**BASIN MANAGEMENT COMMITTEE BOARD OF DIRECTORS**

**Agenda Item 5a: Minutes of the Meeting of March 21st, 2018**

| Agenda Item | Discussion or Action |
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| **1. CALL TO ORDER**<br><br>**2. PLEDGE OF ALLIGANCE**<br><br>**3. ROLL CALL** | Director Ochylski serving as chair called the meeting to order at 1:35 pm and Director Garfinkel led the Pledge of Allegiance.<br><br>Mr. Miller, acting Clerk, called roll to begin the meeting. Director Zimmer, Director Garfinkel, Director Gibson, and Chairperson Ochylski were all present. |
| **4. Board Member Comments** | Director Ochylski: I have to leave at 3:00 pm today for pending flood issues if we are not completed by then our vice chair will take over.<br><br>Director Garfinkel: The RAC is sponsoring a meeting with the Board of Supervisors chambers on April 4 to explain the legal ramifications of everything that is going on with SGMA and land use. There will be some lawyers present to answer questions at that time. |
| **5a. Minutes of the Meeting of March 21st, 2018**<br><br>**5b. Approval of Budget update and Invoice Register through December 2017** | No Board or Public comment.<br><br>Director Garfinkel: Motion to accept the consent agenda.<br>Director Gibson: Second the Motion.<br><br>**Ayes: Director Zimmer, Director Garfinkel, Director Gibson, Chairperson Ochylski**<br>**Nays: None**<br>**Abstain: None**<br>**Absent: None** |
| **6. Executive Director's Report** | Executive Director, Rob Miller, provided a verbal overview of the written content of the Executive Director's report.<br><br><u>Questions from the Board</u><br><br>Director Garfinkel: We spoke at the last meeting about that we're going to do a metric for the upper aquifer, has that been established?<br><br>Mr. Miller: You will see more about that in the draft annual report that Cleath Harris is currently authoring.<br><br>Director Zimmer: I had question regarding the funding and financing of programs. It talks about the staff engaging in the IRWM process of the creek discharge, can you expand on that?<br><br>Mr. Miller: There hasn't been any new development on that, but we did submit a summary of the project about a year ago and it got included in the list of IRWM projects. It was to do the up-front work that would be necessary to accomplish a creek discharge. Ultimately that might be an investment that would have to be considered here at the community level if we're not successful in securing funds from the IRWM. The tracer and travel time studies was a 6 figure number, and other local communities are making similar investments in projects like these. That's a decision that will be in front of us at some |

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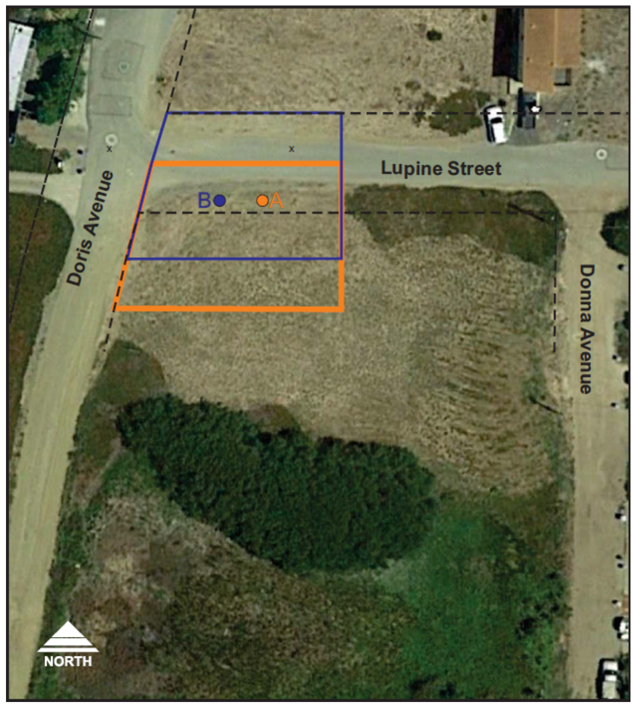
| | point.<br><br>Public Comment<br><br>No public comment.<br><br>Response from the BMC<br><br>No Response |
| **7a. Update on Status of Basin Plan Infrastructure Projects** | Mr. Miller: Gave a detailed overview on the status of the Basin Plan Infrastructure Projects and showed the following exhibit to show work area options for a Lupine Street Monitoring Well.<br><br><br><br><br>Director Ochylski: Just for clarification, the Cleath Harris contract was contingent on the agency's approving the budget, has everyone approved that budget?<br><br>Mr. Miller: Yes, the County is working on an internal process, but yes Cleath has already begun.<br><br>Public Comment<br><br>Mr. Cesena: Do you know anywhere in the State, not just locally, where metering has been attempted?<br><br>Ms. Stuckey: There are areas in the State that do meter. They are within management districts that do it pursuant to their principal acts. The County is in a position to monitor pursuant to its police power. I think some Counties have done so but I'm not sure which ones. I think most jurisdictions are planning to start metering pursuant to the authorities under SGMA and their groundwater sustainability plans.<br><br>Director Zimmer: The blending project for Skyline Well, I think we could put that in the completed status. Maybe change the name of the project to the Blending Project and |

Rosina Nitrate Removal or something of that nature.

Mr. Miller: We will list that project as complete.

Director Gibson: I see a potential benefit of monitoring individual meters. I would also like to put forth the concept of how it may be beneficial to first offer meters for people to use voluntarily as well as having people read the meters voluntarily. Imposing meters on people would come to the County, and that is a political issue that will need a very good basis to engage. In the Director's Report, Rob, you mentioned that new wells in the upper and lower aquifer viewed as aquifer management not eligible for grants under Prop 1. I've been talking a lot about denitrifying upper aquifer for drinking water. Can we not go back to the idea that anything we pull out of the upper aquifer and treat is cleaning up that aquifer?

Mr. Miller: That is a good observation; after multiple conversations as to why our programs prevent or reverse sea water intrusion they couldn't get over the fact that we are pulling it out of the ground and not treating it. Treatment efforts are more grant eligible. The challenge there is that operation and maintenance costs are not, which are about $1,000 an acre ft.

Director Gibson: We have talked about extending upper aquifer denitrification. I'd be interested in bringing it back as a discussion item, with possibility of grant funding. It's such a direct effect on the aquifer by displacing pumping and a direct way to fight sea water intrusion.

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| **7b. Support for Potential Basin Boundary Modification Request for Los Osos Groundwater Basin** | Ms. Martin: Gave a detailed presentation on the Potential Basin Boundary Modification Request for Los Osos Groundwater Basin.<br><br>Director Ochylski: For the March 26th meeting could you give a time and place?<br><br>Ms. Martin: Yes, it's at 6:00 PM at the Cal Fire Training Center.<br><br>Director Garfinkel: I asked at a previous meeting for a better definition of the boundary between the second area and our basin management area where the line cuts across. Is that in Montana de Oro or is it below that? The dotted line that runs east and west?<br><br>Ms. Martin: This is all State Park area through here. There is a map on our SGMA website that you can zoom and see all the roads in that area, as well as the adjudication and fringe areas.<br><br>Director Garfinkel: Would the BMC have to go back to court to get revisions to our court order?<br><br>Ms. Martin: No, we had a discussion with the State about that, this should be in the confines of your ISJ.<br><br>Director Gibson: If our adjudicated area is bigger than the Basin, there is no problem since we are managing more than the Basin. The only thing the State cares about it that we are managing the Basin, or that, that part of the Basin is adjudicated.<br><br>Director Garfinkel: Do court documents have to be modified?<br><br>Director Gibson: No, at this point it doesn't seem like that. Cathy, you've received positive feedback from DWR about this correct?<br><br>Ms. Martin: Yes, we've been talking for a year now. We've had a couple meetings with them and they like our approach. They prefer the jurisdictional approach for this Basin.<br><br>Director Gibson: Would you be asking the Basin Management Committee as an entity to write a letter to support, or individual purveyors, or both?<br><br>Ms. Martin: Yes, we have an action item for the BMC to have the Executive Director provide a letter of support. Also, for the jurisdictional approach, to get a new sub basin, the law requires us to have ¾ support. That would mean letters of support or a resolution from all affected agencies or water purveyors within the system. We would like to have that before mid-May.<br><br>Director Zimmer: Did you mention that there is a characterization study?<br><br>Ms. Martin: Yes, we received some comments from the State when we met with them and incorporated the comments. Cleath Harris is finalizing that study for us. It will be a public draft, so we hope to receive any additional comments before April 10th.<br><br>Director Zimmer: How will the Eastern Valley Sub Basin comply with the BMC? Will that be its own entity?<br><br>Ms. Martin: The Los Osos Area Sub Basin and Eastern Valley Sub Basin are two separate identities for management. |

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| | Director Gibson: Yes, the Eastern Valley Sub Basin would be for the County to deal with and hopefully there wouldn't be much that we'd have to do.<br><br><u>Public Comment</u><br><br>Mr. Edwards: How is this going to help manage our Basin? I support the letter though and see no problem with that. Ms. Martin regarding your timeline, I know the BMC was working with and paying Cleath Harris in the Basin Management Boundary Determination early on, but my question is, when did we stop paying and the County start?<br><br><u>BMC Comments</u><br><br>Mr. Miller: So, in the first year of this committee we had a budget and line item for Basin Boundary Study and Modification and this committee paid $20,000 - $25,000 for that study. That was the only expenditure that this committee made. After that and the request was turned down on a scientific basis. After that denial is when the County took the lead on it. The advantage of this process is clarity of management with the State. As we pursue further actions that might fall under DWR's jurisdiction for grants or other reasons, we would now have clear management boundaries.<br><br>Director Gibson: The functional advantage of that is we have a Basin Management Plan that applies to the adjudicated area. If we can get the designation of the Eastern Valley as a sub basin, we have confirmed that there is no interaction between those two basins to take into consideration. So, it validates our Basin Management and leaves the Eastern Valley to be managed on its own merits.<br><br>Ms. Martin: To Rob's point, the Flood Control District did hire Cleath Harris for this to help SGMA efforts, because we need a Groundwater Sustainability Plan by 2020. So, this is a preliminary report to help fill that in as well.<br><br>Mr. Miller: This is an action item, so we are hoping to take Staff's action.<br><br>Director Ochylski: So, are we in support of sending a letter of support?<br><br>Director Zimmer: I motion that we authorize staff to send in a letter of support.<br><br>Director Garfinkel: I second that.<br><br>**Ayes: Unanimous.**<br>**Nays: None**<br>**Abstain: None.**<br>**Absent: None** |
| **7c. Water Conservation Program Update** | Mr. Miller: Gave a detailed overview of the Water Conservation Program Update.<br><br>Director Zimmer: Are the costs for community meeting, such as facilities, going through the BMC?<br><br>Mr. Miller: Yes, the facility cost is minimal, about $40-$50 an hour.<br><br>Director Zimmer: Since there are so many rebates out there with boundaries and zones, some of these rebates may or may not apply, we are trying to design a trifold manual with |

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| | all this information. We are currently working on that.<br><br><u>Public Comment</u><br><br>Mr. Edwards: Between the individual purveyor conservation programs, Title 19, the building construction code, and the rebate program, all these programs are confusing for people. Once we're able to simplify those for people it will have a tremendous effect. I think we should organize singular program to change wasteful plumbing fixtures for instant water conservation. I also think it would be instructive to have updates on our bimonthly meetings about how much has been applied for and conserved under Title 19 and the rebate programs.<br><br><u>BMC Comments</u><br><br>Director Garfinkel: I think we should follow through with Mr. Edwards suggestion and track that conservation.<br><br>Mr. Miller: I think it's a good idea as well. |
| **7d. Groundwater Basin Modeling for Adaptive Management** | Mr. Miller: Gave a detailed overview of Groundwater Basin Modeling for Adaptive Management Report.<br><br>Director Zimmer: So, we have $10,000 for Cleath to do this work, if we decide not to do the transient model, what are the next steps?<br><br>Mr. Miller: Everything in Cleath's scope of work is included in the $10,000. It's a complete package of those items included in the attached proposal. The reason I brought forward the transient model is when we talk about adaptive management, people want to talk about what happens if we have a drought, and I want to be transparent that's not what we're doing. We are looking at infrastructure over a steady state with sustained production at current levels.<br><br>Director Garfinkel: To be more specific, the SEAWAT that we're talking about, is that one we'd have to purchase?<br><br>Mr. Miller: No, we already use SEAWAT as part of the current groundwater model. It has more capabilities than what we are currently using.<br><br>Director Gibson: I appreciate you looking into it, but the cost benefit isn't quite there yet. Another part of it is, do we have enough observations on this Basin to really make a transient model work right now, maybe in time.<br><br><u>Public Comment</u><br><br>Mr. Edwards: I don't support the idea at this time. Perhaps when we get a few years down the road, when we have a new Program C well in the ground, or Program B nitrate removal up and running. It would be premature, and we need to get more facilities on the ground before we can begin to look at this.<br><br><u>BMC Comments</u> |

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| | Director Gibson: Motion to Approve the proposed scope and fee for hydrogeologic services in an amount not to exceed $10,000, as approved in the calendar year 2018 budget.<br><br>Director Garfinkel: I second that.<br><br>**Ayes: Unanimous.**<br>**Nays: None**<br>**Abstain: None.**<br>**Absent: None** |
| **8. PUBLIC COMMENTS ON ITEMS NOT APPEARING ON THE AGENDA** | Mr. Edwards: I feel there are several things that should be on upcoming agendas. We didn't get a creek discharge update today, but I feel that project priority is slipping, and I think we need to move forward on that. We didn't have the delivery of treated water to dryland farmers, I would like to see it back on the agenda. Is anyone going to talk about the $10 Million that is getting taken out of our community because the County settled the ARB Lawsuit; that was money for our water projects. I would encourage committee members to read the Resource Management System for the County, I feel like there are a lot of inaccuracies in it.<br><br>Mr. Cesena: I like the idea of revisiting the recycled water contracts, I just don't think that should happen. I'd also like a bigger picture look at what is going on at planning and development at the County in terms of building permits that are being issued. |
| **9. ADJOURNMENT** | Meeting was adjourned at 2:45 pm.<br>The next meeting will be on May 16th at the South Bay Community Center in Los Osos at 1:30 pm. |

**TO:** Los Osos Basin Management Committee

**FROM:** Rob Miller, Interim Executive Director

**DATE:** May 16, 2018

**SUBJECT:** Item 5b – Approval of Budget Update and Invoice Register through May 16, 2018, 2018

## Recommendations

Staff recommends that the Committee review and approve the report.

## Discussion

Staff has prepared a summary of costs incurred as compared to the adopted budget through May 16, 2018 (see Attachment 1). A running invoice register is also provided as Attachment 2. Staff recommends that the Committee approve the current invoices, outlined in Attachment 3. Payment of invoices will continue to be processed through Brownstein Hyatt as noted in previous meetings.

**Attachment 1: Cost Summary (Year to Date) for Calendar Year 2018**

| Item | Description | Budget Amount | Costs Incurred | Percent Incurred | Remaining Budget |
|---|---|---|---|---|---|
| 1 | Monthly meeting administration, including preparation, staff notes, and attendance | $50,000 | $13,256.63 | 26.5% | $36,743 |
| 2 | Meeting expenses - facility rent (if SBCC needed for larger venue) | $1,000 | $240.00 | 24.0% | $760 |
| 3 | Meeting expenses - audio and video services | $6,000 | $0.00 | 0.0% | $6,000 |
| 4 | Adaptive Management - Groundwater Modeling | $10,000 | $0.00 | 0.0% | $10,000 |
| 5 | Semi annual seawater intrusion monitoring | $26,400 | $1,320.00 | 5.0% | $25,080 |
| 6 | Annual Report - not including Year 1 start up costs | $29,600 | $21,355.00 | 72.1% | $8,245 |
| 7 | Grant writing (outside consultant) | $5,000 | $0.00 | 0.0% | $5,000 |
| 8 | Creek Recharge and Replenishment Studies | $15,000 | $0.00 | 0.0% | $15,000 |
| 9 | Cuesta by the Sea Monitoring well | $115,000 | $840.00 | 0.7% | $114,160 |
| 10 | Conservation programs (not including member programs) | $10,000 | $0.00 | 0.0% | $10,000 |
| | Subtotal | $268,000 | $0.00 | | $230,988 |
| | 10% Contingency | $26,800 | | | |
| | **Total** | **$294,800** | **$37,011.63** | **12.6%** | **$257,788** |
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| | LOCSD (38%) | $112,024 | | | |
| | GSWC (38%) | $112,024 | | | |
| | County of SLO (20%) | $58,960 | | | |
| | S&T Mutual (4%) | $11,792 | | | |
| Notes | | | | | |

**Attachment 2: Invoice Register for Los Osos BMC for Calendar Year 2018 (through May 16, 2018)**

| Vendor | Invoice No. | Amount | Month of Service | Description | Budget Item | Previously Approved |
|---|---|---|---|---|---|---|
| CHG | 20180203 | $11,095.00 | Feb-18 | Annual Report | 6 | Yes |
| Wallace Group | 0384-0011-01 | $5,325.00 | Jan-18 | Administration | 1 | Yes |
| CHG | 20180303 | $10,260.00 | Mar-18 | Annual Report | 6 | |
| CHG | 20180304 | $1,320.00 | Mar-18 | Semi-annual groundwater monitoring | 5 | |
| CHG | 20180305 | $840.00 | Mar-18 | Cuesta-By-The-Sea Monitoring Well | 9 | |
| Wallace Group | 45731 | $3,475.47 | Feb-18 | Administration | 1 | |
| Wallace Group | 45911 | $4,456.16 | Mar-18 | Administration | 1 | |
| SBCC | 99 | $120.00 | Jul-17 | Meeting Expenses-Facility Rent | 2 | |
| SBCC | 113 | $120.00 | Mar-18 | Meeting Expenses-Facility Rent | 2 | |
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| **Total** | | **$37,011.63** | | | | |

Not yet approved

# ATTACHMENT 3

## Current Invoices Subject to Approval for Payment (Warrant List as of May 16, 2018):

| Vendor | Invoice # | Date of Services | Amount of Invoice |
|---|---|---|---|
| CHG | 20180303 | Mar-18 | $10,260.00 |
| CHG | 20180304 | Mar-18 | $1,320.00 |
| CHG | 20180305 | Mar-18 | $840.00 |
| Wallace Group | 45731 | Feb-18 | $3,475.47 |
| Wallace Group | 45911 | Mar-18 | $4,456.16 |
| SBCC | 99 | Jul-17 | $120.00 |
| SBCC | 113 | Mar-18 | $120.00 |

**TO:** Los Osos Basin Management Committee

**FROM:** Rob Miller, Interim Executive Director

**DATE:** May 16, 2018

**SUBJECT:** Item 6 – Executive Director's Report

**Recommendations**

Staff recommends that the Committee receive and file the report, and provide staff with any direction for future discussions.

**Discussion**

This report was prepared to summarize administrative matters not covered in other agenda items and also to provide a general update on staff activities.

<u>Basin Infrastructure Program Update</u>

Staff elected to defer this regular agenda item to the June meeting to allow for more preparation on the subject of second Program C expansion well. A number of letters have been received from the community on the topic, and a complete discussion will take place in June.

<u>Funding and Financing Programs to Support Basin Plan Implementation</u>

As indicated in the January 2018 meeting the State Board confirmed that sea water intrusion mitigation projects under Program C are eligible for low interest loans but are not currently eligible for grants under Proposition 1. New wells in the upper and lower aquifer are viewed as aquifer management, not aquifer clean-up as defined by the State, therefore we will need to look for future funding rounds and other opportunities. Staff has engaged in the IRWM process with SLO County for the Los Osos Creek Replenishment and Recharge Project (IRWM Project ID 2017 NT-07).

During the March BMC meeting, the committee requested additional information regarding the grant eligibility of Program B project. Staff is currently working on that issue and will bring it back in a subsequent meeting. In addition, staff continues to look for strategic partners to team on the baseline studies required to accomplish a creek discharge project. Key initial tasks include water quality monitoring within the stream, installation of downgradient monitoring wells, and additional modeling and travel time testing.

<u>Status of Zone of Benefit Analysis</u>

Similar to previous updates, no special tax measure is being pursued by staff to fund BMC administrative or capital costs. This item has been removed from the BMC budget for 2018. At the March meeting, the BMC approved a formal review of assets in place and pending, under the principles of adaptive management. The Zone of Benefit approach can be initiated at any time as directed by the BMC.

Sustainable Groundwater Management Act (SGMA) and Basin Boundary Modification Request (BBMR) Updates

*SGMA Update*: As indicated in the July 2017 update, the Plan Area defined in the Los Osos Basin Plan and approved by the Court is largely exempt from the requirements of SGMA. However, SGMA compliance is currently required in the areas outside of the adjudicated management area, but within the State's designated basin boundary (i.e., "fringe areas", see attached Figure 1).

On April 4, 2017, the County of San Luis Obispo (County) Board of Supervisors decided to become the Groundwater Sustainability Agency (GSA) for the Los Osos Basin "fringe areas". The GSA's first key steps is understanding the "fringe areas". The County and its consultant, Cleath-Harris Geologists, Inc., are in the process of finalizing a basin characterization study (Study), in order to characterize and develop a hydrogeologic conceptual model of the "fringe areas". The Study is available on line at: <https://www.slocountywater.org/site/Water%20Resources/SGMA/lososos/>.

*BBMR Update*: The California Department of Water Resources (DWR) is responsible for defining basin boundaries, but recognizes that refined scientific data or jurisdictional information may warrant boundary modifications. As such, DWR will periodically open basin boundary modification request periods for local agencies to submit requests and supporting scientific or jurisdictional information. DWR opened a 6-month request window on January 1, 2018. Local agencies may submit requests by June 30, 2018 for DWR consideration. More information on DWR's process can be found at: < http://water.ca.gov/groundwater/sgm/basin_boundaries.cfm >.

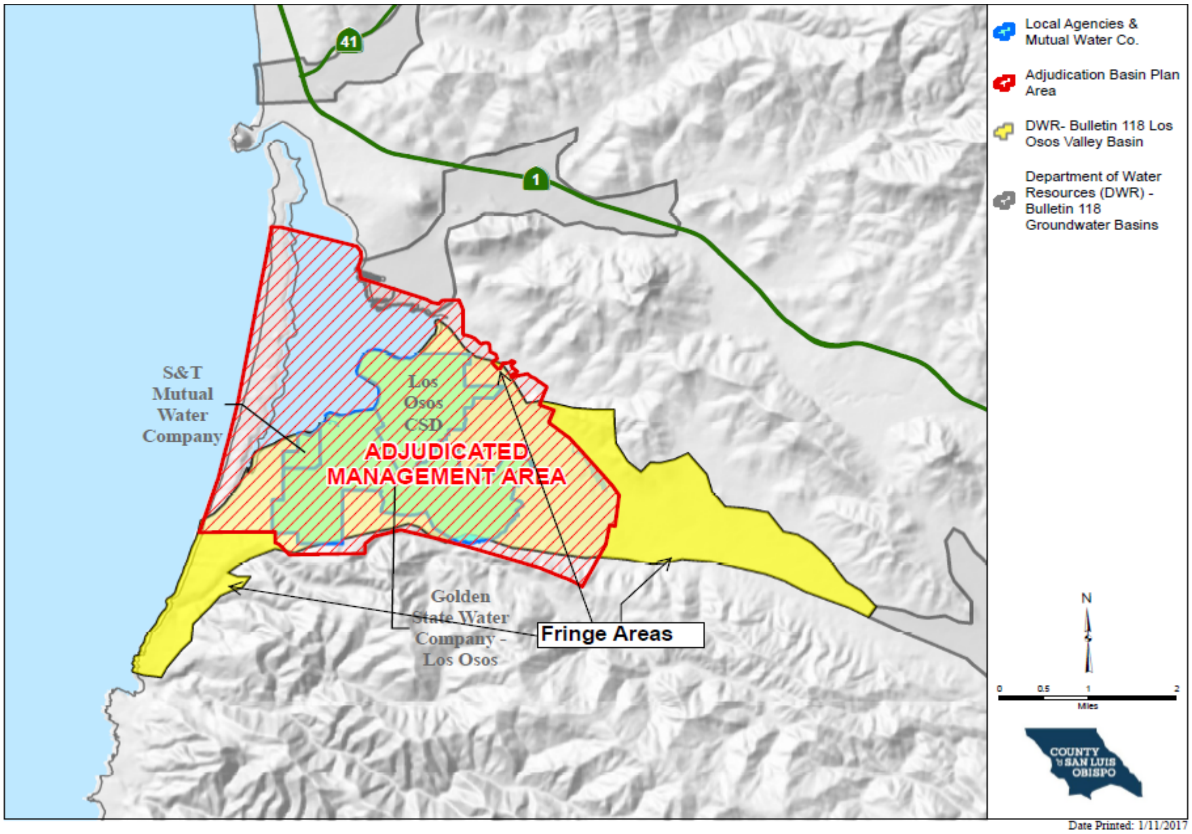
On March 20, 2018, County staff submitted the notice of intent to explore a boundary modification for the Los Osos Basin to DWR. Basin outreach for the BBMR process included presenting 1) the recommended Los Osos Basin boundary modifications (see Figure 2), 2) review supporting scientific information from the Study, and 3) BBMR regulation procedures for providing comments to the County and DWR. Public meetings included the March 21, 2018 Los Osos BMC meeting and an evening meeting hosted by the County on March 26, 2018. The BMC authorized the release of a letter of support, which was issued on May 8, 2018 (see attached copy).

On June 5, 2018, County Staff will present the recommended Los Osos Basin boundary modifications to the County Board of Supervisors, and the Board will consider submitting a BBMR to the DWR. Please consider attending and providing comments during the meeting, held at the County Government Center, 1055 Monterey Street, San Luis Obispo, CA 93408. Please see the agenda regarding time of day for the item, available on May 29th and located at: <https://www.slocounty.ca.gov/Departments/Board-of-Supervisors/Board-Meetings,-Agendas-and-Minutes.aspx>.

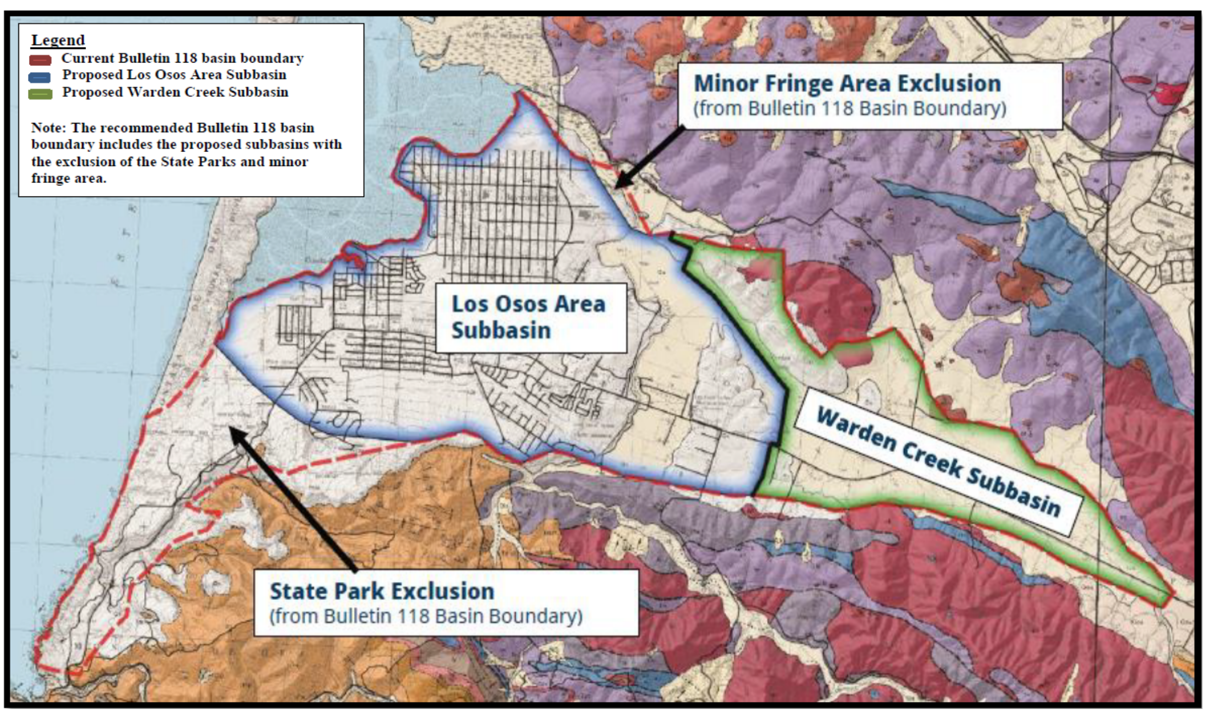
Benefits from the proposed basin boundary modification includes the following:

- The proposed modifications will better align the adjudicated area boundary with the Bulletin 118 Los Osos Basin boundary, founded on the best available scientific information.
- The proposed basin boundary modifications will clarify that the Basin Management Committee's management efforts are focused on the Adjudicated area and the County Los Osos Basin GSA's SGMA management efforts are focused in a separate subbasin.

## Figure 1. Current Los Osos Valley Groundwater Basin




## Figure 2. Proposed Los Osos Basin Boundary Modification



Los Osos Wastewater Project Flow and Connection Update

- Of the 177 unconnected properties, 72 are waiting for the County/USDA/LOCSD low-income grant program to pay for their connection leaving 105 properties that may require enforcement. Of the 105 properties, 32 are in the process of connecting (ie: obtained a building permit), and 13 have responded to the County's survey giving reasons why they are not connected yet. Subtracting those categories leaves 60 properties (1.3% of 4583 total parcels) that are the focus of the Code enforcement process.
- The County is in the process of securing a Board date & preparing a staff report to amend the County Code. The Board date is scheduled for August 7, 2018.
- Influent flows into the treatment facility are peaking at 0.50 mgd. No recycled water deliveries have been made to irrigation users yet. Effluent is being disposed at both Broderson and Bayridge leachfields. As of 3/31/2018, effluent disposal totaled 133.7 AF to Broderson and 6.5 AF to Bayridge leachfields. The development of the expected groundwater mount downgradient of Broderson continues as shown in the attached recent hydrograph of monitoring well FW-6. Recycled water agreements are being finalized with LOCSD and GSWC for the delivery of recycled water to the schools and urban areas, and the schools will be retrofitted to receive recycled water during the 2018 summer break.

Option to Bring Morro Bay Wastewater to Los Osos WWRF

Similar to staff's last update, it was determined that both summer and winter peak day flows at the City of Morro Bay are expected to exceed the available capacity in the Los Osos Wastewater Reclamation Facility, and therefore an expansion would be required to accommodate the higher flows. A number of peak day flows of over 3 mgd have been observed at the existing Morro Bay facility. Additional information on the Morro Bay project can be found here: http://morrobaywrf.com/.

May 7, 2018

Supervisor Peschong, Chair
Board of Supervisors
County of San Luis Obispo
1055 Monterey St., Room D-430
San Luis Obispo, CA 93408

Re: Letter in Support of the Basin Boundary Modification Request for the Los Osos Valley Groundwater Basin

Dear County Board of Supervisors:

The Basin Management Committee ("BMC") is writing this letter in support of the County of San Luis Obispo's ("County") Board of Supervisors for the Los Osos Basin Fringe Areas Groundwater Sustainability Agency ("Los Osos Basin GSA"), request to modify the boundaries of the Los Osos Valley Groundwater Basin (DWR Bulletin 118 Basin No. 3-8 ("Los Osos Basin")).

