	2.24	0.08
3/1/15	2.60	0.43
7/19/15	2.54	1.69
7/20/15	2.36	0.24

Hydrologic records from County Department of Public Works.

There is no current rating curve for Sensor 751. A rating curve is needed to correlate stage records to streamflow volume records, therefore, no streamflow volumes are reported. Development of a rating curve for Sensor 751 is recommended.

Warden Creek (Figure 1) drains approximately 9 square miles of the eastern Los Osos Valley. This creek flows along 3,700 feet of the northern basin boundary, at low invert elevations (less than 20 feet above sea level) in an area underlain by shallow bedrock. The U.S. Geological Survey reported winter flows in Warden Creek similar to Los Osos Creek, but with larger baseflow during the summer, because Warden Creek serves as a drain (point of groundwater discharge) for shallow groundwater at the north end of the Los Osos Creek floodplain (Yates and Wiese, 1988).

7. DATA INTERPRETATION

Groundwater level and groundwater quality data for 2015, together with selected historical data, have been used to develop the following information:

- Groundwater elevation contour maps for the Perched Aquifer, Upper Aquifer (with Alluvial Aquifer), and Lower Aquifer for both Spring and Fall 2015 conditions.
- Water level hydrographs for wells representative of aquifers in the Western, Central, and Eastern Areas of the basin.
- The lateral extent of seawater intrusion and the Fall 2015 position of the seawater intrusion front.
- Estimates of groundwater in storage for Spring and Fall 2015, including amount above mean sea level.
- Estimates of groundwater in storage for Spring 2005, for comparison to Spring 2015, including the volume of seawater intrusion.

- Basin Yield Metric, Basin Development Metric, Water Level Metric, Chloride Metric, and Nitrate Metric.

7.1 Water Level Contour Maps

Water level contour maps for Spring 2015 are presented in Figures 10, 11, and 12 for the Perched Aquifer, Upper Aquifer with Alluvial Aquifer, and Lower Aquifer, respectively. Corresponding water level contour maps for Fall 2015 are presented in Figures 13, 14, and 15. The water level elevations are shown at a 5-foot contour interval based on the ordinary kriging interpolation method, which provides a best (least-squares) estimate of values at unmeasured points based on the mapped values.

Water level data available from irrigation and domestic wells were used in the development of the water level contour maps, although these water levels are not listed in the data tables in this report (Table 3 through 8). To develop contour maps useful for groundwater storage estimates, a few wells located along the basin boundaries were added to the monitoring network, along with additional control points in the perched and upper aquifers. Water levels from alternate dates (not from Spring or Fall 2015) were included in the contour maps at four locations. All groundwater elevations were adjusted to a common datum (NAVD 88) prior to contouring and groundwater storage calculations. These adjustments are approximate, pending a review of all reference point elevations by a licensed land surveyor.

Perched Aquifer water level contour maps (Figures 10 and 13) show the highest groundwater elevations at Bayridge Estates (Well FW31 at the Bayridge Estates wastewater disposal field), with a radial direction of groundwater flow from the higher topographic elevations to lower elevations. There is little change in Perched Aquifer groundwater elevation contours between Spring and Fall 2015, with an average water level decline over the period of approximately one foot (ranging from declines of 0.4 feet to 1.8 feet at individual wells).

Contour maps for the Upper Aquifer and Alluvial Aquifer (Figures 11 and 14) show the highest groundwater elevations are at the southern edge of the Los Osos Creek valley. The general direction of groundwater flow is to the northeast along the creek valley and to the northwest toward the Morro Bay estuary. Significant features include a pumping depression interpreted to be present in the area of downtown Los Osos, and a groundwater high interpreted to be present beneath dune sand ridges in Baywood Park. Upper Aquifer groundwater elevation contours are similar between Spring and Fall 2015, averaging approximately one foot of water level decline over the period (ranging from a 16-foot decline to a 2-foot rise at individual wells).

Contour maps for the Lower Aquifer (Figures 12 and 15) show the highest groundwater elevations are at the southern edge of the Los Osos Creek valley and near the eastern basin boundary. Groundwater flow in the Lower Aquifer is generally toward Central Area pumping depressions. Lower aquifer groundwater elevations over most of the Western and Central Areas are below sea level. One of the pumping depressions is centered around a monitoring well (LA19), which may

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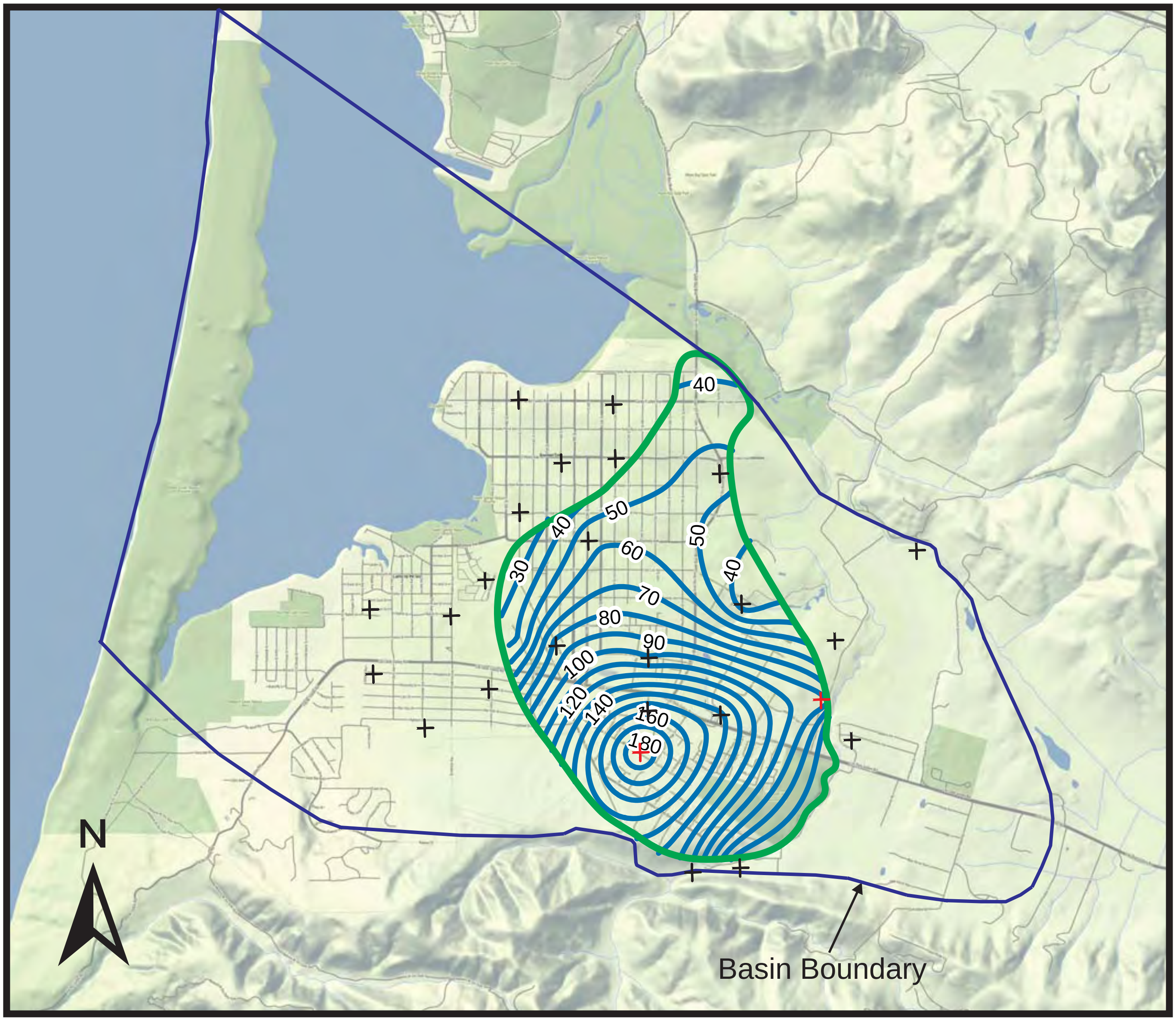

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 Groundwater elevation contour in feet above sea level (NAVD 88 datum)

Approximate limits of Perched Aquifer

+ Spring 2015 groundwater elevation data point (contours blanked outside of Perched Aquifer limits)

+ Alternate date groundwater elevation data point

Figure 10
Spring 2015 Water Level Contours
Perched Aquifer
Los Osos Groundwater Basin
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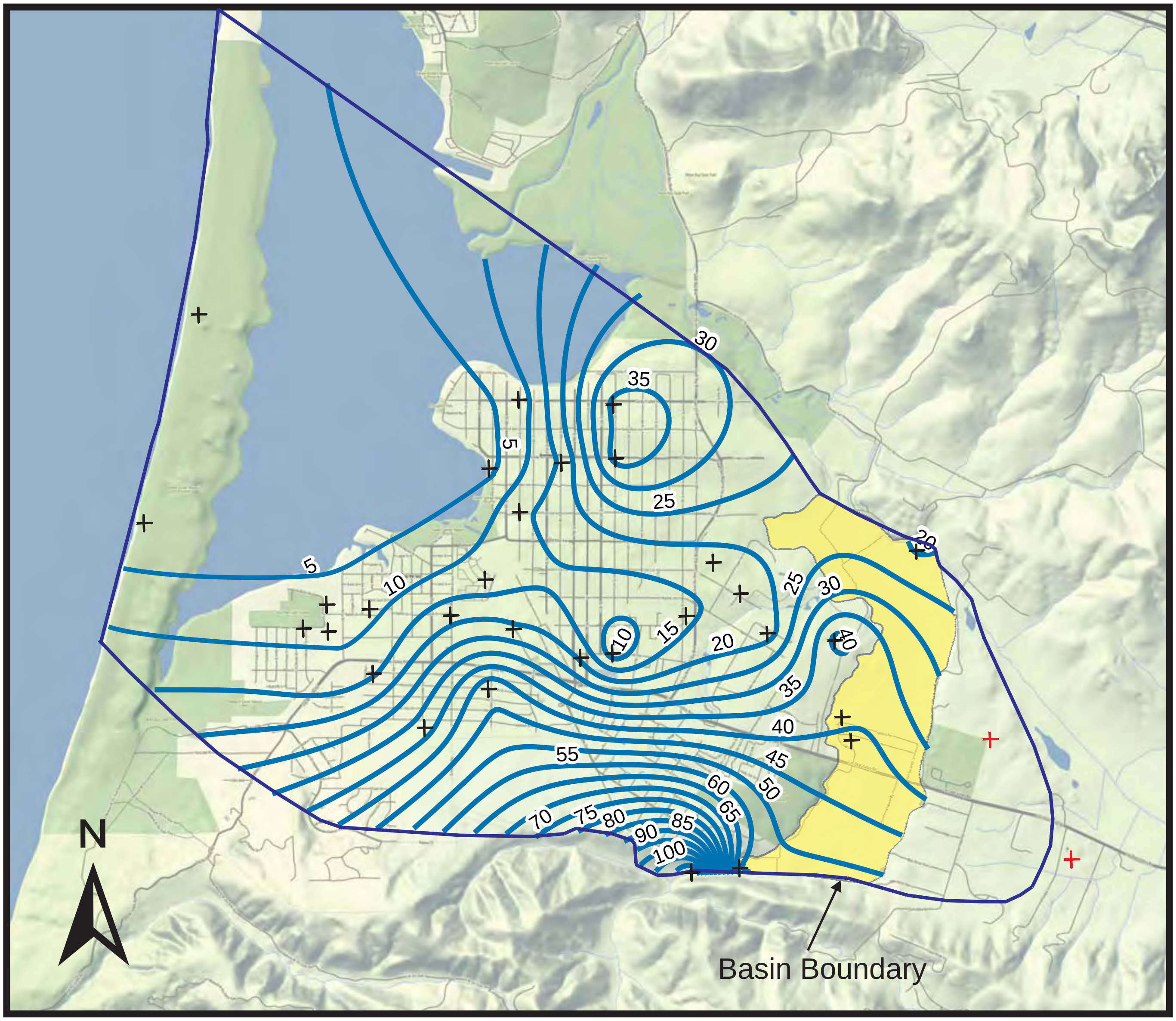

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 Groundwater elevation contour in feet above sea level (NAVD 88 datum)

Limits of Alluvial Aquifer

+ Spring 2015 groundwater elevation data point (contours blanked outside of Upper Aquifer and Alluvial Aquifer limits)

+ Alternate date groundwater elevation data point

Figure 11
Spring 2015 Water Level Contours
Upper Aquifer and Alluvial Aquifer
Los Osos Groundwater Basin
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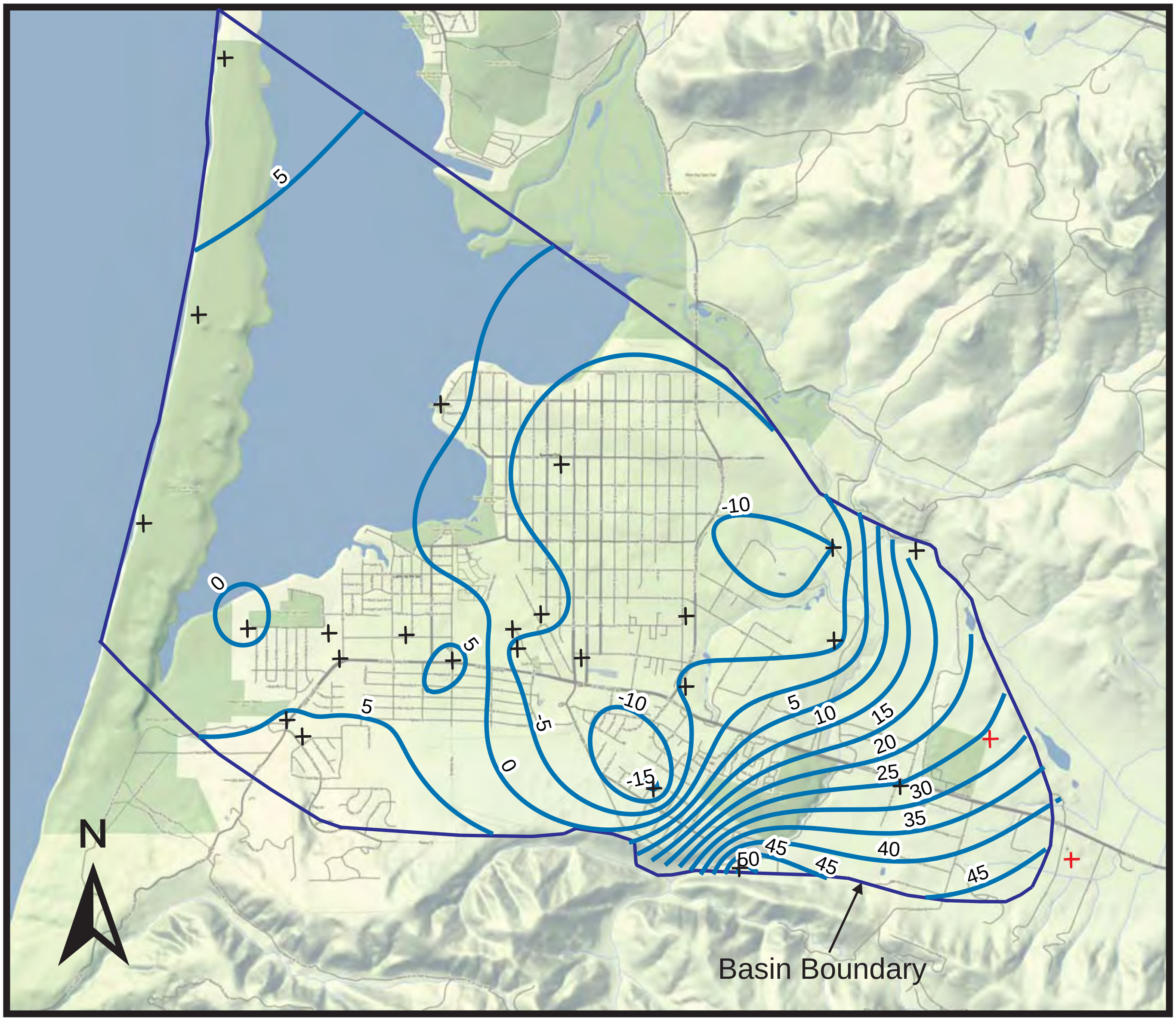

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 — Groundwater elevation contour in feet above sea level (NAVD 88 datum)

+ Spring 2015 groundwater elevation data point

+ Alternate date groundwater elevation data point

Figure 12
Spring 2015 Water Level Contours
Lower Aquifer
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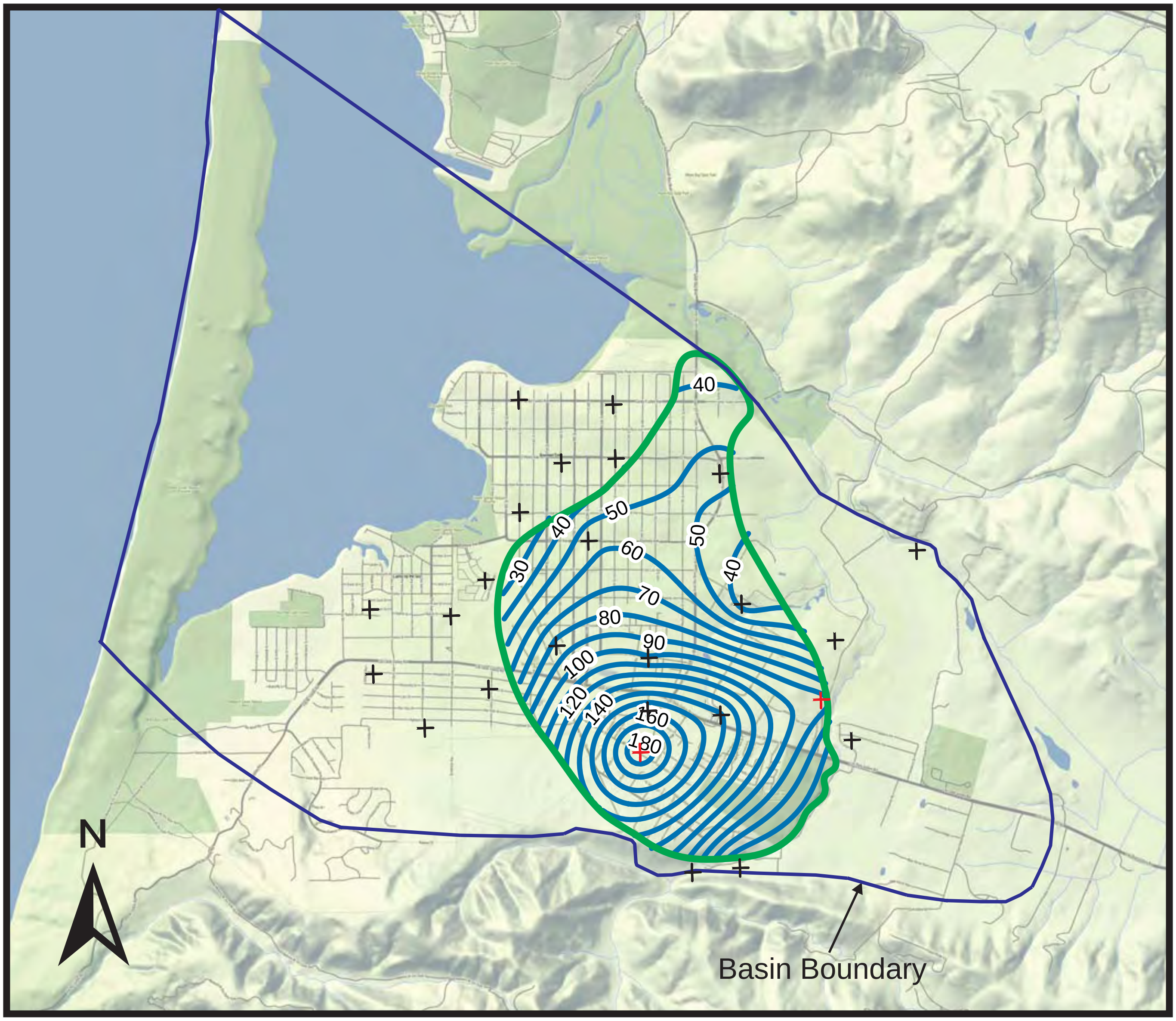

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 — Groundwater elevation contour in feet above sea level (NAVD 88 datum)

Approximate limits of Perched Aquifer

\+ Fall 2015 groundwater elevation data point (contours blanked outside of Perched Aquifer limits)

\+ Alternate date groundwater elevation data point

Figure 13
Fall 2015 Water Level Contours
Perched Aquifer
Los Osos Groundwater Basin
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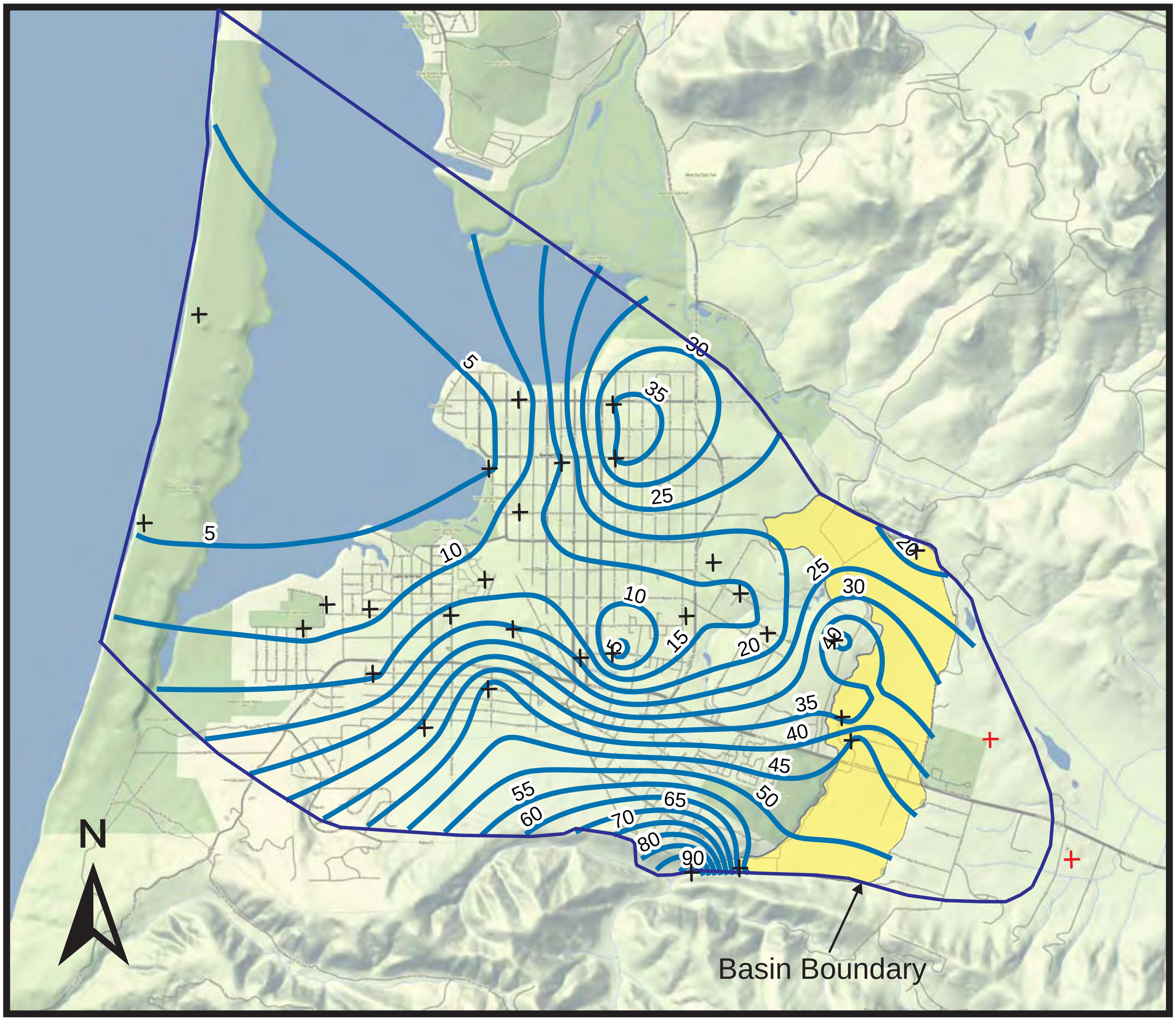

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 — Groundwater elevation contour in feet above sea level (NAVD 88 datum)

Limits of Alluvial Aquifer

+ Fall 2015 groundwater elevation data point (contours blanked outside of Upper Aquifer and Alluvial Aquifer limits)

+ Alternate date groundwater elevation data point

Figure 14
Fall 2015 Water Level Contours
Upper Aquifer and Alluvial Aquifer
Los Osos Groundwater Basin
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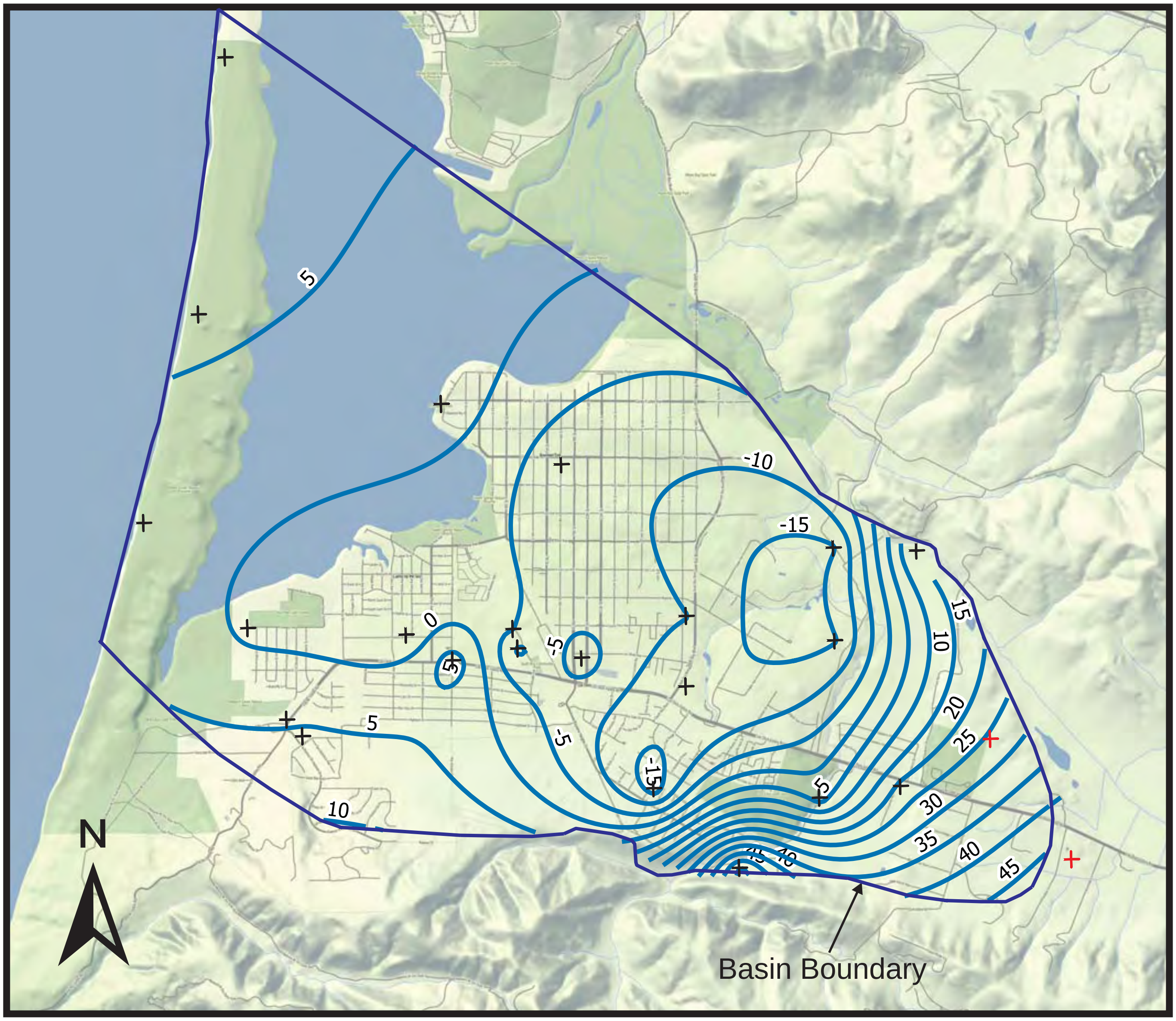

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 — Groundwater elevation contour in feet above sea level (NAVD 88 datum)

+ Fall 2015 Groundwater elevation data point

+ Alternate date groundwater elevation data point

Figure 15
Fall 2015 Water Level Contours
Lower Aquifer
Los Osos Groundwater Basin
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be due to an inaccurate wellhead elevation. A review of all monitoring network wellhead elevations by a licensed surveyor is recommended.