The BMC is comprised of three water purveyors in Los Osos – Los Osos Community Services District (LOCSD), Golden State Water Company (GSWC) and S&T Mutual Water Company (S&T) and the County of San Luis Obipso (County), as part of the adjudication of groundwater in the Basin. The BMC also supports the proposed basin boundary modification.

As you know, the BMC is the entity responsible for implementing the groundwater management plan ("Basin Plan"), for the Los Osos Basin. The Basin Plan provides a comprehensive plan for the long-term sustainable management of the Los Osos Basin. The BMC was formed pursuant to the San Luis Obispo County Superior Court approval of the resolution of the groundwater basin adjudication in *Los Osos Community Services District v. Southern California Water company [Golden State Water Company]* et al. (San Luis Obispo County Superior Court Case No.CV 040126) (Adjudicated Plan Area). The BMC has been actively managing the adjudicated management area pursuant to the court approval since October 2015.

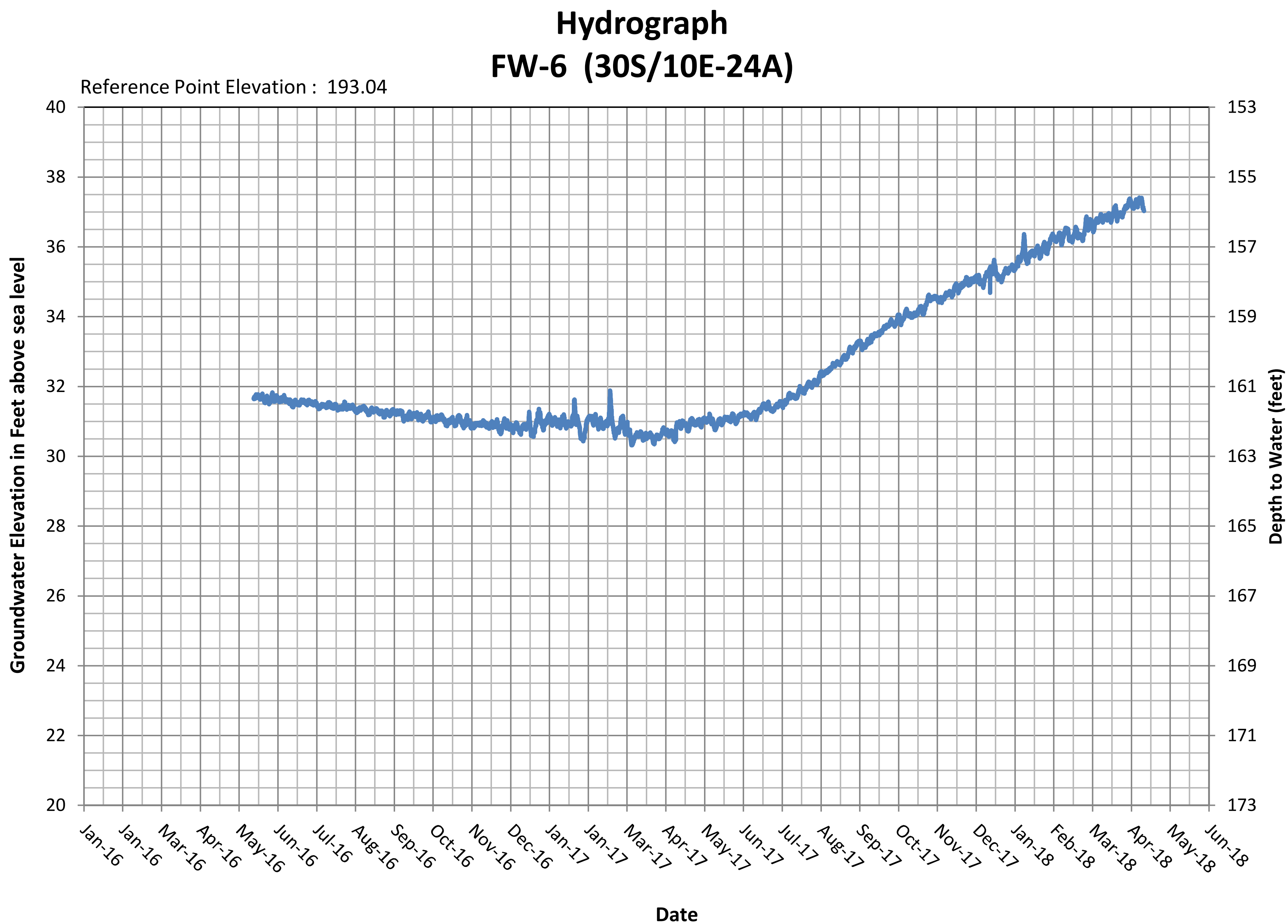
Groundwater from the Los Osos Basin is the sole water supply source for this region. The proposed basin boundary modification request includes two jurisdictional subdivisions ("subbasins") and two scientific exclusion areas (see attached Figure). The proposed Los Osos Area Subbasin is within the Adjudicated Plan Area and includes both scientific exclusion areas, the removal of Montana De Oro State Park to the Los Osos fault line and a minor fringe area removal (44 acres). Both exclusion areas and the proposed adjacent Fringe Area subbasin (Warden Creek Subbasin) are not included in the BMC Basin Plan based on differing geology, hydrogeological groundwater barriers with minimal groundwater connectivity to the Adjudicated Plan Area, and differing land use (recreation (State Parks), agricultural/rural, and urban). The proposed modifications will not affect the court-approved Stipulated Judgement and Basin Plan requirements but will help align the adjudicated area boundary with the Bulletin 118 Los Osos Basin boundary, founded on the best available scientific information. Ultimately, the proposed Los Osos Basin boundary modifications will support the BMC's and the Los Osos Basin GSA's management efforts in the two proposed subbasins.

The BMC supports the Los Osos Basin GSA modification request, as set forth from County staff consultation and the study prepared by Cleath-Harris Geologists. The proposed basin boundary modifications will result in a more accurate boundary to support a sustainable groundwater basin and improve sustainable management within the basin and participation by the appropriate parties.

Sincerely,

Rob Miller
Executive Director

Proposed Los Osos Basin Boundary



Hydrograph
FW-6 (30S/10E-24A)
Reference Point Elevation : 193.04
Groundwater Elevation in Feet above sea level
Depth to Water (feet)
Date
40
38
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34
32
30
28
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**TO:** Los Osos Basin Management Committee

**FROM:** Rob Miller, Interim Executive Director

**DATE:** May 16, 2018

**SUBJECT:** Item 7a – Presentation of Draft 2017 Annual Report

## Recommendations

Recommendations:
1. Receive a presentation from BMC staff regarding the draft 2017 Annual Report; and
2. Confirm June date for BMC meeting to approve final 2017 Annual Report for submission to the Court.

## Discussion

Section 5.8.3 of the Final Judgment requires that the preparation of an Annual Report by June 30 of each year. The BMC retained Cleath Harris Geologists (CHG) to prepare the second Annual Report for calendar year 2017. The draft work product prepared by CHG is attached, and a staff summary will be provided at the meeting. Please note that the development of an upper aquifer metric is not currently addressed in the draft. This issue will be discussed in concept during the May BMC meeting, but will be addressed by staff in writing prior to the consideration of the final 2017 Annual Report. A brief special meeting may be necessary in late June to adopt the report.

## Financial Considerations

Budget items 5 and 6 in the adopted calendar year 2018 to $56,000 for monitoring and preparation of the annual report. At this time, no budget adjustments are recommended.

**DRAFT**

# LOS OSOS BASIN PLAN
# GROUNDWATER MONITORING PROGRAM
# 2017 ANNUAL MONITORING REPORT

Prepared for the

BASIN MANAGEMENT COMMITTEE

MAY 2018

CLEATH-HARRIS GEOLOGISTS
71 Zaca Lane, Suite 140
San Luis Obispo, California 93401

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**EXECUTIVE SUMMARY**

The 2017 Annual Report describes Basin activities related to the Los Osos Basin Plan (LOBP) Groundwater Monitoring Program, and provides results and interpretation of these activities in calendar year 2017. The LOBP Groundwater Monitoring Program is necessary to accomplish the following continuing goals set forth in Section 2.4 of the LOBP (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 LOBP, 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.

**Groundwater Production**

Groundwater production for calendar year 2017 is summarized in Table ES-1 below. Purveyor production has increased by five 5 percent compared to 2016, while total basin production has decreased by 4 percent compared to 2016 due to lower estimated production for community facilities and agriculture.

**Table ES-1. Groundwater Production for Calendar Year 2016**

| Description | Production in Acre-Feet |
|---|---|
| Los Osos Community Services District | 570 |
| Golden State Water Company | 450 |
| S&T Mutual Water Company | 30 |
| **Purveyor Subtotal** | **1,050** |
| Domestic wells | 220 |
| Community facilities | 130 |
| Agricultural wells | 670 |
| **Total Estimated Production** | **2,070** |

**Basin Status**

The status of the Basin in terms of key parameters and metrics are as follows:

> **Precipitation**. The basin received above normal rainfall in 2017. The drought condition for San Luis Obispo County improved from exceptional drought (the highest intensity) to abnormally dry (the lowest intensity) during 2017.
>
> **Seawater intrusion front movement**. The seawater intrusion front retreated toward the coast between Fall 2016 and Fall 2017 (an improvement).
>
> **Basin Yield Metric**. The Basin Yield Metric improved between 2016 and 2017, and has met the LOBP goal for two consecutive years.
>
> **Water Level Metric**. The Water Level Metric improved between Spring 2016 and Spring 2017, but has not reached the target value.
>
> **Chloride Level Metric**. The Chloride Metric improved between Fall 2016 and Fall 2017, but has not reached the target value.
>
> **Nitrate Metric**. The Nitrate Metric did not improve between Winter 2016 and Winter 2017, and has not reached the target value.

Recommendations for improving the quality and availability of data are contained in Chapter 9 of the Annual Report. The recommendations include developing a rating curve for the stream gage on Los Osos Creek, developing specific yield values for individual aquifers to improve groundwater storage estimates, re-evaluating the Water Level Metric target, and further evaluation of wellbore flow and Upper Aquifer influence at Chloride Metric well LA10.

**LOBP Metrics**

As described in Section 7 ("Data Interpretation") of this Annual Report, the LOBP established several metrics to measure nitrate impacts to the Upper Aquifer, seawater intrusion into the Lower Aquifer, and the effect of management efforts of the Basin Management Committee (BMC). These metrics allow the Parties, the BMC, regulatory agencies, and the public to evaluate the status of nitrate levels and seawater intrusion, and the impact of implementation of the LOBP programs in the Basin through objective, numerical criteria that can be tracked over time. The status of key Basin metrics is summarized in Table ES-2.

| Table ES-2. LOBP Metric Summary | | | |
|---|---|---|---|
| **Metric** | **LOBP Goal** | **Calculated Value from 2017 Data** | **Recommended Actions in Addition to LOBP Programs** |
| **Basin Yield Metric** | 80 or less | 75 | Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2) |
| **Water Level Metric** | 8 feet above mean sea level or higher | 1.5 feet above mean sea level | Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2) |
| **Chloride Level Metric** | 100 mg/L or lower | 132 mg/L | Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2) |
| **Nitrate Metric** | 10 mg/L or lower | 32 mg/L (NO3-N) | None recommended |

## Adaptive Management Program

In addition to the programs described in the LOBP, the following additional measures are recommended in the context of adaptive management. Details regarding each program are provided in Section 10 of this Annual Report:

**Potential Adaptation of Urban Water Use Efficiency Program.** The BMC plans to take a close look at the Urban Water Use Efficiency Program to determine which conservation measures are the most efficient and effective to meet the LOBP's goals. This analysis may result in adaptation of some of the conservation measure set forth in the LOBP, including the addition of outdoor measures as described in Section 10.

**Development of Contingency Plan.** The BMC plans to develop a contingency plan and related actions in the event Basin Metric trends fail to demonstrate progress toward LOBP goals, including defined schedules and milestones.

**Discussion and Development of Metrics for Future Growth.** The BMC plans to provide input into the Los Osos Community Plan, including consideration of Basin Metrics and defined goals as they relate to the timing of future growth.

**Additional Water Quality Metrics.** The BMC intends to consider developing additional metrics and/or numerical goals to protect the upper aquifer from water quality threats, such as seawater intrusion and chromium-6 contamination.

## LOBP Infrastructure Programs

The status of LOBP infrastructure programs is summarized Table ES- 3.

| Table ES-3. Basin Infrastructure Projects | | | | |
|---|---|---|---|---|
| **Project Name** | **Parties Involved** | **Funding Status** | **Capital Cost** | **Status** |
| **Program A** | | | | |
| Water Systems Interconnection | LOCSD/ GSWC | Fully Funded | Construction Value: $103,550 | Project completed February 2017, with final approval in March 2017 |
| Upper Aquifer Well (8th Street) | LOCSD | Fully Funded | $250,000 | Well was drilled and cased in December 2016. Budget remaining $250,000 to equip the well. Design RFP was issued in April, and a consultant should be retained by June 2017. Project to be completed by June 2018 or earlier if possible. |
| South Bay Well Nitrate Removal | LOCSD | Completed | | |
| Palisades Well Modifications | LOCSD | Completed | | |
| Blending Project (Skyline Well) | GSWC | Fully Funded | Previously funded through rate case | Blending of Skyline Well and Rosina Well Project was completed. Project required modifications to include a new nitrate removal unit. Permits and equipment secured. Delivery of the treatment unit is estimated for the beginning of July. Assuming 4 weeks for installation, start-up is anticipated in September 2017. |
| Water Meters | S&T | Completed | | |
| **Program B** | | | | |
| LOCSD Wells | LOCSD | Not Funded | BMP: $2.7 mil | Project not initiated |
| GSWC Wells | GSWC | Not Funded | BMP: $3.2 mil | Project not initiated |
| Community Nitrate Removal Facility | LOCSD/GSWC | Partial | First phase combined with GSWC Program A | GSWC's Program A Blending Project allows for incremental expansion of the nitrate facility and can be considered a first phase in Program B. |

| Project Name | Parties Involved | Funding Status | Capital Cost | Status |
|---|---|---|---|---|
| **Program C** | | | | |
| Expansion Well No. 1 (Los Olivos) | GSWC | Fully Funded | Previously funded through rate case | Well has been drilled and cased. GSWC is in the equipping phase. Well can be used, if needed, using on-site generator. Formal startup of the well with permanent equipment is anticipated in July 2017. |
| Expansion Well No. 2 | GSWC | Pending Funding Vote | BMP: $2.0 mil | Property acquisition phase is on-going through efforts of LOCSD. Two sites are currently being reviewed, and both appear to be viable for new east side lower aquifer wells, Environmental studies initiated in December 2016 for expansion well #2. |
| Expansion Well 3 and LOVR Water Main Upgrade | GSWC | Pending Funding Vote | BMP: $1.6 mil | Property acquisition phase is on-going through efforts of LOCSD. Two sites are currently being reviewed, and both appear to be viable for new east side lower aquifer wells. |
| LOVR Water Main Upgrade | GSWC | Pending Funding Vote | BMP: $1.53 mil | Project not initiated |
| S&T/GSWC Interconnection | S&T/ GSWC | Pending | BMP: $30,000 | Conceptual design |
| **Program M** | | | | |
| New Zone D/E lower aquifer monitoring well in Cuesta by the Sea | All Parties | Not funded | $100,000 | Pending funding plan |

# 1. INTRODUCTION

The Los Osos groundwater basin was adjudicated in October 2015 (*Los Osos Community Services District v. Southern California Water Company [Golden State Water Company] et al.* (San Luis Obispo County Superior Court Case No. CV 040126) and is 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). This is the third Annual Report for the basin.

The 2017 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 LOBP (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 LOBP goals, 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) Program

- State Water Resource Control Board's (SWRCB) salt and nutrient monitoring guidelines as adopted in the state Recycled Water Policy

- Recycled Water Management Plan requirements for the Los Osos Water Recycling Facility (LOWRF)

This report was prepared by Cleath-Harris Geologists (CHG). Wallace Group contributed to the Executive Summary and produced Chapter 10 (Adaptive Management). BMC member agency staff provided assistance during field monitoring activities and with Annual Report review.

## 2. BACKGROUND

In August 2008, the Superior Court of the State of California for the County of San Luis Obispo (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 LOBP in January 2015. The LOBP 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 LOBP, providing water level and water quality data that serve as measures of effectiveness for LOBP programs and activities with respect to the restoration of basin water resources. A final Stipulated Judgment was approved by the Court on October 14, 2015.

The Sustainable Groundwater Management Act (SGMA) took effect on January 1, 2015, and requires that certain actions be taken in groundwater basins designated as either high or medium priority by the California Department of Water Resources (DWR), including the Los Osos Basin. DWR identified the Los Osos Basin as a high priority basin subject to critical conditions of overdraft due to seawater intrusion and nitrate impairment (DWR, 2014, 2016). SGMA does not apply to the LOBP plan areas covered by the Stipulated Judgment, which are shown in Figure 1. In order to comply with SGMA, the County formed the Groundwater Sustainability Agency (GSA) to cover groundwater basin areas between the Bulletin 118 Basin boundaries (Basin 3-8) and the LOBP area boundary, which are designated as "fringe areas". Hydrogeologic characterization of the fringe areas in support of a Basin Boundary Modification Request was initiated in 2017.

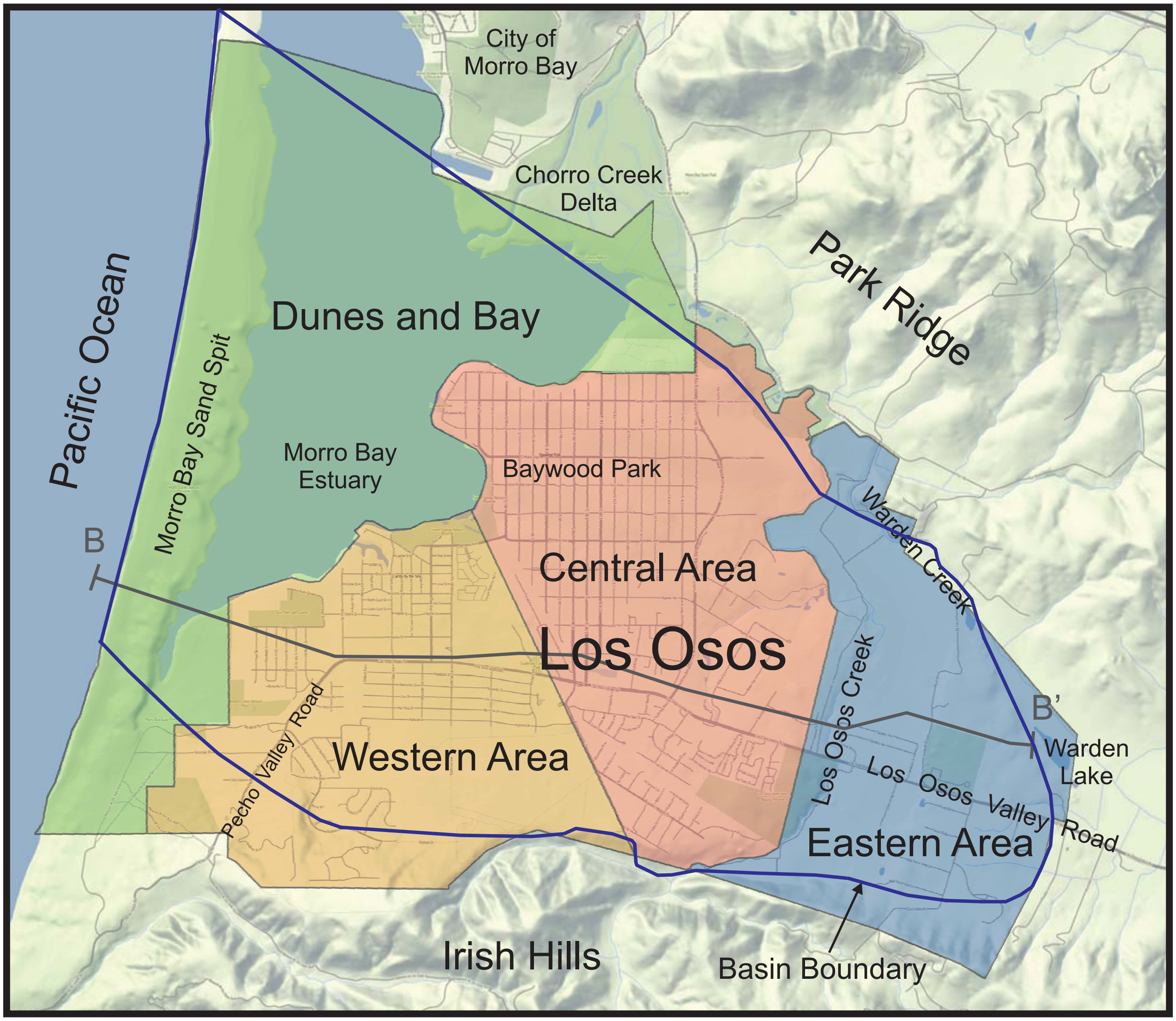
### 2.1 Groundwater Monitoring History

Groundwater monitoring has been performed by public agencies, water purveyors, and consultants for various basin studies and programs over several decades. A list of historical investigations, monitoring reports, and monitoring programs with a major focus on basin water levels and water quality through 2017 is included in Appendix A.

### 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 LOBP. 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).




Base Image: Stamen-Terrain



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 19). 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
2017 Annual Report

Cleath-Harris Geologists

- 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 LOBP via established metrics.

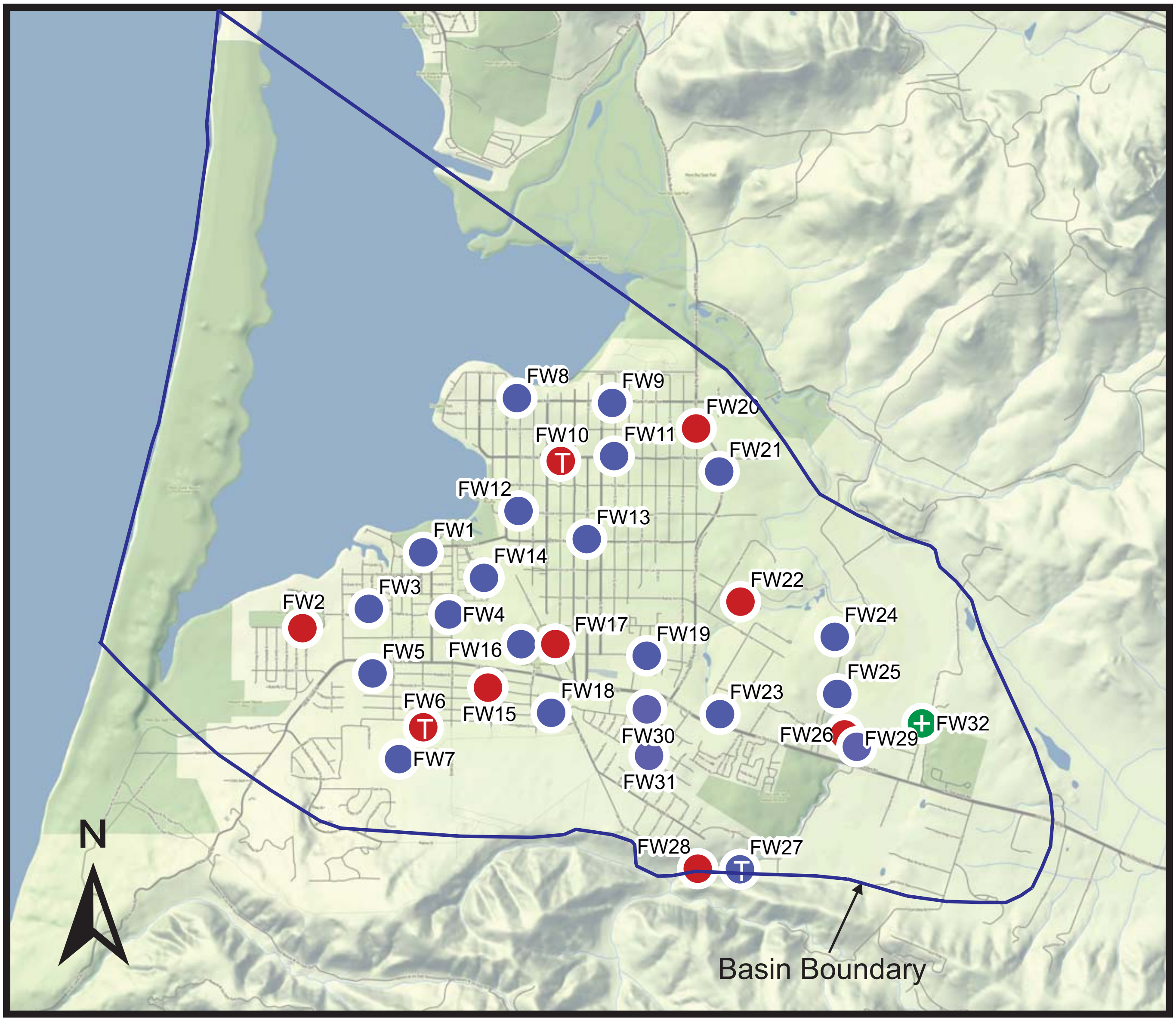
There were a total of 85 wells in the LOBP Groundwater Monitoring Program in 2016, including 37 BMC member agency monitoring wells, 17 municipal wells (active and inactive) and 31 private wells. Two private wells and one agency monitoring well have been added to the monitoring program, for a total of 88 network wells in 2017. Private well participation in the monitoring program during 2017 was 82 percent (27 out of 33 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 B. Construction of a nested Upper Aquifer and Lower Aquifer monitoring wells near the bay was recommended in the LOBP and approved in 2017 (budgeted for 2018).

### 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 is performed at LOBP Groundwater Monitoring Program locations. Equipping of eight monitoring locations with water level transducers was planned to provide an efficient and high level of resolution for tracking dynamic changes in Basin groundwater levels. Seven of the eight locations were equipped with transducers through 2017 (see Section 7.2).

Of the 88 wells currently in the groundwater monitoring network, 32 are representative of First Water, 18 are representative of the Upper Aquifer, and 38 are representative of the Lower Aquifer. Spatially, 5 water level monitoring wells are located in the Dunes and Bay Area, 25 wells are located in the Western Area, 38 are located in the Central Area, and 20 are located in the Eastern Area.




Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

## Explanation

- LOBP Water Level Monitoring Well
- 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
2017 Annual Report

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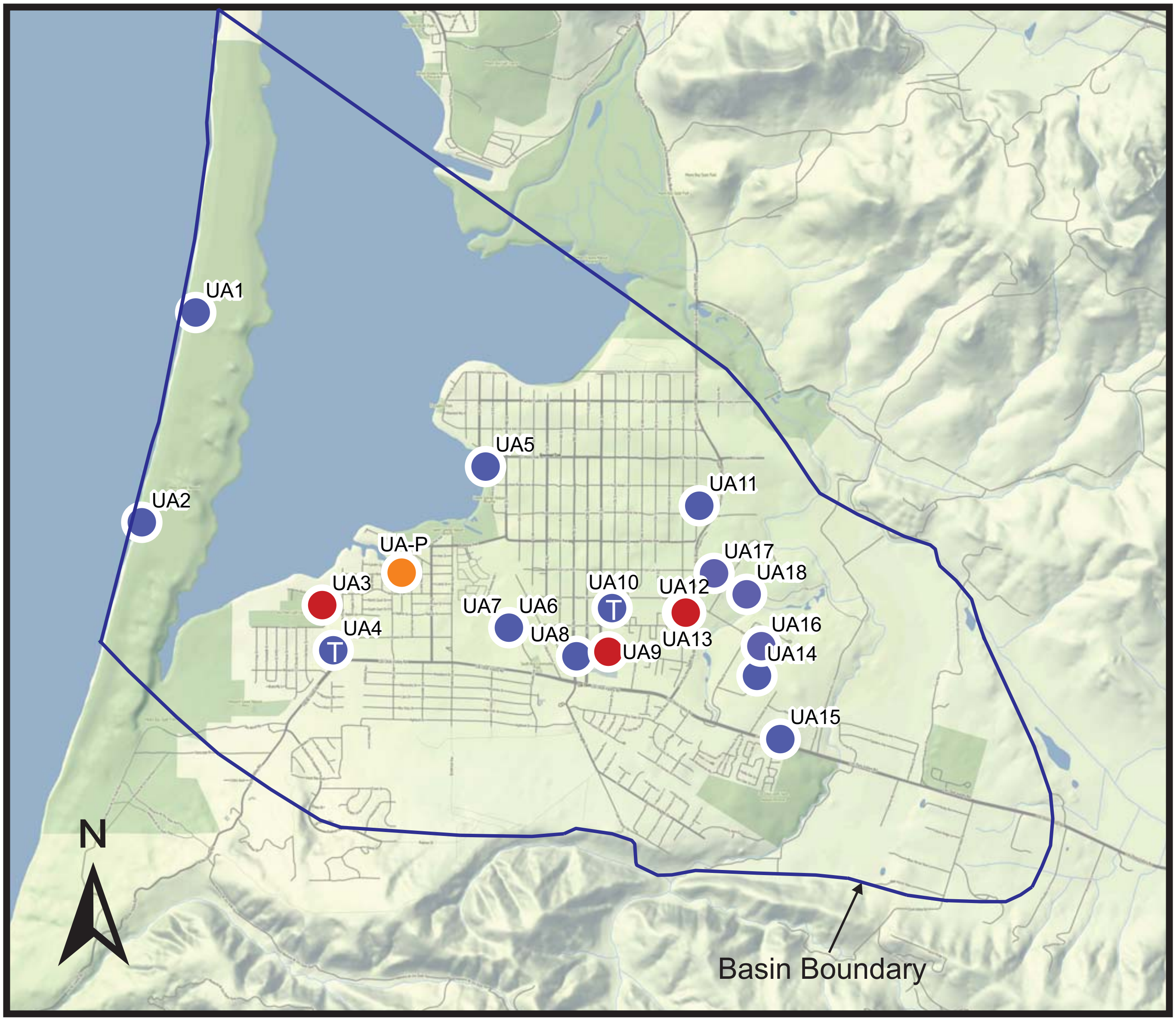


Base Image: Stamen-Terrain

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Scale: 1 inch ≈ 4,000 feet

Explanation

- LOBP Water Level Monitoring Well
- 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
2017 Annual Report

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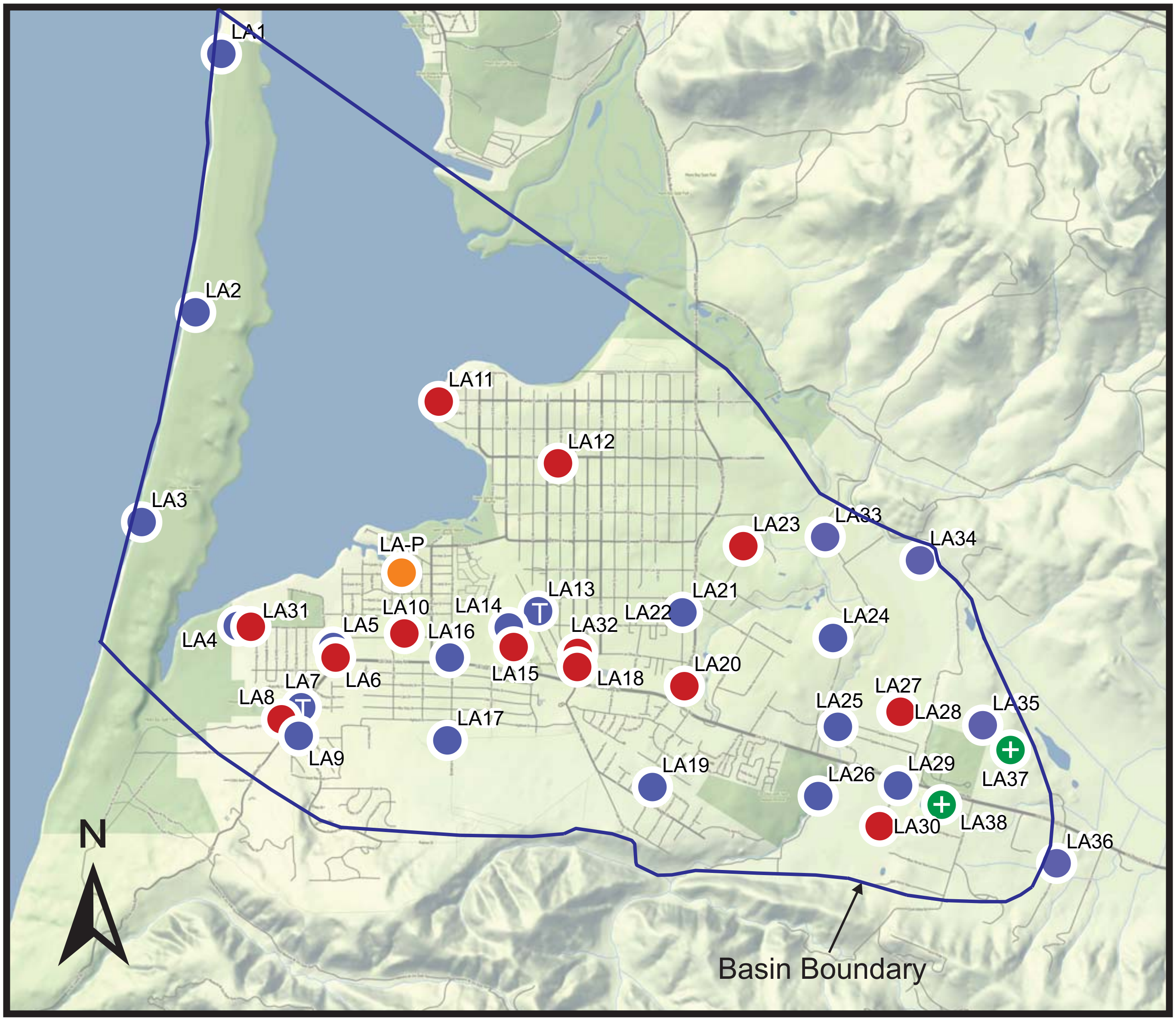


Base Image: Stamen-Terrain

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Scale: 1 inch ≈ 4,000 feet

## Explanation

- LOBP Water Level Monitoring Well
- 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

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

Figure 4
Groundwater Monitoring Program
Lower Aquifer Wells
Los Osos Groundwater Basin
2017 Annual Report

Cleath-Harris Geologists

*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. This 50-foot thick interface occurs within unconfined sediments and would rise and fall seasonally with water level fluctuations. Where First Water is close to ground 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 (Figure 5). 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, 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 aquifer production is planned under infrastructure program B . Monitoring the upper aquifer in the urban area, those properties contained within the Urban Reserve Line as shown in Figure 10 of the LOBP, is important to both local purveyors and rural residential parcels.

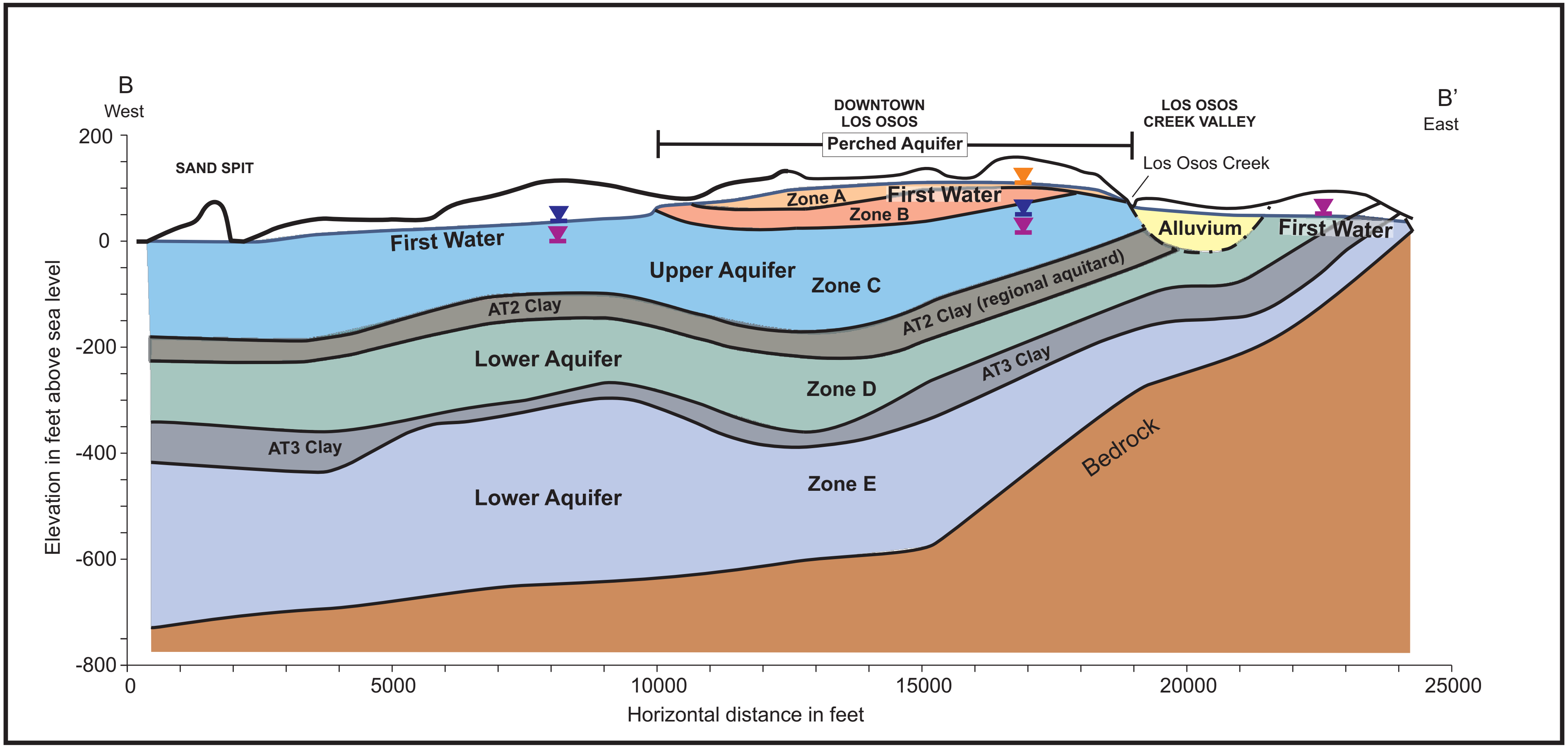
*Lower Aquifer*

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 LOBP programs, is necessary to halt, slow and/or reverse 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




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
2017 Annual Report

Cleath-Harris Geologists

hydrocarbons or emerging contaminants. Hexavalent Chromium has also been a concern in several shallow wells as described in the 2015 Annual Groundwater Monitoring Report (CHG, 2015). 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, as described below.

*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, although additional constituents are quantified in the general minerals suite performed by the analytical laboratory (See Appendix C). 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 | 1.0 | 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 as $CaCO_3$ | 10 | mg/L |
| Chloride | 1.0 | mg/L |
| Nitrate - Nitrogen | 0.1 | mg/L |
| Sulfate | 2.0 | mg/L |
| Boron | 0.1 | mg/L |
| Calcium | 1.0 | mg/L |
| Magnesium | 1.0 | mg/L |
| Potassium | 1.0 | mg/L |
| Sodium | 1.0 | mg/L |

[1]From LOBP (ISJ Group, 2015)

The Lower Aquifer (via Well LA4 and Well LA14) will also be monitored using down hole geophysics once every three years (natural gamma and induction logs) to provide a unique measure of seawater intrusion over time in one location within the basin. Vertical movement of the freshwater-seawater interface has historically averaged 2-3 feet per year between 1985 and 2015 (CHG, 2015). The practical resolution of the methodology for measuring vertical interface movement is close to 5 feet, so a three-year monitoring frequency provides sufficient time to identify movement, based on the historical data. LA4 is located near the Sea Pines Golf Course in the Western Area, and LA14 is located at the north end of Palisades Avenue. Seawater is highly conductive, compared to fresh water, and an induction log performed in a borehole penetrating the fresh water/seawater interface shows the vertical transition from fresh water to seawater. The next scheduled geophysical logging is for October 2018.

*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 LOWRF operation, 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.

| 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 | | 0.050 |
| Caffeine | Stimulant | | 0.050 |
| NDMA (Nitroso-dimethylamine) | Disinfection Byproduct | | 0.002 |
| Gemfibrozil | Pharmaceutical Residue | Performance | 0.010 |
| DEET (Diethyl-meta-toluamide) | Personal Care Product | | 0.050 |
| Iopromide | Pharmaceutical Residue | | 0.050 |
| Sucralose | Food additive | | 0.100 |
| Ammonia | N/A | Surrogate | N/A |
| Nitrate-Nitrogen | N/A | | N/A |
| Total Organic Carbon | N/A | | N/A |
| UV Light Absorption | N/A | | N/A |
| Specific Conductance | N/A | | N/A |

[1]From LOBP (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 quarterly or 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 June, and Fall water levels may extend beyond October into December. 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, 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. The schedule for Fall water quality testing performed under the LOWRF Groundwater Monitoring Program (First Water and Upper Aquifer) has been moved by San Luis Obispo County from October to December.

### 2.2.4 SGMA Activities

In June 2017, San Luis Obispo County authorized a basin characterization study for the Basin fringe areas with Basin Boundary Modification Request (BBMR) preparations. These fringe areas, which lie outside of the Basin Plan Areas but within the DWR Bulletin 118 basin boundary, were the subject of a BBMR in 2016 that was denied by the DWR due to lack of supporting scientific evidence. A new BBMR is planned for 2018 that includes scientific evidence from the fringe area characterization study.

# 3. CONDUCT OF WORK

This Groundwater Monitoring Program Annual Report covers monitoring activities performed during the 2017 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 2017.

## 3.1 Services Provided

All 2017 groundwater monitoring data compiled for this report, unless described otherwise, comes from the following monitoring programs:

- 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 Waste Discharge Order R3-2011-0001 Groundwater Monitoring Program: water level and water quality data.
- LOBP Groundwater Monitoring Program: water level and water quality 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 for laboratory analytical testing. The field methods approved for use in the LOBP Groundwater Monitoring Program are presented in Appendix D. 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 2017 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. Seven monitoring network wells are currently 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 are included in Appendix D.

### 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. Sampling procedures for general mineral and nitrate sampling (with additional procedures for wastewater indicator compounds) are presented in Appendix D.

An induction electric log, which is used periodically at Wells LA4 and LA14, measures formation specific conductance using high frequency alternating currents that are induced into the formation. The technique may be used in open boreholes or wells cased with PVC, but not in steel-cased wells. Seawater is highly conductive, compared to fresh water, and an induction log performed in a borehole penetrating the fresh water/seawater interface will show the vertical transition from fresh water to seawater. By convention, conductivity measurements from the induction tool are put through an electrical reciprocator and converted to a resistivity curve on the log. The gamma ray log, which is also performed periodically at Wells LA4 and LA14, measures naturally occurring gamma emissions from the formation surrounding the borehole. These emissions can penetrate both PVC and steel-cased wells, and are typically used to measure clay content when gamma active clays are present (Welenco, 1996). Since natural gamma emissions are not affected by changes in water quality, the gamma ray log can be used as a depth calibration tool when comparing induction logs from different monitoring events.

### 3.3 Monitoring Staff Affiliations

Monitoring services that contributed data to the 2017 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. Rincon Consultants performed semi-annual (June and December) water level monitoring and water quality sampling at selected private wells and monitoring wells for the LOWRF Groundwater Monitoring Program.

- Los Osos Water Purveyors (LOCSD, GSWC, S&T). Water agency staff performed semi-annual water level monitoring and water quality sampling at municipal water supply wells.

- Los Osos BMC (LOCSD, GSWC, S&T, and County). CHG performed semi-annual (April and October) water level monitoring, water quality sampling at private wells, monitoring wells, and municipal supply wells for the LOBP Groundwater Monitoring Program.

## 4. MONITORING RESULTS

The results of groundwater monitoring activities performed in 2017 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 B. Laboratory analytical reports of groundwater samples collected for the LOWRF Groundwater Monitoring Program are contained in their respective June and December 2017 monitoring program reports (Rincon Consultants, 2017b, 2018).

### 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. Available water levels for wells labeled "Private" are not reported herein, but those listed as measured have been used for aggregated water level contour maps. "Private" wells refer to domestic wells, agricultural irrigation wells, and monitoring wells that are not controlled by BMC member agencies.

Spring water levels were measured in April 2017 for the County Semi-Annual Water Level Monitoring Program and the Lower Aquifer Monitoring Program, and in April and May for the LOWRF Groundwater Monitoring Program. Fall water levels were measured in October 2017 for the County Semi-Annual Water Level Monitoring Program and the LOBP Groundwater Monitoring Program. The LOWRF Groundwater Monitoring Program schedule moved from October to December beginning in Fall 2016. For consistency with the LOBP and County programs, however, CHG also monitored water levels at selected LOWRF monitoring program wells in October 2016, rather than using the December 2016 LOWRF monitoring event values.

| Table 3. Spring 2017 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 (not measured) | | | |
| FW2 | 30S/10E-13L8 | 32.63 [1] | 4/11/2017 | 21.49 | 11.14 |
| FW3 | 30S/10E-13G | 50.95 [1] | 4/10/2017 | 42.3 | 8.65 |
| FW4 | 30S/10E-13H | 49.33 [1] | 4/11/2017 | 23.46 | 25.87 |
| FW5 | 30S/10E-13Q2 | 101.27 [1] | 4/10/2017 | 86.72 | 14.55 |
| FW6 | 30S/10E-24A | 193.04 [1] | 4/10/2017 | 162.29 | 30.75 |
| FW7 | 30S/10E-24Ab | Not measured (damaged) | | | |
| FW8 | 30S/11E-7L4 | 45.76 [1] | 4/11/2017 | 35.6 | 10.16 |
| FW9 | 30S/11E-7K3 | 90.71 [1] | 4/17/2017 | 51.63 | 39.08 |
| FW10 | 30S/11E-7Q1 | 25.29 [1] | 4/10/2017 | 6.94 | 18.35 |
| FW11 | 30S/11E-7R2 | 61.93 [1] | 4/13/2017 | 20.92 | 41.01 |
| FW12 | 30S/11E-18C2 | 34.55 [1] | 4/13/2017 | 18.29 | 16.26 |
| FW13 | 30S/11E-18B2 | 79.89 [1] | 4/13/2017 | 18.26 | 61.63 |
| FW14 | 30S/11E-18E1 | PRIVATE (measured) | | | |
| FW15 | 30S/11E-18N2 | 125.53 [1] | 4/10/2017 | 83.94 | 41.59 |
| FW16 | 30S/11E-18L11 | 88.02 [1] | 4/13/2017 | 46.31 | 41.71 |
| FW17 | 30S/11E-18L12 | 103.85 [1] | 4/13/2017 | 17.9 | 85.95 |
| FW18 | 30S/11E-18P | 150.00 [2] | not measured | | |
| FW19 | 30S/11E-18J7 | 125.74 [1] | 4/12/2017 | 19.53 | 106.21 |
| FW20 | 30S/11E-8Mb | 95.00 [2] | 4/13/2017 | 42.4 | 52.6 |
| FW21 | 30S/11E-8N4 | 95.99 [1] | 4/13/2017 | 36.2 | 59.79 |
| FW22 | 30S/11E-17F4 | PRIVATE (not measured) | | | |
| FW23 | 30S/11E-17N4 | PRIVATE (measured) | | | |
| FW24 | 30S/11E-17J2 | PRIVATE (measured) | | | |
| FW25 | 30S/11E-17R1 | PRIVATE (not measured) | | | |
| FW26 | 30S/11E-20A2 | PRIVATE (not measured) | | | |
| FW27 | 30S/11E-20L1 | PRIVATE (measured) | | | |
| FW28 | 30S/11E-20M2 | PRIVATE (measured) | | | |
| FW29 | 30S/11E-20A1 | PRIVATE (measured) | | | |
| FW30 | 30S/11E-18R1 | PRIVATE (not measured) | | | |
| FW31 | 30S/11E-19A | 213 [2] | 4/20/2017 | 31.6 | 181.4 |
| FW32+ | 30S/11E-21D14 | PRIVATE (measured) | | | |

NOTES: 1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (NAVD88)
+ added for current reporting year

| Table 4. Spring 2017 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 | 16.01 [1] | 5/24/2017 | 12.39 | 3.6 |
| UA2 | 30S/10E-14B1 | 19.48 [1] | 5/24/2017 | 15.9 | 3.6 |
| UA3 | 30S/10E-13F4 | 19.00 [2] | 4/4/2017 | 10 | 9.0 |
| UA4 | 30S/10E-13L1 | 38.68 [3] | 4/11/2017 | 31.6 | 7.1 |
| UA5 | 30S/11E-7N1 | 9.13 [3] | 4/13/2017 | 3.5 | 7.5 |
| UA6 | 30S/11E-18L8 | 79.18 [1] | 4/17/2017 | 56.9 | 22.3 |
| UA7 | 30S/11E-18L7 | 79.16 [1] | 4/17/2017 | 64.5 | 14.7 |
| UA8 | 30S/11E-18K7 | 135.65 [3] | 4/12/2017 | 118.7 | 17.0 |
| UA9 | 30S/11E-18K3 | 121.18 [3] | 4/17/2017 | 120 | 1.2 |
| UA10 | 30S/11E-18H1 | 107.10 [3] | 4/10/2017 | 93 | 14.1 |
| UA11 | 30S/11E-17D | PRIVATE (not measured) | | | |
| UA12 | 30S/11E-17E9 | 105.85 [3] | 4/13/2017 | 88.17 | 17.7 |
| UA13 | 30S/11E-17E10 | 106.00 [2] | 4/13/2017 | 92.1 | 13.9 |
| UA14 | 30S/11E-17P4 | PRIVATE (not measured) | | | |
| UA15 | 30S/11E-20B7 | PRIVATE (not measured) | | | |
| UA16 | 30S/11E-17L4 | PRIVATE (measured) | | | |
| UA17 | 30S/11E-17E1 | PRIVATE (measured) | | | |
| UA18 | 30S/11E-17F2 | PRIVATE (measured) | | | |

NOTES:
1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (assume NAVD88)
3 elevation as reported by County records (datum unknown, likely NGVD 29)

| Table 5. Spring 2017 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 | 23.13 [1] | 5/24/2017 | 15.83 | 7.3 |
| LA2 | 30S/10E-11A2 | 16.07 [1] | 5/24/2017 | 11.49 | 4.6 |
| LA3 | 30S/10E-14B2 | 19.47 [1] | 5/24/2017 | 17.54 | 1.9 |
| LA4 | 30S/10E-13M1 | 41.20 [3] | 4/17/2017 | 44.53 | -3.3 |
| LA5 | 30S/10E-13L7 | 37.00 [2] | 4/11/2017 | 33 | 4.0 |
| LA6 | 30S/10E-13L4 | 68.00 [2] | 5/17/2017 | 63.5 | 4.5 |
| LA7 | 30S/10E-13P2 | PRIVATE (not measured) | | | |
| LA8 | 30S/10E-13N | 138.50 [2] | 4/11/2017 | 134 | 4.5 |
| LA9 | 30S/10E-24C1 | 178.32 [3] | 4/17/2017 | 176 | 2.3 |
| LA10 | 30S/10E-13J1 | 95.31 [3] | 4/17/2017 | 79 | 16.3 |
| LA11 | 30S/10E-12J1 | 8.43 [1] | 4/11/2017 | 5.26 | 3.2 |
| LA12 | 30S/11E-7Q3 | 24.30 [3] | 4/13/2017 | 35.3 | -11.0 |
| LA13 | 30S/11E-18F2 | 100.00 [3] | 4/11/2017 | 104.47 | -4.5 |
| LA14 | 30S/11E-18L6 | 79.36 [1] | 4/17/2017 | 78.1 | 1.3 |
| LA15 | 30S/11E-18L2 | 85.00 [2] | 4/13/2017 | 106.2 | -21.2 |
| LA16 | 30S/11E-18M1 | 106.82 [3] | 4/17/2017 | 99.01 | 7.8 |
| LA17 | 30S/11E-24A2 | 210.40 [3] | not measured | | |
| LA18 | 30S/11E-18K8 | 135.74 [3] | 4/12/2017 | 137.83 | -2.1 |
| LA19 | 30S/11E-19H2 | 256.20 [3] | 4/18/2017 | 271.31 | -15.1 |
| LA20 | 30S/11E-17N10 | 140.00 [2] | 4/17/2017 | 164 | -24.0 |
| LA21 | 30S/11E-17E7 | 105.85 [3] | 4/18/2017 | 111.14 | -5.3 |
| LA22 | 30S/11E-17E8 | 105.85 [3] | 4/18/2017 | 124.9 | -19.1 |
| LA23 to LA30 | | PRIVATE (measured LA24, LA26, LA27, LA29) | | | |
| 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 (measured) | | | |
| LA34 | 30S/11E-8F | 26.15 [1] | 4/27/2017 | 3.5 | 22.7 |
| LA35 | 30S/11E-21Bb | 96.00 [2] | 4/4/2017 | 64 | 32 |
| LA36 | 30S/11E-21Ja | PRIVATE (not measured) | | | |
| LA37+ | 30S/11E-21B1 | 81 [2] | 4/17/2017 | 59.92 | 21.08 |
| LA38+ | 30S/11E-21E | PRIVATE (not measured) | | | |

NOTES:
1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (assume NAVD88)
3 elevation as reported by County records (datum unknown, likely NGVD 29)
\+ added for current reporting year

## Table 6. Fall 2017 Water Levels - First Water

| Well ID | State Well Number | R. P. Elevation and Datum (feet) | Date | Water Level (Feet) Depth | Water Level (Feet) Elevation |
|---|---|---|---|---|---|
| FW1 | 30S/10E-13A7 | PRIVATE (not measured) | | | |
| FW2 | 30S/10E-13L8 | 32.63 [1] | 10/2/2017 | 23.34 | 9.3 |
| FW3 | 30S/10E-13G | 50.95 [1] | 10/2/2017 | 41.46 | 9.5 |
| FW4 | 30S/10E-13H | 49.33 [1] | 10/2/2017 | 25.9 | 23.4 |
| FW5 | 30S/10E-13Q2 | 101.27 [1] | 10/10/2017 | 86.4 | 14.9 |
| FW6 | 30S/10E-24A | 193.04 [1] | 10/5/2017 | 159.16 | 33.9 |
| FW7 | 30S/10E-24Ab | Not measured (damaged) | | | |
| FW8 | 30S/11E-7L4 | 45.76 [1] | 10/3/2017 | 37.54 | 8.2 |
| FW9 | 30S/11E-7K3 | 90.71 [1] | 10/2/2017 | 52.86 | 37.9 |
| FW10 | 30S/11E-7Q1 | 25.29 [1] | 10/5/2017 | 8.19 | 17.1 |
| FW11 | 30S/11E-7R2 | 61.93 [1] | 10/2/2017 | 22.96 | 39.0 |
| FW12 | 30S/11E-18C2 | 34.55 [1] | 10/12/2017 | 19.61 | 14.9 |
| FW13 | 30S/11E-18B2 | 79.89 [1] | 10/12/2017 | 21.2 | 58.7 |
| FW14 | 30S/11E-18E1 | PRIVATE (measured) | | | |
| FW15 | 30S/11E-18N2 | 125.53 [1] | 10/2/2017 | 83.38 | 42.2 |
| FW16 | 30S/11E-18L11 | 88.02 [1] | 10/3/2017 | 45.69 | 42.3 |
| FW17 | 30S/11E-18L12 | 103.85 [1] | 10/4/2017 | 21.02 | 82.8 |
| FW18 | 30S/11E-18P | 150.00 [2] | 10/2/2017 | 24.61 | 125.4 |
| FW19 | 30S/11E-18J7 | 125.74 [1] | 10/12/2017 | 24.7 | 101.0 |
| FW20 | 30S/11E-8Mb | 95.00 [2] | 10/12/2017 | 42.99 | 52.0 |
| FW21 | 30S/11E-8N4 | 95.99 [1] | 10/12/2017 | 36.97 | 59.0 |
| FW22 | 30S/11E-17F4 | PRIVATE (not measured) | | | |
| FW23 | 30S/11E-17N4 | PRIVATE (measured) | | | |
| FW24 | 30S/11E-17J2 | PRIVATE (measured) | | | |
| FW25 | 30S/11E-17R1 | PRIVATE (not measured) | | | |
| FW26 | 30S/11E-20A2 | PRIVATE (measured) | | | |
| FW27 | 30S/11E-20L1 | PRIVATE (measured) | | | |
| FW28 | 30S/11E-20M2 | PRIVATE (measured) | | | |
| FW29 | 30S/11E-20A1 | PRIVATE (measured) | | | |
| FW30 | 30S/11E-18R1 | PRIVATE (measured) | | | |
| FW31 | 30S/11E-19A | 213 [2] | 10/3/2017 | 30.0 | 183 |
| FW32+ | 30S/11E-21D14 | PRIVATE (measured) | | | |

NOTES:
1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (NAVD88)
+ added for current reporting year

| Table 7. Fall 2017 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 | 16.01 [1] | 11/2/2017 | 12.03 | 4.0 |
| UA2 | 30S/10E-14B1 | 19.48 [1] | 11/1/2017 | 15.85 | 3.6 |
| UA3 | 30S/10E-13F4 | 19.00 [2] | 10/10/2017 | 15 | 4.0 |
| UA4 | 30S/10E-13L1 | 38.68 [3] | 10/5/2017 | 31.96 | 6.7 |
| UA5 | 30S/11E-7N1 | 11.00 [2] | 10/8/2017 | 4.5 | 6.5 |
| UA6 | 30S/11E-18L8 | 79.18 [1] | 10/25/2017 | 59.2 | 20.0 |
| UA7 | 30S/11E-18L7 | 79.16 [3] | 10/25/2017 | 67.81 | 11.4 |
| UA8 | 30S/11E-18K7 | 135.65 [3] | 10/9/2017 | 122.12 | 13.5 |
| UA9 | 30S/11E-18K3 | 121.18 [3] | 10/10/2017 | 122 | -0.8 |
| UA10 | 30S/11E-18H1 | 107.10 [3] | 10/5/2017 | 96.06 | 11.0 |
| UA11 | 30S/11E-17D | PRIVATE (not measured) | | | |
| UA12 | 30S/11E-17E9 | 105.85 [3] | 10/11/2017 | 92.65 | 13.2 |
| UA13 | 30S/11E-17E10 | 106.00 [2] | 10/18/2017 | 94.4 | 11.6 |
| UA14 | 30S/11E-17P4 | PRIVATE (not measured) | | | |
| UA15 | 30S/11E-20B7 | PRIVATE (not measured) | | | |
| UA16 | 30S/11E-17L4 | PRIVATE (measured) | | | |
| UA17 | 30S/11E-17E1 | PRIVATE (measured) | | | |
| UA18 | 30S/11E-17F2 | PRIVATE (measured) | | | |

NOTES:
1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (assume NAVD88)
3 elevation as reported by County records (datum unknown, likely NGVD 29)

**Table 8. Fall 2017 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 | 23.13 [1] | 11/1/2017 | 15.71 | 0.1 |
| LA2 | 30S/10E-11A2 | 16.07 [1] | 11/2/2017 | 11.18 | 5.2 |
| LA3 | 30S/10E-14B2 | 19.47 [1] | 11/1/2017 | 17.8 | -1.0 |
| LA4 | 30S/10E-13M1 | 41.20 [3] | 10/5/2017 | 45.17 | -4.0 |
| LA5 | 30S/10E-13L7 | 37.00 [2] | 10/4/2017 | 33.9 | 3.1 |
| LA6 | 30S/10E-13L4 | 68.00 [2] | 10/25/2017 | 77 | -9.0 |
| LA7 | 30S/10E-13P2 | PRIVATE (not measured) | | | |
| LA8 | 30S/10E-13N | 138.50 [2] | 10/2/2017 | 135 | 3.5 |
| LA9 | 30S/10E-24C1 | 178.32 [3] | 10/12/2017 | 174 | 4.3 |
| LA10 | 30S/10E-13J1 | 95.31 [3] | 10/10/2017 | 87 | 8.3 |
| LA11 | 30S/10E-12J1 | 8.43 [1] | 10/4/2017 | 6.99 | 1.4 |
| LA12 | 30S/11E-7Q3 | 24.30 [3] | 10/19/2018 | 39.3 | -15.0 |
| LA13 | 30S/11E-18F2 | 100.00 [3] | 10/5/2017 | 108.36 | -8.4 |
| LA14 | 30S/11E-18L6 | 79.36 [1] | 10/25/2017 | 81.52 | -2.2 |
| LA15 | 30S/11E-18L2 | 85.00 [2] | 10/19/2017 | 96.8 | -11.8 |
| LA16 | 30S/11E-18M1 | 106.82 [3] | 10/25/2017 | 101.71 | 5.1 |
| LA17 | 30S/11E-24A2 | 210.40 [3] | not measured | | |
| LA18 | 30S/11E-18K8 | 135.74 [3] | 10/9/2017 | 141.75 | -6.0 |
| LA19 | 30S/11E-19H2 | 256.20 [3] | 10/26/2017 | 274.21 | -18.0 |
| LA20 | 30S/11E-17N10 | 140.00 [2] | 10/13/2017 | 168 | -28.0 |
| LA21 | 30S/11E-17E7 | 105.85 [3] | 10/26/2017 | 118.4 | -12.6 |
| LA22 | 30S/11E-17E8 | 105.85 [3] | 10/11/2017 | 128.8 | -23.0 |
| LA23 to LA30 | | PRIVATE (measured LA24, LA25, LA29, LA30) | | | |
| 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 (measured) | | | |
| LA34 | 30S/11E-8F | 26.15 [1] | 10/12/2017 | 6.64 | 19.5 |
| LA35 | 30S/11E-21Bb | 96.00 [2] | 10/3/2017 | 78 | 8.8 |
| LA36 | 30S/11E-21Ja | PRIVATE | | | |
| LA37+ | 30S/11E-21B1 | 81 [2] | 10/5/2017 | 66.93 | 14.1 |
| LA38+ | 30S/11E-21E | PRIVATE (measured) | | | |

NOTES:
1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (assume NAVD88)
3 elevation as reported by County records (datum unknown, likely NGVD 29)
+ added for current reporting year

## 4.2 Water Quality Results

Available Fall 2017 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 2017 water quality monitoring at First Water or Upper Aquifer Wells. Available Spring and Fall 2017 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. Groundwater monitoring field logs and laboratory analytical reports for the 2017 LOBP Groundwater Monitoring Program are included in Appendix C.

"Private" wells refer to domestic wells, agricultural irrigation wells, and monitoring wells that are not controlled by BMC member agencies. Private well participation in the monitoring program during 2017 was 82 percent (27 out of 33 wells).