Lower Aquifer groundwater elevation contours are similar between Spring and Fall 2015, averaging approximately 1.5 foot of water level decline in water level over the period (ranging from a 10-foot decline to a 5-foot rise at individual wells).

7.2 Water Level Hydrographs

Water levels hydrographs for representative First Water, Upper Aquifer, and Lower Aquifer wells have been compiled for the Western and Central basin areas, including one of the Lower Aquifer wells in the Dunes and Bay area. These wells present the general water level trends, but other wells may be included in future Annual Reports. Eastern area water level hydrographs may also be presented in future annual reports, pending private well owner agreements. The hydrographs are shown in Figures 16, 17, and 18, respectively.

Water level trends over the last 10 years, based on the Western and Central area wells shown in hydrographs, average 0.7 feet of decline per year in First Water, 0.5 feet of decline per year in the Upper Aquifer, and 0.9 feet of rise in Lower Aquifer water levels between Spring 2005 and Spring 2015. The declining water levels in First Water and Upper Aquifer wells are interpreted to be mainly in response to over 30 inches of decline in the cumulative departure from mean precipitation curve between 2005 and 2015 (Figure 9). The rising water levels in Lower Aquifer wells are interpreted to be mainly in response to an average annual decline of over 4 percent per year in Lower Aquifer production in the Western and Central areas between 2005 and 2015. Between Spring 2014 and Spring 2015, the short term trend in the representative wells averaged 1.34 feet of water level decline in First Water wells, 0.25 feet of decline in Upper Aquifer wells, and 0.2 feet of decline in Lower Aquifer wells.

Seawater has a density that is 1.025 times greater than fresh water. For every foot of fresh water head above sea level, the seawater interface will be displaced 40 feet below sea level, according to the Gyhben-Herzberg relation (Freeze and Cherry, 1979). Upper aquifer water levels at the bay front (wells UA3, UA4, and UA5) are high enough to avoid seawater intrusion in the Upper Aquifer at those locations. If water level declines in the Upper Aquifer continue, however, a Water Level Metric for the Upper Aquifer may be appropriate, pending review and survey (as needed) of wellhead elevations by a licensed land surveyor.

7.3 Seawater Intrusion

Methodology to track the position of the seawater intrusion front was developed in the 2005 seawater intrusion study. Information from water quality data and geophysical log interpretation were used to position the leading edge (toe) of the 250 mg/L chloride intrusion front, including the approximate slope of the intrusion front in cross-section (Cleath & Associates, 2005). In

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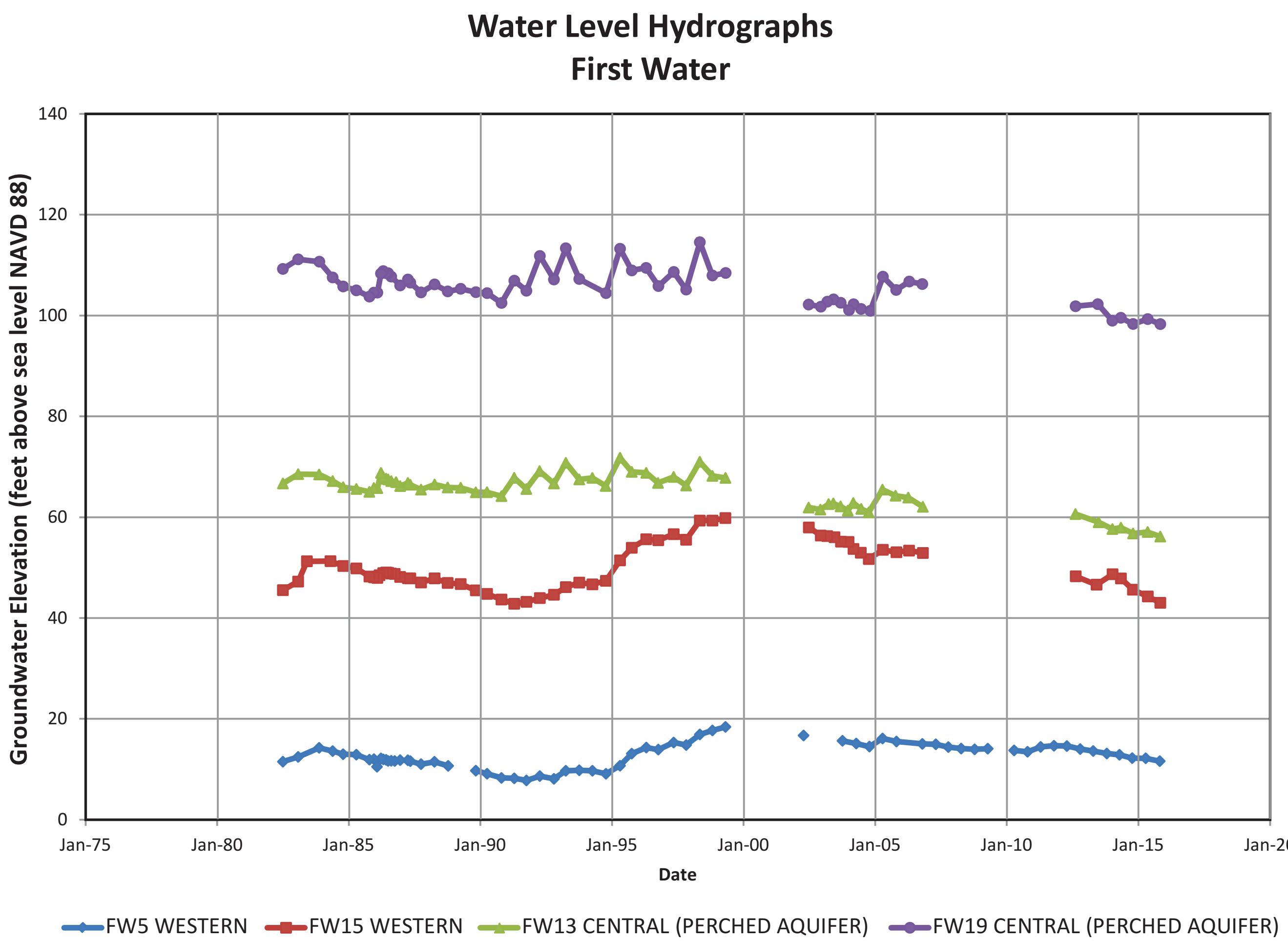

Figure 16
Water Level Hydrographs
Perched Aquifer/First Water
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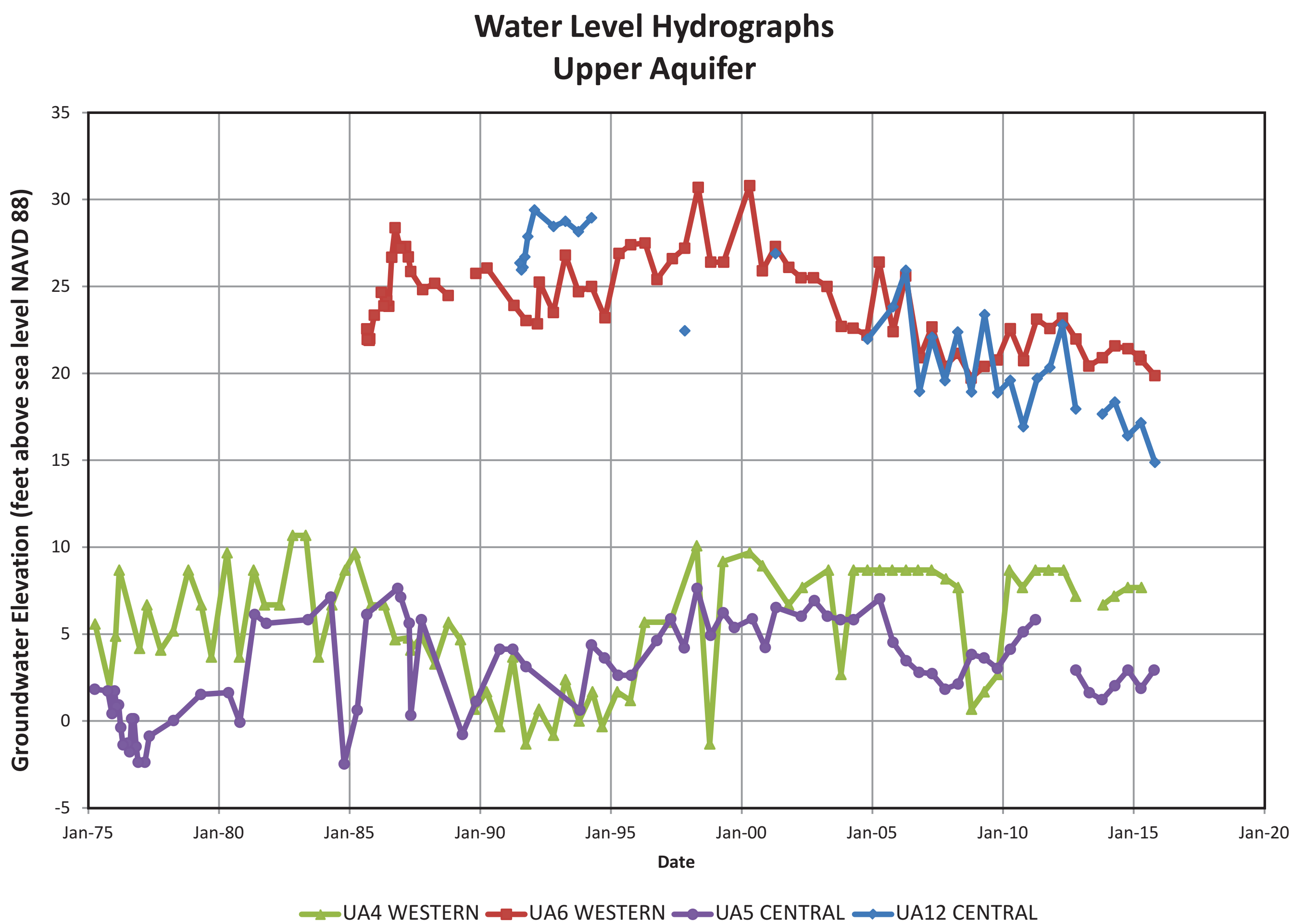

NOTE: Constant water level elevations over a few years (2004-2007) at well UA4 may indicate measuring equipment problem due to obstruction or falling water.

Figure 17
Water Level Hydrographs
Upper Aquifer
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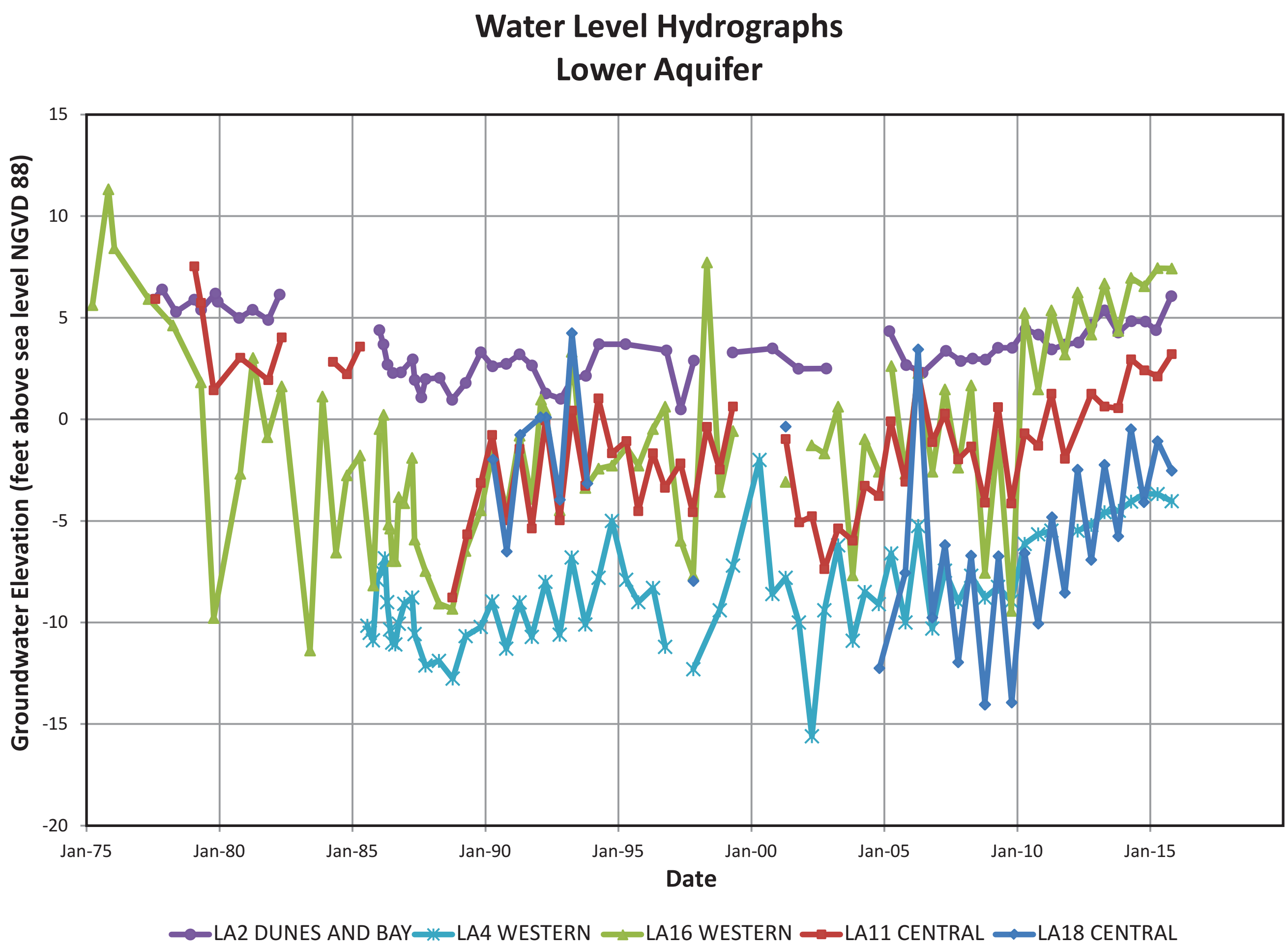

Figure 18
Water Level Hydrographs
Lower Aquifer
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subsequent seawater intrusion monitoring reports (CHG 2010; 2014; 2015c; 2015d) the leading edge of the intrusion front was interpreted using the same slope developed in the 2005 study.

For the 2015 Annual Report, CHG has revised and simplified the methodology for tracking the seawater intrusion front in the Western Area. The revised methodology contours lower aquifer chloride concentrations directly to establish a vertical front, rather than using the leading edge (toe) of a sloped front. Six wells are used for developing the 250 mg/L chloride isopleth: LA8, LA10, LA11, LA12, LA15, and LA32.

The position of the Fall 2015 seawater intrusion front in Lower Aquifer Zone D is shown in Figure 19, along with the corresponding 2005 seawater intrusion front, using the revised methodology. The resulting inland advance of the intrusion front is up to approximately 1,900 feet, or 190 feet per year, between 2005 and 2015. Figure 19 is a simplification of basin conditions, and the calculated position of the intrusion front and associated velocity of the intrusion front movement can vary significantly from year to year due to localized chloride fluctuations, particularly at well LA10.

Seawater intrusion fronts for historical periods based on the revised (vertical front contouring) method plot approximately 700 feet closer to the coast, compared to the previous (leading edge contouring) method. The calculated rates of intrusion are similar for both methods. CHG has revised the methodology because the leading edge method relies on a slope estimate which is now 10 years old and would require additional drilling/geophysics to update, while the revised method is based entirely on current water quality results.

Contouring for the intrusion front (250 mg/L chloride isopleth) shown in Figure 19 uses the ordinary kriging interpolation method, which provides a best (least-squares) estimate of values at unmeasured points based on the mapped values. Chloride concentrations at Dunes and Bay Area wells LA2 and LA3 are two orders of magnitude greater than the Western Area wells and were not used for contouring the intrusion front in the Western Area. The ordinary kriging interpolation method involves weighted linear interpolation, whereas the chloride concentrations approaching wells LA2 and LA3 on the sandspit do not appear to follow linear gradients.

The location of the intrusion front is also shown in cross-section on Figure 20. Lower Aquifer Zone D intrusion is discussed above. There is insufficient information to represent Lower Aquifer Zone E intrusion in a plan view figure. The only Western Area well which represents Zone E water quality is LA4, located near Sea Pines Golf Course. Water quality at LA4 has been close to seawater since first sampled in 1985 (Cleath & Associates, 2005). Other control points for Zone E water quality along the B-B' cross-section orientation in Figure 20 are LA15 and LA18 in the Central Area. The seawater front reached LA15 in 2009, but there has been no evidence of further inland movement toward LA18. In 2013, LA15 was modified to remove Zone E production (CHG, 2014).

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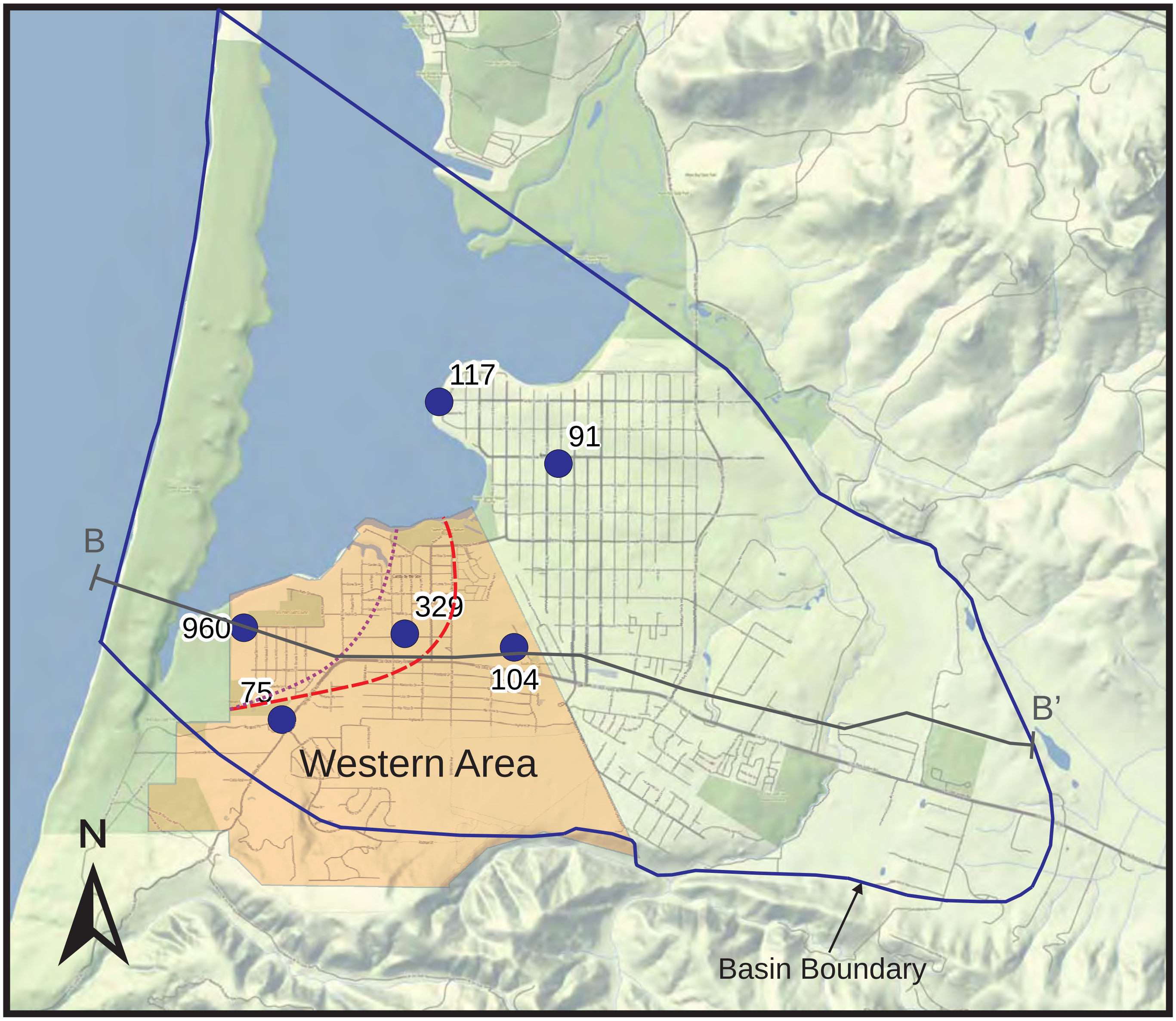

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

329
Groundwater with Fall 2015 Lower Aquifer Chloride Concentration in milligrams per liter (mg/L).

2015 seawater intrusion front in Western Area (250 mg/l chloride isopleth)

2005 seawater intrusion front in Western Area (250 mg/l chloride isopleth)

B B' Cross-section alignment (Figures 5 and 20)

Figure 19
Seawater Intrusion Front
Western Area Lower Aquifer Zone D
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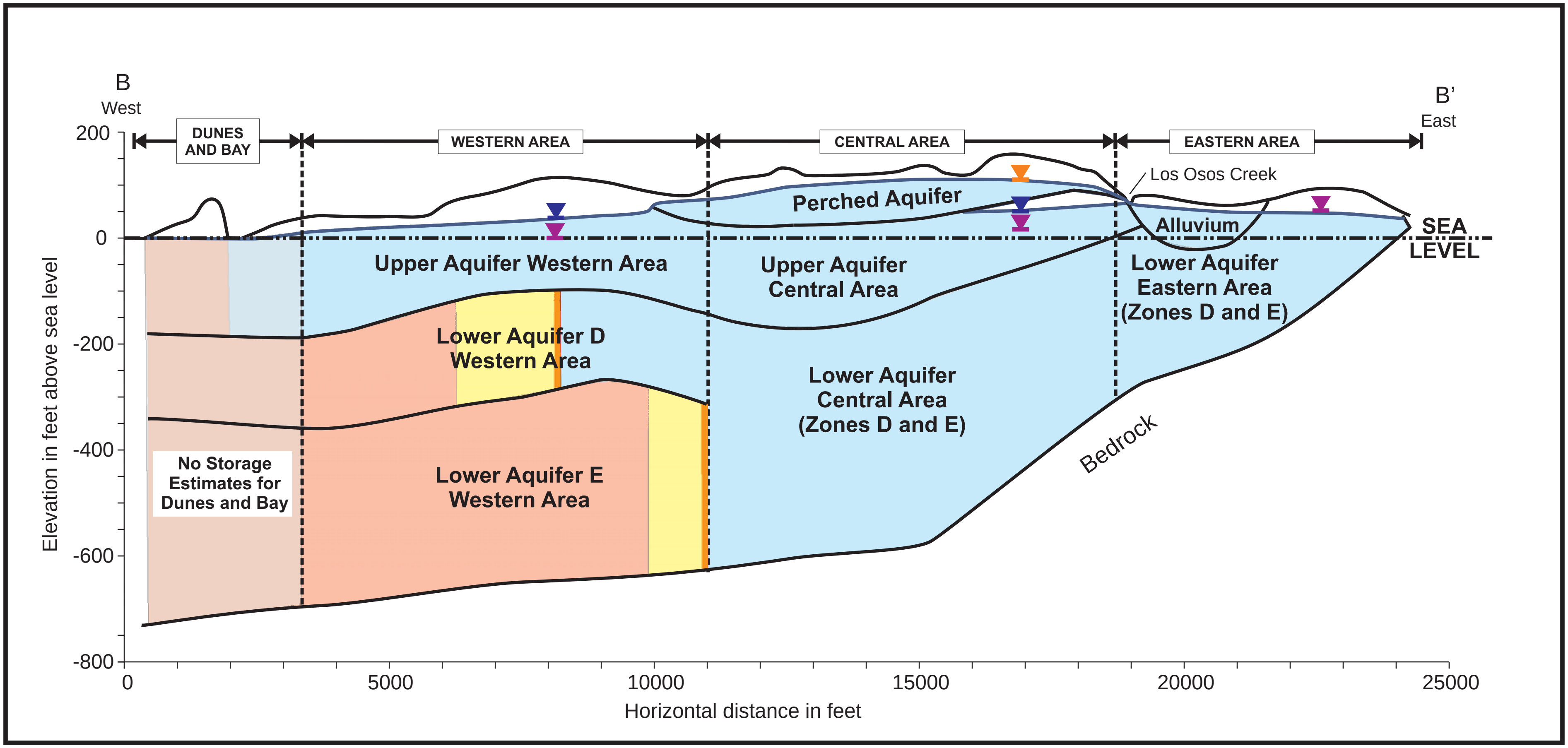

Cross-section alignment shown in Figure 19

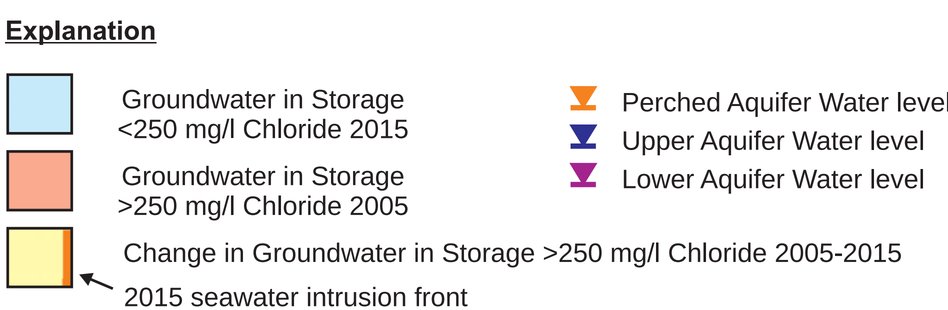

Figure 20
Basin Storage Compartments
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7.4 Groundwater in Storage

Groundwater in storage for basin areas and aquifers has been estimated through a systematic approach of water level contouring, boundary definition, volume calculations, and aquifer property estimation. The methodology was developed to facilitate change in storage calculations from year to year. An example storage calculation for the Eastern Area is shown in Appendix G.

Storage estimates were performed for Spring 2015 and Spring 2005 (for historical reference) and included separate estimates for the following areas and aquifers shown in Figure 20:

- Perched Aquifer
- Western Area Upper Aquifer
- Western Area Lower Aquifer
- Central Area Upper Aquifer
- Central Area Lower Aquifer
- Eastern Area Alluvial and Lower Aquifer

The various storage compartments are shown conceptually in Figure 20. Storage estimates for the Lower Aquifer in the Western and Central basin are divided into fixed pore space volume and confined pore space volume components. The fixed volume component of storage is based on the specific yield of the aquifer sediments, and is fixed because the Lower Aquifer is never dewatered in the Western and Central areas. The confined component adds a relatively small volume of transient storage associated with the aquifer pressure, and is based on the storativity of the aquifer. Confined and semi-confined aquifer storativity values are typically orders of magnitude less than the specific yield. The average specific yield for basin sediments is estimated at 0.1 (Appendix G). The storativity value used for the confined aquifer in the Western and Central areas is estimated at 0.0008 (Cleath & Associates, 2005).

The fixed volume storage component of the Lower Aquifer in the Western Area has been further divided into the volume intruded by seawater and the non-intruded volume. The intruded volume is defined as groundwater with a chloride concentration of 250 mg/L or greater. Zone E in the Western Area is mostly intruded (Figure 20), while Zone D is mostly non-intruded groundwater (Figure 19). Calculations for intruded versus non-intruded storage volumes are only performed for Zone D.

All storage calculations were based on upper and lower contoured surfaces specific to the aquifer and storage type (i.e. fixed volume versus confined volume, and total volume versus volume above sea level). For example, elevation contours on the base of the Perched Aquifer were used as the lower bounding surface for Perched Aquifer storage calculations, so no storage was assigned to unsaturated pore space between the base of the perched aquifer and saturated Upper Aquifer sediments (Figure 20). Table 16 summarizes the estimates of fresh groundwater in storage for 2015.