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 Groundwater Monitoring Program. The missing constituents include specific conductance, alkalinity (bicarbonate, carbonate, and total), calcium, magnesium, and potassium.

Lower Aquifer wells LA2 and LA3 were not sampled in 2017. These are Morro Bay sand spit wells that are scheduled for water quality monitoring every five years to track changes in salinity at the coast (2015 LOBP). The next scheduled water quality sampling event on the sand spit will be in 2020.

### 4.2.3 Nitrate and Chloride Results

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 June and December 2017 in the County's LOWRF Groundwater Monitoring Program reports (Rincon Consultants, 2017b, 2018). Nitrate concentration trends are tracked using the Nitrate Metric (see Section 7.5.3).

Lower Aquifer water quality results for 2017 show one water supply well (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 (see Section 7.5.3).

### 4.2.4 CEC Results

CEC sampling was conducted at well FW5 and FW26 in October 2017 (Table 12). Well FW5 is hydraulically downgradient of the Broderson leach field site. Well FW26 is located in the Los Osos Creek Valley (Figure 2). CEC results are presented in Table 12, with laboratory reports included in Appendix C.

| LOBP Well | State Well Number | Date | SC | pH (field) | TDS | Alkalinity CO3 | HCO3 | Total as CaCO3 | Cl | NO3-N | SO4 | B | Ca | Mg | K | Na | T (field) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | µS/cm | pH units | mg/L | | | | | | | | | | | | °F |
| FW2* | 30S/10E-13L8 | 12/14/17 | *928*[1] | 6.32 | 650 | -- | -- | -- | 120 | 44 | 31 | 0.14 | -- | -- | -- | 150 | 64.6 |
| FW6* | 30S/10E-24A | 12/19/17 | *550*[1] | 7.04 | 440 | -- | -- | -- | 120 | 10 | 19 | <0.05 | -- | -- | -- | 47 | 58.1 |
| FW10* | 30S/11E-7Q1 | Bi-annual schedule (not sampled in 2017) | | | | | | | | | | | | | | | |
| FW15* | 30S/11E-18N2 | 12/14/17 | *685*[1] | 6.43 | 530 | -- | -- | -- | 93 | 27 | 39 | 0.24 | -- | -- | -- | 62 | 66.9 |
| FW17* | 30S/11E-18L12 | 12/14/17 | *882*[1] | 6.53 | 540 | -- | -- | -- | 81 | 48 | 74 | 0.17 | -- | -- | -- | 58 | 70.7 |
| FW20* | 30S/11E-8Mb | Bi-annual schedule (not sampled in 2017) | | | | | | | | | | | | | | | |
| FW22* | 30S/11E-17F4 | 12/14/17 | *680*[1] | 6.94 | 420 | -- | -- | -- | 140 | 1.3 | 24 | <0.05 | -- | -- | -- | 62 | 61.5 |
| FW26 | 30S/11E-20A2 | 10/3/17 | 673 | 6.93 | 370 | <10 | 210 | 170 | 82 | <0.5 | 41.2 | <0.1 | 35 | 35 | <1 | 35 | 56.7 |
| FW28 | 30S/11E-20M2 | 10/3/17 | 836 | 7.70 | 490 | <10 | 240 | 200 | 47 | <0.5 | 89.9 | <0.1 | 63 | 48 | <1 | 30 | 67.3 |
| UA3 | 30S/10E-13F4 | 10/12/2017 | 607 | 6.5 | 390 | <10 | 100 | 80 | 73 | 19.2 | 29.5 | <0.1 | 26 | 19 | 2 | 64 | -- |
| UA9 | 30S/11E-18K3 | 10/12/2017 | 319 | 6.7 | 220 | <10 | 60 | 50 | 42 | 9.3 | 7.6 | <0.1 | 15 | 11 | <1 | 27 | -- |
| UA13 | 30S/11E-17E10 | 10/12/2017 | 506 | 6.88 | 310 | <10 | 110 | 90 | 58 | 14 | 23.3 | <0.1 | 24 | 23 | 1 | 40 | 65.8 |

**Table 9. Fall 2017 Water Quality Results - First Water and Upper Aquifer**

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 less than Practical Quantitation Limit as listed in laboratory report.
* = readings from LOWRF Groundwater Monitoring Program sampling event in December 2017 (Rincon Consultants, 2018)
[1] *Field measurements*

## Table 10. Spring 2017 Water Quality Results - Lower Aquifer

| LOBP 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 (field) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 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 |
| LA8 | 30S/10E-13N | 04/11/17 | 434 | 6.45 | 270 | <10 | 50 | 40 | 77 | 7.3 | 12.4 | <0.1 | 17 | 14 | 1 | 38 | 64.8 |
| LA9 | 30S/10E24C1 | 04/10/17 | 490 | 7.0 | 310 | <10 | 70 | 50 | 89 | 5.7 | 15.9 | <0.1 | 18 | 16 | 1 | 43 | 65.6 |
| LA10 | 30S/10E-13J1 | 04/10/17 | 957 | 7.5 | 720 | <10 | 80 | 60 | 231 | 2.6 | 14.7 | <0.1 | 52 | 48 | 2 | 35 | 68.5 |
| LA11 | 30S/10E-12J1 | 04/11/17 | 1380 | 7.29 | 880 | <10 | 350 | 280 | 167 | <0.5 | 186 | 0.2 | 75 | 86 | 4 | 81 | 69.3 |
| LA12 | 30S10E-7Q3 | 04/10/17 | 839 | 7.78 | 480 | <10 | 300 | 240 | 91 | <0.5 | 49.5 | 0.2 | 47 | 43 | 2 | 54 | 70.9 |
| LA15 | 30S/11E-18L2 | WELL OFFLINE | | | | | | | | | | | | | | | |
| LA18 | 30S/11E-18K8 | 04/12/17 | 616 | 7.5 | 450 | <10 | 290 | 240 | 31 | <0.5 | 38 | <0.1 | 57 | 32 | 2 | 27 | 72.0 |
| LA20 | 30S/11E-17N10 | 04/10/17 | 624 | 7.0 | 380 | <10 | 280 | 230 | 39 | 0.6 | 26.7 | 0.1 | 35 | 34 | 2 | 40 | 68.7 |
| LA22 | 30S/11E-17E8 | 04/13/17 | 466 | 7.52 | 300 | <10 | 150 | 120 | 46 | 6.7 | 13.2 | <0.1 | 26 | 24 | 1 | 29 | 66.7 |
| LA23 | PRIVATE (not sampled) | | | | | | | | | | | | | | | | |
| LA28 | PRIVATE (not sampled) | | | | | | | | | | | | | | | | |
| LA30 | PRIVATE (not sampled) | | | | | | | | | | | | | | | | |
| LA31+ | 30S/10E-13M2 | 04/17/17 | 3380 | 7.47 | 2060 | <10 | 60 | 50 | 907 | 0.6 | 178 | 0.2 | 114 | 109 | 4 | 413 | 66.6 |
| LA32+ | 30S/11E-18K9 | 04/10/17 | 461 | 7.16 | 270 | <10 | 190 | 150 | 35 | 1.9 | 19.1 | <0.1 | 24 | 23 | 1 | 31 | 72.0 |

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; °C = Celsius (some values converted from degrees Fahrenheit as reported on field logs); + indicates proposed addition to monitoring program; < indicates less than Practical Quantitation Limit as listed in laboratory report.

## Table 11. Fall 2017 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 (field) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 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 |
| LA8 | 30S/10E-13N | 10/02/17 | 438 | 7.94 | 290 | <10 | 30 | 30 | 78 | 7.6 | 13.2 | <0.1 | 15 | 14 | 1 | 36 | 65.3 |
| LA9 | 30S/10E-24C1 | 10/12/17 | 484 | 6.7 | 270 | <10 | 70 | 60 | 89 | 6 | 16.3 | <0.1 | 19 | 17 | 2 | 46 | -- |
| LA10 | 30S/10E-13J1 | 10/12/17 | 702 | 6.8 | 510 | <10 | 80 | 60 | 164 | 3.4 | 12.5 | <0.1 | 39 | 36 | 2 | 33 | -- |
| LA11 | 30S/10E-12J1 | 10/04/17 | 1370 | 7.59 | 850 | <10 | 300 | 250 | 162 | <0.5 | 191 | 0.3 | 76 | 86 | 5 | 90 | 69.6 |
| LA12 | 30S10E-7Q3 | 10/04/17 | 826 | 7.76 | 470 | <10 | 220 | 180 | 92 | <0.5 | 45 | 0.2 | 48 | 45 | 2 | 56 | 70.7 |
| LA15 | 30S/11E-18L2 | 10/05/17 | 768 | 7.75 | 400 | <10 | 180 | 150 | 102 | 0.7 | 27 | <0.1 | 50 | 44 | 2 | 40 | 70.2 |
| LA18 | 30S/11E-18K8 | 10/09/17 | 619 | 7.69 | 350 | <10 | 220 | 180 | 30 | <0.5 | 35.5 | <0.1 | 56 | 32 | 2 | 27 | 70.0 |
| LA20 | 30S/11E-17N10 | 10/12/17 | 583 | 6.8 | 320 | <10 | 260 | 210 | 41 | 0.7 | 27.9 | 0.2 | 37 | 36 | 2 | 43 | -- |
| LA22 | 30S/11E-17E8 | 10/11/17 | 476 | 7.5 | 260 | <10 | 150 | 120 | 47 | 7.2 | 14 | <0.1 | 26 | 25 | 1 | 29 | 70.3 |
| LA23 | PRIVATE (not sampled) | | | | | | | | | | | | | | | | |
| LA28 | PRIVATE (not sampled) | | | | | | | | | | | | | | | | |
| LA30 | 30S/11E-20H1 | 10/3/17 | 876 | 7.69 | 500 | <10 | 350 | 280 | 56 | <0.5 | 74.5 | 0.1 | 60 | 52 | 1 | 36 | 64.9 |
| LA31 | 30S/10E-13M2 | 10/5/2017 | 3350 | 7.66 | 2190 | <10 | 60 | 50 | 960 | 0.7 | 160 | 0.2 | 116 | 109 | 5 | 411 | 66.7 |
| LA32 | 30S/11E-18K9 | 10/9/2017 | 493 | 7.51 | 270 | <10 | 200 | 160 | 36 | 1.4 | 23.1 | <0.1 | 26 | 25 | 1 | 33 | 70.0 |

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

| Table12. CEC Monitoring Results | | | | | | |
|---|---|---|---|---|---|---|
| Constituent or Parameter | Units | FW5 | FW26 | QA1 Travel Blank | QA2 Equipment Blank | LOWRF Recycled Water[1] |
| | | October 18, 2017 | | | | Sep. 5, 2017 |
| **Health-based** | | | | | | |
| 17β-estradiol | ng/L | ND (<1) | ND (<1) | ND (<1) | ND (<1) | ND (<5)[2] |
| Triclosan | ng/L | ND (<2) | ND (<2) | ND (<2) | ND (<2) | ND (<10) |
| Caffeine[3] | ng/L | 1.6 | 1 | 2.5 | 2.1 | ND (<5) |
| NDMA | ng/L | ND (<2) | ND (<2) | -- | -- | 4.7 |
| **Performance-based** | | | | | | |
| Gemfibrozil | ng/L | ND (<1) | ND (<1) | ND (<1) | ND (<1) | ND(<5) |
| DEET | ng/L | 1.3 | 1.7 | 2 | 1.4 | 280 |
| Iopromide | ng/L | ND (<5) | ND (<5) | ND (<5) | ND (<5) | ND (<5) |
| Sucralose | ng/L | 260 | 16 | 17 | 8.2 | 87,000 |
| **Surrogate** | | | | | | |
| Ammonia | mg/L | ND (<0.10) | 0.19 | -- | -- | -- |
| Nitrate-Nitrogen | mg/L | 40 | ND (<0.2) | -- | -- | 2[4] |
| Total Organic Carbon | mg/L | 0.57 | 1.2 | -- | -- | -- |
| UV Light Absorption | 1/cm | 0.028 | 0.026 | -- | -- | -- |
| Specific Conductance | µmhos/cm | 960 | 680 | -- | -- | -- |

1 2017 LOWRF CEC Blue Ribbon Report and Annual Report (SLO Co. 2016a, 2016b).
2 As 17-alpha Ethinyl Estradiol
3 Blank Contamination. Analyte also detected in the laboratory method blank.
4 30-day average for Total Nitrogen
ng/L = nanograms per liter; mg/L = milligrams per liter, µmhos/cm = micromhos per centimeter; : "--" = no result available
ND (< ) = indicates less than Method Reporting Limit as listed in laboratory report ("not detected")

Caffeine, one of the health-based class indicators of CEC indicators, was detected in both groundwater samples (FW5 and FW26), in both field blanks (QA1 and QA2), and in the laboratory method blank (see page 9 of the laboratory results in Appendix C). The laboratory blank contained more caffeine than the submitted samples, which indicates that the caffeine reported was likely due to sample/equipment contamination at the laboratory.

DEET (Diethyl-meta-toluamide), a personal care product used for insect repellent, was also detected in the groundwater samples and field blanks at concentrations close to the method reporting limit, but not in the laboratory blank. DEET sample/equipment contamination in the laboratory blank was reported in the prior October 2016 sampling event (CHG, 2017).

Sucralose, an artificial sweetener, was detected at 260 nanograms per liter (ng/L) in groundwater from FW5, and is an indicator of wastewater influence. FW5 is hydraulically downgradient of the Broderson leach field. Sucralose was also detected in groundwater from FW26 (Los Osos Creek valley) and in the field blanks at levels close to the method reporting limit, but not in the laboratory blank. Discussion with Weck Laboratory staff, however, indicates that sucralose is commonly found in their laboratory method blanks at levels between 10-20 mg/L, which is the range reported for the field blanks and FW26.

Nitrate-nitrogen was reported at 40 mg/L in groundwater from FW5, and not detected in groundwater from FW26. Available CEC-constituent quality of recycled water from LOWRF is also provided in Table 12 for comparison.

Results of the CEC testing indicate a wastewater influence at FW5, but not at FW26. The sucralose detection at FW5 in October 2017 (260 ng/L) is similar to the prior concentration measured in October 2016 (280 ng/L), while the nitrate-nitrogen concentration is greater (40 mg/L in 2017 compared to 26 mg/L in 2016). The wastewater influence at FW5 is interpreted to be a residual from septic tank discharges, rather than from recycled water discharges at Broderson. Groundwater mounding in the upper aquifer associated with Broderson discharges was not observed off-site until mid-2017, based on the hydrograph for FW6.

## 4.3 Geophysics

Induction and natural gamma logging has been performed at Lower Aquifer monitoring well LA4 (30S/10E-13M1) and LA14 (30S/11E-18L6). Seawater is highly conductive, compared to fresh water, and an induction log performed in a borehole penetrating the fresh water/seawater interface will show the vertical transition from fresh water to seawater. Because natural gamma emissions are not affected by changes in water quality, the gamma ray log can be used as a depth calibration tool when comparing induction logs from different monitoring events. Geophysical monitoring events were performed in 1985, 2004, 2009, 2014, and 2015. Results and interpretation are included in the 2015 Annual Report (CHG, 2016). The next scheduled geophysical logging is in October 2018.

## 5. GROUNDWATER PRODUCTION

Annual basin groundwater production between 1970 and 2013 was reported in the LOBP (ISJ Group, 2015. Tables 13 and 14 present municipal and basin production beginning in calendar year 2013.

| Table 13. Municipal Groundwater Production (2013-2017) | | | | |
|---|---|---|---|---|
| **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 |
| 2016 | 520 | 450 | 30 | 1,000 |
| 2017 | 570 | 450 | 30 | 1,050 |

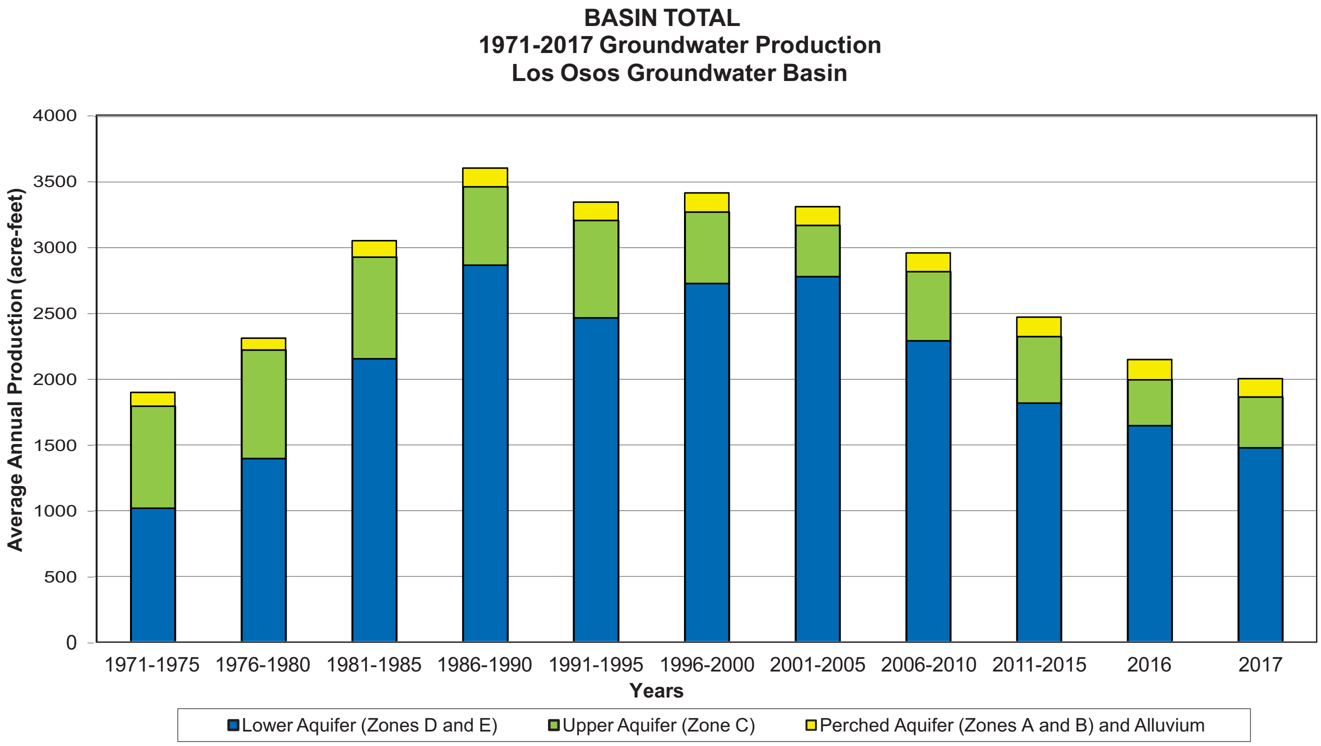
Note: All figures rounded to the nearest 10 acre-feet

| Table 14. Basin Groundwater Production (2013-2017) | | | | | |
|---|---|---|---|---|---|
| **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 |
| 2016 | 1,000 | 220 | 140 | 800 | 2,160 |
| 2017 | 1,050 | 220 | 130 | 670 | 2,070 |

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

Figure 6 shows the historical pumping distribution between basin aquifers since 1970, along with the pumping distribution in the Western Area. Figure 7 show the historical pumping distribution for the Central and Eastern areas. There has been a 34 percent reduction in basin production over the last 10 years, with current production similar to the values reported for the mid-1970s. The largest reduction in pumping has occurred in the Lower Aquifer Western Area (Figure 6).

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 are based on meter readings. Domestic and community facilities' groundwater production estimates are based on the last reported water use estimates for 2013 from the LOBP, with minor adjustments in 2016 for the inclusion of additional residences in the Eastern Area (CHG, 2016). Agricultural and turf water use for 2017 has been estimated using a soil-moisture budget. Details of the agricultural water use estimate are included in Appendix F.



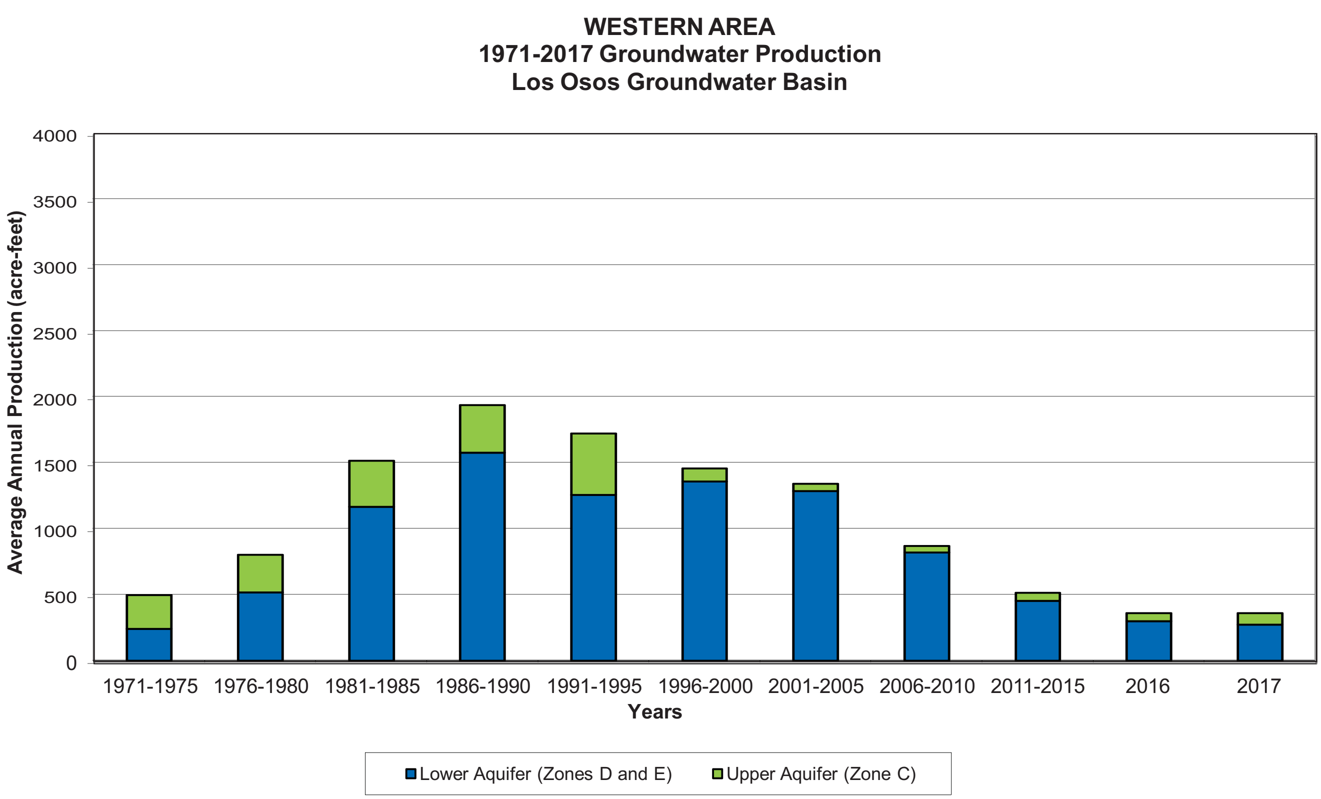




Figure 6
Basin Production 1971-2017
Basin Total and Western Area
Los Osos Goundwater Basin
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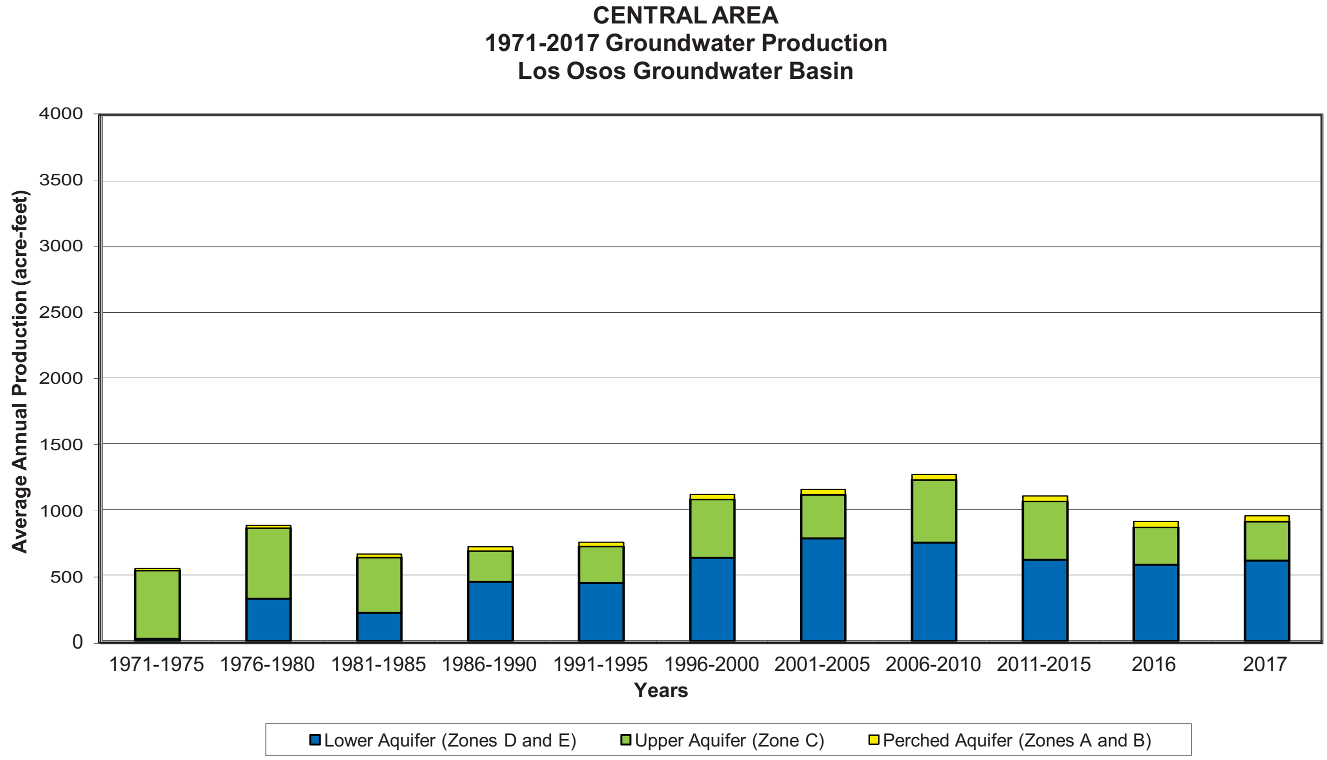


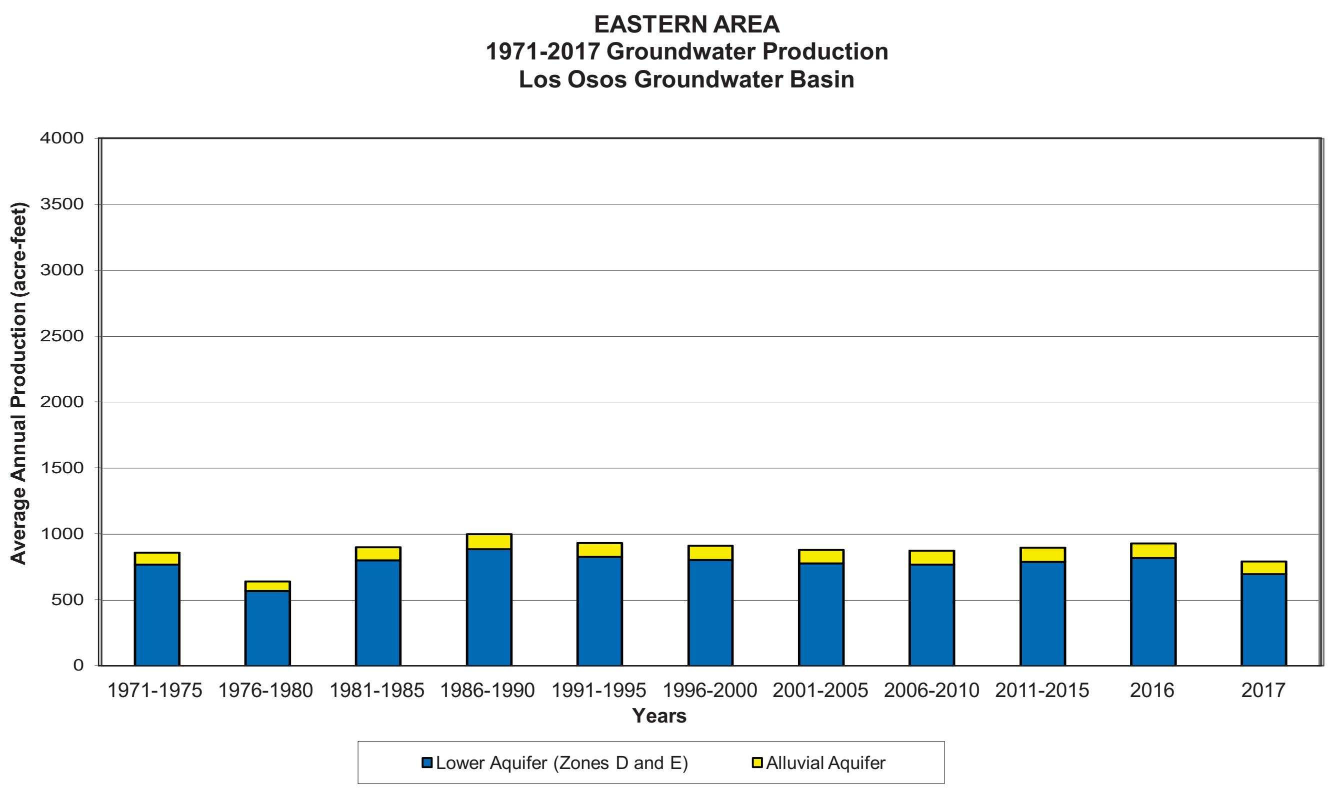


Figure 7
Basin Production 1971-2017
Central and Eastern Areas
Los Osos Groundwater Basin
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## 6. PRECIPITATION AND STREAMFLOW

Precipitation data are currently available from a County gage located at the former Los Osos landfill (Station #727). Continuous precipitation records for Station #727 are available beginning with the 2006 rainfall year (July 2005 through June 2006), and show that rainfall has averaged 15.79 inches, with a minimum of 6.81 inches in the 2014 rainfall year and a maximum of 31.77 inches in the 2011 rainfall year. Precipitation for the 2017 rainfall year was reported at 26.63 inches. Records for Station #727 through the calendar year 2017 are included in Appendix G. 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 15.

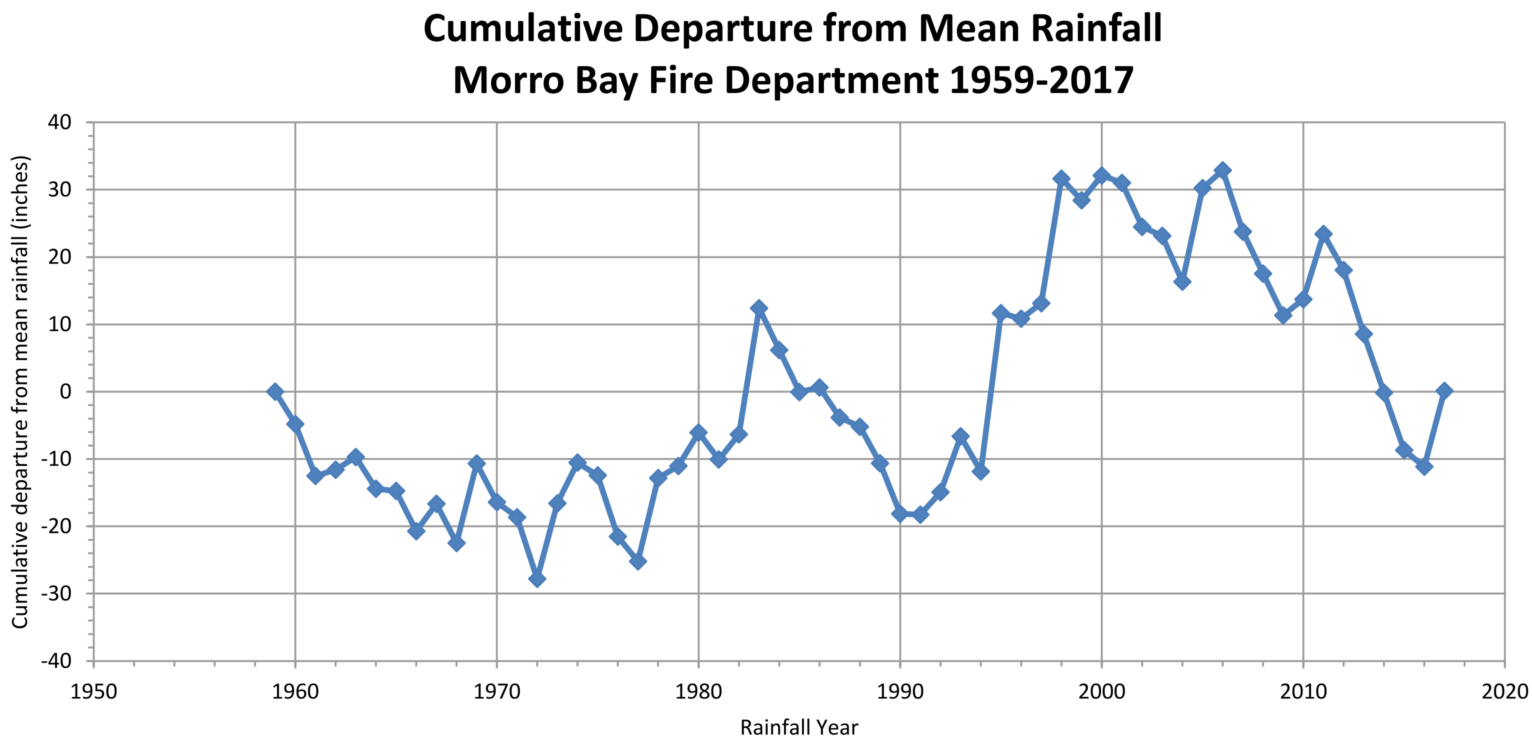
**Table 15. Active and Former Precipitation Stations**

| Station No. | Name | Period of Record (rainfall years) | Average Annual Precipitation (inches) |
|---|---|---|---|
| 144.1 | Bender | 1955-1987 | 19.17 |
| 152 | Morro Bay Fire Dept. | 1959-2017 (active) | 16.29 |
| 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 | 2006-2017 (active) | 15.79* |

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

Figure 8 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.

San Luis Obispo County had been in exceptional drought conditions (D4 - the greatest intensity level) between 2014 and 2016, based on information from the U.S. Drought Monitor, a partnership of federal agencies (NDMC/USDA/NOAA, 2014-2016). In 2017, local drought conditions were relieved by above-normal rainfall. Between the end of February and December 2017, San Luis Obispo County was ranked as abnormally dry, the lowest drought intensity level (NDMC/USDA/NOAA, 2017).



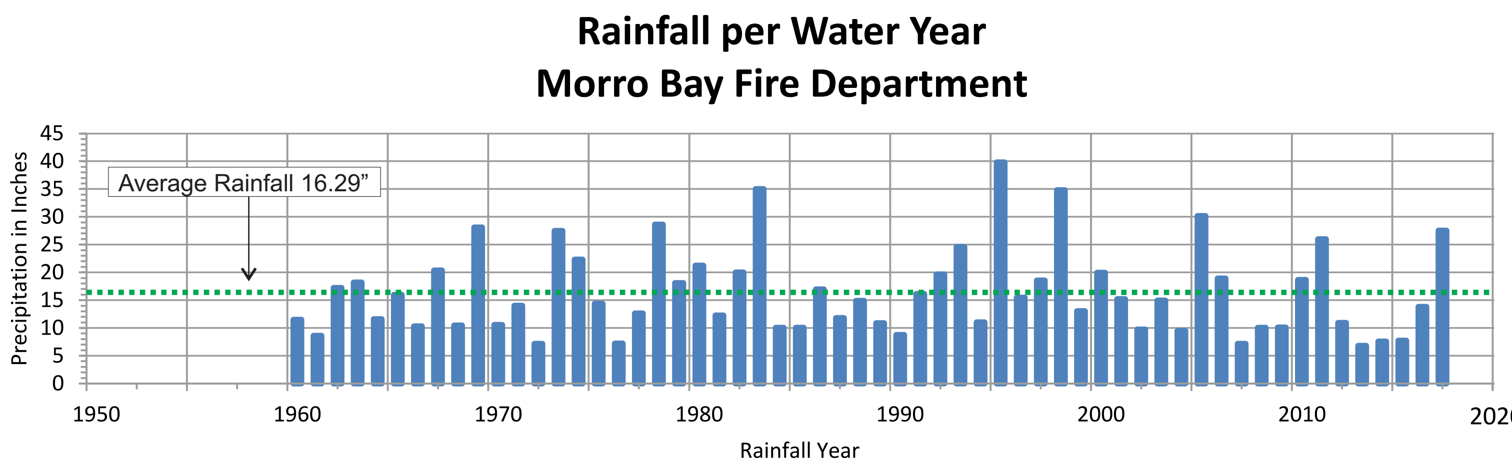




Figure 8
Cumulative Departure from
Mean Rainfall at Morro Bay Fire Department
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Los Osos Creek drains the Clark Valley watershed. Streamflow on Los Osos Creek is monitored by a County gage (formerly Gage #6, now Sensor 751) at the Los Osos Valley Road 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 G.

Streamflow was recorded at the gage on 133 days during the 2017 water year (October 1, 2016 to September 30, 2017), including 131 days of continuous flow between January 4 and May 15, 2017. The dates, maximum stage, and corresponding daily precipitation value from Station #727 for the peak flow days in each month are listed below in Table 16.

**Table 16. Maximum Stream Stage for Los Osos Creek, 2017 Water Year**

| Date | Maximum Stream Stage County Sensor #751 (feet) |
|---|---|
| 12/16/2016 | 2.87 |
| 1/20/2017 | 5.06 |
| 2/17/2017 | 5.62 |
| 3/1/2017 | 3.77 |
| 4/7/2017 | 2.64 |
| 5/1/2017 | 2.30 |

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. Graphs of the available stream stage data over time for water years 2011 through 2017 are included in Appendix G.

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 2017, together with selected historical data, have been used to develop the following information:

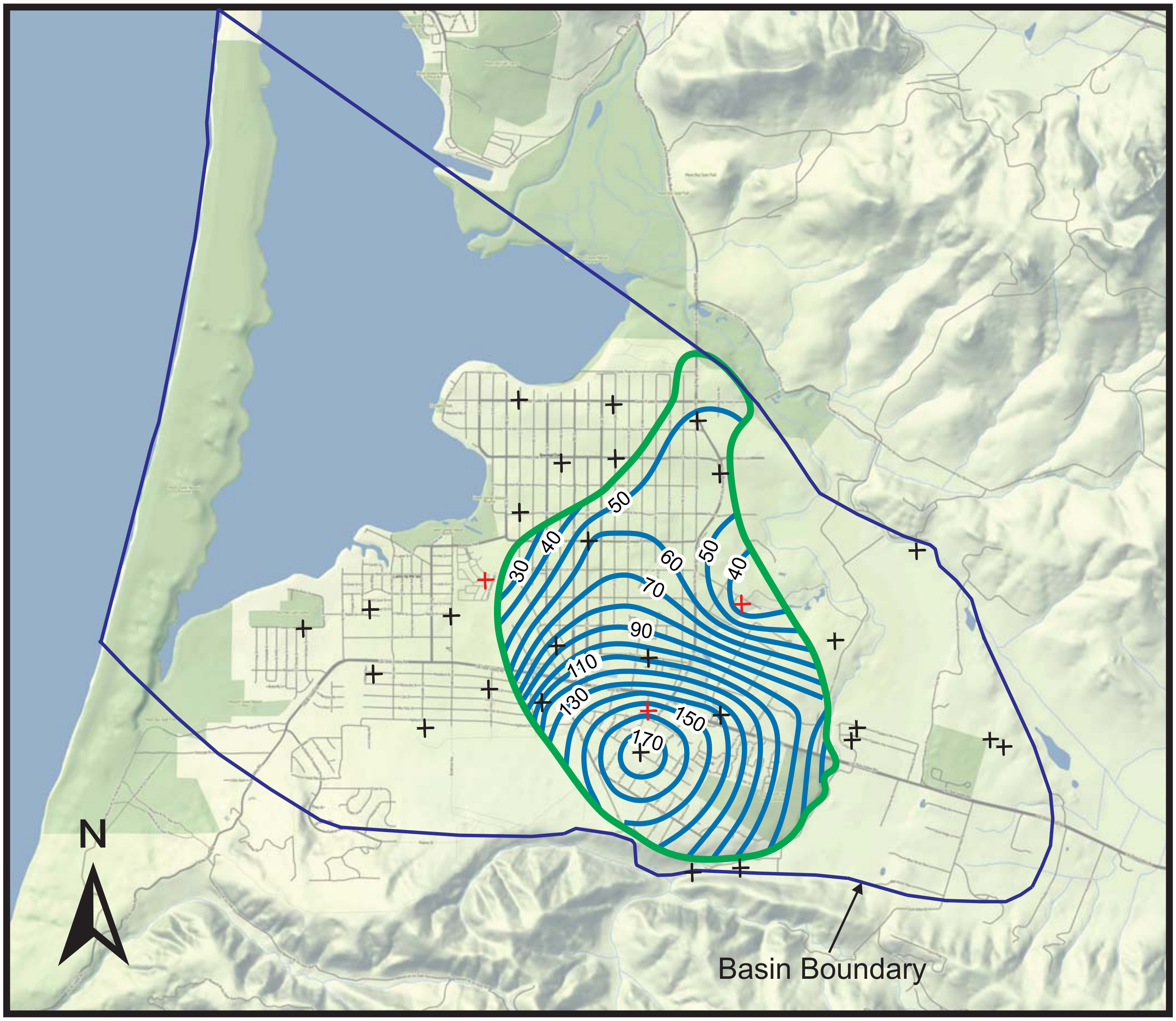
- Groundwater elevation contour maps for the Perched Aquifer, Upper Aquifer (with Alluvial Aquifer), and Lower Aquifer for both Spring and Fall 2017 conditions.
- Water level hydrographs for wells representative of aquifers in the Western, Central, and Eastern Areas of the basin.
- The lateral extent of seawater intrusion and the Fall 2017 position of the seawater intrusion front.
- Estimates of groundwater in storage for Spring and Fall 2017, including amount above mean sea level.
- Estimates of changes to groundwater in storage from Spring 2016 to Spring 2017, 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 2017 are presented in Figures 9, 10, and 11 for the Perched Aquifer, Upper Aquifer with Alluvial Aquifer, and Lower Aquifer, respectively. Corresponding water level contour maps for Fall 2017 are presented in Figures 12, 13, and 14. 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 private 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 continue the development of contour maps useful for groundwater storage estimates, three wells located in the Eastern Area were added to the monitoring network, along with one additional first water control point (spring seep) in the Western Area. Water levels from alternate dates (not from Spring or Fall 2017) were included in the contour maps at three 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 9 and 12) 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. Although the fall measurement at FW31 was slightly higher elevation than the spring measurement due to recycled water discharge operations, overall Perched Aquifer groundwater levels declined approximately 2.3 feet from spring to fall.




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 2017 groundwater elevation data point (contours not applicable outside of Perched Aquifer limits)

+ Alternate date groundwater elevation data point

Figure 9
Spring 2017 Water Level Contours
Perched Aquifer
Los Osos Groundwater Basin
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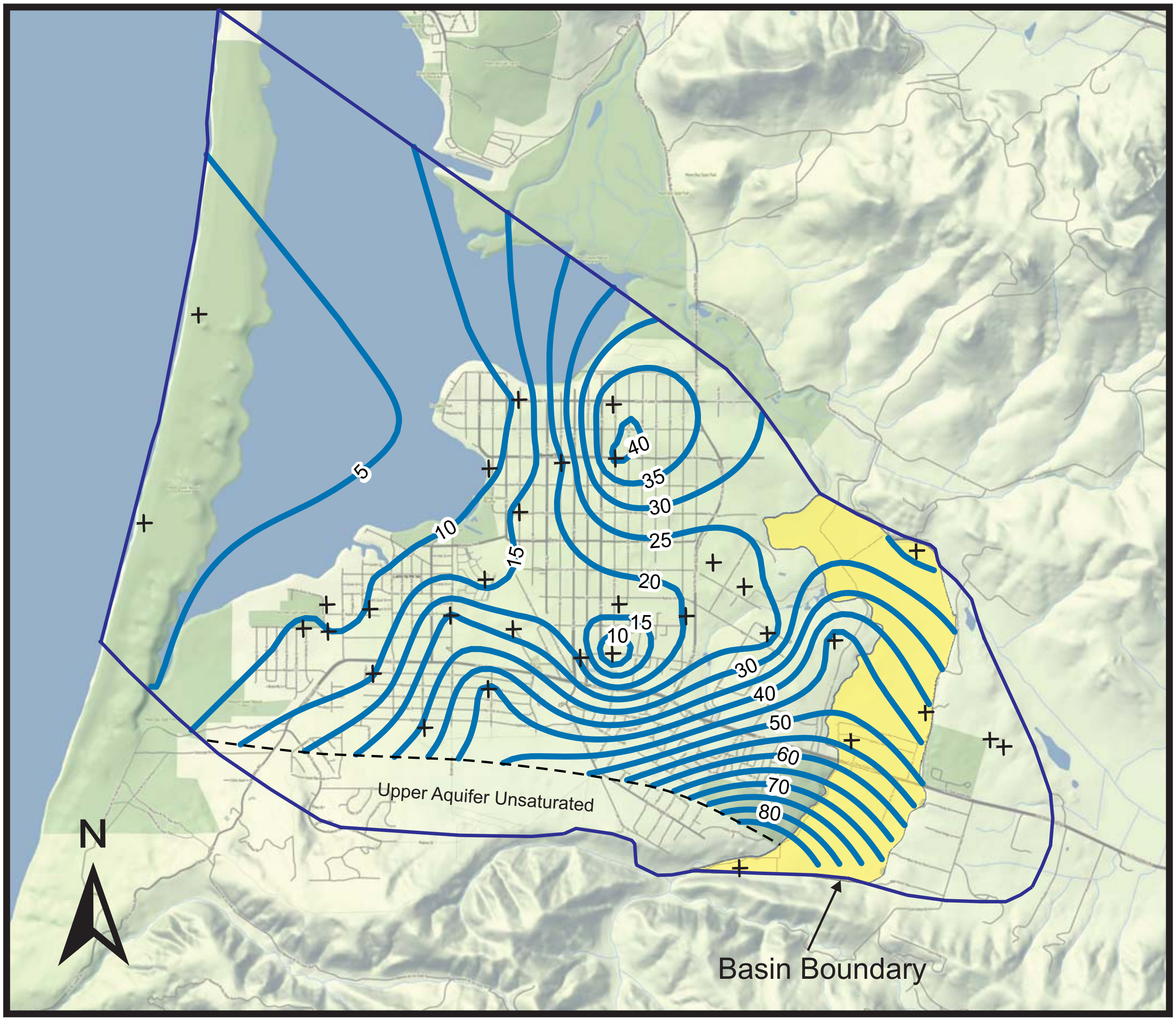


Base Image: Stamen-Terrain

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 2017 groundwater elevation data point (contours not applicable outside of Upper Aquifer and Alluvial Aquifer limits)

NOTE: Area where Upper Aquifer is unsaturated along southern Basin boundary determined from comparison of water levels with aquifer base contours.

Figure 10
Spring 2017 Water Level Contours
Upper Aquifer and Alluvial Aquifer
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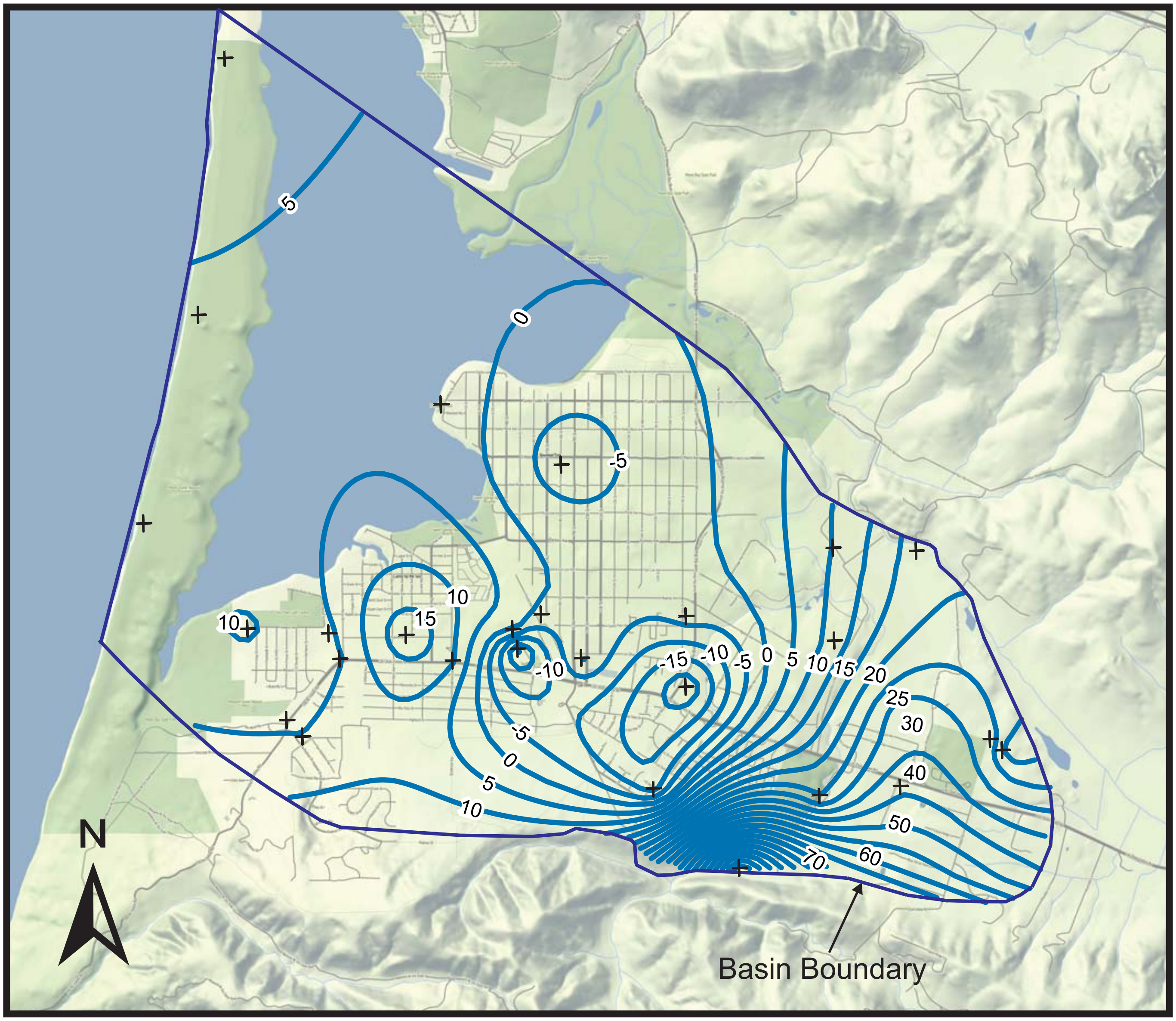


Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Figure 11
Spring 2017 Water Level Contours
Lower Aquifer
Los Osos Groundwater Basin
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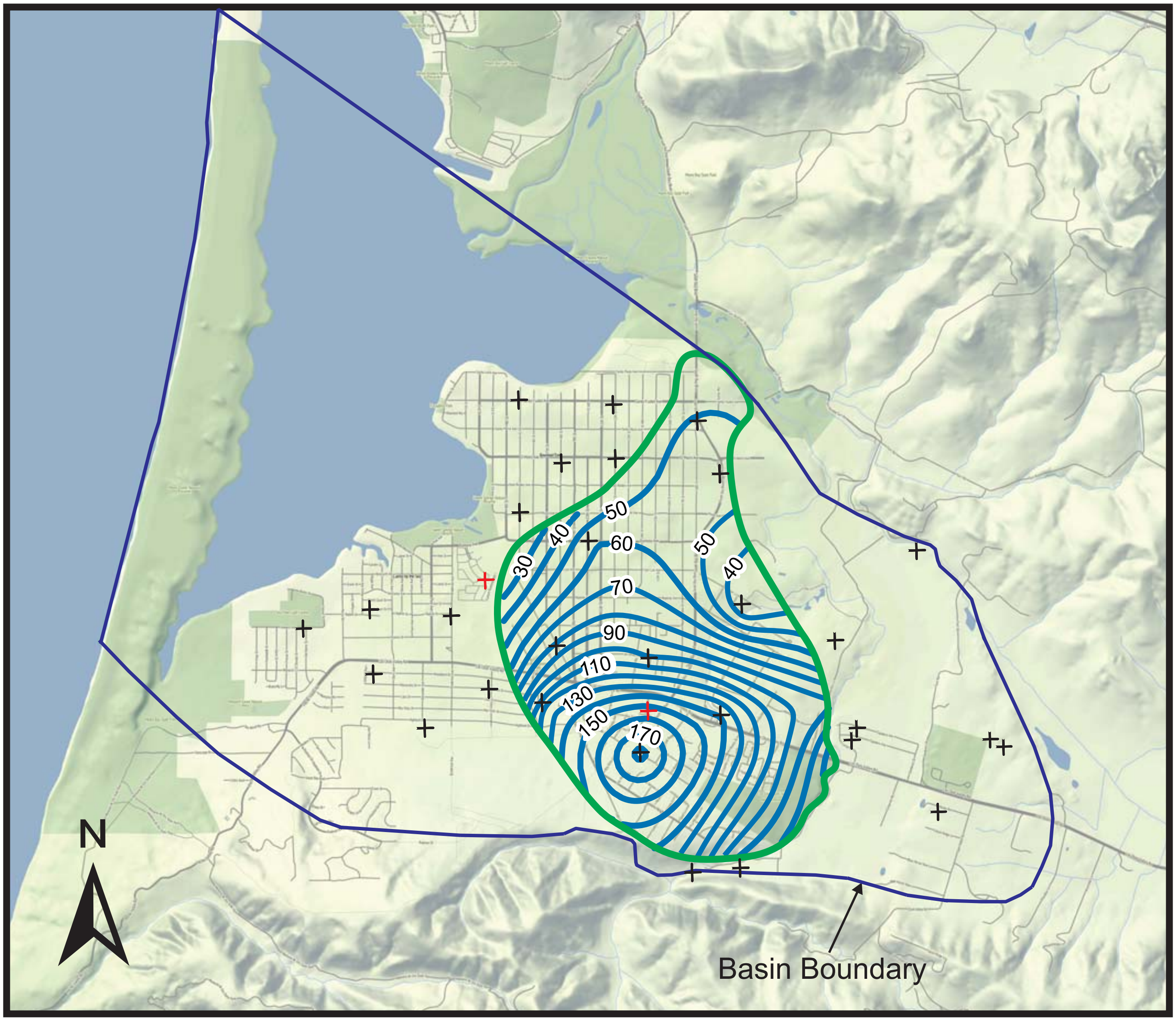
Explanation

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

+ Spring 2017 groundwater elevation data point




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 2017 groundwater elevation data point (contours not applicable outside of Perched Aquifer limits)

+ Alternate date groundwater elevation data point (December 2017 for LOWRF program private wells)

Figure 12
Fall 2017 Water Level Contours
Perched Aquifer
Los Osos Groundwater Basin
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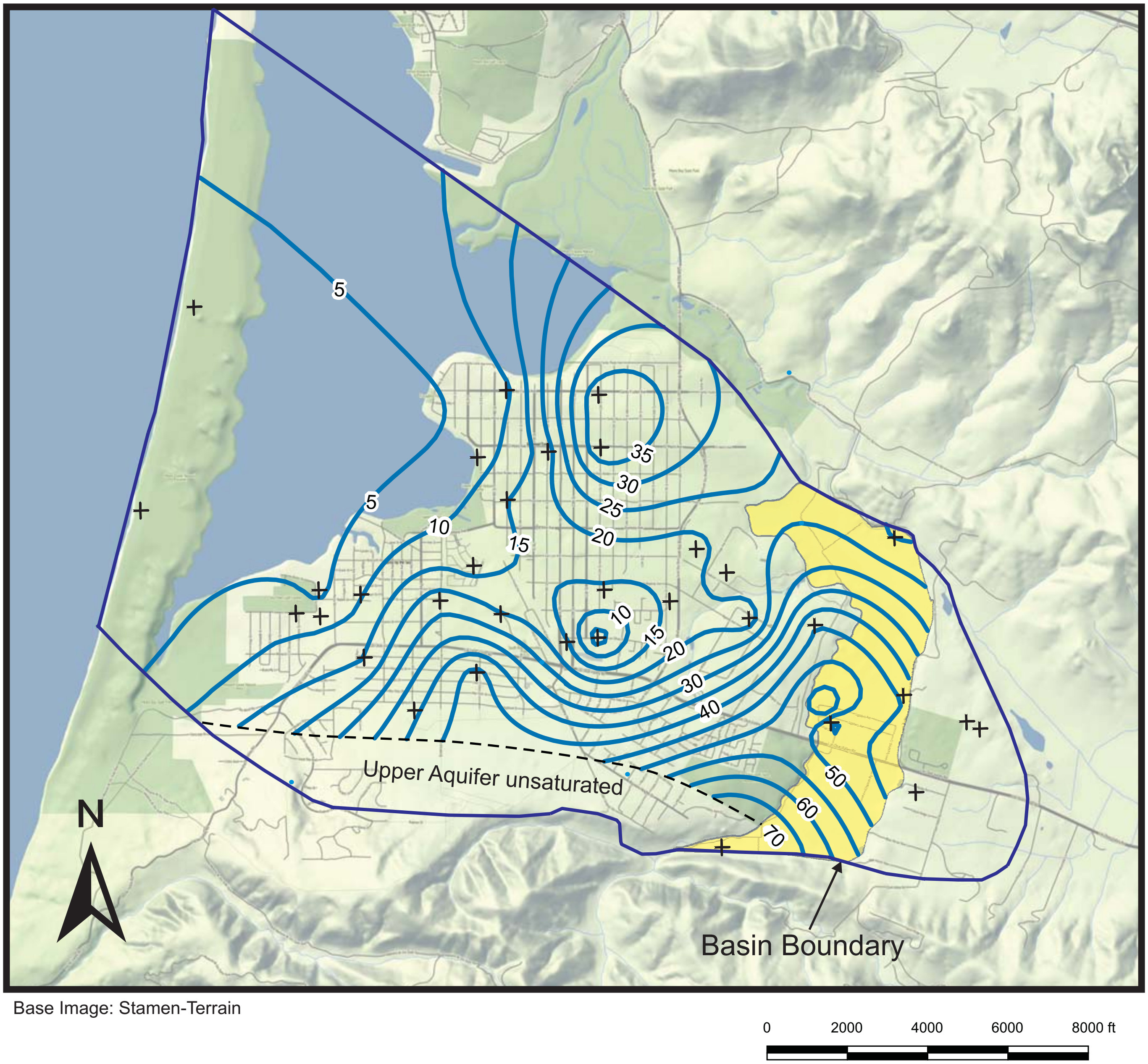


## Explanation

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

Limits of Alluvial Aquifer

\+ Fall 2017 groundwater elevation data point (contours not applicable outside of Upper Aquifer and Alluvial Aquifer limits)

NOTE: Area where Upper Aquifer is unsaturated along southern Basin boundary determined from comparison of water levels with aquifer base contours.

Figure 13
Fall 2017 Water Level Contours
Upper Aquifer and Alluvial Aquifer
Los Osos Groundwater Basin
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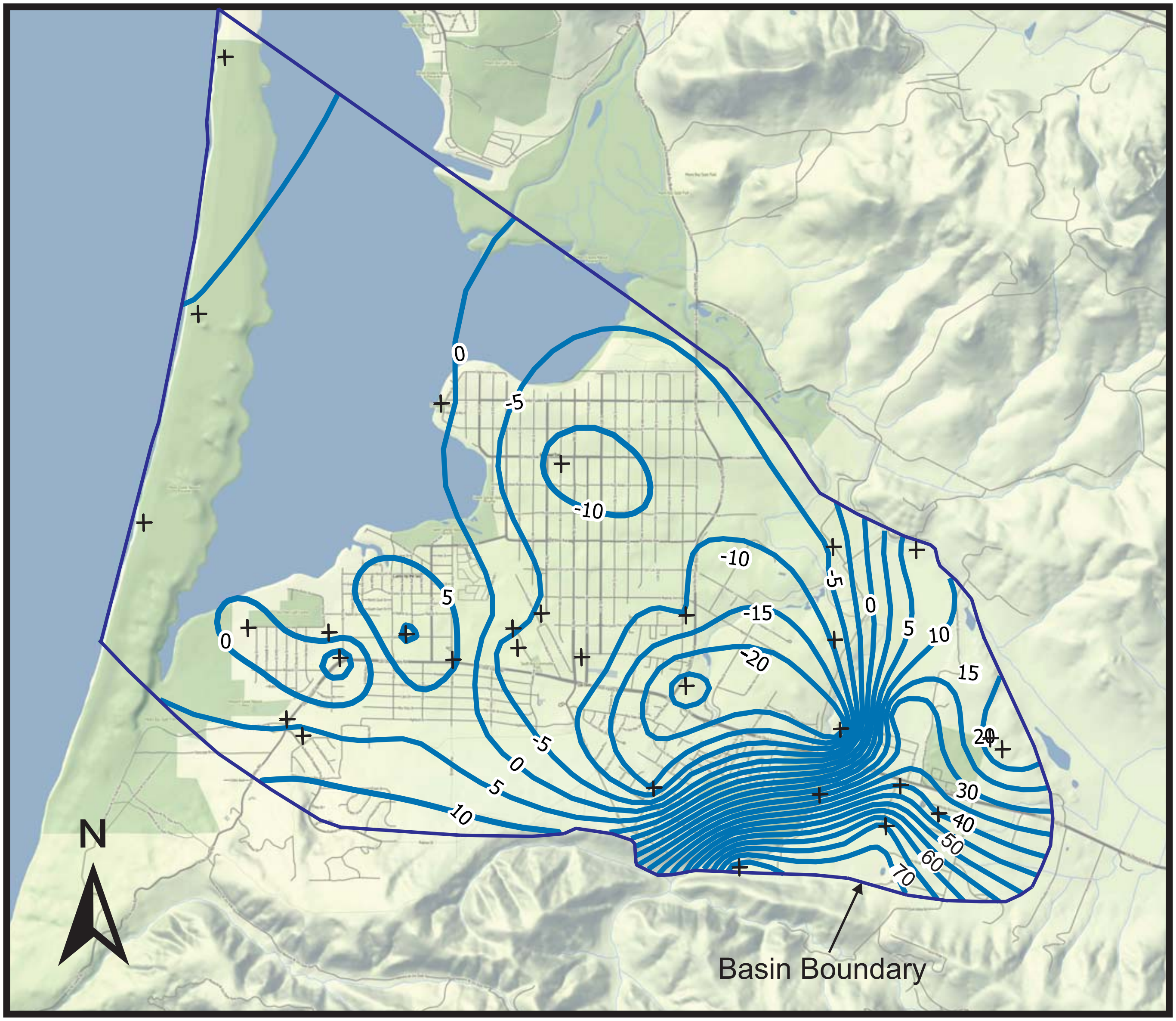


Base Image: Stamen-Terrain

Scale: 1 inch ≈ 4,000 feet

Explanation

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

+ Fall 2017 Groundwater elevation data point

Figure 14
Fall 2017 Water Level Contours
Lower Aquifer
Los Osos Groundwater Basin
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Contour maps for the Upper Aquifer and Alluvial Aquifer (Figures 10 and 13) 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 averaged approximately 2.5 feet of water level decline from Spring 2017 to Fall 2017.