Table 16. Spring and Fall 2015 Groundwater in Storage (<250 mg/L Chloride)

Basin Area	Aquifer	Zone	Spring 2015		Fall 2015	
			Total	Above Sea Level	Total	Above Sea Level
			ACRE-FEET			
Western and Central	Perched	A, B	4,200	4,200	4,200	4,200
	Upper	C	27,000	7,700	26,600	7,200
Western	Lower (fixed vol.)	D[1]	14,300	0	14,300	0
	Lower (confined vol.)[2]	D[1]	80	1	70	1
Central	Lower (fixed vol.)	D, E	56,100	0	56,100	0
	Lower (confined vol.)[2]	D, E	90	3	80	2
Eastern	Alluvial and Lower	Alluvial, D, E	17,900	3,400	18,000	3,500
TOTAL			119,700	15,300	119,400	14,900

NOTES: [1] Western Area Zone E not included due to high chloride.
[2]Lower aquifer confined volume estimates shown for comparison to fixed volumes

Total fresh groundwater in storage for the basin (excluding Dunes and Bay area) averaged close to 120,000 acre feet in 2015, with approximately 15,000 acre-feet above sea level (Table 16). There was a calculated seasonal storage decline of 300 acre-feet between Spring 2015 and Fall 2015. Although 300 acre-feet of absolute storage is within the margin of error of the methodology (i.e. not meaningful), a 300 acre-feet difference between two storage calculations can provide meaningful information about the basin. Differences in storage calculations cancel out systematic error and reduce the margin of error attributable to specific yield estimates and contouring data sets. A sensitivity analysis would be recommended to evaluate the potential range of error associated with groundwater storage estimates and change in groundwater storage estimates.

There is approximately 70,000 acre-feet of fixed volume storage within the Lower Aquifer in the Western Area Zone D and Central Area (Table 16). Because groundwater levels in the Lower Aquifer within the Western and Central areas average more than 100 feet above the top of the aquifer, dewatering is unlikely, and this volume of storage will not change. The Lower Aquifer confined pore space volume, by comparison, represents the water that is available without dewatering any portion of the Lower Aquifer, and is essentially the pressure component. Water is relatively incompressible, so once the pore spaces of an aquifer have been filled, substantial confining pressure is required to further increase the storage volume. Conversely, there is a much greater drop in aquifer water levels for storage withdrawals under confined conditions, compared to unconfined conditions. This is why the calculated confined volume of water shown in Table 16 for the Lower Aquifer Western Area and Central Area totals less than 200 acre-feet. As previously mentioned, this smaller storage volume assumes a confined aquifer storativity of 0.0008, compared to the unconfined specific yield of 0.1.

Table 17 compares Spring 2015 groundwater in storage with Spring 2005. Lower Aquifer storage calculations were for fixed pore space volumes only (no confined pore space volumes), but included Western Area Zone E. The confined pore space volumes are not calculated for the storage comparison because they represent less than 0.2 percent of total storage.

Table 17. Spring 2005 and Spring 2015 Groundwater in Storage Comparison

Basin Area	Aquifer	Zone	Spring 2005		Spring 2015	
			Total	Above Sea Level	Total	Above Sea Level
			ACRE-FEET			
Western and Central	Perched	A, B	5,000	5,000	4,200	4,200
	Upper	C	29,400	10,400	27,000	7,700
Western	Lower	D (Cl <250 mg/L)[1]	17,000	na[2]	14,300	na[2]
		D (Cl >250 mg/L)[1]	3,900		6,600	
		E (Cl >250 mg/L)[1,3]	59,500		59,500	
Central	Lower	D, E	56,100		56,100	
Eastern	Alluvial and Lower	Alluvial, D, E	19,300	4,800	17,900	3,400
TOTAL			190,200	20,200	185,600	15,300

NOTES: [1] Chloride less than/greater than 250 mg/L (non-intruded/intruded) - fixed volume only

[2]Lower aquifer volumes above sea level negligible (<10 acre-feet)

[3]Lower aquifer Zone E mostly intruded in Western Area

The total decline in storage between 2005 and 2015 is estimated at approximately 4,600 acre feet, or 460 acre-feet per year. There has also been a decline in fresh groundwater storage (<250 mg/L chloride) of 2,700 acre-feet, or 270 acre-feet per year. By comparison, basin production between 2005 and 2015 averaged 2,760 acre-feet per year. Some of the storage decline is likely due to basin pumping in excess of the safe yield, and some due to the drought conditions. As previously mentioned, a sensitivity analysis would be recommended to evaluate error associated with the change in storage estimates to support future data interpretation.

7.5 Basin Metrics

The Basin Plan established two methods for measuring progress in management of seawater intrusion (ISJ Group, 2015): one based on comparing annual groundwater extractions with the sustainable yield of the basin as calculated by the basin numerical groundwater model, and one based on evaluating water level and water quality data from the LOBP Groundwater Monitoring Program. The first method involves the Basin Yield Metric (BYM) and the Basin Development

Metric (BDM), while the latter method involves the Water Level Metric, The Chloride Metric, and the Nitrate Metric.

7.5.1 Basin Yield Metric

The Basin Yield Metric compares the actual amount of groundwater extracted in a given year with the sustainable yield of the basin under then-current conditions. Sustainable yield is estimated using the basin model as the maximum amount of water that may be extracted from the basin with none of the active wells producing water with chloride concentration in excess of 250 mg/L (ISJ Group, 2015). A chloride concentration of 250 mg/L is the recommended limit for drinking water (one-half of the Secondary Maximum Contaminant Level Upper Limit of 500 mg/L). The Basin Yield Metric for 2015 is a ratio expressed as follows:

$$\frac{\text{2015 Groundwater Production}}{\text{2015 Sustainable Yield}} \ast 100$$

Groundwater production in 2015 was 2,170 acre-feet. The sustainable yield of the basin with the infrastructure in place in 2015 was estimated using the basin model to be 2,450 acre-feet per year (ISJ Group, 2015). Therefore, the Basin Yield Metric in 2015 is 89. The corresponding Basin Yield Metric was 98 in 2014, and was the first year the metric has been below 100 since 1978. The Basin Plan objective for the Basin Yield Metric is 80 or less.

Figure 21 compares the Basin Yield Metric and area production in the basin since 2005. The Basin Yield Metric has dropped from an average of 128 between 2005 and 2009 to 89 in 2015. There has been a significant reduction in total production and the lower aquifer production, especially in the Western Area. Two development scenarios from the Basin Plan are also compared in Figure 21.

7.5.2 Basin Development Metric

The Basin Development Metric compares the sustainable yield of the basin in a given year with the maximum sustainable yield of the basin with all potential Basin Plan projects implemented (ISJ Group, 2015). The Basin Yield Metric for 2015 is a ratio expressed as follows:

$$\frac{\text{2015 Sustainable Yield}}{\text{Maximum Sustainable Yield}} \ast 100$$

The 2015 sustainable yield is estimated at 2,450 acre-feet. The maximum sustainable basin yield with all Basin Plan projects implemented is estimated at 3,500 acre-feet. Therefore, the Basin Development Metric in 2015 is 70. There has been no change in the Basin Development Metric since last calculated in 2013. The purpose of the metric is to inform the BMC on the percentage of the basin's maximum potential sustainable yield that has been developed (70 percent in 2015). There is no Basin Plan objective for the Basin Development Metric.

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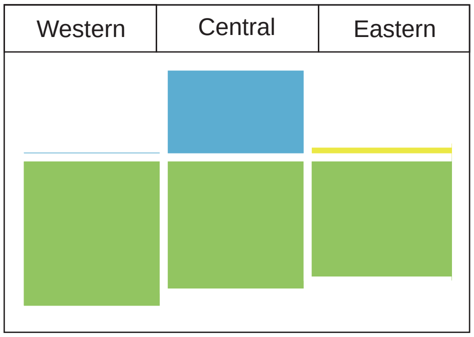
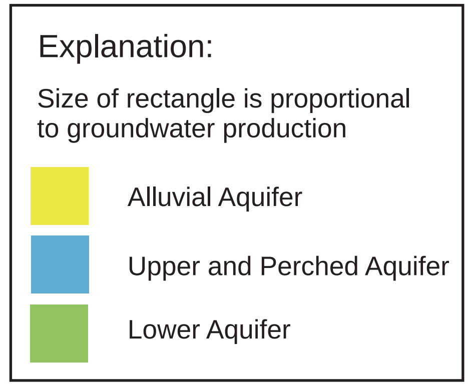
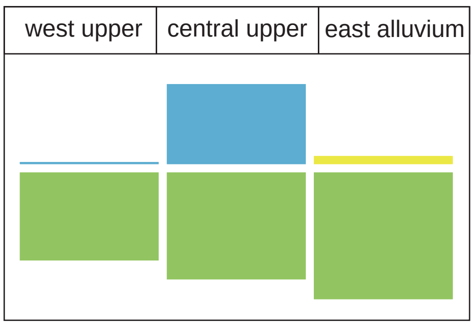
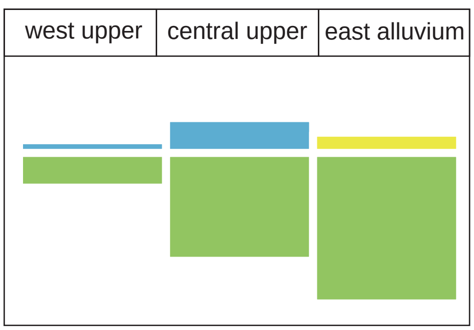


2005-2009
Average Production 3,060 AFY
Basin Yield Metric = 128

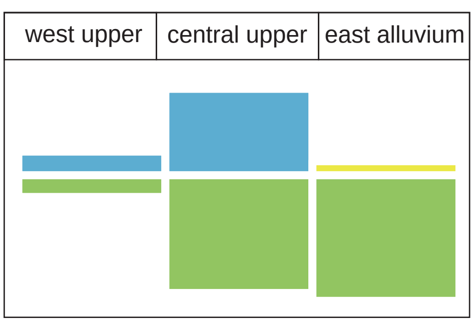




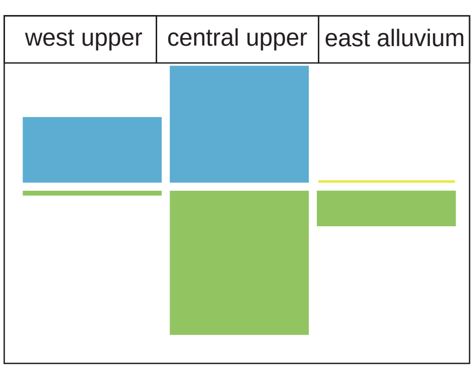
2010-2014
Average Production 2,600 AFY
Basin Yield Metric = 106



Year 2015
Average Production 2,170 AF
Basin Yield Metric = 89



E+AC+U (No Further Development Scenario - refer to Basin Plan for full description)
Average Production 2,230 AFY
Basin Yield Metric = 74



E+UG+ABC (Buildout Scenario - refer to Basin Plan for full description)
Average Production 2,380 AFY
Basin Yield Metric = 71

Figure 21
Basin Yield Metric Comparison
Los Osos Groundwater Basin
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Note: historical (pre-2015) and future/projected Basin Yield Metrics are from Basin Plan.

As presented in Basin Plan (ISJ Group, 2015), the estimated sustainable yield of the basin will increase beginning with urban water reinvestment Program U and basin infrastructure Program A, both of which are currently in progress (portions of Program A were completed in 2015). For basin metrics calculations, increases to the sustainable yield will be credited when a basin program has been fully implemented.

7.5.3 Water Level, Chloride, and Nitrate Metrics

The Water Level, Chloride, and Nitrate Metrics are measurements of the effectiveness of basin management. The Water Level and Chloride Metrics address changes in the Lower Aquifer related to seawater intrusion mitigation, while the Nitrate Metric addresses changes in First Water and the Upper Aquifer related to nitrate contamination mitigation.

Water Level Metric

The Water Level Metric is defined as the average Spring groundwater elevation, measured in feet above mean sea level, in five Lower Aquifer wells. These wells are LA2, LA3, LA11, LA14, and LA16 (Figure 4).

Two Water Level Metric wells (LA14 and LA16) are positioned in the Western Area near the current seawater intrusion front (250 mg/L chloride isopleth) and one well is in the Central Area on the bay front (LA11). As basin production is redistributed through the basin infrastructure program, these Water Level Metric wells will monitor Lower Aquifer groundwater levels in critical areas near the seawater intrusion front.

The last two Water Level Metric wells are located on the Morro Bay sandspit (LA2 and LA3), where monitoring will help evaluate regional effects, rather than just localized water level rebound. Water in these wells ranges from 25 to 45 percent seawater, and density corrections to equivalent freshwater head were made in prior metric calculations. The density correction was intended to include the effects of seawater mixing over time to the Water Level Metric. Upon review of the 2015 monitoring data, however, the density corrections for the sandspit wells are not recommended when calculating the Water Level Metric. The reasons for not applying the density correction are because (a) there is significant lag time between water level changes and the resulting water quality response, and (b) the seawater density component of equivalent freshwater head does not provide seawater intrusion mitigation (i.e. is not beneficial and should not be added to the Water Level Metric). Table 18 presents the 2015 Water Level Metric without density correction. Figure 22 graphs historical trends in the metric.

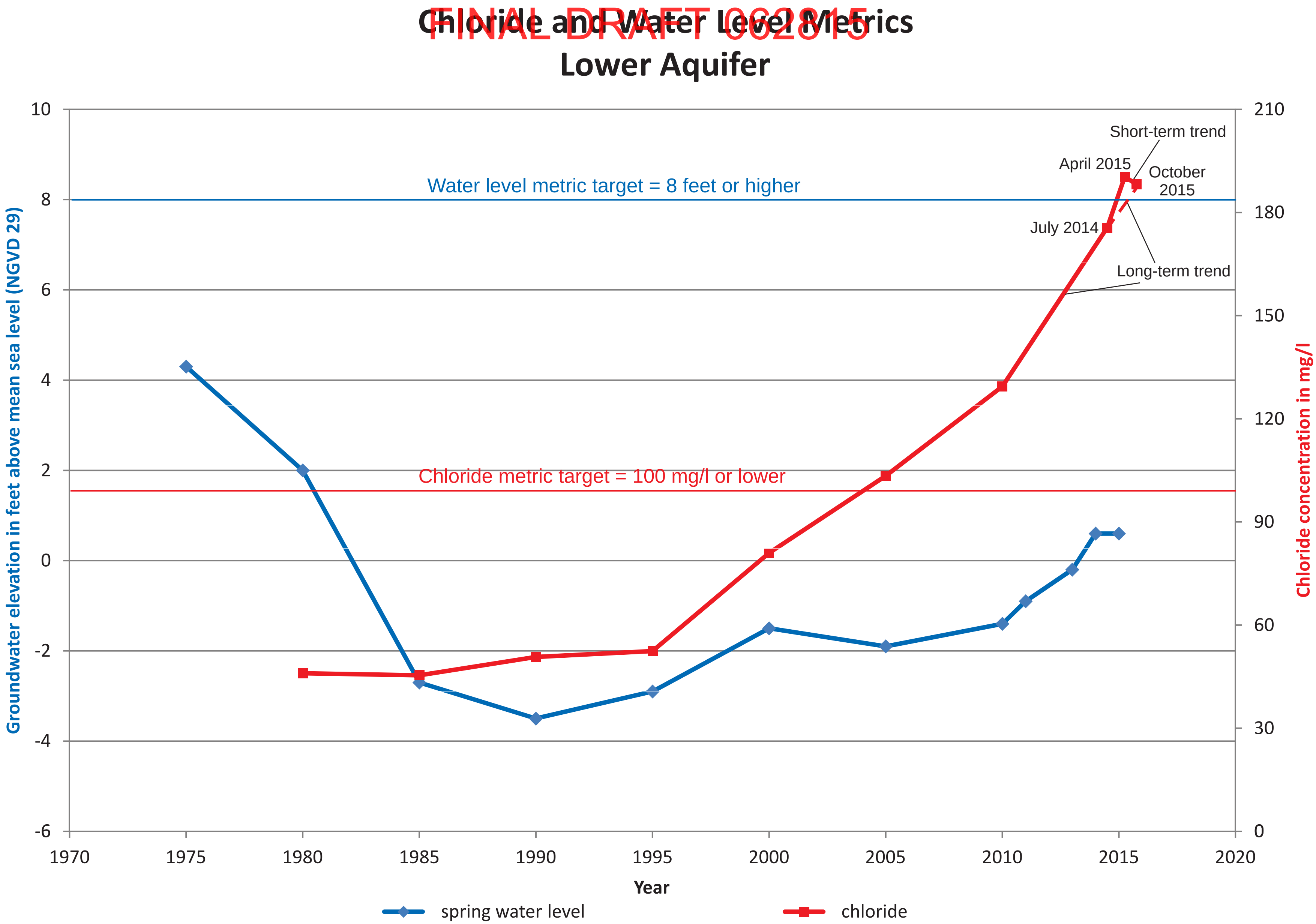

Figure 22
Chloride and Water Level Metric
Los Osos Groundwater Basin
2015 Annual Report

Cleath-Harris Geologists

Table 18. 2015 Water Level Metric	
Metric Well	**Spring 2015 Groundwater Elevation (feet above sea level - NGVD 29 Datum)**
LA2	1.6
LA3	0.2
LA11	-0.7
LA14	-2.7
LA16	4.6
Water Level Metric (average)	0.6 feet

The Spring 2015 Water Level Metric is 0.6 feet NGVD 29 (approximately 3.4 feet NAVD 88). Mean sea level is approximately 0 feet in the NVGD 29 datum. The metric was rising from 2005 through 2014, likely in response to a decrease in Lower Aquifer production, but did not change between 2014 and 2015 (Figure 22). The Basin Plan objective for the Water Level Metric is 8 feet or higher (ISJ Group, 2015). Removal of the density correction at the sandspit wells, and adjustment of reference point elevations to the NGVD datum has lowered the metric compared to prior calculations. Reevaluation of the metric objective may be appropriate, however, additional monitoring to establish the metric trend under LOWWP project conditions, along with a review of all well elevation reference points by a licensed surveyor is recommended prior to considering a change in the water level metric objective.

Chloride Metric

The Chloride Metric is defined as the weighted average concentration of chlorides in four key Lower Aquifer wells. One key well (LA10) is within the historical path of seawater intrusion (Cleath & Associates, 2005). Reduction in pumping from the Lower Aquifer should result in measurable declines in chloride concentrations at this well, as the hydraulic head in the Lower Aquifer increases and the hydraulic gradient toward land decreases or reversed. The LOBP Groundwater Monitoring Program schedule for measuring the Chloride metric is in the Spring and Fall.

There are also three key wells on the perimeter of the seawater intrusion front (LA8, LA11, and LA12). Wells LA11 and LA12 monitor Lower Aquifer chloride concentrations in the northern portion of the basin, while LA8 monitors chloride concentrations in the southern portion. When calculating the Chloride Metric, the concentration of Well LA10 is given twice the weight of the other three wells, in order to increase the sensitivity of the metric to management actions. Table 19 presents the Spring and Fall 2015 Chloride Metric. Figure 22 graphs historical values in the metric. The Chloride Metric is a simplification of basin conditions, and can vary significantly from year to year due to localized chloride fluctuations, particularly at well LA10. The Chloride Metric target level is 100 mg/L or lower.

Table 19. 2015 Chloride Metrics		
Metric Well	**Spring 2015 Chloride Concentrations**	**Fall 2015 Chloride Concentrations**
LA8	77 mg/L	75 mg/L
LA10	331 mg/l (double counted for average)	329 mg/l (double counted for average)
LA11	112 mg/L	117 mg/L
LA12	101 mg/L	91 mg/L
Chloride Metric (weighted average)	190 mg/L	188 mg/L

Data Source: LOWRF Baseline Groundwater Monitoring Program.

A response in the chloride metric to changes in Lower Aquifer production can take years to develop. There was a delay of 15-20 years between the onset of water level declines in the 1970's and chloride metric increases in the 1990's (Figure 22). The 2015 water quality monitoring results indicate continued advance of the seawater intrusion front. There has been a short-term decline in the rate of intrusion between April and October 2015. A comparison between July 2014 and October 2015, however, indicates a continued trend of increases in the Chloride Metric (Figure 22).

Nitrate Metric

The Nitrate Metric is defined as the average concentration of nitrate in five First Water key wells located in areas of the basin that have been impacted by elevated nitrate concentrations. Focusing on shallow, adversely impacted wells provides a sensitive method of tracking changes in nitrate concentrations in groundwater over time. The LOBP Groundwater Monitoring Program schedule for measuring the Nitrate Metric is in the Fall. Table 20 presents the Nitrate Metric for Fall 2015. Figure 23 graphs historical values in the metric, along with the 5-year average from 2002-2006. A new 5-year average will be available in 2016, after which a 5-year running average will be used to track long-term trends in the Nitrate Metric over time (ISJ Group, 2015).

Table 20. 2015 Nitrate Metric	
Metric Well	**Fall 2015 Nitrate-Nitrogen Concentrations**
FW2	27.8 mg/L
FW6	18.6 mg/L
FW10	23.4 mg/L
FW15	24.8 mg/L
FW17	32.6 mg/L
Nitrate Metric (average)	25.4 mg/L (NO3-N)

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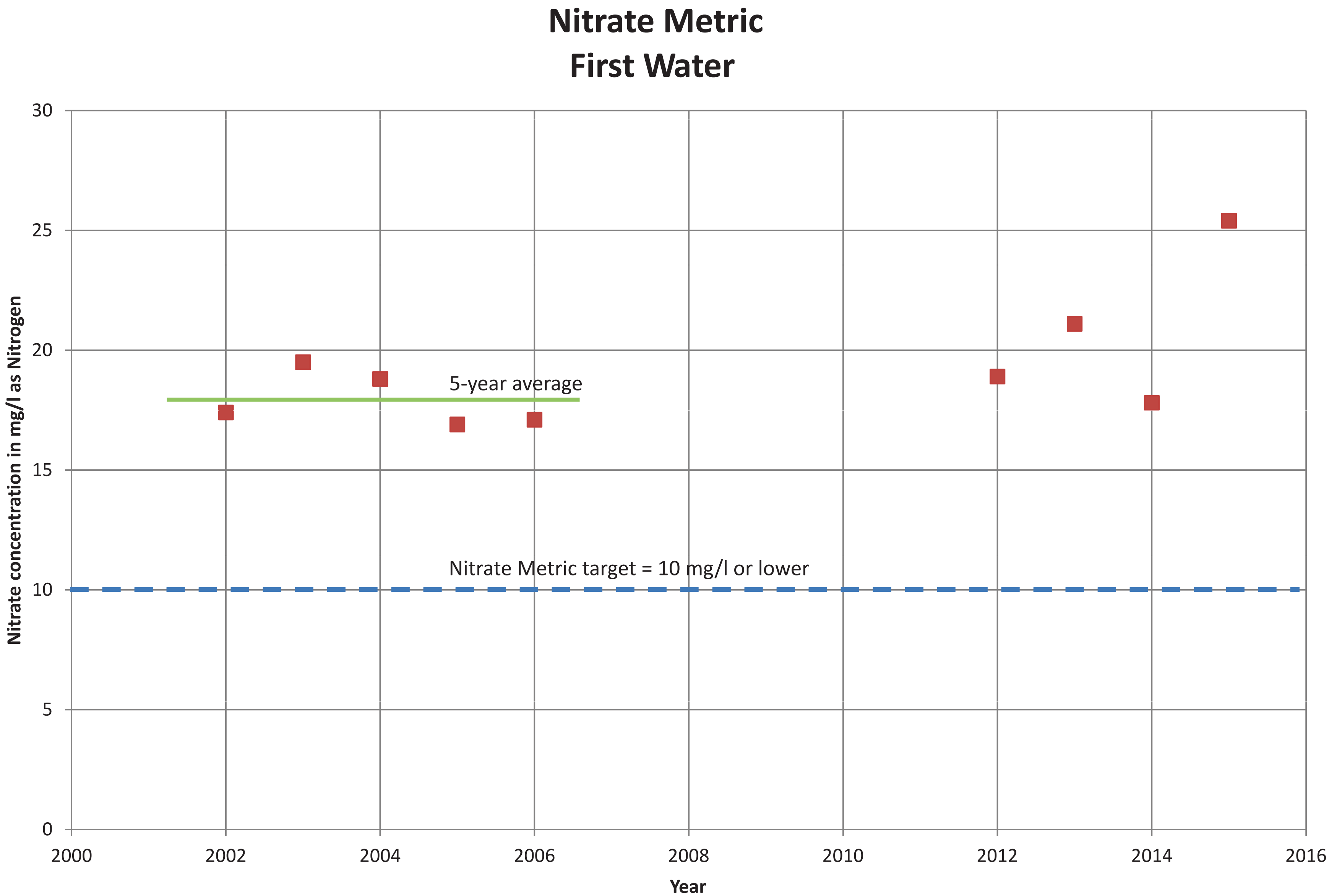

Note: Nitrate metric wells reconstructed in 2002, sampled from 2002-2006 and 2012 to present.

Figure 23
Nitrate Metric
Los Osos Groundwater Basin
2015 Annual Report

Cleath-Harris Geologists

The Nitrate Metric was measured at 25.4 mg/L nitrate-nitrogen (NO3-N), which is 2.5 times the Maximum Contaminant Level of 10 mg/L (the drinking water standard). Independent of Basin Plan actions, construction and operation of the LOWWP will largely stop nitrate loading in the basin from septic disposal within the wastewater service area. Nitrate concentrations in the basin are expected to begin declining over the next decade. If nitrate-nitrogen concentrations the impacted Nitrate Metric wells decrease to a 5-year running average of 10 mg/L or less, it may reasonably be inferred that nitrate concentrations are generally lower across the Upper Aquifer, or will be in the reasonably foreseeable future.

8. BASIN STATUS

The status of the Los Osos Groundwater Basin in 2015 is summarized as follows:

- There have been four consecutive years of below normal rainfall from 2012 through 2015. Rainfall for 2015 was 8.6 inches below average at Station #152 (Morro Bay Fire Department) and 7.0 inches below average at Station #727 (Los Osos Landfill). San Luis Obispo County was in exceptional drought conditions (the greatest intensity level) during 2015, based on information from the U.S. Drought Monitor, a partnership of federal agencies (NDMC/USDA/NOAA, 2015).

- Long-term water level trends over the last 10 years, based on the Western and Central area well hydrographs shown in Figures 16-18, averaged 0.7 feet of decline per year in First Water, 0.5 feet of decline per year in the Upper Aquifer, and 0.9 feet of rise per year in Lower Aquifer water levels. Between Spring 2014 and Spring 2015, the short term trend in these wells averaged 1.34 feet of water level decline in First Water wells, 0.25 feet of decline in Upper Aquifer wells, and 0.2 feet of decline in Lower Aquifer wells.

- The Fall 2015 location of the seawater intrusion front in Lower Aquifer Zone D in the Western Area is shown in Figure 19, along with the corresponding intrusion front location in 2005. The inland advance of seawater intrusion was up to approximately 1,900 feet, averaging 190 feet per year between 2005 and 2015.

- The Basin Yield Metric dropped from 98 in 2014 to 89 in 2015. The Basin Plan objective for the Basin Yield Metric is 80 or less, therefore the metric improved during 2015.

- The Basin Development Metric in 2015 indicates that 70 percent of the maximum potential sustainable yield of the basin has been developed. There is no Basin Plan objective for the Basin Development Metric, and there has been no change in the metric value since last calculated in 2013.

- The Water Level Metric was unchanged between Spring 2014 and Spring 2015, but remains several feet below the target value, indicating a lack of improvement in 2015.

- The Chloride Metric was stable between Spring and Fall 2015, but has been increasing relative to the target value between Fall 2014 and Fall 2015, indicating a lack of improvement in 2015.

- The Nitrate Metric increased relative to the target value between 2014 and 2015, indicating a lack of improvement in 2015.

9. RECOMMENDATIONS

The following LOBP Groundwater Monitoring Program recommendations are provided for BMC consideration:

- Add up to 12 existing wells to the monitoring network (shown in Figures 2, 3, and 4). Most of these wells are monitored for other programs and will provide useful control for groundwater level contours and seawater intrusion front delineation (Section 2.2).
- Add a new Upper Aquifer and Lower Aquifer monitoring well near the bay, as recommended in the Basin Plan (ISJ Group, 2015).
- Retain a licensed surveyor to review all available documentation on reference point elevations and to perform wellhead surveys as needed (Section 3.2.1, 7.1, 7.2, and 7.5.3).
- Develop a rating curve for stream flow Sensor 751 on Los Osos Creek (Section 6).
- Complete an outreach program for domestic well owner participation. Water level and water quality data from these wells would improve water level contours and water quality trend evaluations (Sections 2.2, 2.2.2, and 7.2).
- Perform a sensitivity analysis to evaluate the potential range of error associated with groundwater storage estimates and change in groundwater storage estimates to support future data interpretation (Section 7.4).
- The County LOWRF Baseline Monitoring Program, which test primarily for nitrogen compounds, does not include testing for all the general mineral constituents listed in the LOBP Groundwater Monitoring Program. Performing the additional general mineral analyses on water samples collected during the fall (October-November) monitoring event is recommended (Section 4.2).

10. ADAPTIVE MANAGEMENT PROGRAM

(Placeholder for BMC use)

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APPENDIX A

Los Osos Basin Plan
Groundwater Monitoring Program Well Information

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Los Osos Basin Plan
Montitoring Well Network
First Water/Perched Aquifer Group

Program ID	State Well Number	Name/Location	Basin Area	Coordinates			Well Type	Current Well Owner	Well Data			Aquifer				
				Latitude	Longitude	RP Elevation* (feet amsl)			Screened Interval (feet bgs)	Well Depth (feet bgs)	Casing Diameter (inches)	Creek Valley Alluvium	Zone A/B	Zone C	Zone D	Zone E
FW1	30S/10E-13A7							PRIVATE								
FW2	30S/10E-13L8	Howard/ Del Norte	Western	35.3149	120.8552	32.63	MW	LOCSD	26-36	37	2			x		
FW3	30S/10E-13G	South Court	Western	35.3162	120.8498	50.95	MW	LOCSD	47-52	54	2			x		
FW4	30S/10E-13H	Broderson/Skyline	Western	35.3158	120.8432	49.33	MW	LOCSD	154-164	164	2			x		
FW5	30S/10E-13Q2	Woodland Dr.	Western	35.3119	120.8495	101.27	MW	LOCSD	97-100	105	2			x		
FW6	30S/10E-24A	Highland/Alexander	Western	35.3083	120.8453	193.04	MW	LOCSD	154-164	164	2			x		
FW7	30S/10E-24Ab	Broderson leachfield	Western	35.3065	120.8460	255.00	MW	LOCSD	200-240	240	5			x		
FW8	30S/11E-7L4	Santa Ysabel/5th	Central	35.3302	120.8377	45.76	MW	LOCSD	40-50	50	2			x		
FW9	30S/11E-7K3	12th/ Santa Ysabel	Central	35.3299	120.8300	90.71	MW	LOCSD	55-65	70	2			x		
FW10	30S/11E-7Q1	LOCSD 8th Street - shallow	Central	35.3260	120.8342	25.29	MW	LOCSD	29-43, 54-75	75	8			x		
FW11	30S/11E-7R2	El Moro/12th St.	Central	35.3263	120.8298	61.93	MW	LOCSD	25-35	35	2			x		
FW12	30S/11E-18C2	Pismo Ave./ 5th St.	Central	35.3227	210.8376	34.55	MW	LOCSD	25-35	35	2			x		
FW13	30S/11E-18B2	Ramona/10th	Central	35.3208	120.8320	79.89	MW	LOCSD	25-35	35	2		x			
FW14	30S/11E-18E1							PRIVATE								
FW15	30S/11E-18N2	Manzanita/Ravenna	Central	35.3109	120.8401	125.53	MW	LOCSD	85-95	95	2		x			
FW16	30S/11E-18L11	Palisades Ave.	Western	35.3138	120.8374	88.02	MW	LOCSD	43-53	53	2		x			
FW17	30S/11E-18L12	Ferrell Ave.	Central	35.3138	120.8346	103.85	MW	LOCSD	25-35	35	2		x			
FW18	30S/11E-18P	Sunnyside #1	Western	35.3095	120.8352	150.00	MW	SLCUSD	15-35	35	2		x			
FW19	30S/11E-18J7	Los Olivos/Fairchild	Central	35.3130	120.8271	125.74	MW	LOCSD	25-35	35	2		x			
FW20	30S/11E-8Mb	Santa Maria/18th Street	Central	35.3287	120.8233	95.00	MW	LOCSD	37-47	47	2		x			
FW21	30S/11E-8N4	South Bay Blvd. OBS	Central	35.3253	120.8213	95.99	MW	LOCSD	40-50	50	2		x			
FW22	30S/11E-17F4							PRIVATE								
FW23	30S/11E-17N4							PRIVATE								
FW24	30S/11E-17J2	USGS Eto North - shallow	Eastern	35.3142	120.8119	71.67	MW	PRIVATE	50-70	70	2			x		
FW25	30S/11E-17R1							PRIVATE								
FW26	30S/11E-20A2							PRIVATE								
FW27	30S/11E-20L1							PRIVATE								
FW28	30S/11E-20M2							PRIVATE								

*Datum	Varies	MW = Monitoring Well

State Well Numbers for Reconstructed Wells

	NEW (2002)	OLD (1982)
FW2	30S/10E-13L8	30S/10E-13L5
FW5	30S/10E-13Q2	30S/10E-13Q1
FW8	30S/11E-7L4	30S/11E-7L3
FW9	30S/11E-7K3	30S/11E-7K2
FW11	30S/11E-7R2	30S/11E-7R1
FW12	30S/11E-18C2	30S/11E-18C1
FW13	30S/11E-18B2	30S/11E-18B1
FW15	30S/11E-18N2	30S/11E-18N1
FW16	30S/11E-18L11	30S/11E-18L3
FW17	30S/11E-18L12	30S/11E-18L4
FW19	30S/11E-18J7	30S/11E-18J6
FW21	30S/11E-8N4	30S/11E-8N2

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Los Osos Basin Plan
Montitoring Well Network
Upper Aquifer Group

Program ID	State Well Number	Name/Location	Basin Area	Coordinates			Well Type	Current Well Owner	Well Data			Aquifer				
				Latitude	Longitude	RP Elevation* (feet amsl)			Screened Interval (feet bgs)	Well Depth (feet bgs)	Casing Diameter (inches)	Creek Valley Alluvium	Zone A/B	Zone C	Zone D	Zone E
UA1	30S/10E-11A1	Sandspit #1 West	Dunes and bay	35.3358	120.8638	16.39	MW	SLO CO.	150-160	160	2			x		
UA2	30S/10E-14B1	Sandspit #3 Shallow	Dunes and bay	35.3219	120.8682	16.83	MW	SLO CO.	190-200	200	1.5			x		
UA3	30S/10E-13F1	GSWC Skyline #1	Western	35.3165	120.8533	19.00	M	GSWC	90-195	206	14			x		
UA4	30S/10E-13L1	S&T Mutual #1	Western	35.3148	120.8531	39.00	M	S&T	100-141	141	8			x		
UA5	30S/11E-7N1	LOCSD 3rd St. Well	Central	35.3256	120.8401	9.13	M	LOCSD	56-84	80	8			x		
UA6	30S/11E-18L8	USGS Palisades OBS East 2"	Western	35.3149	120.8381	75.80	MW	SLO CO.	100-140	140	2			x		
UA7	30S/11E-18L7	USGS Palisades OBS West 2"	Western	35.3149	120.8381	75.40	MW	SLO CO.	180-220	220	2			x		
UA8	30S/11E-18K7	LOCSD 10th St. Observation West	Central	35.3130	120.8326	135.65	MW	LOCSD	200-220	220	2			x		
UA9	30S/11E-18K3	GSWC Los Olivos #3	Central	35.3133	120.8300	121.18	M	GSWC	148-202, 222-232	232	8			x		
UA10	30S/11E-18H1	LOCSD - 12th St.	Central	35.3161	120.8297	107.10	M	LOCSD	112-125, 145-159, 172-186, 216-231	232	10			x		
UA11	30S/11E-17D							PRIVATE								
UA12	30S/11E-17E9	So. Bay Blvd OBS shallow	Central	35.3158	120.8240	105.85	MW	LOCSD	184-194	204	2			x		
UA13	30S/11E-17E10	LOCSD South Bay upper	Central	35.3159	120.8239	106.00	M	LOCSD	170-210	220	8			x		
UA14	30S/11E-17P4							PRIVATE								
UA15	30S/11E-20B7							PRIVATE								

*Datum Varies	M = Municipal
	MW = Monitoring Well

FINAL DRAFT 062815

Los Osos Basin Plan
Montitoring Well Network
Lower Aquifer Group

Program ID	State Well Number	Name/Location	Basin Area	Coordinates			Well Type	Well Owner	Well Data			Aquifer				
				Latitude	Longitude	RP Elevation* (feet amsl)			Screened Interval (feet bgs)	Well Depth (feet bgs)	Casing Diameter (inches)	Creek Valley Alluvium	Zone A/B	Zone C	Zone D	Zone E
LA1	30S/10E-2A1	Sandspit #2 North	Dunes and Bay	35.3530	120.8617	15.83	MW	SLO CO.	220-230	230	2					x
LA2	30S/10E-11A2	Sandspit #1 East	Dunes and Bay	35.3358	120.8638	16.39	MW	SLO CO.	234-244	244	2				x	
LA3	30S/10E-14B2	Sandspit #3 Deep	Dunes and	35.3219	120.8682	16.83	MW	SLO CO.	270-280	280	2				x	
LA4	30S/10E-13M1	USGS Howard West	Western	35.3149	120.8597	41.20	MW	PRIVATE	477-537	820	6					x
LA5	30S/10E-13L7	S&T Mutual #4	Western	35.3146	120.8531	37.00	M	S&T	160-300	300	8					
LA6	30S/10E-13L4	GSWC Pecho #1	Western	35.3129	120.8522	68.00	M	GSWC	240-380	675	14				x	
LA7	30S/10E-13P2							PRIVATE								
LA8	30S/10E-13N	S&T Mutual #5	Western	35.3088	120.8565	138.50	M	S&T	260-340	350	8				x	
LA9	30S/10E-24C1	GSWC Cabrillo #1	Western	35.3077	120.8552	178.32	M	GSWC	250-500	508	10				x	
LA10	30S/10E-13J1	GSWC Rosina #1	Western	35.3145	120.8468	95.31	M	GSWC	290-406	409	10				x	x
LA11	30S/10E-12J1	Morro Bay Observation #5	Central	35.3299	120.8440	8.43	MW	SLO CO.	349-389	389	2					x
LA12	30S/11E-7Q3	LOCSD 8th St. Lower	Central	35.3259	120.8342	24.30	M	LOCSD	230-270	270	10				x	
LA13	30S/11E-18F2	LOCSD Ferrell #2	Central	35.3159	120.8358	100.00	M	LOCSD	425-620	625	12				x	x
LA14	30S/11E-18L6	USGS Palisades OBS 6"	Western	35.3149	120.8381	75.84	MW	SLO CO.	355-375, 430-480, 550-600	620	6				x	x
LA15	30S/11E-18L2	LOCSD Palisades	Western	35.3136	120.8377	85.00	M	LOCSD	340-380	394	12				x	
LA16	30S/11E-18M1	Former CCW #5 - Broderson OBS	Western	35.3128	120.8430	107.00	MW	PRIVATE	330-355, 395-415, 465-505, 530-575	577	10				x	x
LA17	30S/11E-24A2	USGS Broderson	Western	35.3074	120.8433	210.40	MW	SLO CO.	800-860	860	6				x	x
LA18	30S/11E-18K8	10th St. Observation East	Central	35.3130	120.8325	135.74	MW	LOCSD	630-650	650	2					x
LA19	30S/11E-19H2	USGS Bayview Heights 6"	Central	35.3043	120.8266	256.20	MW	SLO CO.	280-380	740	6				x	
LA20	30S/11E-17N10	GSWC South Bay #1	Central	35.3111	120.8240	140.00	M	GSWC	225-295, 325-395, 485-695	715	12			x	x	x
LA21	30S/11E-17E7	So. Bay Blvd OBS deep #3	Central	35.3158	120.8240	105.85	MW	LOCSD	480-490, 500-510	520	2					x
LA22	30S/11E-17E8	So. Bay Blvd OBS middle #2	Central	35.3158	120.8240	105.85	MW	LOCSD	270-280, 370-380	390	2				x	
LA23	30S/11E-17C1							PRIVATE								
LA24	30S/11E-17J1	USGS Eto North - deep	Eastern	35.3142	120.8119	71.62	I	PRIVATE	160-190, 245-260	260	6				x	x
LA25	30S/11E-20Aa							PRIVATE								
LA26	30S/11E-20G2	USGS Eto South	Eastern	35.3037	120.8131	99.66	I	PRIVATE	300-360	370	6					x
LA27	30S/11E-16Ma							PRIVATE								
LA28	30S/11E-16Mb							PRIVATE								
LA29	30S/11E-21E3							PRIVATE								
LA30	30S/11E-20H1							PRIVATE								

*Datum Varies	M = Municipal
	MW = Monitoring Well

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Los Osos Groundwater Basin
Monitoring Tasks
First Water/Perched Aquifer Group

Program Well ID	CASGEM Program Reporting	Basin Plan Monitoring	County Water Level Program	LOWRF Baseline Groundwater Monitoring Program	**Planned 2016 Monitoring for BMC***
FW1	no	L			**L**
FW2	yes	L, G		L, G	
FW3	yes	L		L	
FW4	yes	L		L	
FW5	yes	L		L	
FW6	yes	TL, G, CEC		G	**TL, CEC**
FW7	yes	L			**L**
FW8	yes	L		L	
FW9	yes	L		L	
FW10	yes	TL, G		G	**TL**
FW11	yes	L		L	
FW12	yes	L		L	
FW13	yes	L		L	
FW14	no	L		L	
FW15	yes	L, G		L,G	
FW16	yes	L		L	
FW17	yes	L, G		L,G	
FW18	no	L			**L**
FW19	yes	L		L	
FW20	yes	L, G		L, G	
FW21	yes	L		L	
FW22	no	L, G		L, G	
FW23	no	L		L	
FW24	no	L	L		
FW25	no	L	L		
FW26	no	L, G, CEC			**L, G, CEC**
FW27	no	TL			**TL**
FW28	no	L, G	L		**G**

L = WATER LEVEL
G = GENERAL MINERAL
CEC = CONSTITUENTS OF EMERGING CONCERN
TL = TRANSDUCER WATER LEVEL
***Private well monitoring pending access**

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Los Osos Groundwater Basin
Monitoring Tasks
Upper Aquifer Group

Program Well ID	CASGEM Program Reporting	Basin Plan Monitoring Code	County Water Level Program	LOWRF Baseline Groundwater Monitoring Program	**Planned 2016 Monitoring for BMC***
UA1	yes	L	L		
UA2	yes	L	L		
UA3	no	L, G			**L, G**
UA4	no	TL			**TL**
UA5	no	L		L	
UA6	yes	L	L		
UA7	yes	L	L		
UA8	no	L			**L**
UA9	no	L, G			**L, G**
UA10	no	TL			**TL**
UA11	no	L		L	
UA12	no	L		L	
UA13	no	L, G			**L, G**
UA14	no	L			**L**
UA15	no	L			**L**

L = WATER LEVEL
G = GENERAL MINERAL
TL = TRANSDUCER WATER LEVEL
***Private well monitoring pending access**

FINAL DRAFT 062815

Los Osos Groundwater Basin
Monitoring Tasks
Lower Aquifer Group

Program Well ID	CASGEM Program Reporting	Basin Plan Monitoring Code	County Water Level Program	LOWRF Baseline Groundwater Monitoring Program	**Planned 2016 Monitoring for BMC[3]**
LA1	yes	L	L		
LA2	yes	L	L		
LA3	yes	L	L		
LA4	no	L, GL			**L, GL**
LA5	no	L	L		
LA6	no	L , G[1]	L		
LA7	no	TL			**TL**
LA8	no	L, G			**L , G**
LA9	no	L			**L, G[2]**
LA10	no	L, G			**L , G**
LA11	no	L, G			**L , G**
LA12	no	L, G			**L , G**
LA13	no	TL			**TL**
LA14	no	L	L		
LA15	no	L, G			**L , G**
LA16	no	L	L		
LA17	yes	L	L		
LA18	yes	L, G			**L , G**
LA19	no	L	L		
LA20	no	L, G			**L , G**
LA21	no	L	L		
LA22	no	L	L		**G[2]**
LA23	no	L, G			**L, G**
LA24	no	L	L		
LA25	no	L			**L**
LA26	no	L	L		
LA27	no	TL			**TL**
LA28	no	L, G			**L, G**
LA29	no	L	L		
LA30	no	L, G			**L, G**
LA31	no	NA			**G**
LA32	no	NA			**G**

L = WATER LEVEL
G = GENERAL MINERAL
GL = GEOPHYSICAL LOG
TL = TRANSDUCER WATER LEVEL

NOTES:
1 - Remove G from LA6 - out of service.
2 - Add G to LA9 and LA22
***Private well monitoring pending access**
Well IDs with both April and October water quality monitoring in Italics

APPENDIX B

Field Methods

Groundwater Level Measurement Procedures for the
Los Osos Basin Plan Groundwater Monitoring Program

Introduction

This document establishes procedures for measuring and recording groundwater levels for the Los Osos Basin Plan (LOBP) Groundwater Monitoring Program, and describes various methods used for collecting meaningful groundwater data.

Static groundwater levels obtained for the LOBP Groundwater Monitoring Program are determined by measuring the distance to water in a non-pumping well from a reference point that has been referenced to sea level. Subtracting the distance to water from the elevation of the reference point determines groundwater surface elevations above or below sea level. This is represented by the following equation:

$$E_{GW} = E_{RP} – D$$

Where:

E_{GW} = Elevation of groundwater above mean sea level (feet)
E_{RP} = Elevation above sea level at reference point (feet)
D = Depth to water (feet)

References

Procedures for obtaining and reporting water level data for the LOBP Groundwater Monitoring Program are based on a review of the following documents.

- State of California, Department of Water Resources, 2010, *Groundwater Elevation Monitoring Guidelines*, prepared for use in the California Statewide Groundwater Elevation Monitoring (CASGEM) program, December. http://www.water.ca.gov/groundwater/casgem/pdfs/CASGEM%20DWR%20GW%20 Guidelines%20Final%20121510.pdf
- State of California, Department of Water Resources, 2014, *Addendum to December 2010 Groundwater Elevation Monitoring Guidelines for the Department of Water Resources' California Statewide Groundwater Elevation Monitoring (CASGEM) Program,* October 2. www.water.ca.gov/groundwater/casgem/pdfs/PSW_addendum.pdf
- U.S. Geological Survey, 1977, *National Handbook of Recommended Methods for Water-Data Acquisition*, a Unites States contribution to the International Hydrological Program. https://pubs.usgs.gov/chapter11/

- U.S. Geological Survey, Office of Ground Water, 1997, *Ground Water Procedure Document 1, Water-level measurement using graduated steel tape, draft stand-alone procedure document.* http://pubs.usgs.gov/tm/1a1/pdf/GWPD1.pdf
- U.S. Geological Survey, Office of Ground Water, 1997, *Ground Water Procedure Document 4, Water-level measurement using an electric tape, draft stand-alone procedure document.* http://pubs.usgs.gov/tm/1a1/pdf/GWPD4.pdf
- U.S. Geological Survey, Office of Ground Water, 1997, *Ground Water Procedure Document 13, Water-level measurement using an air line, draft stand-alone procedure document.* http://pubs.usgs.gov/tm/1a1/pdf/GWPD13.pdf
- U.S. Geological Survey, 2001, *Introduction to Field Methods for Hydrologic and Environmental Studies*, Open-File Report 2001-50, 241 p. https://pubs.er.usgs.gov/publication/ofr0150

Well Information

Table 1 below lists important well information to be maintained in a well file or in a field notebook. Additional information that should be available to the person collecting water level data include a description of access to the property and the well, the presence and depth of cascading water, or downhole obstructions that could interfere with a sounding cable.

Table 1
Well File Information

Well Completion Report	Hydrologic Information	Additional Information to be Recorded
Well name	Map showing basin boundaries and wells	Township, Range, and ¼ ¼ Section
Well Owner	Name of groundwater basin	Latitude and Longitude (Decimal degrees)
Drilling Company	Description of aquifer	Assessor's Parcel Number
Location map or sketch	Confined, unconfined, or mixed aquifers	Description of well head and sounding access
Total depth	Pumping test data	Reference point elevations
Perforation interval	Hydrographs	Well use and pumping schedule if known
Casing diameter	Water quality data	Date monitoring began
Date of well completion	Property access instructions/codes	Land use

Reference Points and Reference Marks

Reference point (RP) elevations are the basis for determining groundwater elevations relative to sea level. The RP is generally that point on the well head that is the most convenient place to measure the water level in a well. In selecting an RP, an additional consideration is the ease of surveying either by Global Positioning System (GPS) or by leveling.

The RP must be clearly defined, well marked, and easily located. A description, sketch, and photograph of the point should be included in the well file. Additional Reference Marks (RMs) may be established near the wellhead on a permanent object. These additional RMs can serve as a benchmark by which the wellhead RP can be checked or re-surveyed if necessary. All RMs should be marked, sketched, photographed, and described in the well file.

All RPs for Groundwater Monitoring Program wells should be reported based on the same horizontal and vertical datum by a California licensed surveyor to the nearest tenth of one foot vertically, and the nearest one foot horizontally. The surveyor's report should be maintained in the project file.

In addition to the RP survey, the elevation of the ground surface adjacent to the well should also be measured and recorded in the well file. Because the ground surface adjacent to a well is rarely uniform, the average surface level should be estimated. This average ground surface elevation is referred to in the U.S.G.S. Procedural Document (GWPD-1, 1997) and DWR guidelines as the Land Surface Datum (LSD).

Water Level Data Collection

Prior to beginning the field work, the field technician should review each well file to determine which well owners require notification of the upcoming site visit, or which well pumps need to be turned off to allow for sufficient water level recovery. Because groundwater elevations are used to construct groundwater contour maps and to determine hydraulic gradients, the field technician should coordinate water level measurements to be collected within as short a period of time as practical. Any significant changes in groundwater conditions during monitoring events should be noted in the Annual Monitoring Report. For an individual well, the same measuring method and the same equipment should be used during each sampling event where practical.

A static water level should represent stable, non-pumping conditions at the well. When there is doubt about whether water levels in a well are continuing to recover following a pumping cycle, repeated measurements should be made. If an electric sounder is being used, it is possible to hold the sounder level at one point slightly above the known water level and wait for a signal that would indicate rising water. If applicable, the general schedule of pump operation should be determined and noted for active wells. If the well is capped but not vented, remove the cap and wait several minutes before measurement to allow water levels to equilibrate to atmospheric pressure.

When lowering a graduated steel tape (chalked tape) or electric tape in a well without a sounding tube in an equipped well, the tape should be played out slowly by hand to minimize the chance of the tape end becoming caught in a downhole obstruction. The tape should be held in such a way that any change in tension will be felt. When withdrawing a sounding tape, it should also be brought up slowly so that if an obstruction is encountered, tension can be relaxed so that the tape can be lowered again before attempting to withdraw it around the obstruction.

Despite all precautions, there is a small risk of measuring tapes becoming stuck in equipped wells without dedicated sounding tubes. If a tape becomes stuck, the equipment should be left on-site and re-checked after the well has gone through a few cycles of pumping, which can free the tape due to movement/vibration of the pump column. If the tape remains stuck, a pumping contractor will be needed to retrieve the equipment. A dedicated sounding tube may be installed by the pumping contractor at that time.

All water level measurements should be made to an accuracy of 0.01 feet. The field technician should make at least two measurements. If measurements of static levels do not agree to within 0.02 feet of each other, the technician should continue measurements until the reason for the disparity is determined, or the measurements are within 0.02 feet.

Record Keeping in the Field

The information recorded in the field is typically the only available reference for the conditions at the time of the monitoring event. During each monitoring event it is important to record any conditions at a well site and its vicinity that may affect groundwater levels, or the field technician's ability to obtain groundwater levels. Table 2 lists important information to record, however, additional information should be included when appropriate.

Table 2
Information Recorded at Each Well Site

Well name	Changes in land use	Presence of pump lubricating oil in well
Name and organization of field technician	Changes in RP	Cascading water
Date & time	Nearby wells in use	Equipment problems
Measurement method used	Weather conditions	Physical changes in wellhead
Sounder used	Recent pumping info	Comments
Reference Point Description	Measurement correction(s)	Well status

Measurement Techniques

Four standard methods of obtaining water levels are discussed below. The chosen method depends on site and downhole conditions, and the equipment limitations. In all monitoring situations, the procedures and equipment used should be documented in the field notes and in final reporting. Additional detail on methods of water level measurement is included in the reference documents.

<u>Graduated Steel Tape</u>
This method uses a graduated steel tape with a brass or stainless steel weight attached to its end. The tape is graduated in feet. The approximate depth to water should be known prior to measurement.

- Estimate the anticipated static water level in the well from field conditions and historical information;
- Chalk the lower few feet of the tape by applying blue carpenter's chalk.
- Lower the tape to just below the estimated depth to water so that a few feet of the chalked portion of the tape is submerged. Be careful not to lower the tape beyond its chalked length.
- Hold the tape at the RP and record the tape position (this is the "hold" position and should be at an even foot);
- Withdraw the tape rapidly to the surface;
- Record the length of the wetted chalk mark on the graduated tape;
- Subtract the wetted chalk number from the "hold" position number and record this number in the "Depth to Water below RP" column;
- Perform a check by repeating the measurement using a different RP hold value;
- All data should be recorded to the nearest 0.01 foot;
- Disinfect the tape by wiping down the submerged portion of the tape with single-use, unscented disinfectant wipe, or let stand for one minute in a dilute chlorine bleach solution and dry with clean cloth.

The graduated steel tape is generally considered to be the most accurate method for measuring static water levels. Measuring water levels in wells with cascading water or with condensing water on the well casing causes potential errors, or can be impossible with a steel tape.

Electric Tape

An electric tape operates on the principle that an electric circuit is completed when two electrodes are submerged in water. Most electric tapes are mounted on a hand-cranked reel equipped with batteries and an ammeter, buzzer or light to indicate when the circuit is completed. Tapes are graduated in either one-foot intervals or in hundredths of feet depending on the manufacturer. Like graduated steel tapes, electric tapes are affixed with brass or stainless steel weights.

- Check the circuitry of the tape before lowering the probe into the well by dipping the probe into water and observe if the ammeter needle or buzzer/light signals that the circuit is completed;
- Lower the probe slowly and carefully into the well until the signal indicates that the water surface has been reached;
- Place a finger or thumb on the tape at the RP when the water surface is reached;
- If the tape is graduated in one-foot intervals, partially withdraw the tape and measure the distance from the RP mark to the nearest one-foot mark to obtain the depth to water below the RP. If the tape is graduated in hundredths of a foot, simply record the depth at the RP mark as the depth to water below the RP;
- Make all readings using the same needle deflection point on the ammeter scale (if equipped) so that water levels will be consistent between measurements;
- Make check measurements until agreement shows the results to be reliable;

- All data should be recorded to the nearest 0.01 foot;
- Disinfect the tape by wiping down the submerged portion of the tape with single-use, unscented disinfectant wipe, or let stand for one minute in a dilute chlorine bleach solution and dry with clean cloth;
- Periodically check the tape for breaks in the insulation. Breaks can allow water to enter into the insulation creating electrical shorts that could result in false depth readings.

The electric tape may give slightly less accurate results than the graduated steel tape. Errors can result from signal "noise" in cascading water, breaks in the tape insulation, tape stretch, or missing tape at the location of a splice. All electric tapes should be calibrated semi-annually against a steel tape that is maintained in the office and used only for calibration.

Air Line

The air line method is usually used only in wells equipped with pumps. This method typically uses a 1/8 or 1/4-inch diameter, seamless copper tubing, brass tubing, stainless steel tubing, or galvanized pipe with a suitable pipe tee for connecting an altitude or pressure gage. Plastic (i.e. polyethylene) tubing may also be used, but is considered less desirable because it can develop leaks as it degrades. An air line must extend far enough below the water level that the lower end remains submerged during pumping of the well. The air line is connected to an altitude gage that reads directly in feet of water, or to a pressure gage that reads pressure in pounds per square inch (psi). The gage reading indicates the length of the submerged air line.

The formula for determining the depth to water below the RP is: $\mathbf{d = k - h}$ where d = depth to water; k = constant; and h = height of the water displaced from the air line. In wells where a pressure gage is used, h is equal to 2.31 ft/psi multiplied by the gage reading. The constant value for k is approximately equivalent to the length of the air line.

- Calibrate the air line by measuring an initial depth to water (d) below the RP with a graduated steel tape. Use a tire pump, air tank, or air compressor to pump compressed air into the air line until all the water is expelled from the line. When all the water is displaced from the line, record the stabilized gage reading (h). Add d to h to determine the constant value for k.
- To measure subsequent depths to water with the air line, expel all the water from the air line, subtract the gage reading (h) from the constant k, and record the result as depth to water (d) below the RP.