Contour maps for the Lower Aquifer (Figures 11 and 14) show the highest groundwater elevations are at the southern edge of the Los Osos Creek valley and near the eastern basin boundary. The steep hydraulic gradient between the upper Los Osos Creek valley and downtown Los Osos suggests significant permeability restrictions between the two areas, possibly fault related (Yates and Weise, 1988; C&A, 2005). Groundwater flow in the Lower Aquifer is generally toward Central Area pumping depressions which are below sea level. Lower Aquifer groundwater elevations averaged approximately 4.5 feet of water level decline from Spring 2017 to Fall 2017.

## 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. The hydrographs are shown in Figures 15, 16, and 17, respectively.

In previous reports, trends for the first water wells have been analyzed in ten-year spans. There was a lapse in monitoring between 2006 and 2012 for three of the five representative first water wells, however, so beginning this year a five-year trend will be analyzed, increasing by one year with each subsequent report until the first water trend analysis returns to a ten-year span.

The spring to spring water level trend for the last 5 years (2012-2017), based on first water hydrographs in Western and Central area wells was 0.2 feet of decline per year (Figure 15). The spring to spring water level trend over the last ten years (2007-2017), based on Central and Western wells in the hydrographs was 0.05 feet of decline per year (relatively flat) in the Upper Aquifer, and 0.47 feet of rise per year in Lower Aquifer water levels (Figures 16 and 17).

The trend of water level declines in First Water and Upper Water hydrographs has diminished compared to prior years, which is attributable to above-normal rainfall for 2017 (Figure 8). The continued trend of rising water levels in Lower Aquifer wells is interpreted to be mainly in response to an average annual decline of over 3 percent per year in Lower Aquifer groundwater production in the Western and Central areas between 2007 and 2017.

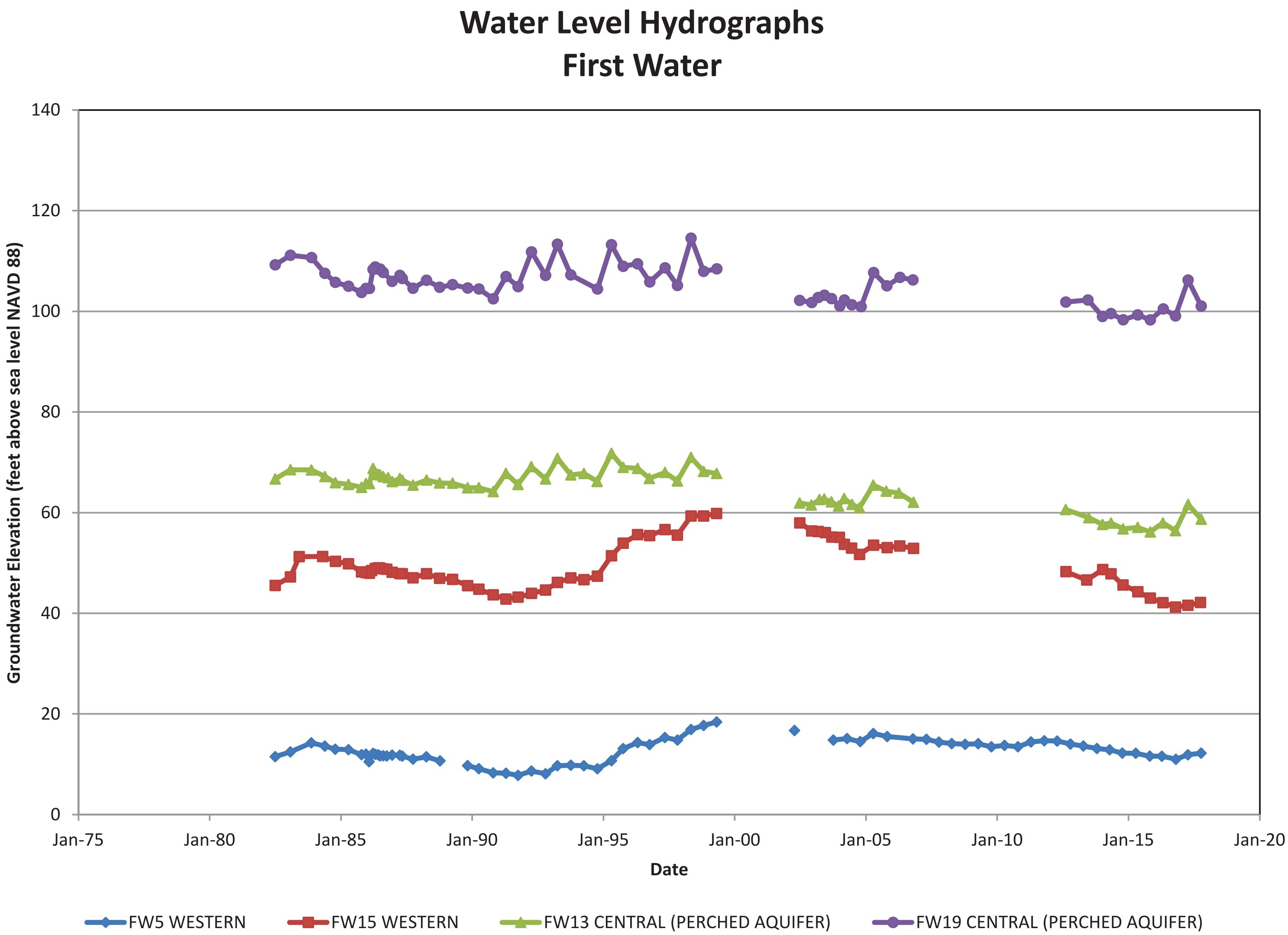


Figure 15
Water Level Hydrographs
Perched Aquifer/First Water
Los Osos Groundwater Basin
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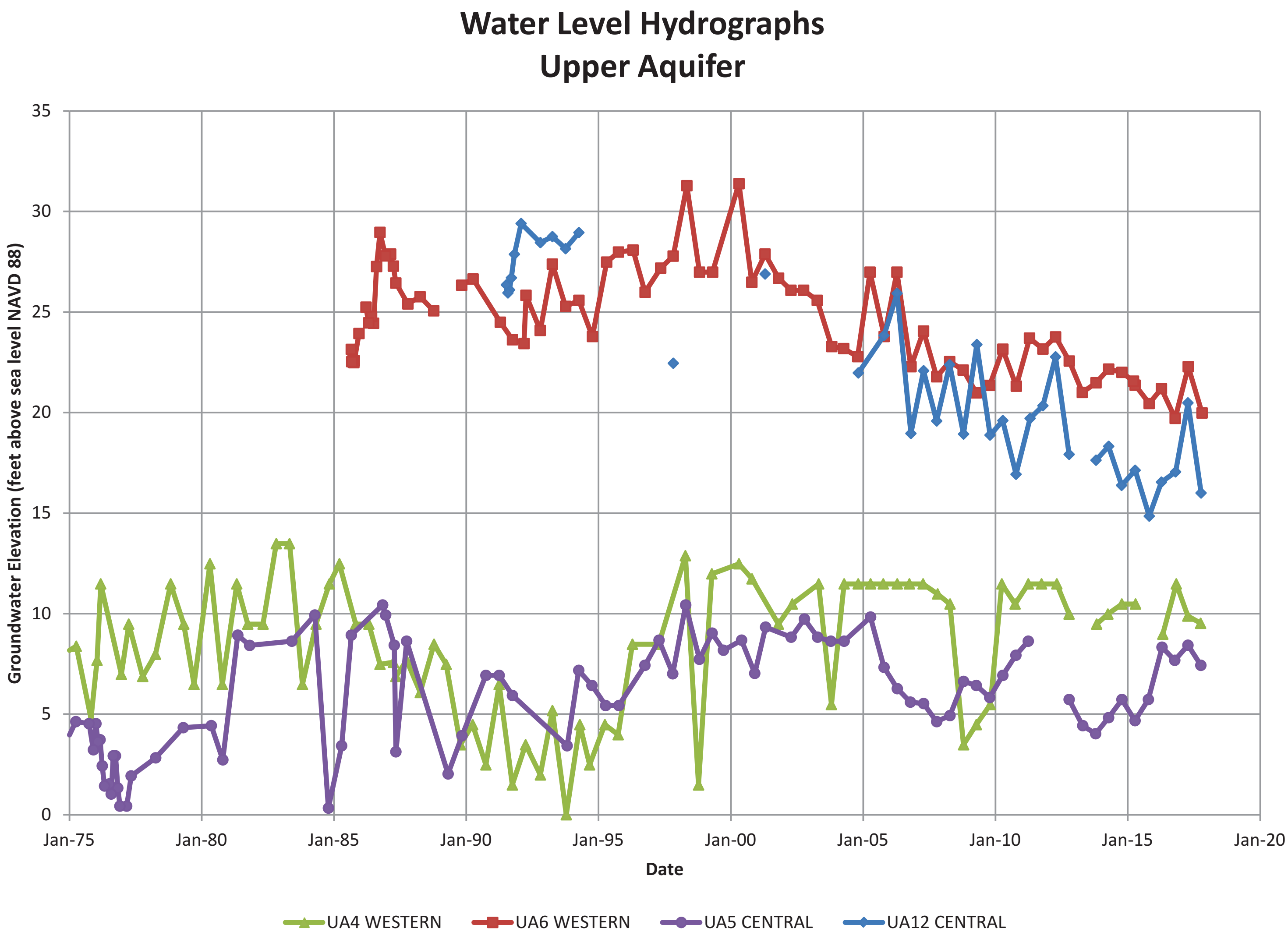


NOTE: Constant water level elevations over a few years (2004-2007) at well UA4 may indicate measuring equipment problem due to obstruction or failing water.

Figure 16
Water Level Hydrographs
Upper Aquifer
Los Osos Groundwater Basin
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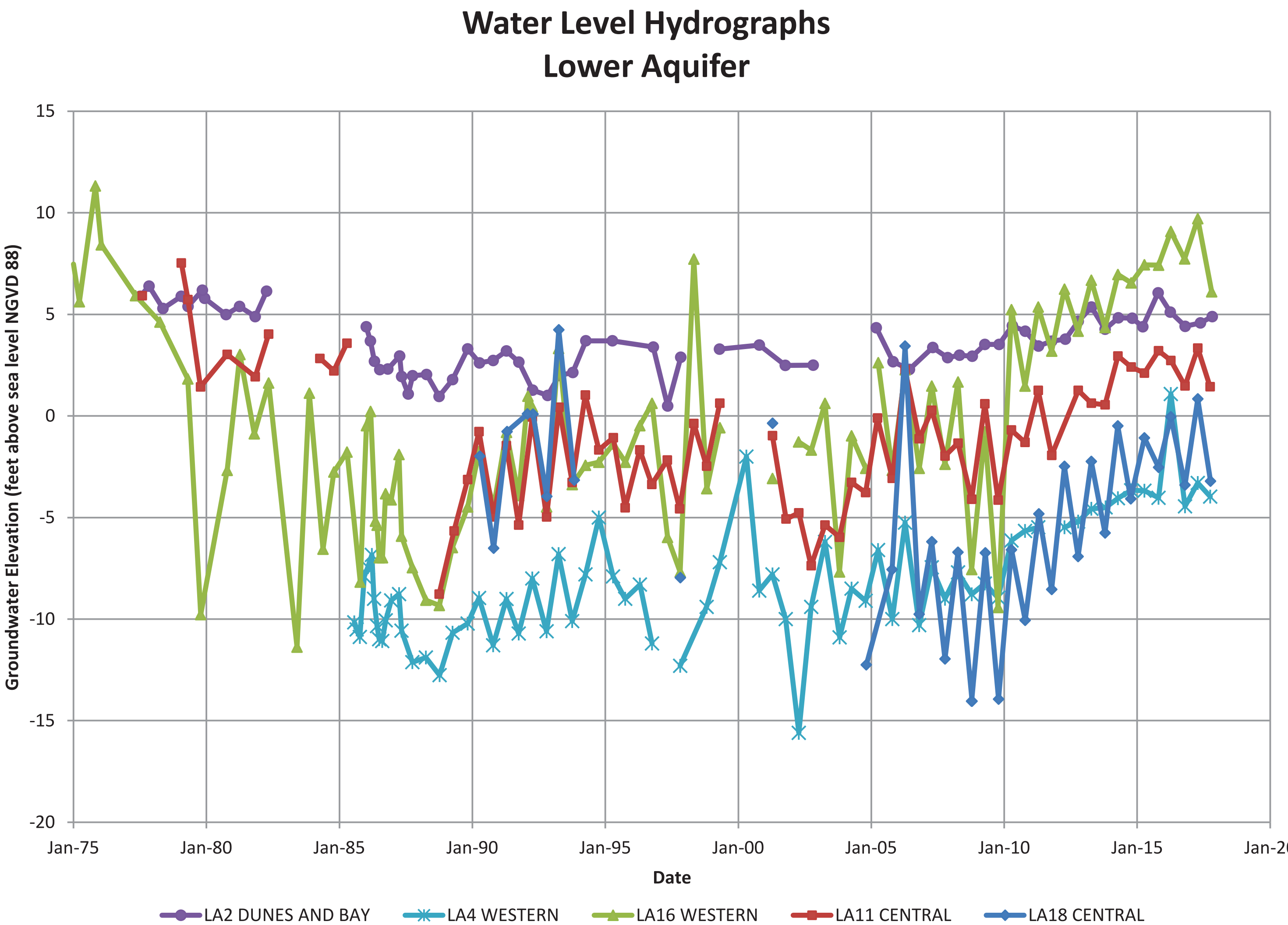


Figure 17
Water Level Hydrographs
Lower Aquifer
Los Osos Groundwater Basin
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Hydrographs for seven wells equipped with pressure transducers are shown in Appendix H. The transducers have been installed to provide greater detail of water level trends and fluctuations. There are three First Water wells, two Upper Aquifer wells, and two Lower Aquifer wells equipped with transducers.

The transducer hydrographs have been interpreted to show the following short-term trends:

- FW6 is screened in the top of the Upper Aquifer (First Water) near the Broderson leach field in the Western Area of the basin. The hydrograph showed a relatively flat water level trend between January and June of 2017, followed by a water level increase of four feet through December 2017. The rise in water level is credited to groundwater mounding on the regional aquitard beneath the Broderson leach field. This mounding is expected to increase the downward hydraulic gradient and promote leakage through the regional aquitard, which will help to mitigate seawater intrusion in the Western Area.

- FW10 is screened at the top of the Upper Aquifer (First Water) in the Central Area of the basin, while UA4 and UA10 are screened at the bottom of the upper aquifer in the Western Area and Central Area of the basin respectively. These wells displayed a seasonal fluctuations of 2-4 feet, including 1-2 feet of interference related to nearby pumping wells.

- FW27 is screened in the alluvial aquifer (First Water) in the Eastern Area of the basin. The well was equipped with a transducer in April of 2017, near the seasonal high water period, and has shown a steady water level decrease of nearly 30 feet from mid-May through December 2017. The relatively large seasonal fluctuation is attributable to the well's location in the upper Los Osos Creek valley (Figure 2), where the majority of seasonal recharge from stream seepage occurs.

- LA13 and LA39 are screened in Lower Aquifer in the Central Area and Eastern Area of the basin, respectively. These wells displayed a seasonal fluctuation of approximately 7-9 feet, including interference related to pumping wells nearby.

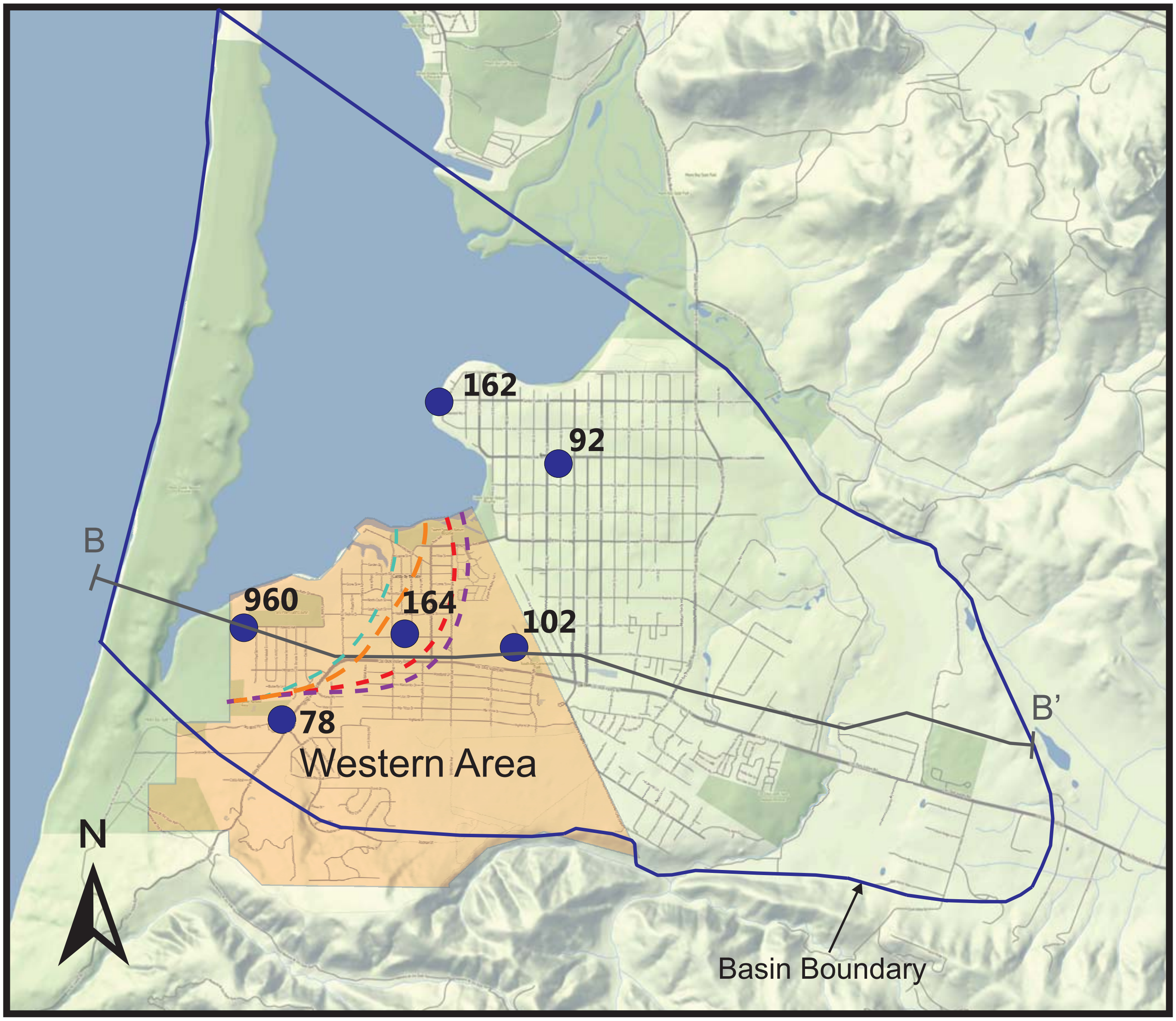
Seawater has a density that is 1.025 times greater than fresh water. For every foot of fresh water head above sea level, the seawater interface will be displaced 40 feet below sea level, according to the Gyhben-Herzberg relation (Freeze and Cherry, 1979). Upper aquifer water levels at the bay front (wells UA3, UA4, and UA5) are currently high enough to avoid seawater intrusion in the Upper Aquifer at those locations, with the exception of UA3 during Fall 2017. Well UA3 is an active municipal well, and regular water level and specific conductance monitoring at the well would be recommended for the purveyor (not a BMC task).

## 7.3 Seawater Intrusion

The position of the Fall 2016 and Fall 2017 seawater intrusion front in Lower Aquifer Zone D is shown in Figure 18, along with the corresponding 2005 seawater intrusion front. The seawater intrusion front corresponds to the position of the 250 mg/L chloride isopleth, based on water quality samples from six lower aquifer wells: LA8, LA10, LA11, LA12, LA15, and LA32 The intrusion front retreated toward the coast up to 1,500 feet between Fall 2016 and Fall 2017, which represents a major reversal of seawater intrusion. However, it is worth noting that Figure 18 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, and from Spring to Fall due to localized chloride fluctuations, particularly at well LA10. Furthermore, the decline in chloride concentrations during 2017 at LA10 was accompanied with an increase in nitrate concentrations at the well (Tables 10 and 11) and lower production in 2017, which suggests wellbore flow from the Upper Aquifer may be influencing LA10 water quality (see Section 7.5.3).

Contouring for the intrusion front (250 mg/L chloride isopleth) shown in Figure 18 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 19. 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 19 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, and geophysics in 2015 at nearby deep monitoring well LA14 continues to show no sign of intrusion. This is interpreted as an indication that historical Zone E intrusion toward the Well LA15 was through a relatively narrow preferential pathway. In 2013, LA15 was modified to remove Zone E production (CHG, 2014).




Base Image: Stamen-Terrain



Explanation

**164**
Groundwater with Fall 2017 Lower Aquifer Chloride Concentration in milligrams per liter (mg/L).

2017 seawater intrusion front in Western Area (250 mg/l chloride isopleth)

2016 seawater intrusion front in Western Area (250 mg/l chloride isopleth)

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 19)

Figure 18
Seawater Intrusion Front
Western Area Lower Aquifer Zone D
Los Osos Groundwater Basin
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## 7.4 Groundwater in Storage

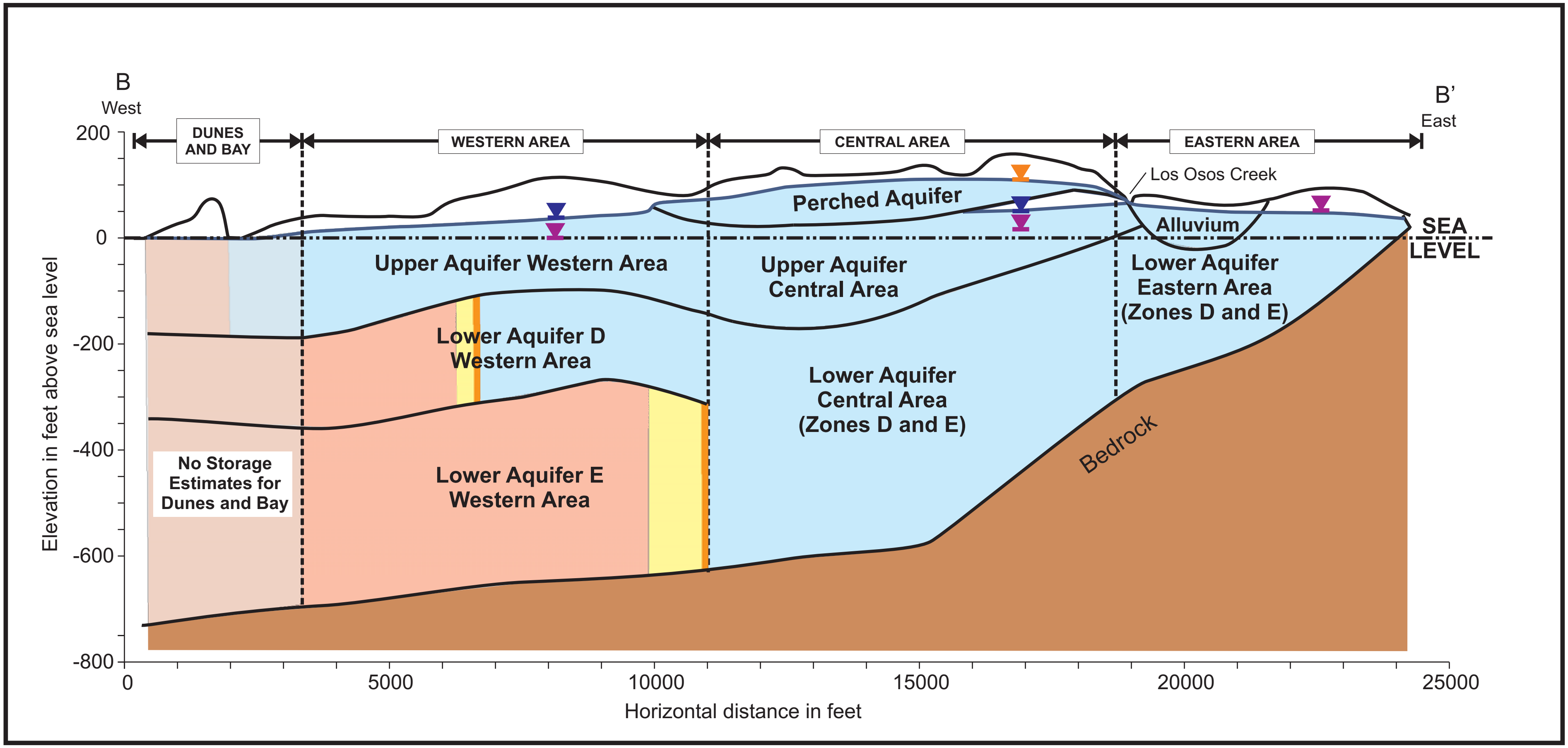
Groundwater in storage for basin areas and aquifers has been estimated through a systematic approach of water level contouring, boundary definition, volume calculations, and aquifer property estimation. The methodology was developed to facilitate change in storage calculations from year to year. An example storage calculation for the Eastern Area is shown in Appendix I. Storage estimates were performed for Spring and Fall 2017 and included separate estimates for the following areas and aquifers shown in Figure 19:

- 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 19. Storage estimates for the Lower Aquifer in the Western and Central basin combine 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 I). The storativity value used for the confined aquifer in the Western and Central areas is estimated at 0.0008 (Cleath & Associates, 2005).

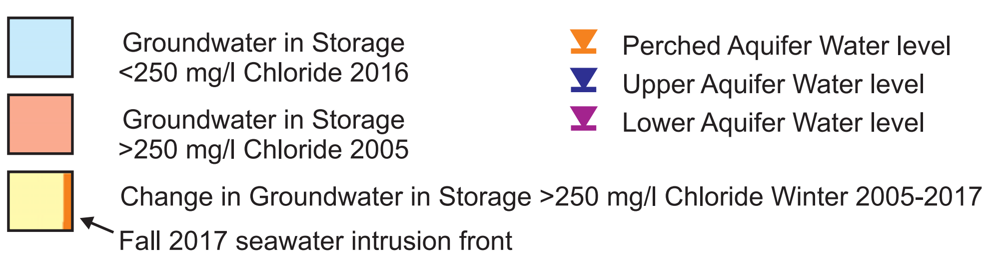
The storage component of the Lower Aquifer in the Western Area Zone D represents the groundwater volume with a chloride concentration of 250 mg/L or less. Zone E in the Western Area is excluded from the storage calculations, because chloride concentrations are mostly above 250 mg/L (Figure 19).

All storage calculations were based on upper and lower contoured surfaces specific to the aquifer (fixed volume and confined volume were combined). 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 19). Appendix I includes a list of wells used for 2017 groundwater elevation contours and associated upper surfaces for storage calculations. Fixed upper and lower surfaces used for storage calculations (base of perched aquifer, top and bottom of regional clay aquitard, and base of permeable sediments were developed from existing contour maps and control points presented in prior reports (Cleath & Associates, 2003, 2005; CHG, 2015). Table 17 summarizes the estimates of fresh groundwater in storage for 2017.




Cross-section alignment shown in Figure 18

**Explanation**




NOTE: Inland movement of intrusion front between Fall 2016 and Fall 2017 shown in Figure 18 is for Lower Aquifer Zone D. There is no evidence of further inland movement of the intrusion front in Zone E.

Figure 19
Basin Storage Compartments
Los Osos Groundwater Basin
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| Table 17. Groundwater in Storage Spring and Fall 2017 (<250 mg/l Chloride) | | | | | | |
|---|---|---|---|---|---|---|
| **Basin Area** | **Aquifer** | **Zone** | **Spring 2017** | | **Fall 2017** | |
| | | | **Total** | **Above Sea Level** | **Total** | **Above Sea Level** |
| | | | **ACRE-FEET** | | | |
| Western and Central | Perched | A, B | 4,700 | 4,700 | 4,500 | 4,500 |
| | Upper | C | 27,700 | 5,900 | 27,000 | 5,100 |
| Western | Lower[1] | D[2] | 15,700 | <10 | 16,400 | <10 |
| Central | Lower[1] | D, E | 56,200 | <10 | 56,200 | <10 |
| Eastern | Alluvial and Lower | Alluvial, D, E | 19,000 | 4,500 | 18,200 | 3,700 |
| TOTAL | | | 123,300 | 15,100 | 122,300 | 13,300 |

NOTES: [1] Includes fixed and confined storage.
[2] Western Area Zone E not included due to chloride >250 mg/L.

Total fresh groundwater in storage for the basin (excluding Dunes and Bay area) averaged close to 123,000 acre-feet in Spring 2017, with approximately 15,000 acre-feet above sea level (Table 17). There was a calculated net seasonal storage decline of 1,000 acre-feet between Spring 2017 and Fall 2017, although there was an estimated gain of 700 acre-feet of freshwater storage in Lower Aquifer Zone D due to a retreating seawater intrusion front in the western Lower Aquifer. The gain of freshwater storage from Spring to Fall is based on movement of the 250 mg/l chloride isopleth in Zone D, similar to what is shown in Figure 18.

There is approximately 72,000 acre-feet of storage within the Lower Aquifer in the Western Area Zone D and Central Area Zones D and E (Table 17). 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 only change with movement of the seawater intrusion front. The Lower Aquifer storage includes a relatively small component (less than 200 acre-feet) of confined pore space volume, representing water that is available without dewatering any portion of the Lower Aquifer (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 smaller storage volume assumes a confined aquifer storativity of 0.0008, compared to the unconfined specific yield of 0.1. Table 18 compares Spring 2016 groundwater in storage with Spring 2017.

| Table 18. Change in Storage Spring 2016 to Spring 2017 (<250 mg/l Chloride) | | | | | | |
|---|---|---|---|---|---|---|
| **Basin Area** | **Aquifer** | **Zone** | **Spring 2016** | | **Change from Spring 2016 to Spring 2017** | |
| | | | **Total** | **Above Sea Level** | **Total** | **Above Sea Level** |
| | | | **ACRE-FEET** | | | |
| Western and Central | Perched | A, B | 4,300 | 4,300 | 400 | 400 |
| | Upper | C | 27,000 | 5,100 | 700 | 800 |
| Western | Lower[1] | D[2] | 14,800 | <10 | 900 | 0 |
| Central | Lower[1] | D, E | 56,200 | <10 | 0 | 0 |
| Eastern | Alluvial and Lower | Alluvial, D, E | 18,000 | 3,500 | 1,000 | 1,000 |
| TOTAL | | | 120,300 | 12,900 | 3,000 | 2,200 |

NOTES: [1] Includes fixed and confined storage.
[2] Western Area Zone E not included due to chloride >250 mg/L.