The air line method is not as accurate as a graduated steel tape or electric and is typically accurate to the nearest one foot at best. Errors can occur from leaky air lines, or when tubing becomes clogged with mineral deposits or bacterial growth. The air line method is not desirable for use in the Groundwater Monitoring Program.

Pressure Transducer

Electrical pressure transducers make it possible to collect frequent and long-term water level or pressure data from wells. These pressure-sensing devices, installed at a fixed depth in a well, sense the change in pressure against a membrane. The pressure changes occur in response to changes in the height of the water column in the well above the transducer membrane. To compensate for atmospheric changes, transducers may have vented cables or they can be used in conjunction with a barometric transducer that is installed in the same well or a nearby observation well above the water level.

Transducers are selected on the basis of expected water level fluctuation. The smallest range in water levels provides the greatest measurement resolution. Accuracy is generally 0.01 to 0.1 percent of the full scale range.

Retrieving data in the field is typically accomplished by downloading data through a USB connection to a portable computer or data logger. A site visit to retrieve data should involve several steps designed to safeguard the stored data and the continued useful operation of the transducer:

- Inspect the wellhead and check that the transducer cable has not moved or slipped (the cable can be marked with a reference point that can be used to identify movement);
- Ensure that the instrument is operating properly;
- Measure and record the depth to water with a graduated steel or electric tape;
- Document the site visit, including all measurements and any problems;
- Retrieve the data and document the process;
- Review the retrieved data by viewing the file or plotting the original data;
- Recheck the operation of the transducer prior to disconnecting from the computer.

A field notebook with a checklist of steps and measurements should be used to record all field observations and the current data from the transducer. It provides a historical record of field activities. In the office, maintain a binder with field information similar to that recorded in the field notebook so that a general historical record is available and can be referred to before and after a field trip.

Quality Control

The field technician should compare water level measurements collected at each well with the available historical information to identify and resolve anomalous and potentially erroneous measurements prior to moving to the next well location. Pertinent information, such as insufficient recovery of a pumping well, proximity to a pumping well, falling water in the casing, and changes in the measurement method, sounding equipment, reference point, or groundwater conditions should be noted. Office review of field notes and measurements should also be performed by a second staff member.

Groundwater Sampling Procedures for the Los Osos Basin Plan Groundwater Monitoring Program

Introduction

This document establishes groundwater sampling procedures for the Los Osos Basin Plan (LOBP) Groundwater Monitoring Program. Groundwater sampling procedures facilitate obtaining a representative groundwater sample from an aquifer for water quality analysis. The water sampling procedures for general mineral and dissolved nitrogen sampling are presented below, along with special procedures for collecting samples for analyzing Constituents of Emerging Concern (CECs).

References

The procedures used for the LOBP Groundwater Monitoring Program have been developed through consideration of the constituents of analysis, well construction and type, and a review of the following references:

- U.S. Environmental Protection Agency, 1999, *Compendium of ERT Groundwater Sampling Procedures*, EPA/540/P-91/007, January 1999. https://www.epa.gov/sites/production/files/2015-06/documents/fieldsamp-ertsops.pdf
- Wilde, F. D., 2004, *Cleaning of Equipment for Water Sampling* (ver 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, Chapter A3, revised April 2004. http://water.usgs.gov/owq/FieldManual/chapter3/Ch3_contents.html
- Wilde, F. D., 2008, *Guidelines for Field-Measured Water Quality Properties* (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, Chapter A6, Section 6, October 2008. http://water.usgs.gov/owq/FieldManual/Chapter6/6.0_contents.html

Well Information

Table 1 below lists important well information to be maintained in a well file or in a field notebook. Additional information that should be available to the person collecting groundwater samples include a description of access to the property and the well, the presence and depth of cascading water, or downhole obstructions that could interfere with sampling equipment.

Table 1
Well File Information

Well Completion Report	Hydrologic Information	Additional Information to be Recorded
Well name	Map showing basin boundaries and wells	Township, Range, and ¼ ¼ Section
Well Owner	Name of groundwater basin	Latitude and Longitude (Decimal degrees)
Drilling Company	Description of aquifer	Assessor's Parcel Number
Location map or sketch	Confined, unconfined, or mixed aquifers	Description of well head and sounding access
Total depth	Pumping test data	Reference point elevations
Perforation interval	Hydrographs	Well use and pumping schedule if known
Casing diameter	Water quality data	Date monitoring began
Date of well completion	Property access instructions/codes	Land use

Groundwater Sampling Procedures

Non-equipped wells

1) Calibrate field monitoring instruments each day prior to sampling;
2) Inspect wellhead condition and note any maintenance required (perform at earliest convenience);
3) Measure depth to static water (record to 0.01 inches) from surveyed reference point;
4) Install temporary purge pump to at least three feet below the water surface (deeper setting may be needed if water level draw down is too great);
5) Begin well purge, record flow rate;
6) Measure discharge water EC (measured to 10 µmhos/cm), pH (measured to 0.01 units), and temperature (measured to 0.1 degrees C) at regular intervals during well purging. Record time and gallons purged. Note discharge water color, odor, and turbidity (visual);
7) A minimum of three casing volumes of water should be removed during purging, or one borehole volume opposite perforated interval, whichever is greater*. In addition, a set of at least three consecutive field monitoring measurements with stable values should be recorded. For EC, stability within 5 percent of the first value in the set is sufficient (typically within 20-50 µmhos/cm). For pH, stability within 0.3 units is sufficient. For temperature, stability within 0.2 degrees C is sufficient;
8) Collect sample directly from discharge tube, note sample color, odor, turbidity (visual). Use only laboratory-provided containers. Wear powder-free nitrile gloves when collecting groundwater samples;
9) Place samples on-ice for transport to the laboratory;
10) Remove temporary pump and rinse with clean water;
11) Close well and secure well box lid;

*note: If well is pumped dry at the minimum pumping rate, the well may be allowed to recover and then sampled by bailer within 24 hours.

Equipped wells

The sampling port for an equipped well must be upstream of any water filtration or chemical feeds. Sample from the discharge line as close to the wellhead as possible. Sampling procedures for equipped wells will vary. For active wells (i.e. wells used daily), the need for purging three casing volumes is unnecessary. Flush supply line from well or holding tank to sampling port, and record one set of EC, pH, and temperature readings prior to sampling. For inactive wells, a field monitoring procedure similar to that described for non-equipped wells above is appropriate. Static water level measurements should also be taken before sampling. Water samples should always be transported on-ice to the laboratory.

Chain-of-Custody

The chain-of-custody and associated sample bottle labels are used to document sample identification, specify the analyses to be performed, and trace possession and handling of a sample from the time of collection through delivery to the analytical laboratory. The sampler should fill out the sample identification labels and affix them to the sample bottles prior to, or upon, sample collection. A chain-of-custody form should be filled out by the sampler and a signature and date/time of sample transfers are required for each relinquishing and receiving party between sample collection and laboratory delivery.

Groundwater Sampling Equipment Decontamination

Field equipment should be cleaned prior to the sampling event and between sampling locations. Sampling pumps and hand bailers should be brushed with a nylon-bristle brush using a solution of 0.1 to 0.2-percent (volume/volume) non-phosphate soap in municipal-source tap water. The equipment should then be triple-rinsed with deionized water. Purge the pump hose of well water between sampling locations by pumping deionized through the hose. Groundwater sampling equipment should be protected from contact with the ground, or other potentially contaminating materials, at all times.

Special procedures for sampling for CEC compounds from unequipped well:

1) A new, teflon-lined polyethylene discharge hose or bailer will be used at each unequipped well sampling location;
2) The sampling pump will be decontaminated prior to each well sampled: Decontamination will consist of brushing pump body, inlet screen, and submerged portion of power cable in a phosphate-free cleaning solution, followed by rinsing, pumping distilled water, and final rinse;

3) Personnel collecting the sample will use powder-free nitrile gloves and observe special precautions for testing as directed by the laboratory (such as no caffeinated drink consumption on day of sampling, standing downwind of sampling port during sample collection, double-bag sample bottles, etc.);
4) Equipment blanks of distilled water pumped through the sampling pump are recommended;
5) A clean water/travel blank of distilled water (from the same source used for pump decontamination) is recommended.

APPENDIX C

Laboratory Analytical Reports for 2015 Lower Aquifer Monitoring

FINAL DRAFT 062815

Spring 2015 Analytical Results

May 11, 2015

Lab ID : CC 1581246-001
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401

Sampled On : April 21, 2015-10:00
Sampled By : Spencer Harris
Received On : April 21, 2015-16:15
Matrix : Ground Water

Description : S & T #5 LA8
Project : SWI Monitoring

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General MineralP:1'5								
Total Hardness as CaCO3	97.5	--	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Calcium	16	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Magnesium	14	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Potassium	2	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Sodium	38	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Cations	3.7	--	meq/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Boron	ND	0.1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Copper	20	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Iron	ND	30	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Manganese	ND	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Zinc	20	20	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
SAR	1.7	--	--		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Alkalinity (as CaCO3)	40	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Hydroxide as OH	ND	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Carbonate as CO3	ND	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Bicarbonate as HCO3	50	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Sulfate	11	2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Chloride	77	1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate as NO3	33.9	0.5	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrite as N	ND	0.2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate + Nitrite as N	7.7	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Fluoride	ND	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Total Anions	3.8	--	meq/L		2320B	04/27/15:204887	2320B	04/27/15:206268
pH	6.9	--	units		4500-H B	04/23/15:204734	4500HB	04/23/15:206085
Specific Conductance	445	1	umhos/cm		2510B	04/23/15:204719	2510B	04/23/15:206051
Total Dissolved Solids	280	20	mg/L		2540CE	04/23/15:204727	2540C	04/24/15:206120
MBAS Screen	Negative	0.1	mg/L		5540C	04/22/15:205092	5540C	04/22/15:206500
Aggressiveness Index	10.1	--	--		4500-H B	04/23/15:204734	4500HB	04/23/15:206085
Langelier Index (20°C)	-1.7	--	--		4500-H B	04/23/15:204734	4500HB	04/23/15:206085
Nitrate Nitrogen	7.7	--	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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TEL: (559)734-9473
FAX: (559)734-8435
CA ELAP Certification No. 2810

May 11, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : GSWC Cabrillo LA9
Project : SWI Monitoring

Lab ID : CC 1581264-002
Customer ID : 8-514

Sampled On : April 22, 2015-09:20
Sampled By : M. Babb
Received On : April 22, 2015-12:22
Matrix : Drinking Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	MCL/AL	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	117	--	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Calcium	19	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Magnesium	17	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Potassium	2	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Sodium	45	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Cations	4.4	--	meq/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Boron	ND	0.1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Copper	ND	10	ug/L	1000[2]	200.7	04/27/15:204860	200.7	04/27/15:206270
Iron	ND	30	ug/L	300[2]	200.7	04/27/15:204860	200.7	04/27/15:206270
Manganese	ND	10	ug/L	50[2]	200.7	04/27/15:204860	200.7	04/27/15:206270
Zinc	30	20	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
SAR	1.8	--	--		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Alkalinity (as CaCO3)	60	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Hydroxide as OH	ND	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Carbonate as CO3	ND	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Bicarbonate as HCO3	70	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Sulfate	16	2	mg/L	500[2]	300.0	04/23/15:204782	300.0	04/24/15:206137
Chloride	95	1	mg/L	500[2]	300.0	04/23/15:204782	300.0	04/24/15:206137
Nitrate as NO3	24.2	0.5	mg/L	45	300.0	04/23/15:204782	300.0	04/24/15:206137
Nitrite as N	ND	0.2	mg/L	1	300.0	04/23/15:204782	300.0	04/24/15:206137
Nitrate + Nitrite as N	5.5	0.1	mg/L	10	300.0	04/23/15:204782	300.0	04/24/15:206137
Fluoride	0.1	0.1	mg/L	2	300.0	04/23/15:204782	300.0	04/24/15:206137
Total Anions	4.6	--	meq/L		2320B	04/27/15:204887	2320B	04/27/15:206268
pH	7.3	--	units		4500-H B		4500HB	04/24/15:206141
Specific Conductance	530	1	umhos/cm	1600[2]	2510B	04/24/15:204762	2510B	04/24/15:206116
Total Dissolved Solids	320	20	mg/L	1000[2]	2540CE	04/27/15:204865	2540C	04/28/15:206275
MBAS Extraction	0.1	0.1	mg/L	0.5[2]	5540C	04/23/15:204758	5540C	04/24/15:206110
Aggressiveness Index	10.8	--	--		4500-H B		4500HB	04/24/15:206141
Langelier Index (20°C)	-1.1	--	--		4500-H B		4500HB	04/24/15:206141
Nitrate Nitrogen	5.5	--	mg/L	10	300.0	04/23/15:204782	300.0	04/24/15:206137

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.
MCL = Maximum Contamination Level. 2 - Secondary Standard. 3 - CDPH Notification Level. AL = Regulatory Action Level.

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May 11, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : GSWC Rosina LA10
Project : SWI Monitoring

Lab ID : CC 1581264-001
Customer ID : 8-514

Sampled On : April 22, 2015-08:10
Sampled By : M. Babb
Received On : April 22, 2015-12:22
Matrix : Drinking Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	MCL/AL	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	431	--	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Calcium	69	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Magnesium	63	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Potassium	2	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Sodium	39	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Cations	10.4	--	meq/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Boron	ND	0.1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Copper	ND	10	ug/L	1000[2]	200.7	04/27/15:204860	200.7	04/27/15:206270
Iron	110	30	ug/L	300[2]	200.7	04/27/15:204860	200.7	04/27/15:206270
Manganese	ND	10	ug/L	50[2]	200.7	04/27/15:204860	200.7	04/27/15:206270
Zinc	30	20	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
SAR	0.8	--	--		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Alkalinity (as CaCO3)	70	10	mg/L		2320B	04/28/15:204904	2320B	04/28/15:206334
Hydroxide as OH	ND	10	mg/L		2320B	04/28/15:204904	2320B	04/28/15:206334
Carbonate as CO3	ND	10	mg/L		2320B	04/28/15:204904	2320B	04/28/15:206334
Bicarbonate as HCO3	80	10	mg/L		2320B	04/28/15:204904	2320B	04/28/15:206334
Sulfate	20	2	mg/L	500[2]	300.0	04/23/15:204782	300.0	04/24/15:206137
Chloride	331	5*	mg/L	500[2]	300.0	04/23/15:204782	300.0	04/24/15:206137
Nitrate as NO3	8.3	0.5	mg/L	45	300.0	04/23/15:204782	300.0	04/24/15:206137
Nitrite as N	ND	0.2	mg/L	1	300.0	04/23/15:204782	300.0	04/24/15:206137
Nitrate + Nitrite as N	1.9	0.1	mg/L	10	300.0	04/23/15:204782	300.0	04/24/15:206137
Fluoride	ND	0.1	mg/L	2	300.0	04/23/15:204782	300.0	04/24/15:206137
Total Anions	11.2	--	meq/L		2320B	04/28/15:204904	2320B	04/28/15:206334
pH	7.1	--	units		4500-H B		4500HB	04/24/15:206141
Specific Conductance	1230	1	umhos/cm	1600[2]	2510B	04/24/15:204762	2510B	04/24/15:206116
Total Dissolved Solids	750	20	mg/L	1000[2]	2540CE	04/27/15:204865	2540C	04/28/15:206275
MBAS Extraction	0.1	0.1	mg/L	0.5[2]	5540C	04/23/15:204758	5540C	04/24/15:206110
Aggressiveness Index	11.2	--	--		4500-H B		4500HB	04/24/15:206141
Langelier Index (20°C)	-0.7	--	--		4500-H B		4500HB	04/24/15:206141
Nitrate Nitrogen	1.9	--	mg/L	10	300.0	04/23/15:204782	300.0	04/24/15:206137

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.
MCL = Maximum Contamination Level. 2 - Secondary Standard. 3 - CDPH Notification Level. AL = Regulatory Action Level.

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ENVIRONMENTAL AGRICULTURAL
Analytical Chemists

May 11, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S-10E-12J1 LA11
Project : SWI Monitoring

Lab ID : CC 1581263-001
Customer ID : 8-514

Sampled On : April 22, 2015-11:10
Sampled By : Bryce Pfeifle
Received On : April 22, 2015-12:22
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General MineralP:1'5								
Total Hardness as CaCO3	475	--	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Calcium	65	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Magnesium	76	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Potassium	5	1	mg/L		200.7	04/27/15:204860	200.7	04/29/15:206464
Sodium	88	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Cations	13.5	--	meq/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Boron	0.3	0.1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Copper	ND	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Iron	350	30	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Manganese	50	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Zinc	ND	20	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
SAR	1.8	--	--		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Alkalinity (as CaCO3)	300	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Hydroxide as OH	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Carbonate as CO3	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Bicarbonate as HCO3	360	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Sulfate	189	2	mg/L		300.0	04/23/15:204882	300.0	04/23/15:206236
Chloride	112	5*	mg/L		300.0	04/23/15:204882	300.0	04/23/15:206236
Nitrate as NO3	ND	0.5	mg/L		300.0	04/23/15:204882	300.0	04/23/15:206236
Nitrite as N	ND	0.2	mg/L		300.0	04/23/15:204882	300.0	04/23/15:206236
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	04/23/15:204882	300.0	04/23/15:206236
Fluoride	0.2	0.1	mg/L		300.0	04/23/15:204882	300.0	04/23/15:206236
Total Anions	13.0	--	meq/L		2320B	04/24/15:204815	2320B	04/24/15:206172
pH	7.8	--	units		4500-H B		4500HB	04/24/15:206141
Specific Conductance	1290	1	umhos/cm		2510B	04/24/15:204762	2510B	04/24/15:206116
Total Dissolved Solids	810	20	mg/L		2540CE	04/27/15:204865	2540C	04/28/15:206275
MBAS Screen	Negative	0.1	mg/L		5540C	04/23/15:204916	5540C	04/23/15:206296
Aggressiveness Index	12.5	--	--		4500-H B		4500HB	04/24/15:206141
Langelier Index (20°C)	0.6	--	--		4500-H B		4500HB	04/24/15:206141
Nitrate Nitrogen	ND	--	mg/L		300.0	04/23/15:204882	300.0	04/23/15:206236

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 11, 2015

Lab ID : CC 1581246-003
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : LOCSD 8th St. LA12
Project : SWI Monitoring

Sampled On : April 21, 2015-15:20
Sampled By : Spencer Harris
Received On : April 21, 2015-16:15
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	305	--	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Calcium	48	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Magnesium	45	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Potassium	2	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Sodium	59	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Cations	8.7	--	meq/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Boron	0.2	0.1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Copper	20	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Iron	670	30	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Manganese	40	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Zinc	170	20	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
SAR	1.5	--	--		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Alkalinity (as CaCO3)	240	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Hydroxide as OH	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Carbonate as CO3	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Bicarbonate as HCO3	290	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Sulfate	55	2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Chloride	101	1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate as NO3	ND	0.4	mg/L		4500NO3F	04/29/15:204972	4500NO3F	04/29/15:206391
Nitrite as N	ND	0.2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate + Nitrite as N	ND	0.1	mg/L		4500NO3F	04/29/15:204972	4500NO3F	04/29/15:206391
Fluoride	ND	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Total Anions	8.7	--	meq/L		2320B	04/24/15:204815	2320B	04/24/15:206172
pH	7.7	--	units		4500-H B		4500HB	04/24/15:206141
Specific Conductance	897	1	umhos/cm		2510B	04/23/15:204719	2510B	04/23/15:206051
Total Dissolved Solids	500	20	mg/L		2540CE	04/23/15:204727	2540C	04/24/15:206120
MBAS Screen	Negative	0.1	mg/L		5540C	04/22/15:205092	5540C	04/22/15:206500
Aggressiveness Index	12.2	--	--		4500-H B		4500HB	04/24/15:206141
Langelier Index (20°C)	0.3	--	--		4500-H B		4500HB	04/24/15:206141
Nitrate Nitrogen	ND	--	mg/L		4500NO3F	04/29/15:204972	4500NO3F	04/29/15:206391

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 11, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : LOCSD Palisades LA15
Project : SWI Monitoring

Lab ID : CC 1581331-001
Customer ID : 8-514

Sampled On : April 29, 2015-09:38
Sampled By : Spencer Harris
Received On : April 29, 2015-10:25
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	77.7	--	mg/L		200.7	05/04/15:205156	200.7	05/04/15:206615
Calcium	13	1	mg/L		200.7	05/04/15:205156	200.7	05/04/15:206615
Magnesium	11	1	mg/L		200.7	05/04/15:205156	200.7	05/04/15:206615
Potassium	ND	1	mg/L		200.7	05/04/15:205156	200.7	05/04/15:206615
Sodium	30	1	mg/L		200.7	05/04/15:205156	200.7	05/04/15:206615
Total Cations	2.9	--	meq/L		200.7	05/04/15:205156	200.7	05/04/15:206615
Boron	ND	0.1	mg/L		200.7	05/04/15:205156	200.7	05/04/15:206615
Copper	30	10	ug/L		200.7	05/04/15:205156	200.7	05/04/15:206615
Iron	1910	30	ug/L		200.7	05/04/15:205156	200.7	05/04/15:206615
Manganese	50	10	ug/L		200.7	05/04/15:205156	200.7	05/04/15:206615
Zinc	70	20	ug/L		200.7	05/04/15:205156	200.7	05/04/15:206615
SAR	1.5	--	--		200.7	05/04/15:205156	200.7	05/04/15:206615
Total Alkalinity (as CaCO3)	60	10	mg/L		2320B	05/01/15:205053	2320B	05/01/15:206569
Hydroxide as OH	ND	10	mg/L		2320B	05/01/15:205053	2320B	05/01/15:206569
Carbonate as CO3	ND	10	mg/L		2320B	05/01/15:205053	2320B	05/01/15:206569
Bicarbonate as HCO3	80	10	mg/L		2320B	05/01/15:205053	2320B	05/01/15:206569
Sulfate	10	2	mg/L		300.0	04/30/15:205076	300.0	04/30/15:206507
Chloride	43	1	mg/L		300.0	04/30/15:205076	300.0	04/30/15:206507
Nitrate as NO3	22.0	0.5	mg/L		300.0	04/30/15:205076	300.0	04/30/15:206507
Nitrite as N	ND	0.2	mg/L		300.0	04/30/15:205076	300.0	04/30/15:206507
Nitrate + Nitrite as N	5.0	0.1	mg/L		300.0	04/30/15:205076	300.0	04/30/15:206507
Fluoride	ND	0.1	mg/L		300.0	04/30/15:205076	300.0	04/30/15:206507
Total Anions	3.1	--	meq/L		2320B	05/01/15:205053	2320B	05/01/15:206569
pH	7.4	--	units		4500-H B	05/04/15:205152	4500HB	05/04/15:206574
Specific Conductance	348	1	umhos/cm		2510B	05/01/15:205056	2510B	05/01/15:206463
Total Dissolved Solids	230	20	mg/L		2540CE	04/30/15:205028	2540C	05/01/15:206466
MBAS Screen	Negative	0.1	mg/L		5540C	04/30/15:205095	5540C	04/30/15:206506
Aggressiveness Index	10.7	--	--		4500-H B	05/04/15:205152	4500HB	05/04/15:206574
Langelier Index (20°C)	-1.1	--	--		4500-H B	05/04/15:205152	4500HB	05/04/15:206574
Nitrate Nitrogen	5.0	--	mg/L		300.0	04/30/15:205076	300.0	04/30/15:206507

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 4, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/11E-18K8 LA18
Project : SWI Monitoring

Lab ID : CC 1581247-002
Customer ID : 8-514

Sampled On : April 21, 2015-15:40
Sampled By : Bryce Pfeifle
Received On : April 21, 2015-16:15
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1]								
Total Hardness as CaCO3	265	--	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Calcium	55	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Magnesium	31	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Potassium	2	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Sodium	27	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Cations	6.5	--	meq/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Boron	ND	0.1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Copper	ND	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Iron	ND	30	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Manganese	90	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Zinc	ND	20	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
SAR	0.7	--	--		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Alkalinity (as CaCO3)	240	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Hydroxide as OH	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Carbonate as CO3	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Bicarbonate as HCO3	290	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Sulfate	39	2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Chloride	33	1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate as NO3	ND	0.5	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrite as N	ND	0.2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Fluoride	0.2	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Total Anions	6.5	--	meq/L		2320B	04/24/15:204815	2320B	04/24/15:206172
pH	7.7	--	units		4500-H B		4500HB	04/24/15:206141
Specific Conductance	634	1	umhos/cm		2510B	04/23/15:204719	2510B	04/23/15:206051
Total Dissolved Solids	400	20	mg/L		2540CE	04/23/15:204727	2540C	04/24/15:206120
MBAS Screen	Negative	0.1	mg/L		5540C	04/22/15:205092	5540C	04/22/15:206500
Aggressiveness Index	12.2	--	--		4500-H B		4500HB	04/24/15:206141
Langelier Index (20°C)	0.4	--	--		4500-H B		4500HB	04/24/15:206141
Nitrate Nitrogen	ND	--	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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CA ELAP Certification No. 2810

May 11, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : GSWC So. Bay #1 LA20
Project : SWI Monitoring

Lab ID : CC 1581264-003
Customer ID : 8-514

Sampled On : April 22, 2015-10:20
Sampled By : M. Babb
Received On : April 22, 2015-12:22
Matrix : Drinking Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	MCL/AL	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral P:1'5								
Total Hardness as CaCO3	234	--	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Calcium	36	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Magnesium	35	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Potassium	2	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Sodium	42	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Cations	6.6	--	meq/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Boron	0.1	0.1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Copper	ND	10	ug/L	1000[2]	200.7	04/27/15:204860	200.7	04/27/15:206270
Iron	ND	30	ug/L	300[2]	200.7	04/27/15:204860	200.7	04/27/15:206270
Manganese	ND	10	ug/L	50[2]	200.7	04/27/15:204860	200.7	04/27/15:206270
Zinc	ND	20	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
SAR	1.2	--	--		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Alkalinity (as CaCO3)	240	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Hydroxide as OH	ND	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Carbonate as CO3	ND	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Bicarbonate as HCO3	290	10	mg/L		2320B	04/27/15:204887	2320B	04/27/15:206268
Sulfate	27	2	mg/L	500[2]	300.0	04/23/15:204782	300.0	04/24/15:206137
Chloride	43	1	mg/L	500[2]	300.0	04/23/15:204782	300.0	04/24/15:206137
Nitrate as NO3	2.5	0.5	mg/L	45	300.0	04/23/15:204782	300.0	04/24/15:206137
Nitrite as N	ND	0.2	mg/L	1	300.0	04/23/15:204782	300.0	04/24/15:206137
Nitrate + Nitrite as N	0.6	0.1	mg/L	10	300.0	04/23/15:204782	300.0	04/24/15:206137
Fluoride	0.2	0.1	mg/L	2	300.0	04/23/15:204782	300.0	04/24/15:206137
Total Anions	6.6	--	meq/L		2320B	04/27/15:204887	2320B	04/27/15:206268
pH	7.4	--	units		4500-H B		4500HB	04/24/15:206141
Specific Conductance	653	1	umhos/cm	1600[2]	2510B	04/24/15:204762	2510B	04/24/15:206116
Total Dissolved Solids	360	20	mg/L	1000[2]	2540CE	04/27/15:204865	2540C	04/28/15:206275
MBAS Extraction	ND	0.1	mg/L	0.5[2]	5540C	04/23/15:204758	5540C	04/24/15:206110
Aggressiveness Index	11.7	--	--		4500-H B		4500HB	04/24/15:206141
Langelier Index (20°C)	-0.1	--	--		4500-H B		4500HB	04/24/15:206141
Nitrate Nitrogen	0.6	--	mg/L	10	300.0	04/23/15:204782	300.0	04/24/15:206137

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.
MCL = Maximum Contamination Level. 2 - Secondary Standard. 3 - CDPH Notification Level. AL = Regulatory Action Level.

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May 4, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/11E-17E8 LA22
Project : SWI Monitoring

Lab ID : CC 1581247-001
Customer ID : 8-514

Sampled On : April 21, 2015-11:30
Sampled By : Bryce Pfeifle
Received On : April 21, 2015-16:15
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1]								
Total Hardness as CaCO3	157	--	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Calcium	25	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Magnesium	23	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Potassium	1	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Sodium	28	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Cations	4.4	--	meq/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Boron	ND	0.1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Copper	ND	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Iron	ND	30	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Manganese	ND	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Zinc	ND	20	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
SAR	1.0	--	--		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Alkalinity (as CaCO3)	120	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Hydroxide as OH	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Carbonate as CO3	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Bicarbonate as HCO3	150	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Sulfate	13	2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Chloride	49	1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate as NO3	31.4	0.5	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrite as N	ND	0.2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate + Nitrite as N	7.1	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Fluoride	ND	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Total Anions	4.6	--	meq/L		2320B	04/24/15:204815	2320B	04/24/15:206172
pH	7.6	--	units		4500-H B		4500HB	04/24/15:206141
Specific Conductance	481	1	umhos/cm		2510B	04/23/15:204719	2510B	04/23/15:206051
Total Dissolved Solids	270	20	mg/L		2540CE	04/23/15:204727	2540C	04/24/15:206120
MBAS Screen	Negative	0.1	mg/L		5540C	04/22/15:205092	5540C	04/22/15:206500
Aggressiveness Index	11.5	--	--		4500-H B		4500HB	04/24/15:206141
Langelier Index (20°C)	-0.4	--	--		4500-H B		4500HB	04/24/15:206141
Nitrate Nitrogen	7.1	--	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 11, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S / 10E-13M2 LA31
Project : SWI Monitoring

Lab ID : CC 1581246-002
Customer ID : 8-514

Sampled On : April 21, 2015-10:55
Sampled By : Spencer Harris
Received On : April 21, 2015-16:15
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral P:1'5								
Total Hardness as CaCO3	739	--	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Calcium	113	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Magnesium	111	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Potassium	5	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Sodium	378	2*	mg/L		200.7	04/27/15:204860	200.7	04/29/15:206464
Total Cations	31.3	--	meq/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Boron	0.2	0.1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Copper	ND	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Iron	ND	30	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Manganese	ND	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Zinc	ND	20	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
SAR	6.0	--	--		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Alkalinity (as CaCO3)	50	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Hydroxide as OH	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Carbonate as CO3	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Bicarbonate as HCO3	60	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Sulfate	180	2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Chloride	950	10*	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate as NO3	2.4	0.5	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrite as N	ND	0.2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate + Nitrite as N	0.5	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Fluoride	ND	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Total Anions	31.6	--	meq/L		2320B	04/24/15:204815	2320B	04/24/15:206172
pH	7.3	--	units		4500-H B		4500HB	04/24/15:206141
Specific Conductance	3430	1	umhos/cm		2510B	04/23/15:204719	2510B	04/23/15:206051
Total Dissolved Solids	1930	20	mg/L		2540CE	04/23/15:204727	2540C	04/24/15:206120
MBAS Screen	Negative	0.1	mg/L		5540C	04/22/15:205092	5540C	04/22/15:206500
Aggressiveness Index	11.4	--	--		4500-H B		4500HB	04/24/15:206141
Langelier Index (20°C)	-0.5	--	--		4500-H B		4500HB	04/24/15:206141
Nitrate Nitrogen	0.5	--	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 11, 2015

Lab ID : CC 1581246-004
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : LOCSD 10th St. LA32
Project : SWI Monitoring

Sampled On : April 21, 2015-15:30
Sampled By : Spencer Harris
Received On : April 21, 2015-16:15
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral P:1'5								
Total Hardness as CaCO3	108	--	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Calcium	17	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Magnesium	16	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Potassium	1	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Sodium	27	1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Cations	3.4	--	meq/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Boron	ND	0.1	mg/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Copper	20	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Iron	130	30	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Manganese	ND	10	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
Zinc	ND	20	ug/L		200.7	04/27/15:204860	200.7	04/27/15:206270
SAR	1.1	--	--		200.7	04/27/15:204860	200.7	04/27/15:206270
Total Alkalinity (as CaCO3)	160	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Hydroxide as OH	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Carbonate as CO3	ND	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Bicarbonate as HCO3	190	10	mg/L		2320B	04/24/15:204815	2320B	04/24/15:206172
Sulfate	20	2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Chloride	38	1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate as NO3	7.0	0.5	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrite as N	ND	0.2	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Nitrate + Nitrite as N	1.6	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Fluoride	0.1	0.1	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326
Total Anions	4.7	--	meq/L		2320B	04/24/15:204815	2320B	04/24/15:206172
pH	7.6	--	units		4500-H B		4500HB	04/24/15:206141
Specific Conductance	504	1	umhos/cm		2510B	04/23/15:204719	2510B	04/23/15:206051
Total Dissolved Solids	270	20	mg/L		2540CE	04/23/15:204727	2540C	04/24/15:206120
MBAS Screen	Negative	0.1	mg/L		5540C	04/22/15:205092	5540C	04/22/15:206500
Aggressiveness Index	11.4	--	--		4500-H B		4500HB	04/24/15:206141
Langelier Index (20°C)	-0.4	--	--		4500-H B		4500HB	04/24/15:206141
Nitrate Nitrogen	1.6	--	mg/L		300.0	04/22/15:204880	300.0	04/22/15:206326

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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FINAL DRAFT 062815

Fall 2015 Analytical Results

November 12, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/10E-11A2 LA2
Project : SWI Monitoring

Lab ID : CC 1583625-002
Customer ID : 8-514

Sampled On : October 21, 2015-17:54
Sampled By : Spencer Harris
Received On : October 22, 2015-11:29
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	6640	--	mg/L		200.7	10/26/15:212471	200.7	10/26/15:215683
Calcium	1030	2*	mg/L		200.7	10/26/15:212471	200.7	10/26/15:215683
Magnesium	990	10*	mg/L		200.7	10/26/15:212471	200.7	10/26/15:215683
Potassium	31	1	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Sodium	1560	10*	mg/L		200.7	10/26/15:212471	200.7	10/26/15:215683
Total Cations	202	--	meq/L		200.7	10/26/15:212471	200.7	10/26/15:215683
Boron	ND	0.1	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Copper	20	10	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Iron	230	30	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Manganese	330	10	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Zinc	20	20	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
SAR	8.3	--	--		200.7	10/26/15:212471	200.7	10/26/15:215683
Total Alkalinity (as CaCO3)	130	10	mg/L		2320B	10/26/15:212454	2320B	10/26/15:215660
Hydroxide as OH	ND	10	mg/L		2320B	10/26/15:212454	2320B	10/26/15:215660
Carbonate as CO3	ND	10	mg/L		2320B	10/26/15:212454	2320B	10/26/15:215660
Bicarbonate as HCO3	150	10	mg/L		2320B	10/26/15:212454	2320B	10/26/15:215660
Sulfate	740	20*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Chloride	6300	100*	mg/L		300.0	11/03/15:212886	300.0	11/04/15:216003
Nitrate as NO3	ND	5*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Nitrite as N	ND	2*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Nitrate + Nitrite as N	ND	1*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Fluoride	ND	1*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Total Anions	196	--	meq/L		2320B	10/26/15:212454	2320B	10/26/15:215660
pH	7.4	--	units		4500-H B	10/23/15:212425	4500HB	10/23/15:215546
Specific Conductance	17700	1	umhos/cm		2510B	10/26/15:212463	2510B	10/26/15:215609
Total Dissolved Solids	13100	20*	mg/L		2540CE	10/23/15:212401	2540C	10/26/15:215607
MBAS Screen	Negative	0.1	mg/L		5540C	10/23/15:212607	5540C	10/23/15:215780
Aggressiveness Index	12.9	--	--		4500-H B	10/23/15:212425	4500HB	10/23/15:215546
Langelier Index (20°C)	0.9	--	--		4500-H B	10/23/15:212425	4500HB	10/23/15:215546
Nitrate Nitrogen	ND	--	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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November 12, 2015

Lab ID : CC 1583625-001
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/10E-14B2 LA3
Project : SWI Monitoring

Sampled On : October 21, 2015-16:25
Sampled By : Spencer Harris
Received On : October 22, 2015-11:29
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral P:1'5								
Total Hardness as CaCO3	7140	--	mg/L		200.7	10/26/15:212471	200.7	10/26/15:215683
Calcium	2830	10*	mg/L		200.7	10/26/15:212471	200.7	10/26/15:215683
Magnesium	20	1	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Potassium	80	1	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Sodium	4040	10*	mg/L		200.7	10/26/15:212471	200.7	10/26/15:215683
Total Cations	321	--	meq/L		200.7	10/26/15:212471	200.7	10/26/15:215683
Boron	ND	0.1	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Copper	370	10	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Iron	480	30	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Manganese	10	10	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Zinc	350	20	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
SAR	20.8	--	--		200.7	10/26/15:212471	200.7	10/26/15:215683
Total Alkalinity (as CaCO3)	360	10	mg/L		2320B	10/26/15:212454	2320B	10/26/15:215660
Hydroxide as OH	40	10	mg/L		2320B	10/26/15:212454	2320B	10/26/15:215660
Carbonate as CO3	140	10	mg/L		2320B	10/26/15:212454	2320B	10/26/15:215660
Bicarbonate as HCO3	ND	10	mg/L		2320B	10/26/15:212454	2320B	10/26/15:215660
Sulfate	530	50*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Chloride	10000	100*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Nitrate as NO3	ND	12*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Nitrite as N	ND	4*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Nitrate + Nitrite as N	ND	3*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Fluoride	ND	2.5*	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573
Total Anions	300	--	meq/L		2320B	10/26/15:212454	2320B	10/26/15:215660
pH	11.0	--	units		4500-H B	11/02/15:212792	4500HB	11/02/15:216012
Specific Conductance	29500	1	umhos/cm		2510B	10/26/15:212463	2510B	10/26/15:215609
Total Dissolved Solids	24700	20*	mg/L		2540CE	10/23/15:212401	2540C	10/26/15:215607
MBAS Screen	Negative	0.1	mg/L		5540C	10/23/15:212607	5540C	10/23/15:215780
Aggressiveness Index	17.4	--	--		4500-H B	11/02/15:212792	4500HB	11/02/15:216012
Langelier Index (20°C)	5.3	--	--		4500-H B	11/02/15:212792	4500HB	11/02/15:216012
Nitrate Nitrogen	ND	--	mg/L		300.0	10/23/15:212461	300.0	10/23/15:215573

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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October 21, 2015

Lab ID : CC 1583447-001
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : S&T #5 LA8
Project : SWI Monitoring

Sampled On : October 6, 2015-10:30
Sampled By : Spencer Harris Sr.
Received On : October 6, 2015-15:04
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	97.5	--	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Calcium	16	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Magnesium	14	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Potassium	1	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Sodium	38	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Cations	3.6	--	meq/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Boron	ND	0.1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Copper	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Iron	ND	30	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Manganese	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Zinc	ND	20	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
SAR	1.7	--	--		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Alkalinity (as CaCO3)	40	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Hydroxide as OH	ND	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Carbonate as CO3	ND	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Bicarbonate as HCO3	40	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Sulfate	10	2	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Chloride	75	1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrate as NO3	30.0	0.5	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrite as N	ND	0.2	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrate + Nitrite as N	6.8	0.1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Fluoride	ND	0.1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Total Anions	3.5	--	meq/L		2320B	10/08/15:211719	2320B	10/08/15:214738
pH	7.2	--	units		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Specific Conductance	422	1	umhos/cm		2510B	10/08/15:211754	2510B	10/08/15:214696
Total Dissolved Solids	310	20	mg/L		2540CE	10/07/15:211713	2540C	10/08/15:214673
MBAS Screen	Negative	0.1	mg/L		5540C	10/07/15:211834	5540C	10/07/15:214789
Aggressiveness Index	10.4	--	--		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Langelier Index (20°C)	-1.4	--	--		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Nitrate Nitrogen	6.8	--	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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October 12, 2015

Lab ID : CC 1583413-002
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401

Sampled On : October 5, 2015-11:30
Sampled By : BABB
Received On : October 5, 2015-14:40
Matrix : Ground Water

Description : GSWC Cabrillo LA9
Project : SWI Monitoring

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General MineralP:1'5								
Total Hardness as CaCO3	75.2	--	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Calcium	12	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Magnesium	11	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Potassium	1	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Sodium	34	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Cations	3.0	--	meq/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Boron	ND	0.1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Copper	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Iron	100	30	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Manganese	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Zinc	ND	20	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
SAR	1.7	--	--		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Alkalinity (as CaCO3)	40	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Hydroxide as OH	ND	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Carbonate as CO3	ND	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Bicarbonate as HCO3	50	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Sulfate	7	2	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Chloride	50	1	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Nitrate as NO3	33.4	0.5	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Nitrite as N	ND	0.2	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Nitrate + Nitrite as N	7.6	0.1	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Fluoride	ND	0.1	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Total Anions	2.9	--	meq/L		2320B	10/07/15:211656	2320B	10/07/15:214661
pH	7.5	--	units		4500-H B	10/07/15:211692	4500HB	10/07/15:214625
Specific Conductance	349	1	umhos/cm		2510B	10/07/15:211681	2510B	10/07/15:214601
Total Dissolved Solids	270	20	mg/L		2540CE	10/06/15:211644	2540C	10/07/15:214592
MBAS Screen	Negative	0.1	mg/L		5540C	10/07/15:211834	5540C	10/07/15:214789
Aggressiveness Index	10.6	--	--		4500-H B	10/07/15:211692	4500HB	10/07/15:214625
Langelier Index (20°C)	-1.3	--	--		4500-H B	10/07/15:211692	4500HB	10/07/15:214625
Nitrate Nitrogen	7.6	--	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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October 12, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : GSWC Rosina LA10
Project : SWI Monitoring

Lab ID : CC 1583413-001
Customer ID : 8-514

Sampled On : October 5, 2015-10:30
Sampled By : BABB
Received On : October 5, 2015-14:40
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral P:1'5								
Total Hardness as CaCO3	460	--	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Calcium	74	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Magnesium	67	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Potassium	2	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Sodium	41	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Cations	11.0	--	meq/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Boron	ND	0.1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Copper	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Iron	120	30	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Manganese	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Zinc	20	20	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
SAR	0.8	--	--		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Alkalinity (as CaCO3)	60	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Hydroxide as OH	ND	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Carbonate as CO3	ND	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Bicarbonate as HCO3	70	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Sulfate	19	2	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Chloride	329	5*	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Nitrate as NO3	7.3	0.5	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Nitrite as N	ND	0.2	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Nitrate + Nitrite as N	1.7	0.1	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Fluoride	ND	0.1	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Total Anions	10.9	--	meq/L		2320B	10/07/15:211656	2320B	10/07/15:214661
pH	7.0	--	units		4500-H B	10/07/15:211692	4500HB	10/07/15:214625
Specific Conductance	1280	1	umhos/cm		2510B	10/07/15:211681	2510B	10/07/15:214601
Total Dissolved Solids	950	20	mg/L		2540CE	10/06/15:211644	2540C	10/07/15:214592
MBAS Screen	Negative	0.1	mg/L		5540C	10/07/15:211834	5540C	10/07/15:214789
Aggressiveness Index	11.0	--	--		4500-H B	10/07/15:211692	4500HB	10/07/15:214625
Langelier Index (20°C)	-0.9	--	--		4500-H B	10/07/15:211692	4500HB	10/07/15:214625
Nitrate Nitrogen	1.7	--	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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October 8, 2015

Lab ID : CC 1583394-001
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401

Sampled On : October 1, 2015-15:28
Sampled By : Spencer B. Harris, J
Received On : October 1, 2015-15:56
Matrix : Ground Water

Description : 30S10E12J1 LA11
Project : SWI Monitoring

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	486	--	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Calcium	68	1	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Magnesium	77	1	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Potassium	4	1	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Sodium	85	1	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Total Cations	13.5	--	meq/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Boron	0.3	0.1	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Copper	ND	10	ug/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Iron	240	30	ug/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Manganese	40	10	ug/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Zinc	ND	20	ug/L		200.7	10/04/15:211536	200.7	10/04/15:214436
SAR	1.7	--	--		200.7	10/04/15:211536	200.7	10/04/15:214436
Total Alkalinity (as CaCO3)	200	10	mg/L		2320B	10/05/15:211539	2320B	10/05/15:214515
Hydroxide as OH	ND	10	mg/L		2320B	10/05/15:211539	2320B	10/05/15:214515
Carbonate as CO3	ND	10	mg/L		2320B	10/05/15:211539	2320B	10/05/15:214515
Bicarbonate as HCO3	250	10	mg/L		2320B	10/05/15:211539	2320B	10/05/15:214515
Sulfate	188	2	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Chloride	117	5*	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Nitrate as NO3	ND	0.5	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Nitrite as N	ND	0.2	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Fluoride	0.1	0.1	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Total Anions	11.3	--	meq/L		2320B	10/05/15:211539	2320B	10/05/15:214515
pH	7.3	--	units		4500-H B	10/05/15:211574	4500HB	10/05/15:214482
Specific Conductance	1280	1	umhos/cm		2510B	10/05/15:211552	2510B	10/05/15:214451
Total Dissolved Solids	840	20	mg/L		2540CE	10/02/15:211488	2540C	10/05/15:214453
MBAS Screen	Negative	0.1	mg/L		5540C	10/02/15:211708	5540C	10/02/15:214637
Aggressiveness Index	11.8	--	--		4500-H B	10/05/15:211574	4500HB	10/05/15:214482
Langelier Index (20°C)	-0.06	--	--		4500-H B	10/05/15:211574	4500HB	10/05/15:214482
Nitrate Nitrogen	ND	--	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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October 21, 2015

Lab ID : CC 1583447-003
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401

Sampled On : October 6, 2015-11:05
Sampled By : Spencer Harris Sr.
Received On : October 6, 2015-15:04
Matrix : Ground Water

Description : LOCSD 8th St. LA12
Project : SWI Monitoring

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral P:1'5								
Total Hardness as CaCO3	298	--	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Calcium	47	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Magnesium	44	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Potassium	2	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Sodium	55	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Cations	8.4	--	meq/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Boron	0.2	0.1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Copper	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Iron	180	30	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Manganese	50	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Zinc	ND	20	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
SAR	1.4	--	--		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Alkalinity (as CaCO3)	230	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Hydroxide as OH	ND	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Carbonate as CO3	ND	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Bicarbonate as HCO3	280	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Sulfate	46	2	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Chloride	91	1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrate as NO3	ND	0.5	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrite as N	ND	0.2	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Fluoride	ND	0.1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Total Anions	8.1	--	meq/L		2320B	10/08/15:211719	2320B	10/08/15:214738
pH	7.4	--	units		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Specific Conductance	828	1	umhos/cm		2510B	10/08/15:211754	2510B	10/08/15:214696
Total Dissolved Solids	490	20	mg/L		2540CE	10/07/15:211713	2540C	10/08/15:214673
MBAS Screen	Negative	0.1	mg/L		5540C	10/07/15:211834	5540C	10/07/15:214789
Aggressiveness Index	11.8	--	--		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Langelier Index (20°C)	-0.03	--	--		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Nitrate Nitrogen	ND	--	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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November 12, 2015

Lab ID : CC 1583679-001
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401

Sampled On : October 28, 2015-08:02
Sampled By : Spencer Harris
Received On : October 28, 2015-09:20
Matrix : Ground Water

Description : 30S/11E-18L2 LA15
Project : SWI Monitoring

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral P:1'5								
Total Hardness as CaCO3	288	--	mg/L		200.7	10/29/15:212664	200.7	10/30/15:215962
Calcium	46	1	mg/L		200.7	10/29/15:212664	200.7	10/30/15:215962
Magnesium	42	1	mg/L		200.7	10/29/15:212664	200.7	10/30/15:215962
Potassium	ND	1	mg/L		200.7	10/29/15:212664	200.7	10/29/15:215888
Sodium	36	1	mg/L		200.7	10/29/15:212664	200.7	10/29/15:215888
Total Cations	7.3	--	meq/L		200.7	10/29/15:212664	200.7	10/30/15:215962
Boron	ND	0.1	mg/L		200.7	10/29/15:212664	200.7	10/30/15:215962
Copper	ND	10	ug/L		200.7	10/29/15:212664	200.7	10/29/15:215888
Iron	ND	30	ug/L		200.7	10/29/15:212664	200.7	10/29/15:215888
Manganese	ND	10	ug/L		200.7	10/29/15:212664	200.7	10/29/15:215888
Zinc	ND	20	ug/L		200.7	10/29/15:212664	200.7	10/29/15:215888
SAR	0.9	--	--		200.7	10/29/15:212664	200.7	10/30/15:215962
Total Alkalinity (as CaCO3)	190	10	mg/L		2320B	10/30/15:212694	2320B	10/30/15:215900
Hydroxide as OH	ND	10	mg/L		2320B	10/30/15:212694	2320B	10/30/15:215900
Carbonate as CO3	ND	10	mg/L		2320B	10/30/15:212694	2320B	10/30/15:215900
Bicarbonate as HCO3	230	10	mg/L		2320B	10/30/15:212694	2320B	10/30/15:215900
Sulfate	29	2	mg/L		300.0	10/29/15:212716	300.0	10/29/15:215907
Chloride	104	1	mg/L		300.0	10/29/15:212716	300.0	10/29/15:215907
Nitrate as NO3	2.8	0.5	mg/L		300.0	10/29/15:212716	300.0	10/29/15:215907
Nitrite as N	ND	0.2	mg/L		300.0	10/29/15:212716	300.0	10/29/15:215907
Nitrate + Nitrite as N	0.6	0.1	mg/L		300.0	10/29/15:212716	300.0	10/29/15:215907
Fluoride	ND	0.1	mg/L		300.0	10/29/15:212716	300.0	10/29/15:215907
Total Anions	7.4	--	meq/L		2320B	10/30/15:212694	2320B	10/30/15:215900
pH	6.8	--	units		4500-H B	10/30/15:212696	4500HB	10/30/15:215889
Specific Conductance	782	1	umhos/cm		2510B	10/30/15:212695	2510B	10/30/15:215884
Total Dissolved Solids	420	20	mg/L		2540CE	10/30/15:212700	2540C	11/02/15:215964
MBAS Screen	Negative	0.1	mg/L		5540C	10/30/15:213196	5540C	10/30/15:216486
Aggressiveness Index	11.1	--	--		4500-H B	10/30/15:212696	4500HB	10/30/15:215889
Langelier Index (20°C)	-0.7	--	--		4500-H B	10/30/15:212696	4500HB	10/30/15:215889
Nitrate Nitrogen	0.6	--	mg/L		300.0	10/29/15:212716	300.0	10/29/15:215907

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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October 29, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30/11E-18K08 LA18
Project : SWI Monitoring

Lab ID : CC 1583566-001
Customer ID : 8-514

Sampled On : October 19, 2015-12:56
Sampled By : Spencer B. Harris, J
Received On : October 19, 2015-14:00
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General MineralP:1'5								
Total Hardness as CaCO3	256	--	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Calcium	53	1	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Magnesium	30	1	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Potassium	2	1	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Sodium	26	1	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Total Cations	6.3	--	meq/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Boron	ND	0.1	mg/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Copper	ND	10	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Iron	ND	30	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Manganese	80	10	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
Zinc	ND	20	ug/L		200.7	10/23/15:212423	200.7	10/23/15:215578
SAR	0.7	--	--		200.7	10/23/15:212423	200.7	10/23/15:215578
Total Alkalinity (as CaCO3)	190	10	mg/L		2320B	10/21/15:212263	2320B	10/21/15:215348
Hydroxide as OH	ND	10	mg/L		2320B	10/21/15:212263	2320B	10/21/15:215348
Carbonate as CO3	ND	10	mg/L		2320B	10/21/15:212263	2320B	10/21/15:215348
Bicarbonate as HCO3	230	10	mg/L		2320B	10/21/15:212263	2320B	10/21/15:215348
Sulfate	33	2	mg/L		300.0	10/20/15:212274	300.0	10/20/15:215369
Chloride	29	1	mg/L		300.0	10/20/15:212274	300.0	10/20/15:215369
Nitrate as NO3	ND	0.5	mg/L		300.0	10/20/15:212274	300.0	10/20/15:215369
Nitrite as N	ND	0.2	mg/L		300.0	10/20/15:212274	300.0	10/20/15:215369
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	10/20/15:212274	300.0	10/20/15:215369
Fluoride	0.2	0.1	mg/L		300.0	10/20/15:212274	300.0	10/20/15:215369
Total Anions	5.3	--	meq/L		2320B	10/21/15:212263	2320B	10/21/15:215348
pH	7.3	--	units		4500-H B	10/21/15:212305	4500HB	10/21/15:215394
Specific Conductance	621	1	umhos/cm		2510B	10/21/15:212279	2510B	10/21/15:215363
Total Dissolved Solids	370	20	mg/L		2540CE	10/21/15:212301	2540C	10/22/15:215439
MBAS Screen	Negative	0.1	mg/L		5540C	10/20/15:212297	5540C	10/20/15:215384
Aggressiveness Index	11.7	--	--		4500-H B	10/21/15:212305	4500HB	10/21/15:215394
Langelier Index (20°C)	-0.2	--	--		4500-H B	10/21/15:212305	4500HB	10/21/15:215394
Nitrate Nitrogen	ND	--	mg/L		300.0	10/20/15:212274	300.0	10/20/15:215369

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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October 12, 2015

Lab ID : CC 1583413-003
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : GSWC So. Bay #1 LA20
Project : SWI Monitoring

Sampled On : October 5, 2015-11:10
Sampled By : BABB
Received On : October 5, 2015-14:40
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	227	--	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Calcium	35	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Magnesium	34	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Potassium	2	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Sodium	41	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Cations	6.4	--	meq/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Boron	0.1	0.1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Copper	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Iron	ND	30	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Manganese	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Zinc	ND	20	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
SAR	1.2	--	--		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Alkalinity (as CaCO3)	230	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Hydroxide as OH	ND	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Carbonate as CO3	ND	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Bicarbonate as HCO3	280	10	mg/L		2320B	10/07/15:211656	2320B	10/07/15:214661
Sulfate	23	2	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Chloride	38	1	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Nitrate as NO3	2.4	0.5	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Nitrite as N	ND	0.2	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Nitrate + Nitrite as N	0.5	0.1	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Fluoride	0.2	0.1	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543
Total Anions	6.2	--	meq/L		2320B	10/07/15:211656	2320B	10/07/15:214661
pH	7.2	--	units		4500-H B	10/07/15:211692	4500HB	10/07/15:214625
Specific Conductance	614	1	umhos/cm		2510B	10/07/15:211681	2510B	10/07/15:214601
Total Dissolved Solids	370	20	mg/L		2540CE	10/06/15:211644	2540C	10/07/15:214592
MBAS Screen	Negative	0.1	mg/L		5540C	10/07/15:211834	5540C	10/07/15:214789
Aggressiveness Index	11.5	--	--		4500-H B	10/07/15:211692	4500HB	10/07/15:214625
Langelier Index (20°C)	-0.3	--	--		4500-H B	10/07/15:211692	4500HB	10/07/15:214625
Nitrate Nitrogen	0.5	--	mg/L		300.0	10/06/15:211663	300.0	10/06/15:214543

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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CA ELAP Certification No. 2810

October 8, 2015

Lab ID : CC 1583394-002
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S11E17E8 LA22
Project : SWI Monitoring

Sampled On : October 1, 2015-13:23
Sampled By : Spencer B. Harris, J
Received On : October 1, 2015-15:56
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral P:1'5								
Total Hardness as CaCO3	164	--	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Calcium	26	1	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Magnesium	24	1	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Potassium	1	1	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Sodium	28	1	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Total Cations	4.5	--	meq/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Boron	ND	0.1	mg/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Copper	ND	10	ug/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Iron	ND	30	ug/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Manganese	ND	10	ug/L		200.7	10/04/15:211536	200.7	10/04/15:214436
Zinc	ND	20	ug/L		200.7	10/04/15:211536	200.7	10/04/15:214436
SAR	1.0	--	--		200.7	10/04/15:211536	200.7	10/04/15:214436
Total Alkalinity (as CaCO3)	100	10	mg/L		2320B	10/05/15:211539	2320B	10/05/15:214515
Hydroxide as OH	ND	10	mg/L		2320B	10/05/15:211539	2320B	10/05/15:214515
Carbonate as CO3	ND	10	mg/L		2320B	10/05/15:211539	2320B	10/05/15:214515
Bicarbonate as HCO3	120	10	mg/L		2320B	10/05/15:211539	2320B	10/05/15:214515
Sulfate	10	2	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Chloride	44	1	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Nitrate as NO3	29.2	0.5	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Nitrite as N	ND	0.2	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Nitrate + Nitrite as N	6.6	0.1	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Fluoride	ND	0.1	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465
Total Anions	3.9	--	meq/L		2320B	10/05/15:211539	2320B	10/05/15:214515
pH	7.4	--	units		4500-H B	10/05/15:211574	4500HB	10/05/15:214482
Specific Conductance	475	1	umhos/cm		2510B	10/05/15:211552	2510B	10/05/15:214451
Total Dissolved Solids	290	20	mg/L		2540CE	10/02/15:211488	2540C	10/05/15:214453
MBAS Screen	Negative	0.1	mg/L		5540C	10/02/15:211708	5540C	10/02/15:214637
Aggressiveness Index	11.2	--	--		4500-H B	10/05/15:211574	4500HB	10/05/15:214482
Langelier Index (20°C)	-0.6	--	--		4500-H B	10/05/15:211574	4500HB	10/05/15:214482
Nitrate Nitrogen	6.6	--	mg/L		300.0	10/02/15:211553	300.0	10/02/15:214465