The values in Table 18 reflect an increase in freshwater storage between Spring 2016 and Spring 2017 of 3,000 acre-feet (as compared to the seasonal storage loss of 1,000 acre-feet between Spring and Fall 2017). The annual change in storage includes an increase in fresh groundwater storage (<250 mg/L chloride) of 900 acre-feet in the Lower Aquifer (including a seasonal gain of 700 acre-feet during 2016). The increased spring storage is consistent with the increased precipitation in Los Osos, compared to the prior four years (26.63 inches of precipitation at Station #727 in the 2017 rainfall year, compared to an average of 9.7 inches from 2013 to 2016).

Freshwater storage in the Western Area of Lower Aquifer Zone D increased by 2,000 acre-feet between Fall 2016 and Fall 2017, then increased by another 700 acre-feet through Fall 2017. The change in Zone D freshwater storage between Fall 2016 and Fall 2017 was a net gain of 2,700 acre-feet, as shown by the westerly retreat of the seawater intrusion front in Figure 18.

A sensitivity analysis was performed to evaluate the potential range of error associated with groundwater storage estimates and change in groundwater storage estimates to support future data interpretation. Three sources of potential error were considered:

- Tape Bias/Survey Error
- Specific Yield Error
- Data Gaps

The sensitivity analysis evaluated how storage calculations are affected by variables (elevation, specific yield, and spatial data) associated with the above sources of error. Storage volumes calculated after applying changes to these variables were compared to the baseline volumes for each storage compartment.

Potential error for storage estimates and change in storage estimates are within 20 percent of baseline for most variables and storage compartments. The data gap sensitivity showed the greatest range in potential error due to a missing Fall 2017 water level that resulted in a projected gain in storage from spring to fall in the perched aquifer, rather than a decline. That type of error, however, is screened for during report preparations and was mitigated with a substituted elevation.

Storage calculations would be improved by assigning a specific yield to each individual aquifer. Correlating specific yields to a more robust sample set of logs for the individual aquifers would be recommended. Detailed results of the sensitivity analysis are presented in Appendix J.

## 7.5 Basin Metrics

The LOBP 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 2017 is a ratio expressed as follows:

$$\frac{\text{2017 Groundwater Production}}{\text{2017 Sustainable Yield}} \ast 100$$

Groundwater production in 2017 was 2,070 acre-feet. The sustainable yield of the basin with the infrastructure in place at year-end 2016 was estimated using the basin model to be 2,760 acre-feet per year (CHG, 2017). The 2016 estimate included the first Program C well and is applicable to year-end 2017, therefore, the Basin Yield Metric in 2017 is 75. The corresponding Basin Yield Metric was 78 in 2016, which was the first year the metric has been below 80 since the early 1970's. The LOBP objective for the Basin Yield Metric is 80 or less, and has been met in 2016 and 2017.

Figure 20 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 75 in 2017. Two development scenarios from the LOBP are also provided for comparison in Figure 20.

Sustainable yield in the equation above is not simply a volume of water, however, but is also the distribution of groundwater pumping across the basin that maintains a stationary seawater front, with no active well producing water with chloride concentrations above 250 mg/l. Long-term climatic conditions are assumed for the sustainable yield.

### 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 LOBP Projects implemented (ISJ Group, 2015) (see Section 10 for brief overview of LOBP Programs). The Basin Development Metric for 2017 is a ratio expressed as follows:

$$\frac{\text{2017 Sustainable Yield}}{\text{Maximum Sustainable Yield}} * 100$$

The 2017 sustainable yield is estimated at 2,760 acre-feet. The maximum sustainable yield with all LOBP projects implemented is estimated at 3,500 acre-feet. Therefore, the Basin Development Metric in 2017 is 79, which is the same value as 2016. The purpose of the metric is to inform the BMC on the percentage of the basin's maximum sustainable yield that has been developed. There is no LOBP objective for the Basin Development Metric.

As presented in the LOBP, the estimated sustainable yield of the basin will increase beginning with urban water reinvestment Program U and basin infrastructure Programs A and C, both of which are currently in progress.

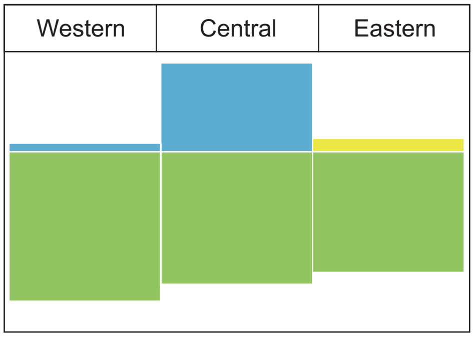
### 7.5.3 Water Level, Chloride, and Nitrate Metrics

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.

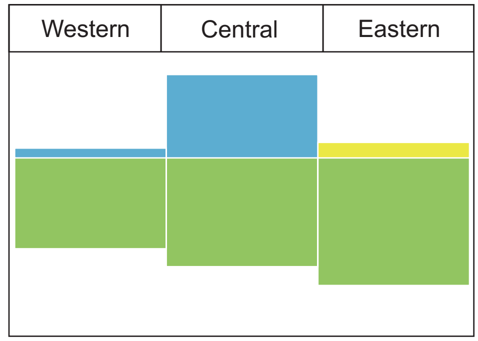
Water Level Metric

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).

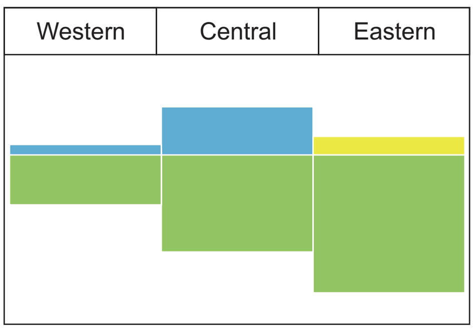
2005-2009
Average Production 3,060 AFY
Basin Yield Metric = 128



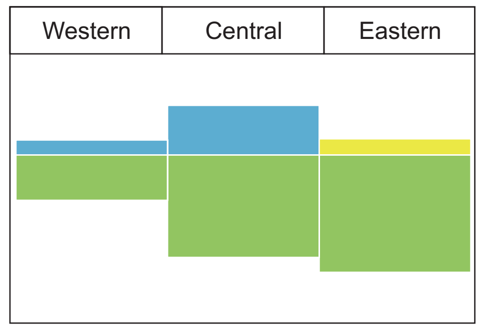

2010-2014
Average Production 2,600 AFY
Basin Yield Metric = 106



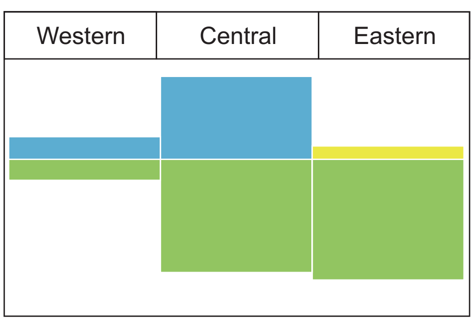

2015-2016
Average Production 2,160 AF
Basin Yield Metric = 78



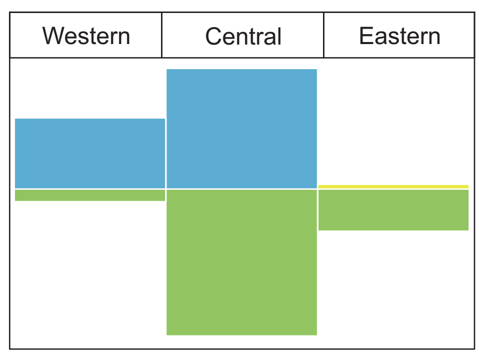

**Year 2017**
**Average Production 2,070 AF**
**Basin Yield Metric = 75**




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




Explanation:

Size of rectangle is proportional to groundwater production

- Alluvial Aquifer
- Upper and Perched Aquifer
- Lower Aquifer

Note: historical (pre-2015) and future/projected Basin Yield Metrics are from LOBP

Figure 20
Basin Yield Metric Comparison
Los Osos Groundwater Basin
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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 sand spit (LA2 and LA3), where monitoring will help evaluate regional effects, rather than just localized water level rebound. Table 19 presents the 2016 Water Level Metric. Figure 21 graphs historical trends in the metric.

**Table 19. 2016 Water Level Metric**

| Metric Well | Spring 2016<br>Groundwater Elevation<br>(feet above sea level - NGVD 29 Datum) |
|---|---|
| LA2 | 1.8[1] |
| LA3 | -0.9[1] |
| LA11 | 0.4[1] |
| LA14 | -1.5[1] |
| LA16 | 7.8 |
| Water Level Metric (average) | 1.5 feet |

Data Source: LOBP and County Groundwater Monitoring Programs
[1]Subtracted 2.8 feet from NAVD 88 elevations in Table 5 to convert to NVGD 29 datum for metric.

The Spring 2017 Water Level Metric is 1.5 feet NGVD 29 (approximately 4.3 feet NAVD 88). Mean sea level is approximately 0 feet in the NVGD 29 datum, and 2.8 feet in the NAVD 88 datum for the central coast. The metric was rising from 2005 through 2014, likely in response to a decrease in Lower Aquifer production, did not change between 2014 and 2015, and has begun rising again (Figure 21). The LOBP 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 29 datum has lowered the metric compared to prior calculations (CHG 2016b). Reevaluation of the metric objective may be appropriate. 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 is reversed. The LOBP Groundwater Monitoring Program schedule for measuring the Chloride metric is in the Spring and Fall.

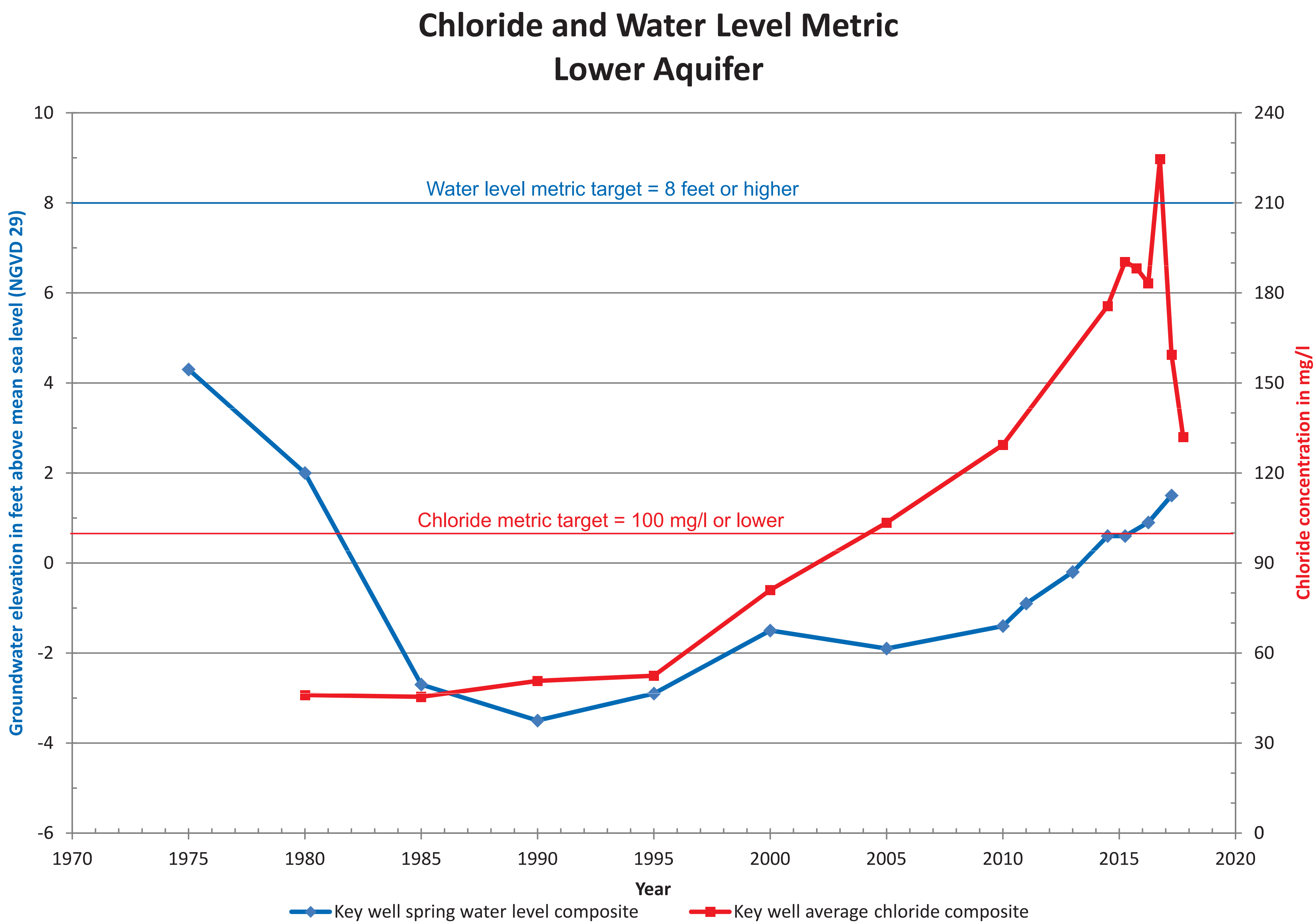


Figure 21
Chloride and Water Level Metric
Los Osos Groundwater Basin
2017 Annual Report

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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 (Refer to the LOBP for a description of the development of the Metric). Table 20 presents the Spring and Fall 2016 Chloride Metric. Figure 21 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 20. 2017 Chloride Metric**

| Metric Well | Spring 2017 Chloride Concentrations | Fall 2017 Chloride Concentrations |
|---|---|---|
| LA8 | 77 mg/L | 78 mg/L |
| LA10 | 231 mg/l (double counted for average) | 164 mg/l (double counted for average) |
| LA11 | 167 mg/L | 162 mg/L |
| LA12 | 91 mg/L | 92 mg/L |
| Chloride Metric (weighted average) | 159 mg/L | 132 mg/L |

Data Source: LOBP Groundwater Monitoring Program (Appendix C)

The 2017 water quality monitoring results indicate a retreat of the seawater intrusion front. Seawater intrusion is typically greatest in the fall, when water level are lowest. Unlike 2016, when a significant increase in the Chloride Metric was observed, a comparison between Spring 2017 and Fall 2017 shows continued decline in the metric. The Chloride Metric has decreased relative to the target value between Fall 2016 (225 mg/L) and Fall 2017 (132 mg/L), indicating improvement in 2017 (Figure 21).

Increasing nitrate concentrations at LA10 suggest wellbore flow from the Upper Aquifer may be influencing the chloride concentration and lowering the Chloride Metric more than would otherwise occur. Wellbore flow refers to water moving vertically through the annual space between a well casing and the borehole wall. In the Western Area, the direction of wellbore flow is downward (from the Upper Aquifer to the Lower Aquifer). The amount of influence from wellbore flow on LA10 water quality was evaluated based on mixing Upper Aquifer water from Fall 2017 (represented by Western Area municipal well UA3) with water from LA10. A mixture of 2 parts Lower Aquifer water (from LA10) with one part Upper Aquifer water (from UA3) would be needed to dilute the chloride at LA10 from the Fall 2016 concentration of 389 mg/l to the Fall 2017 concentration of 164 mg/l. This mixture, however, would produce a much greater nitrate concentration (60 mg/l) than measure at LA10 in Fall 2017 (15 mg/L). In order to produce a nitrate concentration of 15 mg/L, only 10 percent of the water at LA10 would need to come from wellbore flow, which would account for approximately 30 mg/L of the 225 mg/L decline in the Chloride Metric between Fall 2016 and Fall 2017.

Based on preliminary mixing calculations, it appears that the chloride concentration at LA10 is partially influenced by Upper Aquifer wellbore flow, but that the majority of the decline in chloride concentration at LA10 is occurring in the Lower Aquifer. Further evaluation of wellbore flow and Upper Aquifer influence at LA10 is recommended as new data becomes available.

<u>Nitrate Metric</u>

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 Nitrate Metric has historically been measured in October, however, the LOWRF Groundwater Monitoring Program, which collects the nitrate data, has moved to a June and December schedule. CHG evaluated the potential effect of this monitoring schedule change on the metric.

The recommended annual monitoring schedule in the LOPB included water sampling in October. Lower aquifer seawater intrusion would typically be at a seasonal maximum in October, while nitrate concentrations in the First Water group would be close to average annual levels based on past monitoring. Table 21 presents nitrate concentration averages for each season through 2017. A complete list of nitrate-nitrogen concentrations and seasonal averages is included in Appendix K.

| Table 21. Seasonal Nitrate-Nitrogen Averages | | | |
|---|---|---|---|
| Season | Year | Metric Wells | All Wells |
| | | Average $NO_3$-N (mg/L) | |
| SPRING MAR-APR-MAY | 2003 | 17 | 11.1 |
| | 2004 | 19.6 | 11.9 |
| | 2005 | 15.7 | 10.4 |
| | 2006 | 18 | 12.3 |
| | 2014 | 18.6 | 14.3 |
| | 2015 | 24.2 | 16.1 |
| | 2016 | 24.1 | 15.7 |
| SPRING AVERAGE | | 19.6 | 13.1 |
| SUMMER JUN-JUL-AUG | 2002 | 16.6 | 11.1 |
| | 2003 | 20 | 12.1 |
| | 2004 | 19.6 | 10.4 |
| | 2012 | 18.9 | 13.2 |
| | 2013 | 21.1 | 16 |
| | 2017 | 21 | 15.8 |
| SUMMER AVERAGE | | 19.5 | 13.1 |
| FALL SEP-OCT-NOV | 2003 | 21.6 | 12.5 |
| | 2004 | 16.8 | 11 |
| | 2005 | 18 | 13.1 |
| | 2006 | 15.4 | 10.5 |
| | 2014 | 24.8 | 15.4 |
| | 2015 | 25.4 | 16.7 |
| FALL AVERAGE | | 20.3 | 13.2 |
| WINTER DEC-JAN-FEB | 2002 | 18.2 | 11.1 |
| | 2003-04 | 22.2 | 12.7 |
| | 2014 | 17.8 | 15 |
| | 2016 | 26 | 16.2 |
| | 2017 | 32.3 | 18.8 |
| WINTER AVERAGE | | 23.3 | 14.8 |
| | | | |
| AVERAGE (ALL SEASONS) | | 20.7 | 13.6 |

As shown in Table 21, average nitrate-nitrogen concentrations in groundwater measured during monitoring events in the fall are closest to the average for all seasons, both for the Nitrate Metric wells and for all nitrate monitoring program wells. The winter monitoring events have the highest nitrate-nitrogen average concentrations, while spring and summer events have the lowest nitrate concentrations. Shifting the monitoring schedule for Nitrate Metric calculation to winter (December) increases the Nitrate Metric by roughly 10-15 percent, compared to fall (October) monitoring, based on the historical data.

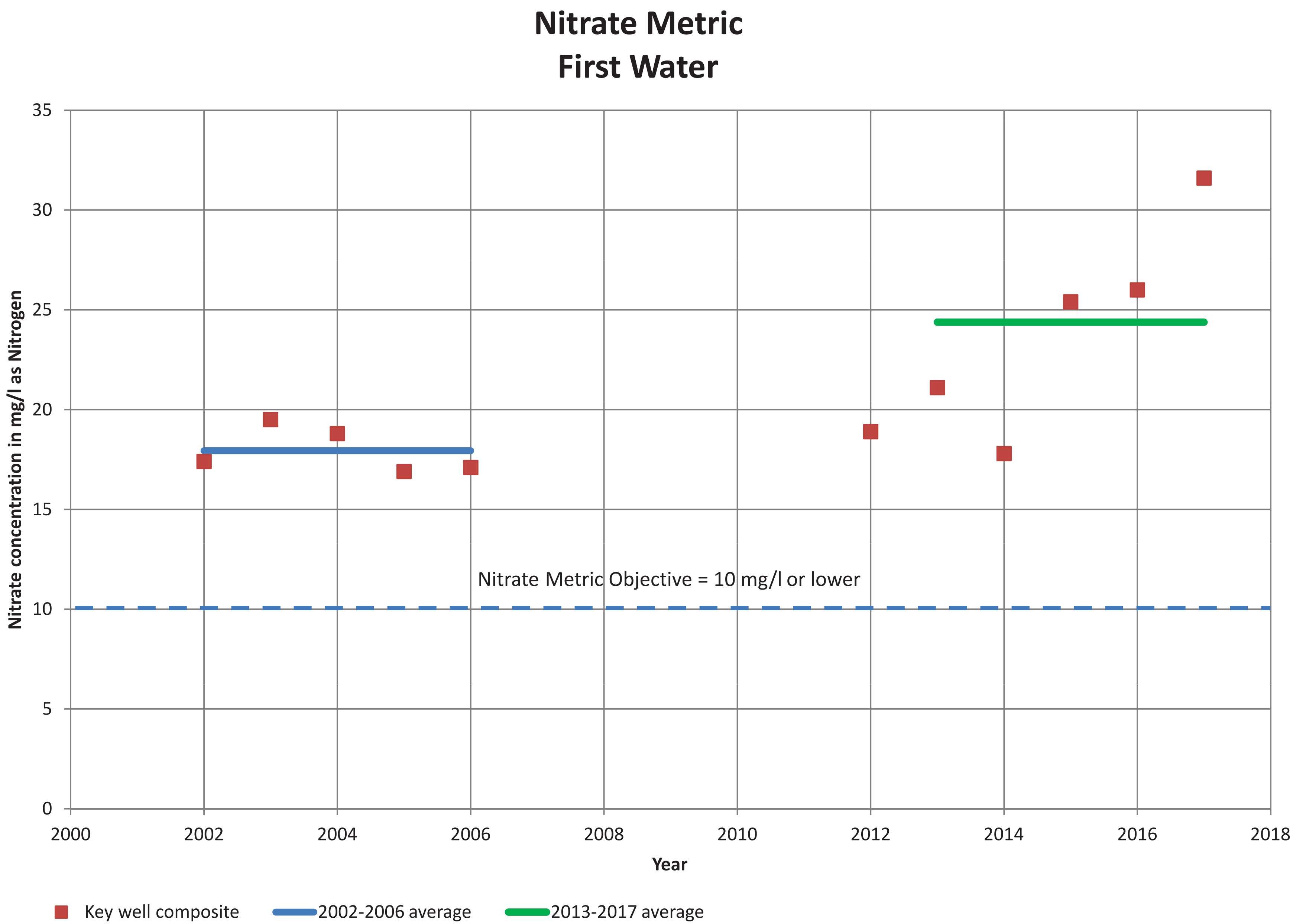
Table 22 presents the Nitrate Metric for 2017. Figure 22 graphs historical values in the metric, along with 5-year average for 2002-2006 and 2013-2017.

**Table 21. 2017 Nitrate Metric**

| Metric Well | Winter 2017 Nitrate-Nitrogen ($NO_3$-N) Concentrations |
|---|---|
| FW2 | 44 mg/L |
| FW6 | 10 mg/L |
| FW10 | 29 mg/L* |
| FW15 | 27 mg/L |
| FW17 | 18 mg/L |
| Nitrate Metric (average) | 32 mg/L |

Data Source: LOWRF Groundwater Monitoring Program (Rincon Consultants, 2017, 2018)
*FW10 not sampled by LOWRF program in 2017, Winter 2016 result used for average

The Nitrate Metric was measured at 32 mg/L nitrate-nitrogen (NO3-N), which is more than three times the Maximum Contaminant Level of 10 mg/L (the drinking water standard). Independent of LOBP actions, construction and operation of the community sewer system and LOWRF 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, but are currently still rising (with some of the rise likely due to the change in monitoring schedule). The Nitrate Metric target is 10 mg/L or lower (ISJ Group, 2015). If nitrate-nitrogen concentrations in groundwater from the 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.




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

Figure 22
Nitrate Metric
Los Osos Groundwater Basin
2017 Annual Report

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## 8. BASIN STATUS

The status of the Los Osos Groundwater Basin in 2017 is summarized as follows:

- The basin received above normal rainfall in 2017. Drought conditions for San Luis Obispo County improved from exceptional drought (the highest intensity) to abnormally dry (the lowest drought intensity level) during 2017, based on information from the U.S. Drought Monitor, a partnership of federal agencies (NDMC/USDA/NOAA, 2016).

- Groundwater production for the basin totaled 2,070 acre-feet in the 2017 calendar year, compared to 2,160 acre-feet in 2016. Purveyor groundwater production increased by 50 acre-feet while community and agricultural water use decreased by 140 acre-feet in 2017, compared to 2016.

- Long-term water level trends over the last 5 years in First Water wells averaged 0.5 feet of decline per year. Long-term water level trends over the last 10 in Upper Aquifer wells averaged 0.1 feet of decline per year, and in Lower Aquifer wells averaged 0.5 feet of rise per year.

- The basin gained 3,000 acre-feet of groundwater in storage between Spring 2016 and Spring 2017, and lost 1,000 acre-feet between Spring 2017 and Fall 2017.

- The seawater intrusion front retreated toward the coast up to 1,500 feet between Fall 2016 and Fall 2017.

- The Basin Yield Metric has improved by decreasing from 78 in 2016 to 75 in 2017, and the metric has met the LOBP goal of 80 or less for two consecutive years.

- The Basin Development Metric in 2017 indicates that 79 percent of the maximum potential sustainable yield of the basin has been developed. There is no LOBP objective for the Basin Development Metric, and there has been no change in the metric value from 2016.

- The Water Level Metric rose by 0.5 feet between Spring 2016 (1 foot) and Spring 2017 (1.5 feet), indicating improvement in 2017, although it remains several feet below the target value.

- The Chloride Metric decreased relative to the target value between Fall 2016 (225 mg/L) and Fall 2017 (132 mg/L), indicating improvement in 2017. Chloride concentrations at LA10 are interpreted to be influenced by wellbore flow from the Upper Aquifer, although the majority of decline in chloride concentration at the well appears to be occurring in the Lower Aquifer.

- The Nitrate Metric increased relative to the target value between 2016 (26 mg/L as N) and 2017 (32.0 mg/L as N), indicating a lack of improvement in 2017. The recent shift in the nitrate monitoring schedule from Fall to Winter may be influencing the nitrate results and increasing the metric compared to prior years.

# 9. RECOMMENDATIONS

The following LOBP Groundwater Monitoring Program recommendations from the 2016 Annual Report were completed, are in progress, or are planned for completion in 2018:

- Add a new Upper Aquifer and Lower Aquifer monitoring well near the bay, as recommended in the LOBP (ISJ Group, 2015). ***- In progress***

- Retain a licensed surveyor to review all available documentation on reference point elevations and to perform wellhead surveys as needed (Section 3.2.1). ***- Planned for 2018***

- 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). ***- Completed***

- Evaluate potential effects on the Nitrate Metric from changes to the LOWRF Groundwater Monitoring Program schedule (Section 7.5.3). ***- Completed***

The following additional LOBP Groundwater Monitoring Program recommendations are provided for BMC consideration. Recommendations on Adaptive Management are provided in Section 10:

- Develop a rating curve for stream flow Sensor 751 on Los Osos Creek (Section 6).

- Develop specific yield values for individual aquifers to improve groundwater storage estimates (Section 7.4).

- Re-evaluate Water Level Metric target after completion of wellhead surveys (Section 7.5.3)

- Further evaluation of wellbore flow and Upper Aquifer influence at LA10 as new data becomes available (Section 7.5.3).

# 10. ADAPTIVE MANAGEMENT PROGRAM AND STATUS OF LOBP PROGRAM IMPLEMENTATION

The LOBP describes seven potential programs of action, each of which focuses on a different aspect of basin management (ISJ Group, 2015; see Section 10.3). Implementation of an identified combination of the LOBP Programs is expected to result in sustainable use of the basin.

The LOBP also provides for periodic review of the implementation of the LOBP through establishment of an Adaptive Management Plan that allows the BMC to do the following:

- Evaluate trends of key basin metrics;
- Identify additional data needs;
- Report the data analysis to various interested parties;

- Modify the LOBP programs and schedule, if necessary, in response to current conditions and observed trends in the groundwater basin;
- Modify procedures to utilize current best management practices; and
- Modify pumping, treatment, and/or water reuse procedures in response to groundwater basin conditions and trends that show signs of degradation of water quality, including increased levels of contamination and/or increased levels of seawater intrusion.

The Adaptive Management Program will provide a status update on the implementation of the LOBP Programs, assess the overall effectiveness of the LOBP, and offer a tool with which to modify the LOBP programs to better meet overall LOBP objectives.

### 10.1 Basin Metrics

As noted in Section 7 ("Data Interpretation") of this Annual Report, the LOBP established several metrics to measure nitrate impacts to the Upper Aquifer, seawater intrusion into the Lower Aquifer, and the effect of management efforts to the BMC. These metrics allow the Parties, the BMC, regulatory agencies and the public to evaluate the status of nitrate levels and seawater intrusion, and the impact of implementation of the LOBP programs, in the Basin through objective, numerical criteria that can be tracked over time. The 2016 metric values are summarized in Table 22 for easy reference during discussion and evaluation of the LOBP programs.

As discussed in Section 7.2, water levels continue to decline in the Upper Aquifer, therefore a water level metric for the upper aquifer may be appropriate. Water level and chloride metric development is recommended for the Upper Aquifer using bay front wells UA3, UA4, and UA5. These metrics would allow year-to-year tracking of seawater intrusion potential in the Upper Aquifer. Metric thresholds could be established through a combination of historical water level data review, Basin Model results, and correlation with the Gyhben-Herzberg relation. These additional Upper Aquifer metrics will be tracked throughout the year and presented in the 2017 Annual Monitoring Report.

### 10.2 Adaptations to LOBP Programs

Based on the basin status (Section 8) and recommendations (Section 9), the BMC intends to continuously develop and pursue additional measures related to the Groundwater Monitoring and Urban Water Use Efficiency programs. The following is an update on additional measures related to the Groundwater Monitoring and Urban Water Use Efficiency program:

**Additional Water Quality Metrics.** In addition to the recommended Upper Aquifer water level and chloride metrics discussed in Section 10.1, the BMC will continue to consider developing additional metrics and/or numerical goals to protect the upper aquifer from water quality threats.

**Contingency Plan Development.** As metric trends and basin response become better defined, the BMC intends to develop contingency plans to respond to unforeseen conditions. As funding and siting for Program C projects progress, detailed milestone schedules will also be developed.

| Table 22. LOBP Metric Summary | | | |
|---|---|---|---|
| **Metric** | **LOBP Goal** | **Calculated Value from 2017 Data** | **Recommended Actions in Addition to LOBP Programs** |
| **Basin Yield Metric:** Comparison of current well production to sustainable yield | 80 or less | 75 | Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2) |
| **Water Level Metric:** Weighted average groundwater elevation in 5 key wells in the lower aquifer | 8 feet above mean sea level or higher | 1.5 feet above mean sea level | Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2) |
| **Chloride Level Metric:** Average chloride concentration in 4 key wells in the lower aquifer | 100 mg/L or lower | 132 mg/L | Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2) |
| **Nitrate Metric:** Average nitrate concentration in 5 key wells in the upper aquifer | 10 mg/L or lower | 32 mg/L (NO3-N) | None recommended |

**Adaptation of Water Conservation Measures.** Evaluate the Urban Water Use Efficiency Program to determine which conservation measures are the most efficient and effective to meet the LOBP's goals.