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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FAX: (559)734-8435
CA ELAP Certification No. 2810

October 21, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/10E - 13M2 LA31
Project : SWI Monitoring

Lab ID : CC 1583447-004
Customer ID : 8-514

Sampled On : October 6, 2015-11:33
Sampled By : Spencer Harris Sr.
Received On : October 6, 2015-15:04
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	756	--	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Calcium	115	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Magnesium	114	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Potassium	5	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Sodium	342	1	mg/L		200.7	10/08/15:211743	200.7	10/08/15:214704
Total Cations	30.1	--	meq/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Boron	0.2	0.1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Copper	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Iron	ND	30	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Manganese	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Zinc	ND	20	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
SAR	5.4	--	--		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Alkalinity (as CaCO3)	30	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Hydroxide as OH	ND	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Carbonate as CO3	ND	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Bicarbonate as HCO3	30	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Sulfate	185	2	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Chloride	960	10*	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrate as NO3	2.4	0.5	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrite as N	ND	2*	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrate + Nitrite as N	0.5	0.1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Fluoride	ND	0.1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Total Anions	31.5	--	meq/L		2320B	10/08/15:211719	2320B	10/08/15:214738
pH	7.1	--	units		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Specific Conductance	3370	1	umhos/cm		2510B	10/08/15:211754	2510B	10/08/15:214696
Total Dissolved Solids	2140	20	mg/L		2540CE	10/07/15:211713	2540C	10/08/15:214673
MBAS Screen	Negative	0.1	mg/L		5540C	10/07/15:211834	5540C	10/07/15:214789
Aggressiveness Index	11.0	--	--		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Langelier Index (20°C)	-0.9	--	--		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Nitrate Nitrogen	0.5	--	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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CA ELAP Certification No. 2810

October 21, 2015

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : LOCSD 10th St. LA32
Project : SWI Monitoring

Lab ID : CC 1583447-002
Customer ID : 8-514

Sampled On : October 6, 2015-10:49
Sampled By : Spencer Harris Sr.
Received On : October 6, 2015-15:04
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	62.0	--	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Calcium	10	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Magnesium	9	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Potassium	ND	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Sodium	21	1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Cations	2.2	--	meq/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Boron	ND	0.1	mg/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Copper	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Iron	100	30	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Manganese	ND	10	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
Zinc	ND	20	ug/L		200.7	10/07/15:211691	200.7	10/07/15:214667
SAR	1.2	--	--		200.7	10/07/15:211691	200.7	10/07/15:214667
Total Alkalinity (as CaCO3)	40	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Hydroxide as OH	ND	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Carbonate as CO3	ND	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Bicarbonate as HCO3	50	10	mg/L		2320B	10/08/15:211719	2320B	10/08/15:214738
Sulfate	3	2	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Chloride	31	1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrate as NO3	26.2	0.5	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrite as N	ND	0.2	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Nitrate + Nitrite as N	5.9	0.1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Fluoride	ND	0.1	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724
Total Anions	2.2	--	meq/L		2320B	10/08/15:211719	2320B	10/08/15:214738
pH	7.2	--	units		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Specific Conductance	248	1	umhos/cm		2510B	10/08/15:211754	2510B	10/08/15:214696
Total Dissolved Solids	190	20	mg/L		2540CE	10/07/15:211713	2540C	10/08/15:214673
MBAS Screen	Negative	0.1	mg/L		5540C	10/07/15:211834	5540C	10/07/15:214789
Aggressiveness Index	10.2	--	--		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Langelier Index (20°C)	-1.6	--	--		4500-H B	10/08/15:211767	4500HB	10/08/15:214714
Nitrate Nitrogen	5.9	--	mg/L		300.0	10/07/15:211775	300.0	10/08/15:214724

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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FINAL DRAFT 062815

APPENDIX D

Geophysics at Well 30S/10E-13M1
(from CHG, 2015b)

Well 30S/10E-13M1

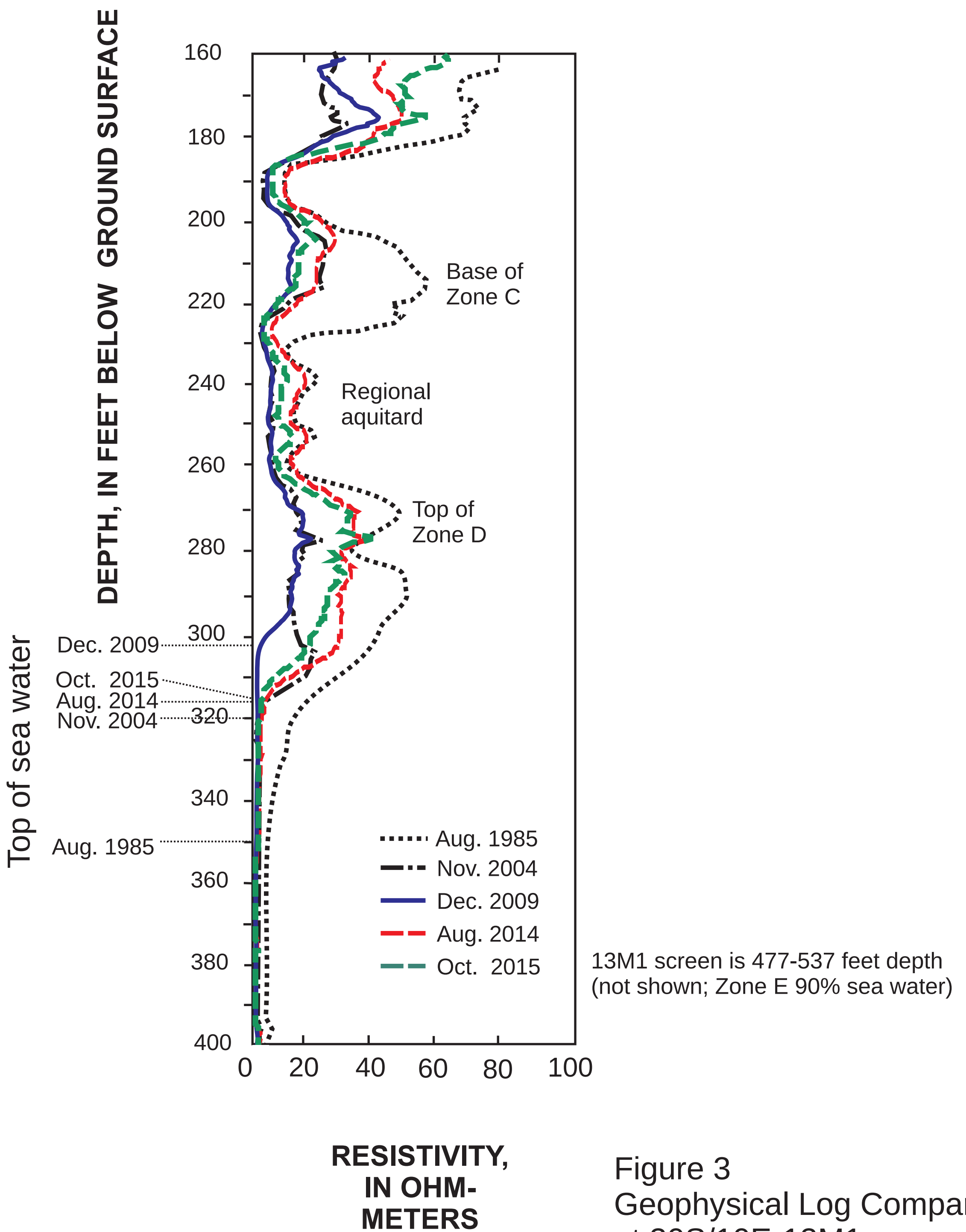


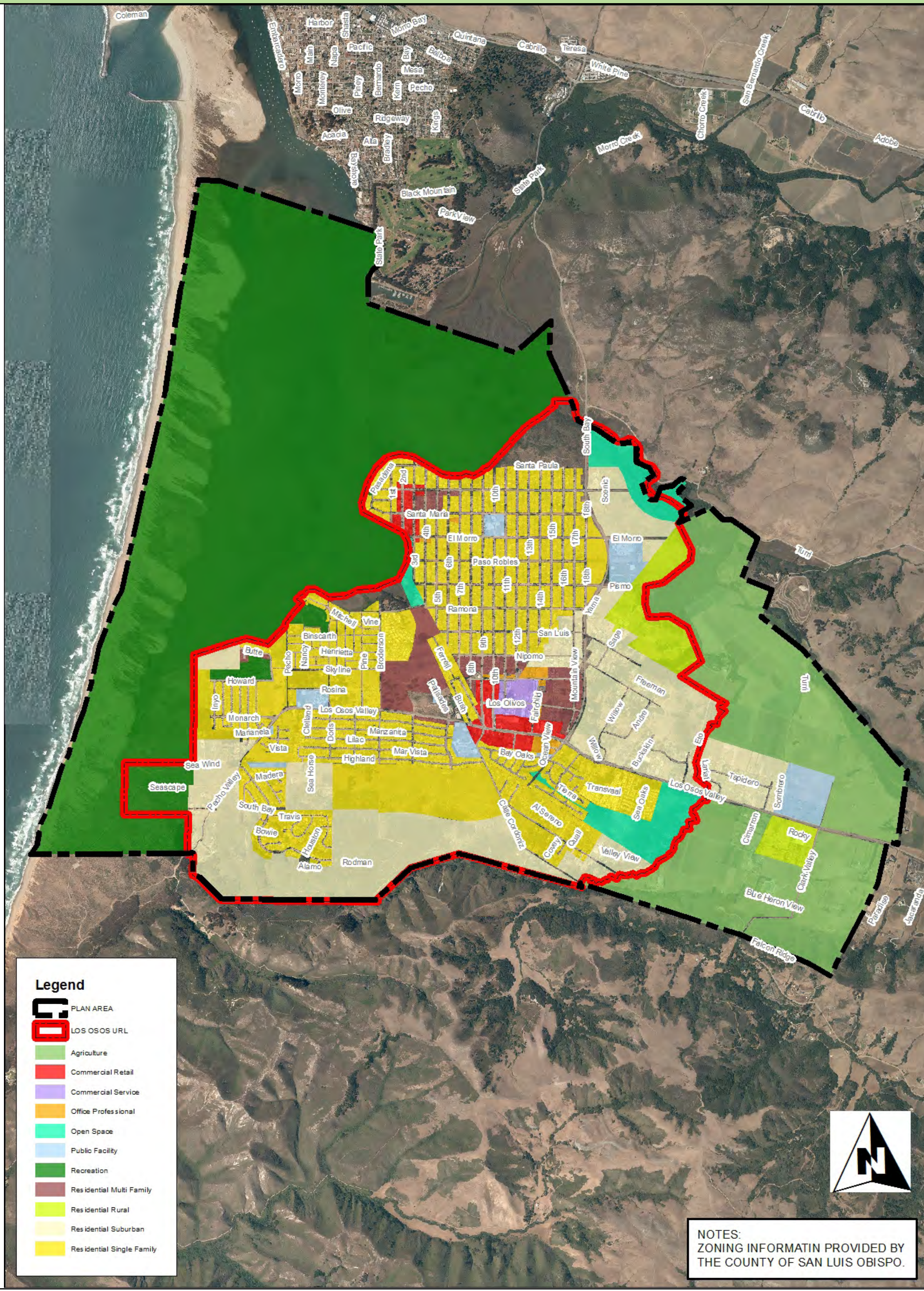
Figure 3
Geophysical Log Comparison
at 30S/10E-13M1
October 2015
Lower Aquifer Monitoring
Los Osos ISJ

Cleath-Harris Geologists

APPENDIX E

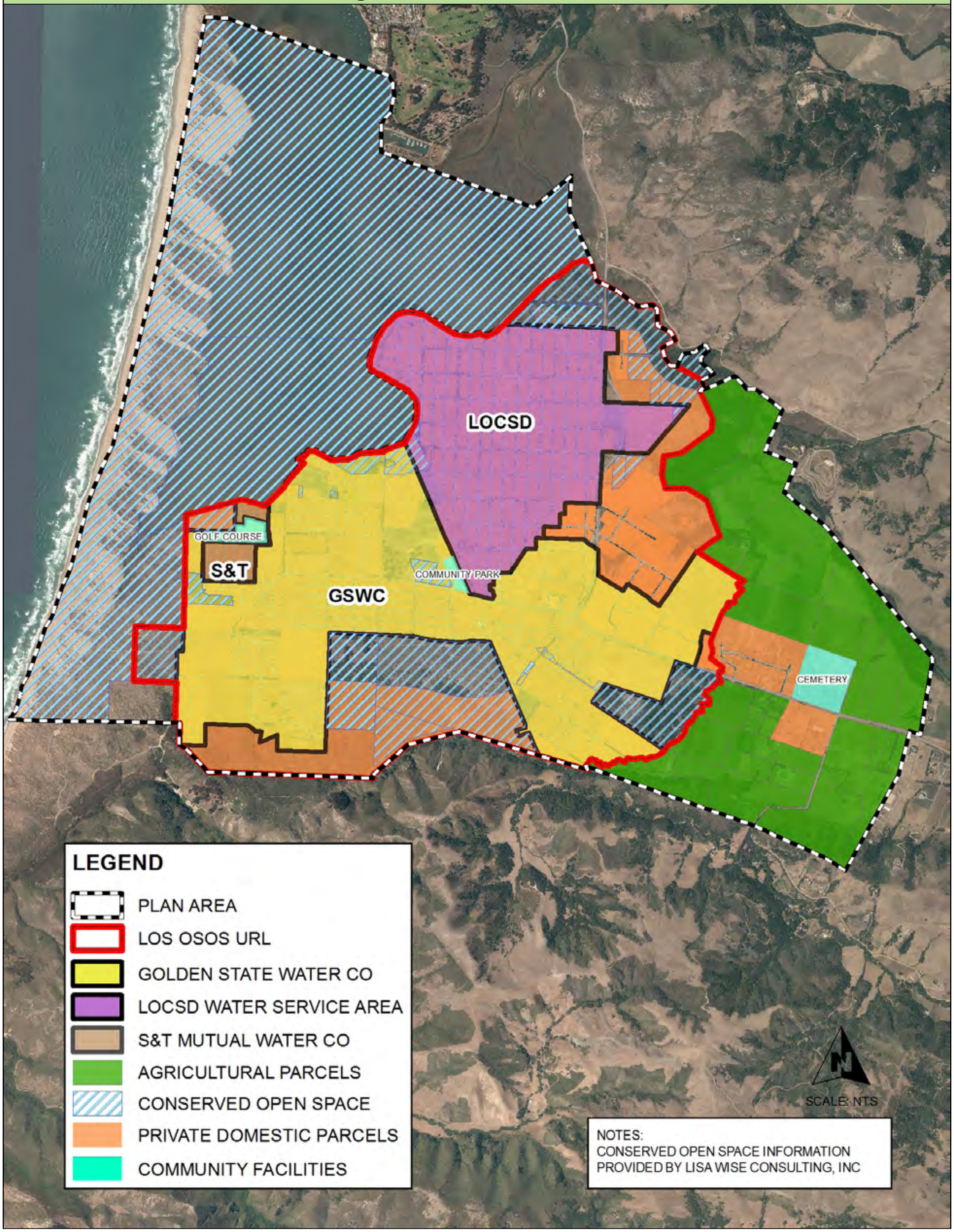
Land Use and Water Use Areas
(from Basin Plan)

Figure 5. Land Uses in the Plan Area



FINAL DRAFT 062815

Figure 10. Water Use Areas



FINAL DRAFT 062815

APPENDIX F

Precipitation and Streamflow Data

FINAL DRAFT 062815

San Luis Obispo County Public Works

Recording Rain Station

MONTHLY PRECIPITATION REPORT

Station Name - Los Osos Landfill # 727

Station Location -

Latitude - 35° 19' 19"

Longitude - 120° 48' 03"

Description - Northeast Los Osos South of Turri Road

Water Years -

Beginning - 2005-2006

Ending - 2015-2016

Station Statistics -

Month	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
Minimum	0.00	0.00	0.00	0.00	0.04	0.12	0.00	0.35	0.00	0.20	0.00	0.00	6.81
Average	0.18	0.03	0.08	1.01	0.81	2.96	3.46	2.60	1.95	1.06	0.37	0.15	14.67
Maximum	1.93	0.20	0.63	6.22	2.17	11.46	10.47	4.61	8.03	3.70	2.64	1.10	31.77

Notes -

Earlier data may be available. Contact Public Works for more information.

FINAL DRAFT 062815

San Luis Obispo County Public Works

Recording Rain Station

MONTHLY PRECIPITATION REPORT

Station Name and no. Los Osos Landfill # 727

*** All units are in inches ***

Water Year	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Total
2015-2016	1.93	0.00	0.08	0.08	1.26	1.85	5.04	0.86					
2014-2015	0.00	0.00	0.00	0.00	0.28	5.20	0.08	0.91	0.43	0.67	0.12	0.00	7.68
2013-2014	0.00	0.00	0.00	0.24	0.28	0.12	0.00	4.06	1.42	0.71	0.00	0.00	6.81
2012-2013	0.00	0.00	0.00	1.18	1.69	2.64	1.02	0.67	0.43	0.31	0.12	0.04	8.11
2011-2012	0.00	0.08	0.04	1.06	2.17	0.16	2.28	0.35	2.68	2.24	0.00	0.00	11.06
2010-2011	0.00	0.00	0.12	1.54	1.85	11.46	3.03	3.78	8.03	0.28	0.59	1.10	31.77
2009-2010	0.00	0.00	0.04	6.22	0.04	2.87	9.76	4.13	1.14	1.93	0.04	0.00	26.18
2008-2009	0.00	0.00	0.00	0.04	0.04	0.75	0.71	4.61	1.06	0.20	0.20	0.35	7.95
2007-2008	0.00	0.00	0.00	0.43	0.12	2.68	10.47	2.99	0.00	0.24	0.00	0.00	16.93
2006-2007	0.00	0.00	0.00	0.12	0.43	2.28	1.26	2.56	0.43	0.35	0.04	0.00	7.48
2005-2006	0.04	0.20	0.63	0.24	0.75	2.52	4.45	3.70	3.90	3.70	2.64	0.00	22.76

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2015-2016**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1													1
2					0.59								2
3						0.04				CURRENT THROUGH 2/29			3
4				0.04									4
5							1.02						5
6							0.75						6
7							0.23						7
8					0.23								8
9					0.04		0.04						9
10					0.04	0.04	0.08						10
11						0.39							11
12													12
13						0.08	0.04						13
14			0.08										14
15				0.04	0.28		0.04						15
16							0.08						16
17								0.67					17
18							0.28	0.19					18
19	1.69					0.51	0.86						19
20	0.24												20
21						0.28							21
22						0.47	0.16						22
23							0.08						23
24						0.04							24
25					0.08								25
26													26
27													27
28													28
29													29
30							0.27						30
31							1.11						31
Total	1.93	0.00	0.08	0.08	1.26	1.85	5.04	0.86					
Cum. Total	1.93	1.93	2.01	2.09	3.35	5.20	10.24	11.10	11.10	11.10	11.10	11.10	

Season Total **11.10**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2014-2015**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1									0.43				1
2						0.51							2
3													3
4						0.67							4
5						0.04							5
6								0.12					6
7								0.51					7
8					0.04			0.20					8
9													9
10								0.08					10
11					0.04	1.22							11
12						1.22							12
13					0.04								13
14											0.12		14
15						0.71				0.47			15
16						0.71							16
17						0.08							17
18						0.04							18
19					0.08								19
20													20
21													21
22					0.04								22
23													23
24													24
25										0.20			25
26													26
27							0.08						27
28													28
29					0.04								29
30													30
31													31

Total	0.00	0.00	0.00	0.00	0.28	5.20	0.08	0.91	0.43	0.67	0.12	0.00	
Cum. Total	0.00	0.00	0.00	0.00	0.28	5.47	5.55	6.46	6.89	7.56	7.68	7.68	

Season Total **7.68**

San Luis Obispo County Public Works
DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2013-2014**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1									0.59	0.24			1
2								0.87	0.20	0.28			2
3								0.04					3
4													4
5													5
6								0.31					6
7						0.12							7
8								0.04					8
9								0.04					9
10								0.08					10
11													11
12													12
13													13
14								0.04					14
15													15
16													16
17													17
18													18
19													19
20					0.20								20
21					0.08								21
22													22
23													23
24													24
25										0.16			25
26								0.87	0.04	0.04			26
27								0.28					27
28				0.24				1.50					28
29									0.16				29
30									0.04				30
31									0.39				31

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	
Total	0.00	0.00	0.00	0.24	0.28	0.12	0.00	4.06	1.42	0.71	0.00	0.00	
Cum. Total	0.00	0.00	0.00	0.24	0.51	0.63	0.63	4.69	6.10	6.81	6.81	6.81	

Season Total **6.81**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2012-2013**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1						0.12				0.28			1
2						0.55							2
3													3
4										0.04			4
5							0.39						5
6							0.31				0.12		6
7									0.24				7
8								0.47	0.08				8
9					0.04								9
10				0.24									10
11				0.87									11
12						0.04							12
13													13
14									0.04				14
15						0.04							15
16					0.08	0.08							16
17					0.47	0.16							17
18					0.24								18
19								0.20					19
20													20
21				0.04									21
22						0.75							22
23						0.24							23
24							0.28					0.04	24
25						0.28	0.04						25
26						0.04							26
27													27
28					0.55								28
29					0.08	0.35							29
30				0.04	0.24				0.04				30
31									0.04				31

Total	0.00	0.00	0.00	1.18	1.69	2.64	1.02	0.67	0.43	0.31	0.12	0.04	
Cum. Total	0.00	0.00	0.00	1.18	2.87	5.51	6.54	7.20	7.64	7.95	8.07	8.11	

Season Total **8.11**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2011-2012**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1													1
2													2
3				0.08	0.04								3
4				0.04	0.28								4
5				0.91									5
6					0.28								6
7								0.04					7
8													8
9													9
10				0.04				0.04		0.55			10
11					0.31					0.16			11
12						0.16				0.28			12
13								0.08		1.02			13
14													14
15								0.08					15
16									0.12				16
17									1.46				17
18									0.12				18
19													19
20					1.26		0.20						20
21							0.87						21
22													22
23							1.22						23
24													24
25									0.63	0.20			25
26		0.04								0.04			26
27													27
28									0.16				28
29								0.12					29
30		0.04	0.04										30
31									0.20				31

Total	0.00	0.08	0.04	1.06	2.17	0.16	2.28	0.35	2.68	2.24	0.00	0.00	
Cum. Total	0.00	0.08	0.12	1.18	3.35	3.50	5.79	6.14	8.82	11.06	11.06	11.06	

Season Total **11.06**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2010-2011**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1							0.39						1
2							2.52		0.08				2
3													3
4			0.04			0.04			0.04			0.59	4
5				0.31		0.75						0.35	5
6				0.24	0.04				0.12			0.12	6
7					0.47								7
8													8
9						0.04							9
10					0.04								10
11									0.04				11
12													12
13						0.04							13
14								0.04					14
15						0.04					0.16		15
16								0.59	0.08		0.16		16
17			0.04	0.04		0.43		0.47			0.16		17
18				0.08		2.95		1.54	0.47		0.08		18
19					0.24	2.24		0.55	2.28				19
20			0.04		0.71	1.06		0.04	2.91				20
21				0.04	0.24	0.35			0.24	0.28			21
22				0.04		1.57			0.04				22
23				0.08	0.12				0.87				23
24				0.28					0.63				24
25						0.79		0.51	0.04				25
26								0.04	0.16				26
27													27
28						0.31			0.04				28
29				0.35		0.83					0.04	0.04	29
30				0.08									30
31							0.12						31

Total	0.00	0.00	0.12	1.54	1.85	11.46	3.03	3.78	8.03	0.28	0.59	1.10	
Cum. Total	0.00	0.00	0.12	1.65	3.50	14.96	17.99	21.77	29.80	30.08	30.67	31.77	

Season Total **31.77**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2009-2010**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1										0.04			**1**
2									0.08				**2**
3									0.43				**3**
4								0.08	0.04				**4**
5								0.51		0.31			**5**
6								0.39	0.20				**6**
7						0.47							**7**
8									0.04				**8**
9								0.63					**9**
10						0.75			0.04				**10**
11										0.98			**11**
12						1.22	0.51		0.08	0.08			**12**
13				5.43		0.04	0.31	0.04					**13**
14				0.79		0.04							**14**
15													**15**
16													**16**
17							0.55				0.04		**17**
18							1.14						**18**
19							0.91						**19**
20					0.04		2.36	0.04		0.51			**20**
21						0.16	2.01	0.12					**21**
22							1.22		0.04				**22**
23			0.04				0.04	0.04					**23**
24								0.39					**24**
25													**25**
26							0.59	1.42					**26**
27						0.08		0.47					**27**
28													**28**
29							0.08		0.04				**29**
30						0.12	0.04		0.04				**30**
31									0.12				**31**
Total	0.00	0.00	0.04	6.22	0.04	2.87	9.76	4.13	1.14	1.93	0.04	0.00	
Cum. Total	0.00	0.00	0.04	6.26	6.30	9.17	18.94	23.07	24.21	26.14	26.18	26.18	

Season Total **26.18**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2008-2009**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1					0.04						0.04		**1**
2							0.08		0.16		0.12		**2**
3									0.59				**3**
4				0.04					0.08				**4**
5											0.04	0.35	**5**
6								0.87					**6**
7										0.20			**7**
8													**8**
9								1.10					**9**
10													**10**
11								0.04					**11**
12								0.04					**12**
13								0.63					**13**
14								0.04					**14**
15													**15**
16						0.12							**16**
17								1.10					**17**
18													**18**
19													**19**
20													**20**
21						0.08							**21**
22						0.43		0.47	0.24				**22**
23							0.51	0.31					**23**
24							0.12						**24**
25						0.12							**25**
26													**26**
27													**27**
28													**28**
29													**29**
30													**30**
31													**31**

Total	0.00	0.00	0.00	0.04	0.04	0.75	0.71	4.61	1.06	0.20	0.20	0.35	
Cum. Total	0.00	0.00	0.00	0.04	0.08	0.83	1.54	6.14	7.20	7.40	7.60	7.95	

Season Total **7.95**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2007-2008**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1								0.08					1
2					0.04			0.24		0.20			2
3								1.02		0.04			3
4							3.66						4
5							0.20						5
6						0.24	0.39						6
7						0.08							7
8							0.08						8
9							0.04						9
10													10
11					0.08								11
12													12
13													13
14													14
15													15
16				0.28									16
17				0.08									17
18						2.24							18
19								0.20					19
20						0.12		0.16					20
21							0.08	0.08					21
22							2.32	0.12					22
23							1.06	0.87					23
24							0.87	0.24					24
25							0.31						25
26							0.63						26
27				0.08			0.67						27
28							0.08						28
29							0.04						29
30							0.04						30
31													31

Total	0.00	0.00	0.00	0.43	0.12	2.68	10.47	2.99	0.00	0.24	0.00	0.00	
Cum. Total	0.00	0.00	0.00	0.43	0.55	3.23	13.70	16.69	16.69	16.93	16.93	16.93	

Season Total **16.93**

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San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2006-2007**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1													1
2								0.04					2
3													3
4							0.12				0.04		4
5													5
6													6
7								0.20					7
8						0.39							8
9						0.94							9
10						0.31		0.71					10
11					0.08								11
12								0.04					12
13				0.08	0.20								13
14					0.08								14
15													15
16													16
17					0.04	0.04	0.04						17
18													18
19										0.04			19
20									0.28	0.24			20
21						0.04							21
22								0.87		0.08			22
23				0.04				0.12					23
24													24
25								0.08					25
26					0.04	0.43		0.16	0.08				26
27						0.12	0.83	0.20	0.08				27
28							0.20	0.16					28
29							0.08						29
30													30
31													31
Total	0.00	0.00	0.00	0.12	0.43	2.28	1.26	2.56	0.43	0.35	0.04	0.00	
Cum. Total	0.00	0.00	0.00	0.12	0.55	2.83	4.09	6.65	7.09	7.44	7.48	7.48	

Season Total **7.48**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2005-2006**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1							1.61						1
2			0.63			0.55	2.32			0.24			2
3								0.04		1.18			3
4										0.59			4
5										0.39			5
6													6
7										0.08			7
8						0.47							8
9					0.59				0.04				9
10									0.28	0.43			10
11		0.16			0.04				0.12				11
12		0.04							0.28				12
13													13
14	0.04						0.24		0.04	0.04			14
15													15
16										0.08			16
17				0.12					0.24	0.04			17
18						0.16	0.16	3.66					18
19													19
20				0.04					0.35				20
21						0.04			0.04		2.60		21
22						0.04					0.04		22
23						0.04							23
24													24
25					0.08	0.12			0.12				25
26				0.08		0.04	0.08			0.63			26
27									0.43				27
28						0.12			1.38				28
29									0.16				29
30					0.04		0.04						30
31						0.94			0.43				31

Total	0.04	0.20	0.63	0.24	0.75	2.52	4.45	3.70	3.90	3.70	2.64	0.00	
Cum. Total	0.04	0.24	0.87	1.10	1.85	4.37	8.82	12.52	16.42	20.12	22.76	22.76	

Season Total **22.76**

Stream Flow

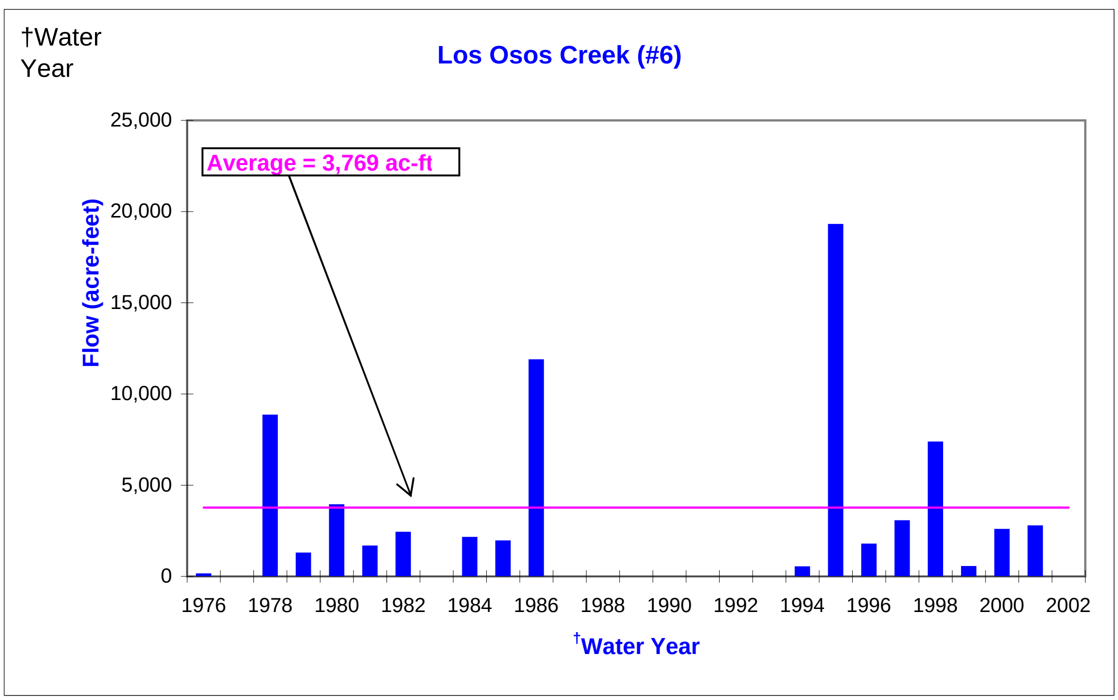
Stream Gage Name: **Los Osos Creek (#6)**
Water Planning Area: **3**

Water Year†	Annual Stream Flow (acre-feet)	Water Year†	Annual Stream Flow (acre-feet)
1976	110 [1]	1990	[9]
1977	0	1991	[10]
1978	8,810	1992	[11]
1979	1,240	1993	[12]
1980	3,890 [2]	1994	497
1981	1,630	1995	19,270
1982	2,390 [3]	1996	1,740
1983	[4]	1997	3,020
1984	2,110	1998	7,340
1985	1,920	1999	505
1986	11,850 [5]	2000	2,540
1987	[6]	2001	2,470
1988	[7]	2002	0
1989	[8]	2003	NA [13]

From Annual Stream Flow Records	
Average Flow:	3,769 AFY
Median Flow:	2,110 AFY
Minimum Flow (2002):	0 AFY
Maximum Flow (1995):	19,270 AFY

[1] gage put into operation in February
[2] missing data for one day in February
[3] missing data for various days in February, March, and April
[4] only visual observations were available for this year
[5] missing data for the end of February and beginning of March
[6-12] no data available for this time period
[13] Data not available at the time the report was published

(notations as recorded in San Luis Obispo County stream flow log books)



† October 1 - September 30

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APPENDIX G

Groundwater Storage Calculation Example and Specific Yield Estimates

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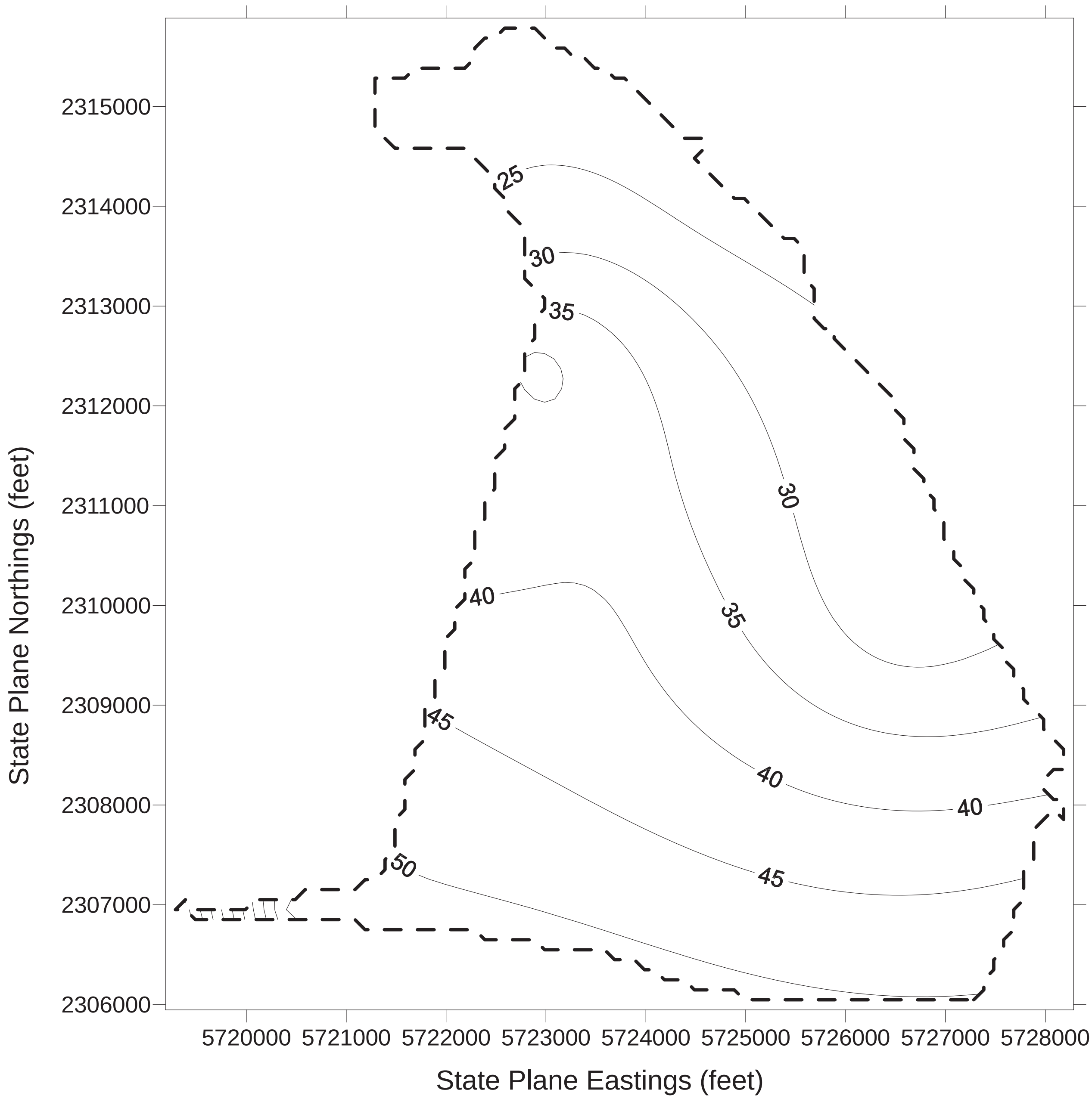
EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 1: GRID AND TRIM WATER LEVEL CONTOURS



Spring 2015
Eastern Area Water Levels
Alluvial Aquifer and Lower Aquifer

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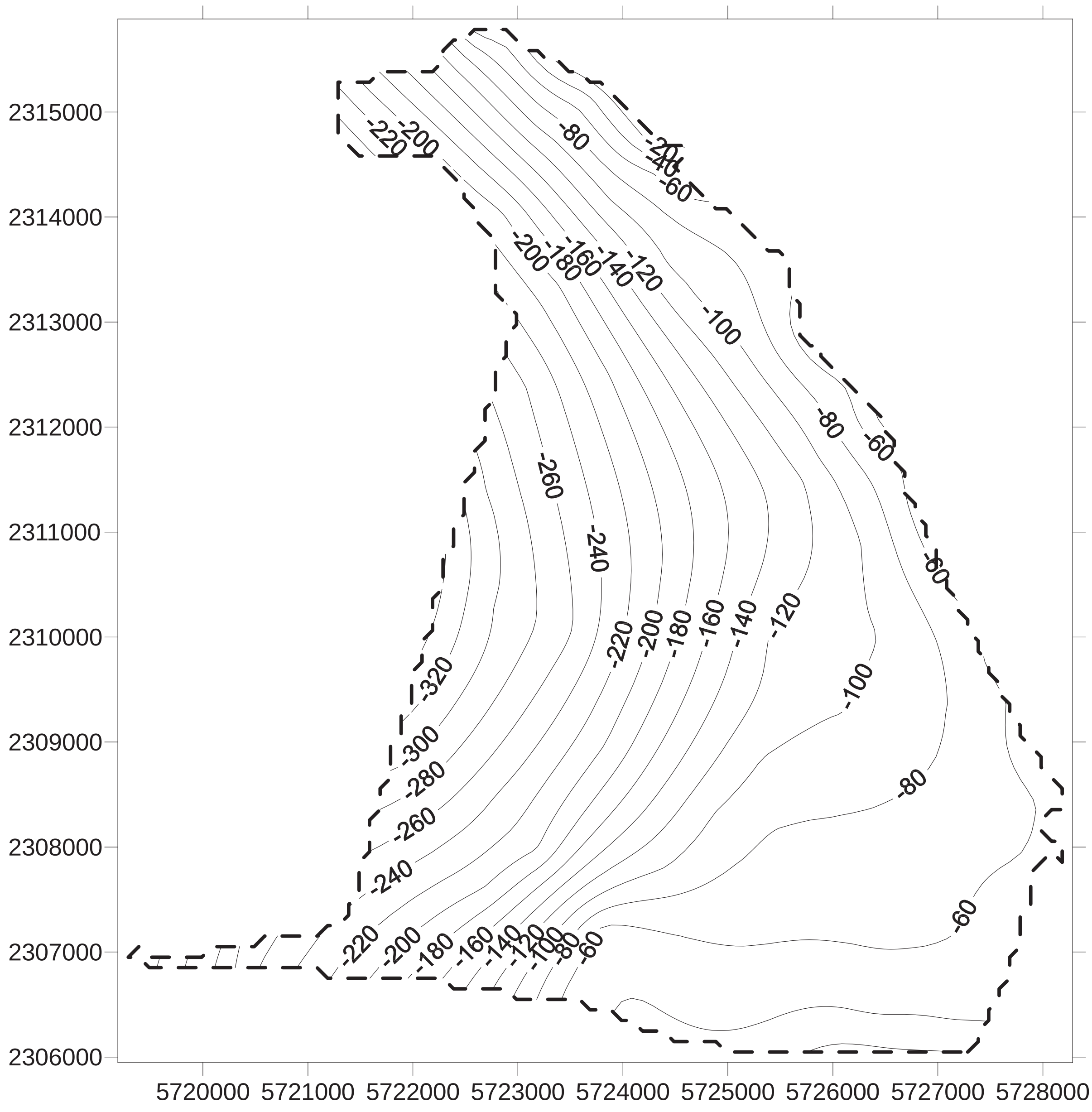
EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 2: GRID AND TRIM BASE OF PERMEABLE SEDIMENTS



Eastern Area
Base of Permeable Sediments

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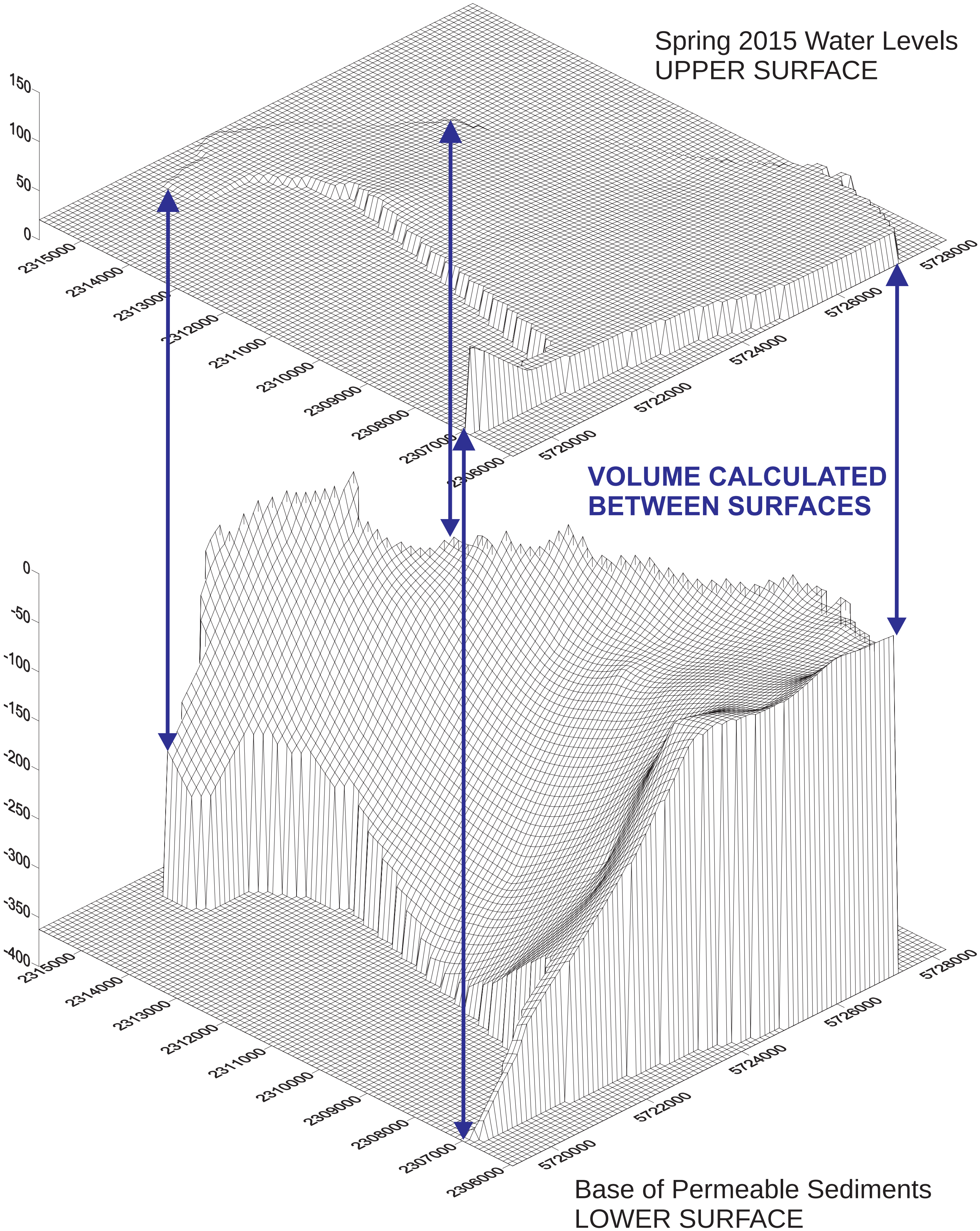
EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 3: MATCH UPPER AND LOWER SURFACE GRIDS



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EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 4: VOLUME COMPUTATION

Grid Volume Computations

Thu Apr 28 17:15:30 2016

Upper Surface

Grid File Name:	C:\CHG 2016\Projects\Los Osos BMC\2015 Annual Report\Contour Maps NAVD88\BLANKED FILES\EASTERN\UA_SPRING NAVD88 with eastern.grd
Grid Size:	100 rows x 92 columns
X Minimum:	5719189
X Maximum:	5728284
X Spacing:	99.945054945055
Y Minimum:	2305947
Y Maximum:	2315886
Y Spacing:	100.39393939394
Z Minimum:	20.35766223355
Z Maximum:	105.59438786398

Lower Surface

Grid File Name:	C:\CHG 2016\Projects\Los Osos BMC\2015 Annual Report\Contour Maps NAVD88\BASE GEOMETRY\EASTERN\BOP Eastern blanked.grd
Grid Size:	100 rows x 92 columns
X Minimum:	5719189
X Maximum:	5728284
X Spacing:	99.945054945055
Y Minimum:	2305947
Y Maximum:	2315886
Y Spacing:	100.39393939394
Z Minimum:	-362.32467224801
Z Maximum:	2.39586300134

Volumes

Z Scale Factor:	1

Total Volumes by:

Trapezoidal Rule:	7813709488.9211
Simpson's Rule:	7809172310.5849
Simpson's 3/8 Rule:	7806317420.98

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EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 5: CALCULATE GROUNDWATER IN STORAGE

Cut & Fill Volumes

Positive Volume [Cut]:	7813709488.9211
Negative Volume [Fill]:	0
Net Volume [Cut-Fill]:	7813709488.9211

Areas

Planar Areas

Positive Planar Area [Cut]:	41665677.518315
Negative Planar Area [Fill]:	0
Blanked Planar Area:	48729527.481685
Total Planar Area:	90395205

Surface Areas

Positive Surface Area [Cut]:	41778804.878129
Negative Surface Area [Fill]:	0

STORAGE CALCULATION

Positive Volume: 7,813,709,488 ft^3 * 0.1 specific yield ÷ 43,560 acre-feet per ft^3 = 17,938 acre-feet

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WELL 30S/10E-12J01 (LA11)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
sand	5	27	22	20	C	
clay	27	32	5	3		
sand (peat)	32	70	38	5		
clay	70	72	2	3		Weighted Specific Yield
gravel	72	82	10	18		10.8
clay	82	96	14	3	D	
sand	96	100	4	20		
silt	100	135	35	5		
clay	135	157	22	3		
gravel	157	158	1	18		
sand	158	169	11	20		
sand and clay	169	194	25	5		
gravel	194	205	11	18		Weighted Specific Yield
sand and clay	205	217	12	5		7.3
clay	217	222	5	3	E	
sand and clay	222	245	23	5		
sand and gravel	245	257	12	18		
sand	257	264	7	20		
sand and gravel	264	274	10	18		
sand	274	290	16	20		
sand and silt	290	304	14	5		
sand	304	323	19	20		
sand and clay	323	330	7	5		
clay	330	339	9	3		
sand	339	341	2	20		
clay	341	346	5	3		
sand	346	352	6	20		
sand and clay	352	356	4	5		
sand	356	370	14	20		Weighted Specific Yield
sand and gravel	370	386	16	18		13.4
clay	386	392	6	3	BEDROCK	Weighted Specific Yield
shale	392	402	10	13		8
Total Depth	402			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**10.6**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

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WELL 30S/10E-13L04 (LA6)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
top soil	0	19	19	unsaturated	C	
clay, some gravel and sand	19	26	7			
gravel, clay and sand	26	41	15			
fine sand	41	61	20	20		
clay, sand, small rocks	61	71	10	7		
clay, few pebbles	71	75	4	7		
fine gravel and sand	75	81	6	18		
sandy clay	81	95	14	5		
hard clay	95	97	2	3		
fine sand	97	115	18	20		
clay	115	118	3	3		
sand and gravel	118	149	31	18		
reddish brown clay, pebbly	149	164	15	7		
gravel	164	170	6	18		Weighted Specific Yield
sand and clay	170	190	20	5		12.9
tan clay, some gravel	190	210	20	7	D	
hard green clay	210	240	30	3		
tan sand	240	248	8	20		
clay and sand	248	260	12	5		
fine sand	260	277	17	20		
gravel	277	283	6	18		
fine sand	283	293	10	20		
fine gravel	293	310	17	18		
sand and clay	310	340	30	5		
coarse gravel	340	356	16	18		Weighted Specific Yield
gravel and clay	356	370	14	7		10.8
fine sand	370	394	24	20	E	
coarse gravel boulders	394	426	32	18		
gravel	426	456	30	18		
clay sand and gravel	456	500	44	7		
sand clay and gravel	500	570	70	7		
gravel and clay	570	600	30	7		
silt and clay	600	619	19	5		
black mud	619	621	2	3		Weighted Specific Yield
gravel	621	670	49	18		12
hard clay, sandstone	670	675	5	3	BEDROCK	Weighted Specific Yield
						3
Total Depth	675			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**11.8**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

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WELL 30S/11E-7Q03 (LA12)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
sandy brown soil	0	6	6	unsaturated	A	Weighted Specific Yield
sand	6	17	11	20		20
clay some gravel	17	20	3	7	C	
sand	20	48	28	20		
clay	48	52	4	3		Weighted Specific Yield
cemented sand	52	127	75	15		15.6
clay	127	230	103	3	D	
sand some gravel	230	245	15	18		Weighted Specific Yield
gravel	245	276	31	18		7.6
clay	276	325	49	3	E	
sand	325	332	7	20		
clay	332	343	11	3		
sand	343	350	7	20		
sand and gravel	350	356	6	18		
rock	356	357	1	15		Weighted Specific Yield
sand and gravel	357	402	45	18		11.1
clay	402	411	9	3	BEDROCK	Weighted Specific Yield
						3
Total Depth	411			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**11.3**

#	corrected depth using e-log

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

WELL 30S/11E-17C01 (LA23)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
sandy soil	0	3	3	unsaturated	A	
sand	3	28	25			
sandy clay	28	34	6	5		Weighted Specific Yield
sand	34	48	14	20		15.5
clay	48	52	4	3	C	
sand and gravel	52	56	4	18		
clay	56	76	20	3		
clay and gravel	76	80	4	7		
sandy clay	80	91	11	5		
sand	91	104	13	20		
clay	104	108	4	3		Weighted Specific Yield
sand	108	114	6	20		9.4
silty clay	114	148	34	5	D	
sandy clay	148	165	17	5		
sand	165	183	18	20		Weighted Specific Yield
sand and gravel	183	230	47	18		12.6
clay	230	236	6	3	E	
sandy clay	236	246	10	5		
sand and gravel	246	254	8	18		Weighted Specific Yield
clay	254	270	16	3		6.5
Total Depth	270			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**11**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

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WELL 30S/11E-17J01 (LA24)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
all inferred from e-log						
no data	0	8	8	unsaturated	C	
clay	8	15	7			
sandy clay	15	37	22	5		
clay	37	40	3	3		
sandy clay	40	48	8	5		Weighted Specific Yield
sand	48	72	24	20		11.2
sandy clay	72	118	46	5	D	
sand	118	128	10	20		
sandy clay	128	150	22	5		
sand	150	163	13	20		
clay	163	168	5	3		Weighted Specific Yield
sand	168	189	21	20		10.6
sandy clay	189	214	25	5	E	
sand	214	220	6	20		
clay with sand beds	220	232	12	5		
sand, some clay	232	244	12	15		
clay	244	262	18	3		
sandy clay	262	271	9	5		
clay	271	278	7	3		
sandy clay	278	291	13	5		
clay	291	297	6	3		
sandy clay and clay	297	315	18	5		
clay	315	319	4	3		Weighted Specific Yield
sand	319	329	10	20		7.1
rock	329	333	4	13	BEDROCK	Weighted Specific Yield
						13
Total Depth	333			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**9.1**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

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WELL 30S/11E-17N10 (LA20)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
fill	0	3	3		A	Weighted Specific Yield
sand	3	37	34	20		20
clay	37	42	5	3	B	
gravelly clay	42	50	8	7		
clay	50	58	8	3		
sand and gravel	58	81	23	18		
sand	81	92	11	20		Weighted Specific Yield
sand and gravel	92	98	6	18		13.7
clayey sand	98	120	22	5	C	
sand and gravel	120	150	30	18		
clayey gravel	150	170	20	7		
gravelly sand	170	187	17	18		
gravelly clay	187	197	10	7		Weighted Specific Yield
sandy gravel	197	210	13	18		12.5
clay	210	225	15	3	D	
sand and gravel	225	250	25	18		
sandy clay	250	260	10	5		
sand and gravel	260	270	10	18		
gravelly clay	270	275	5	7		
gravelly sand	275	290	15	18		
sandy clay	290	320	30	5		Weighted Specific Yield
sand	320	400	80	20		14.6
sandy clay	400	480	80	5	E	
gravelly sand	480	530	50	18		
sand / silty sand	530	630	100	5		Weighted Specific Yield
sandy clay	630	750	120	5		6.9
Total Depth	750			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**10.8**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

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WELL 30S/11E-18K08 (LA18)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
						Weighted Specific Yield
sand	50	110	60	20	A & B	20.00
sandy clay	110	132	22	5	C	
cemented sand	132	151	19	15		
sandy clay	151	158	7	5		
sand	158	195	37	20		
sandy clay	195	200	5	5		
sand	200	225	25	20		
sandy clay	225	235	10	5		
sand	235	254	19	20		
sandy clay	254	260	6	5		Weighted Specific Yield
sand with gravel	260	264	4	18		14.5
sandy clay	264	288	24	5	D	
clayey sand	288	305	17	5		
sandy clay	305	310	5	5		
clayey sand	310	324	14	5		
clay with sand	324	350	26	5		
silty sand	350	370	20	3		
sandy clay	370	380	10	5		
sand	380	386	6	20		
sandy clay	386	395	9	5		Weighted Specific Yield
silty sand	395	490	95	3		4.4
clay sandy clay	490	515	25	5	E	
silty sand	515	592	77	3		Weighted Specific Yield
sand with seashells	592	660	68	20		10.1
Total Depth	660			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**10.1**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

FINAL DRAFT 062815

WELL 30S/11E-18M01 (LA16)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
fine brown sand	40	70	30	20	C	
sand, sandy clay	70	160	90	5		Weighted Specific Yield
sand	160	165	5	20		9.2
sandy clay	165	245	80	5	D	
sandy clay with gravel	245	275	30	7		
sandy clay	275	350	75	5		Weighted Specific Yield
sand and gravel	350	372	22	18		6.7
sandy clay with gravel	372	392	20	5	E	
sandy clay	392	460	68	7		
sandy clay with gravel	460	490	30	5		
sandy clay	490	536	46	7		
sand and gravel	536	562	26	18		Weighted Specific Yield
sandy clay with gravel	562	630	68	7		7.7
Total Depth	630			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**7.7**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

FINAL DRAFT 062815

WELL 30S/11E-20G02 (LA26)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
silty-clay-soil	0	11	11	unsaturated	C	
gravel	11	15	4			
clayey sand	15	53	38	5		
gravel	53	55	2	18		Weighted Specific Yield
clayey sand	55	75	20	5		5.4
clay	75	117	42	3	D	
gravel	117	120	3	18		
sand	120	197	77	20		Weighted Specific Yield
coarse sand and gravel	197	213	16	18		14.6
clayey sand	213	290	77	5	E	
sand	290	315	25	20		Weighted Specific Yield
gravelly sand	315	335	20	18		10.2
bedrock, tight rock	335	380	45	15	BEDROCK	Weighted Specific Yield
						15
Total Depth	380			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**11.2**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*