**Discussion and Recommendation of Criteria for Future Growth.** Provide input into the Los Osos Community Plan (LOCP), including consideration of Basin Metrics and defined goals as they relate to the timing of future growth within the basin. In its May 2017 meeting, the BMC authorized the release of a letter to the County Planning Department and Coastal Commission staff recommending that future development should be subject to the following provisions:
1. Any growth projections in the updated Los Osos Community Plan should be consistent with the water supply estimates provided in the Basin Management Plan.
2. The Community Plan should acknowledge any infrastructure projects contemplated by the Basin Plan that would require coastal planning action subject to the authority of the

Coastal Commission. This provision would help expedite completion of any affected projects.

3. Amendments to the County's Growth Management Ordinance [separate from the Community Plan/LCP] should provide a growth rate for Los Osos consistent with the adaptive management provision of the Basin Plan. In particular, the rate of growth must be set so that the monitoring provisions of the Basin Plan confirms the adequacy of a sustainable water supply in support of any contemplated future growth.

## 10.3 LOBP Programs

The LOBP outlines a number of programs developed to meet the goals of the various metrics outlined above. The BMC has analyzed the impacts of implementing various combinations of programs on the Basin.[1] In particular, the BMC modeled the impact of each combination on the Basin Yield Metric, Water Level Metric and Chloride Metric. Based on this analysis, the LOBP recommends the following programs for immediate implementation:[2]

- Groundwater Monitoring Program;
- Urban Water Use Efficiency Program;
- Urban Water Reinvestment Program;
- Basin Infrastructure Programs A and C; and
- Wellhead Protection Program.

### 10.3.1 Groundwater Monitoring Program

In order to allow calculation of the above metrics with a higher degree of accuracy, the BMC has implemented the Groundwater Monitoring Program. The Groundwater Monitoring Program is designed to collect, organize and report data regarding the health of the Basin from a current network of 85 wells.[3] In addition to facilitating the calculation of metrics, this data provides information needed to manage the Basin for long-term sustainability. Implementation of the Groundwater Monitoring Program also satisfies various external monitoring requirements, such as the California Statewide Groundwater Elevation Monitoring Program (CASGEM) and waste discharge and recycled water permits for the LOWRF. Monitoring under the program began in 2014 and will continue to occur in the spring and fall of each year when water levels are typically at their highest and lowest. This Annual Report represents the second monitoring event under the Groundwater Monitoring Program. The BMC plans to continue to report the values for all Basin

1 The LOBP analyzed the following seven potential programs: (1) Groundwater Monitoring Program; (2) Urban Water Use Efficiency Program: (3) Water Reinvestment Program; (4) Basin Infrastructure Program; (5) Supplemental Water Program; (6) Imported Water Program; (7) Wellhead Protection Program.

2 The LOBP also recommends the following programs for potential implementation if the County and the Coastal Commission were to allow future development in Los Osos as part of the LOCP and the Los Osos Habitat Conservation Plan (LOHCP): (1) Basin Infrastructure Program B; and (2) either Basin Infrastructure Program D or the Agricultural Water Reinvestment Program. Since additional development has not been authorized, these additional programs have not been included in this Annual Report.

3 The wells are distributed laterally across the Western, Central and Eastern Areas and vertically among First Water and the Upper and Lower Aquifers. Twelve existing wells were added to the program since 2015.

metrics and other relevant, non-proprietary data to the Parties, the Court and the public in its future Annual Reports. Additional recommendations and planned actions relating to the Groundwater Monitoring Program are described in Section 9. Table 23 summarizes the status of the various implementation tasks set forth in the LOBP that related to the Groundwater Monitoring Program.

### 10.3.2 Urban Water Use Efficiency Program

In order to reduce annual groundwater production from the Basin, and thus reduce the Basin Yield Metric, the LOBP recommends implementation of the Urban Water Use Efficiency Program. In October 2012, the San Luis Obispo County Board of Supervisors adopted a Water Conservation Implementation Plan ("County Water Conservation Plan"), the details of which are described in Table 24. The County Water Conservation Plan was configured to provide detailed financial and administrative structure, while substantially conforming to the LOBP. Under this program, all properties connecting to the sewer project are required to be retrofitted prior to connection, and completion is expected by end of 2017. By that time, it is anticipated that all properties will be connected to the sewer and all indoor water fixtures subject to the County Conservation Program will be upgraded. Table 25 shows the total fixtures retrofitted and the total rebates provided as of May 2017.

| Table 23. Basin Groundwater Monitoring Program Status | | | |
|---|---|---|---|
| **Recommended Implementation Measure** | **Current Status** | **Funding Status** | **Projected Completion** |
| **Wellhead Surveys:** Perform wellhead surveys to establish reference point elevations and locations | Not initiated | | |
| **Protocols and Objectives:** Establish well monitoring protocols and data quality objectives | Complete | | |
| **Water Level Monitoring:** Assign water level monitoring responsibilities to the Parties or other stakeholders | Complete | | |
| **Access to Private Wells:** Contact private well owners to request permission for participation in the groundwater elevation and water quality portions of the Groundwater Monitoring Program | Most contacts made as of April 2018. | Fully funded | Ongoing |
| **Water Quality Monitoring:** Assign water quality monitoring responsibilities. The BMC will adopt a set of procedures for recording groundwater elevations and sampling for water quality. | Complete | | |
| **Data:** Assign data compilation, organization and reporting duties | Complete | | |

| Table 24. Summary from Adopted 2012 County Water Conservation Plan | | | | | |
|---|---|---|---|---|---|
| **Implementation Program Plan Measure Number** | **Measure** | **Customer Category** | **Program Length** | **Total Estimated Activities** | **Total Estimated Budget** |
| **Category 1. Residential Programs** | | | | | |
| 1A | Subsidize Partial Community Retrofit, Residential | Single-Family Residential Toilets | 3 Years | 8,000 | $2,061,375 |
| | | Single-Family Residential Showerheads | 3 Years | 8,000 | $368,575 |
| | | Single-Family Residential Faucet Aerators | 3 Years | 13,500 | $100,769 |
| 1B | Residential Clothes Washer Rebate | Single-Family Residential Washer | 5 years | 2,000 | $385,000 |
| 1C | Options for Fully Retrofitted Residences | Hot Water on Demand; Dishwashers, | 3 years | 500 | 199,525 |
| 1D | Retrofit on Resale | Single-Family Residential: Owners complete retrofits through this ongoing water conservation measure. | | | $0 |
| **Category 2 - Commercial and Institutional** | | | | | |
| 2A | Subsidize Partial Community Retrofit, Commercial | Commercial | 3 years | 141 | $192,223 |
| 2B | Replace Restaurant Spray Nozzles | Commercial | 3 years | 45 | $3,649 |
| 2C | Institutional Building Retrofit | Institutional | 3 years | 13 | $38,588 |
| 2D | Commercial High Efficiency Clothes Washer Rebate | Commercial | 3 years | 40 | $14,280 |
| **Category 3 - Education and Outreach Program** | | | | | |
| 3A | Residential Water Surveys | Single-Family Residential | 3years | 5,000 | $824,250 |
| 3B | Commercial, Industrial and | Commercial | 3 years | 141 | $35,102 |

| Table 24. Summary from Adopted 2012 County Water Conservation Plan | | | | | |
|---|---|---|---|---|---|
| **Implementation Program Plan Measure Number** | **Measure** | **Customer Category** | **Program Length** | **Total Estimated Activities** | **Total Estimated Budget** |
| | Institutional Surveys | | | | |
| 3C | Public Information Program | Single-Family Residential | 10 years | 23,000 | $220,500 |
| 3D | Media Campaign | Single-Family Residential | 10 years | 7,000 | $178,500 |
| **Category 4 - New Development (developer pays to implement water conservation measures)** | | | | | $0 |
| **Contingency for Additional Measures in Years 4-10** | | | | | $327,600 |
| Plan Development Cost to Date | | | | | $50,000 |
| **Total Funding Commitment** | | | | | $5,000,000 |

| Table 25. Summary of Conservation Rebates Provided through May, 2017 | | | |
|---|---|---|---|
| **Fixture** | **2016 Cumulative Total** | **2017 Cumulative Total** | **6/2016 through 5/2017** |
| Toilets | 3,246 | 3,315 | 69 |
| Showerheads | 2,362 | 2,380 | 18 |
| Faucet aerators | 3,211 | 3,226 | 15 |
| Clothes washers | 101 | 109 | 8 |
| Total Value of Provided Rebates | $907,270 | $924,474 | $17,204 |

In 2016 the BMC recommended programs to be added to the County Water Conservation Plan. The proposed BMC programs are outlined in Table 26. The County is currently processing an item for the Board of Supervisor's Consent Agenda for June or July of 2017 to modify the Water Conservation Rebate Program to incorporate some of the BMC's recommendations, and to establish rebates as an ongoing element of the County Water Conservation Program. The additional conservation measures recommended for adoption by the Board were intended to have a clear nexus with the Los Osos Wastewater Project, and they are outlined in Table 27.

| Table 26. BMC Recommended Water Conservation Measures | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Item No.** | **Conservation Measure Name** | **Draft Rebate Amount** | **Water Savings Potential and Assumptions (ac-ft/year)** | **Estimated Savings per Unit (gal/yr)** | **Fixture or Program Estimated Lifespan** | **Cost of rebate per acre-ft saved** | **Approximate Savings Potential (AFY)[4]** |
| Indoor-1 | Hot water recirculation system | $300 | EPA Water Sense estimates > 10,000 gal/year, assume 5,000 to 10,000 gal/year | 7,000 | 10 | $1,396 | 50 to 100 |
| Indoor -2 | High efficiency clothes washer | $250 | 3,000 to 5,000 gal/year, depending on household size | 3,300 | 5 | $4,936 | 40 to 60 |
| Indoor - 3 | Replace 1.6 gpf toilets with 1.28 or below | $250 | 1,000 to 2,000 gal/year, depending on use | 1,500 | 20 | $2,715 | 30 to 50 (See Note 5) |
| Indoor - 4 | Replace 2.0 gpm showerheads with 1.5 gpm | $40 | 1,000 to 2,000 gal/year, depending on use | 1,500 | 10 | $869 | 30 to 50 (See Note 5) |
| Outdoor - 1 | Septic tank repurpose - roof water only | $500 (see Note 3) | Assume 3 to 4 tank volumes, at 1,000 gallons each | 3,500 | 20 | $2,327 | 40 to 60 (See Note 1) |
| Outdoor - 2 | Septic tank repurpose - with recycled water hauling | $500 (see Note 3) | Potentially eliminate outdoor potable usage | 6,000 | 20 | $1,358 | 70 to 90 (See Note 1) |
| Outdoor - 3 | Gray water system | $500 (see Note 3) | Potentially eliminate outdoor potable usage | 6,000 | 20 | $1,358 | 70 to 90 (See Note 1) |
| Outdoor - 4 | Laundry to landscape program | $50 (see Note 3) | 1,000 to 1,500 gallons per year, depending on use | 1,250 | 5 | $2,606 | 10 to 20 (see Note 1) |
| **Notes:** | 1. Total savings for outdoor programs are not additive. For example, outdoor use can be addressed through gray water or hauled recycled water.<br>2. All estimates depend on use patterns and other factors. Values are stated for comparison.<br>3. Only one $500 rebate will be provided per property under programs Outdoor -1, 2, and 3. Participants in these programs are not eligible for program Outdoor - 4. Property owners who have already backfilled their septic tank will receive a rebate of $500 for implementation of an alternative storage tank/basin with a minimum of 500 gallons of capacity.<br>4. Approximate Savings Potential assumes total 4,500 unit participation.<br>5. Assumes 2 replacement fixtures per household unit. | | | | | | |

| Table 27. Updated County Water Conservation Plan<br>Los Osos Wastewater Project Proposed Rebate Program | | | |
|---|---|---|---|
| **Measures Required for Connection to the Wastewater System** | | | |
| **Fixture or Appliance** | **Existing Fixture Flow Rate** | **New Fixture Flow Rate Eligible for Rebate** | **Rebates** |
| Toilets<br>Residential & Commercial | Greater than 1.6 gpf | 1.28 gpf or less | $250 |
| Showerheads<br>Residential & Commercial | Greater than 2.0 gpm | 1.5 gpm or less | $40 |
| Faucet Aerators<br>Residential | Greater than 1.5 gpm | 1.5 gpm or less | $5 |
| Faucet Aerators<br>Commercial | Greater than 0.5 gpm | 0.5 gpm | $5 |
| Urinals<br>Commercial | Greater than 1.0 gpf | 0.5 gpf or less | $500 |
| Pre-rinse Spray valves<br>Commercial | Greater than 1.15 gpm | 1.15 gpm or less | N/A |
| **Optional Measures Eligible for Rebates<br>(Requires Connection to the Wastewater System and Compliance with Above Measures)** | | | |
| Toilets<br>Residential & Commercial | Equal to 1.6 gpf | 1.28 gpf or less | $250 |
| Washers<br>Residential & Commercial | Less than Tier 3, Water Factor 4 | Tier 3, Water Factor 4 or Less | $450[1] |
| Hot Water Recirc System<br>Residential & Commercial | N/A | N/A | $350 |
| Showerheads<br>Residential & Commercial | 1.5 gpm or more | Less than 1.5 gpm | $40 |
| Complete Gray Water System | N/A | N/A | $500 |
| Laundry only Gray Water System | N/A | N/A | $50 |
| Recycled Water Irrigation<br>Commercial & Institutional | N/A | N/A | Negotiated |

gpf = gallons per flush
gpm = gallons per minute

Notes: [1] Rebate not retroactive to prior rebated or prior purchased appliances.

### 10.3.3 Urban Water Reinvestment Program

Implementation of the Urban Water Reinvestment Program was recommended in the LOBP to increase the sustainable yield of the Basin (and thus reduce the Basin Yield Metric). The Water Reinvestment Program will accomplish the LOBP's goal of reinvesting all water collected and treated by the LOWRF in the Basin, either through direct percolation to the aquifers or reuse. Water treated by the LOWRF will be of a sufficient quality to directly percolate into the Basin or to reuse for landscape or agricultural irrigation purposes. The planned uses of that water are listed in Table 28.[4]

**Table 28. Planned Recycled Water Uses in the Urban Water Reinvestment Program**

| Potential Use | Estimated Annual Volume (AFY) |
|---|---|
| Broderson Leach Fields | 448 |
| Bayridge Estates Leach Fields | 33 |
| Urban Reuse | 63 |
| Sea Pines Golf Course | 40 |
| Los Osos Valley Memorial Park | 50 |
| Agricultural Reuse | 146 |
| **Total** | **780** |

The LOWRF construction was completed in March 2016. As of January 4, 2018, the sewer service area had a 95 percent connection status. Flows from the wastewater plant are averaging approximately 450,000 gallons per day, with weekend peaks of 470,000 gallons per day (approximately 504 AFY). With 95 percent of the lateral connections completed, average wastewater flows are lower than anticipated. Projecting the actual average flow per connection through the remainder of the project results in a total estimated volume of 580 AFY, which is 200 AFY less than the anticipated 780 AFY.

Treated water in 2017 was transported to the Broderson and Bayridge leach fields. The anticipated groundwater mound was detected hydraulically downgradient of the Broderson site beginning in June 2017. Recycled water for irrigation will be provided to the schools, parks, and various agricultural areas within the basin once flows at the wastewater plant approach anticipated volumes.

The BMC is currently analyzing the feasibility, cost, and water supply benefits of a dry weather discharge to Los Osos Creek as a means of recharging the lower aquifer and enhancing basin yield. The results of the current study will be summarized in future Annual Reports.

4 This Table was reproduced (with slight edits) from Table 2 of the LOBP.

### 10.3.4 Basin Infrastructure Programs

Implementation of the Basin Infrastructure Program is designed to reduce Purveyor groundwater production from the Lower Aquifer in the Western Area and replace it with additional pumping from the Upper Aquifer and Central and Eastern Areas. This shift will also increase the Basin's sustainable yield, which in turn will help to drive down the Basin Yield Metric.

The Program is divided into four parts, designated Programs A through D. Programs A and B shift groundwater production from the Lower Aquifer to the Upper Aquifer, and Programs C and D shift production within the Lower Aquifer from the Western Area to the Central and Eastern Areas, respectively. A fifth program, Program M, was also established in the Basin Management Plan for the development of a Groundwater Monitoring Program (See Chapter 7 of the BMP), and a new lower aquifer monitoring well in the Cuesta by the Sea area was recommended in the 2015 Annual Report. Table 29 provides an overview of status of the Projects that are currently moving forward or have been completed. Note, no projects are currently moving forward in Program D, thus they are not shown in Table 29.

### 10.3.5 Wellhead Protection Program

The Wellhead Protection Program is designed to protect water quality in the Basin by managing activities within a delineated source area or protection zone around drinking water wells. This program consists primarily of the Purveyors conducting Drinking Water Source Assessment and Protection surveys for each of their wells, as well as construction and operation of the LOWRF. The BMC will identify specific actions to protect water quality in the Basin as deemed appropriate in the future, though no specific actions are recommended at this time.

| Table 29. Basin Infrastructure Projects | | | | |
|---|---|---|---|---|
| **Project Name** | **Parties Involved** | **Funding Status** | **Capital Cost** | **Status** |
| **Program A** | | | | |
| Water Systems Interconnection | LOCSD/ GSWC | Fully Funded | Construction Value: $103,550 | Project completed February 2017, with final approval in March 2017 |
| Upper Aquifer Well ($8^{th}$ Street) | LOCSD | Fully Funded | $250,000 | Well was drilled and cased in December 2016. Budget remaining $250,000 to equip the well. Design RFP was issued in April, and a consultant should be retained by June 2017. Project to be completed by June 2018 or earlier if possible. |
| South Bay Well Nitrate Removal | LOCSD | Completed | | |
| Palisades Well Modifications | LOCSD | Completed | | |
| Blending Project (Skyline Well) | GSWC | Fully Funded | Previously funded through rate case | Blending of Skyline Well and Rosina Well Project was completed. Project required modifications to include a new nitrate removal unit. Permits and equipment secured. Delivery of the treatment unit is estimated for the beginning of July. Assuming 4 weeks for installation, start-up is anticipated in September 2017. |
| Water Meters | S&T | Completed | | |
| **Program B** | | | | |
| LOCSD Wells | LOCSD | Not Funded | BMP: $2.7 mil | Project not initiated |
| GSWC Wells | GSWC | Not Funded | BMP: $3.2 mil | Project not initiated |
| Community Nitrate Removal Facility | LOCSD/GSWC | Partial | First phase combined with GSWC Program A | GSWC's Program A Blending Project allows for incremental expansion of the nitrate facility and can be considered a first phase in Program B. |

| Project Name | Parties Involved | Funding Status | Capital Cost | Status |
|---|---|---|---|---|
| **Program C** | | | | |
| Expansion Well No. 1 (Los Olivos) | GSWC | Fully Funded | Previously funded through rate case | Well has been drilled and cased. GSWC is in the equipping phase. Well can be used, if needed, using on-site generator. Formal startup of the well with permanent equipment is anticipated in July 2017. |
| Expansion Well No. 2 | GSWC | Pending Funding Vote | BMP: $2.0 mil | Property acquisition phase is on-going through efforts of LOCSD. Two sites are currently being reviewed, and both appear to be viable for new east side lower aquifer wells, Environmental studies initiated in December 2016 for expansion well #2. |
| Expansion Well 3 and LOVR Water Main Upgrade | GSWC | Pending Funding Vote | BMP: $1.6 mil | Property acquisition phase is on-going through efforts of LOCSD. Two sites are currently being reviewed, and both appear to be viable for new east side lower aquifer wells. |
| LOVR Water Main Upgrade | GSWC | Pending Funding Vote | BMP: $1.53 mil | Project not initiated |
| S&T/GSWC Interconnection | S&T/ GSWC | Pending | BMP: $30,000 | Conceptual design |
| **Program M** | | | | |
| New Zone D/E lower aquifer monitoring well in Cuesta by the Sea | All Parties | Not funded | $100,000 | Pending funding plan |

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# APPENDIX A

## Groundwater Monitoring History

**Groundwater Monitoring 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 investigations, monitoring reports, and monitoring programs with a major focus on basin water levels and water quality through December 31, 2017, which is the end of the period covered by this Annual Report.

Historical Investigations

- *Los Osos-Baywood Ground Water Protection Study* (DWR, 1973);
- *Morro Bay Sandspit Investigation* (DWR, 1979);
- *Los Osos - Baywood Park Phase I Water Quality Management Study* (Brown & Caldwell, 1983);
- *Hydrogeology and Water Resources of the Los Osos Valley Ground-Water Basin, San Luis Obispo County, Water-Resources Investigation 88-4081* (U.S. Geological Survey, 1988);
- *Task F - Sanitary Survey and Nitrate Source Study* (Metcalf & Eddy, 1995);
- *Sea Water Intrusion Assessment and Lower Aquifer Source Investigation of the Los Osos Valley Groundwater Basin* (Cleath & Associates, 2005);
- *Task 3 Upper Aquifer Water Quality Characterization* (Cleath & Associates, 2006);

Monitoring Reports:

- *Baywood Groundwater Study - Fourth Quarter 1998 (San Luis Obispo County Engineering Department, 1999)*;
- *Quarterly and Semi-Annual Groundwater Monitoring Reports for the Los Osos Nitrate Monitoring Program* (Cleath & Associates, 2002-2006)
- *Water Quality Monitoring Results Summary, November 2009-January 2010, Los Osos Valley Groundwater Basin* (CHG, 2010);
- *Semi-Annual Groundwater Monitoring Reports for Los Osos Water Recycling Facility Baseline Groundwater Quality Monitoring* (CHG, 2012-2013);
- *Semi-Annual Groundwater Monitoring Reports for Los Osos Water Recycling Facility Baseline Groundwater Quality Monitoring* (Rincon Consultants, 2014a, 2014b, 2014c, 2017a, 2017b, 2018; CHG 2015c, 2015d);
- *Semi-Annual Groundwater Monitoring Reports for Lower Aquifer* (CHG, 2014-2015);

- *Annual Groundwater Monitoring Reports for Los Osos Basin Plan* (CHG, 2015);

- 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.

- 2012-2017 Los Osos Water Recycling Facility Groundwater Monitoring Program. Water levels measured semi-annually, currently on a June and December schedule; program remains active.

- 2014-2015 Lower Aquifer Monitoring Program. Water levels measured semi-annually; program ended in 2015 (replaced by LOBP Groundwater Monitoring Program).

In addition to water quality and water level reporting, this 2017 Annual Report compiles groundwater production, precipitation, and stream flow data from the following sources:

- 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 community facility, domestic and agricultural irrigation wells is not metered. Production estimates for domestic wells are based on water use surveys performed in 2009 with adjustments from aerial photo review. Production estimates for community facility and agricultural wells are based on a soil-moisture budget using local precipitation, land use, and evapotranspiration data.

# APPENDIX B

## Los Osos Basin Plan
## Groundwater Monitoring Program Well Information

**Los Osos Basin Plan**
**Monitoring 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 | | | | | | | | |
| FW29 | 30S/11E-20A1 | | | | | | | PRIVATE | | | | | | | | |
| FW30 | 30S/11E-18R1 | | | | | | | PRIVATE | | | | | | | | |
| FW31 | 30S/11E-19A | Bayridge Field #2 | Central | 35.3066 | 120.8276 | 213 | MW | LOCSD | 18-38 | 38 | 4 | | x | | | |
| FW32 | 30S/11E-21D14 | | | | | | | 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 |

**Los Osos Basin Plan**
**Monitoring 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-13F4 | GSWC Skyline #1 | Western | 35.3165 | 120.8533 | 19 | M | GSWC | 90-195 | 206 | 14 | | | x | | |
| UA4 | 30S/10E-13L1 | S&T Mutual #1 | Western | 35.3148 | 120.8531 | 38.68 | 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 | M | LOCSD | 170-210 | 220 | 8 | | | x | | |
| UA14 | 30S/11E-17P4 | | | | | | | PRIVATE | | | | | | | | |
| UA15 | 30S/11E-20B7 | | | | | | | PRIVATE | | | | | | | | |
| UA16 | 30S/11E-17L4 | | | | | | | PRIVATE | | | | | | | | |
| UA17 | 30S/11E-17E10 | | | | | | | PRIVATE | | | | | | | | |
| UA18 | 30S/11E-17F2 | | | | | | | PRIVATE | | | | | | | | |

| | |
|---|---|
| *Datum Varies | M = Municipal |
| | MW = Monitoring Well |

**Los Osos Basin Plan**
**Monitoring 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 | | | | | | | | |
| LA31 | 30S/11E-13M2 | | | | | | | PRIVATE | | | | | | | | |
| LA32 | 30S/11E-18K9 | LOCSD 10th Street Production | Central | 35.3103 | 120.8325 | 135 | M | LOCSD | 235-270, 350-49 | 490 | 14 | | | x | x | |
| LA33 | 30S/11E-17A1 | | | | | | | PRIVATE | | | | | | | | |
| LA34 | 30S/11E-8F | Los Osos Landfill | Eastern | 35.3201 | 120.8052 | 26.15 | MW | SLO CO. | 37.5-47.5 | 47.5 | | | | | x | |
| LA35 | 30S/11E-21Bb | LOWRF South Well | Eastern | 35.3076 | 120.7993 | 96 | Ind | SLO CO. | 135-235 | 235 | | | | | | x |
| LA36 | 30S/11E-21Ja | | | | | | | PRIVATE | | | | | | | | |
| LA37 | 30S/11E-21B1 | Andre Windmill Well | Eastern | 35.3069 | 120.7976 | 81.39 | MW | SLO CO. | | | 6 | | | | | x |
| LA38 | 30S/11E-21E | | | | | | | PRIVATE | | | | | | | | |

| | |
|---|---|
| *Datum Varies | M = Municipal |
| + New for 2017 Reporting Year | MW = Monitoring Well |
| | Ind = Industrial Well |
| | I = Irrigation |

**Los Osos Basin Plan**
**Monitoring Well Network 2017**
**FIRST WATER**

| Program Well ID | CASGEM Program Reporting | Basin Plan Monitoring Code | County Water Level Program | LOWRF Groundwater Monitoring Program[1] | **Planned 2018 Monitoring Program[2]** |
|---|---|---|---|---|---|
| FW1 | no | L | | | **L** |
| FW2 | yes | L, G | | L, G | **L** |
| FW3 | yes | L | | L | **L** |
| FW4 | yes | L | | L | **L** |
| FW5 | yes | L | | L | **L** |
| FW6 | yes | TL, G, CEC | | G | **TL, CEC** |
| FW7 | yes | L | | | **L** |
| FW8 | yes | L | | L | **L** |
| FW9 | yes | L | | L | **L** |
| FW10 | yes | TL, G | | G | **TL** |
| FW11 | yes | L | | L | **L** |
| FW12 | yes | L | | L | **L** |
| FW13 | yes | L | | L | **L** |
| FW14 | no | L | | L | **L** |
| FW15 | yes | L, G | | L,G | **L** |
| FW16 | yes | L | | L | **L** |
| FW17 | yes | L, G | | L,G | **L** |
| FW18 | no | L | | | **L** |
| FW19 | yes | L | | L | **L** |
| FW20 | yes | L, G | | L, G | **L** |
| FW21 | yes | L | | L | **L** |
| FW22 | no | L, G | | L, G | **L** |
| FW23 | no | L | | 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 | | |
| FW29[3] | no | L | L | | |
| FW30[3] | no | L | | L | **L** |
| FW31[3] | no | L | | | **L** |
| FW32[3] | no | L | | | **L** |

**L = WATER LEVEL**
**G = GENERAL MINERAL**
**CEC = CONSTITUENTS OF EMERGING CONCERN**
**TL = TRANSDUCER WATER LEVEL**

**NOTES:**
**1 - Summer and winter monitoring schedule**
**2 - Spring and fall monitoring schedule**
**3 - Well added to LOBP program**

## Los Osos Basin Plan
## Monitoring Well Network 2017
## UPPER AQUIFER

| Program Well ID | CASGEM Program Reporting | Basin Plan Monitoring Code | County Water Level Program | LOWRF Groundwater Monitoring | **Planned 2018 Monitoring Program[2]** |
|---|---|---|---|---|---|
| UA2 | yes | L | L | | |
| UA3 | yes | L, G | | | **L, G** |
| UA4 | no | TL | | | **TL** |
| UA5 | no | L | | L | **L** |
| UA6 | no | L | L | | |
| UA7 | yes | L | L | | |
| UA8 | yes | L | | | **L** |
| UA9 | no | L, G | | | **L, G** |
| UA10 | no | TL | | | **TL** |
| UA11 | no | L | | L | **L** |
| UA12 | no | L | | L | **L** |
| UA13 | no | L, G | | | **L, G** |
| UA14 | no | L | | | **L** |
| UA15 | no | L | | | **L** |
| UA16[3] | no | L | L | | |
| UA17[3] | no | L | L | | |
| UA18[3] | no | L | L | | |

**L = WATER LEVEL**
**G = GENERAL MINERAL**
**TL = TRANSDUCER WATER LEVEL**

**NOTES:**
**1 - Summer and winter monitoring schedule**
**2 - Spring and fall monitoring schedule**
**3 - Well added to LOBP program**

# Los Osos Basin Plan
# Monitoring Well Network 2017
# LOWER AQUIFER

| Program Well ID | CASGEM Program Reporting | Basin Plan Monitoring Code | County Water Level Program | **Planned 2018 Monitoring Program[2]** |
|---|---|---|---|---|
| LA2 | yes | L | L | |
| LA3 | yes | L | L | |
| LA4 | yes | 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, GL | L | **GL** |
| *LA15* | no | L, G | | **L , G** |
| LA16 | no | L | L | |
| LA17 | no | L | L | |
| *LA18* | yes | L, G | | **L , G** |
| LA19 | yes | 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** |
| *LA31* [3] | no | G | | **G** |
| *LA32* [3] | no | G | | **G** |
| LA33[3] | no | L | | **L** |
| LA34[3] | no | L | L | |
| LA35[3] | no | L | | **L** |
| LA36[3] | no | L | | **L** |
| LA37[3] | no | L | | **L** |
| LA38[3] | no | L | | **L** |

**L = WATER LEVEL**
**G = GENERAL MINERAL**
**GL = GEOPHYSICAL LOG (2018)**
**TL = TRANSDUCER WATER LEVEL**

**NOTES:**
**1 - Remove G from LA6 - out of service.**
**2 - Add G to LA9 and LA22**
**3 - Well added to LOBP program**
***Well IDs with both April and October water quality monitoring in Italics***

# APPENDIX C

## Field Logs and Laboratory Analytical Reports for 2017 BMC Monitoring

Note: There are no Groundwater Monitoring Field Logs for Wells LA9, LA10, LA20, UA9, and UA3; These wells were sampled by owner (GSWC).

**Spring 2017 Field Logs and Analytical Results**

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 4/11/2017
Operator: A.Berge, W. Forbes
Well number and location: 30S/11E-13N (LA8)
Site and wellhead conditions: Damp cool. Chlorinated water purged from line for one minute @ 200 gpm

Static water depth (feet): 134
Well depth (feet): 350
Water column (feet): 216
Casing diameter (inches): 8
Minimum purge volume (gal) --
Purge rate (gpm): 200
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): --
Time begin purge: 9:38 AM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 9:39 | 200 | 425.6 | 6.45 | 18.2 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 9:40 am |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 4/11/2017
Operator: A.Berge, W. Forbes
Well number and location: 30S/11E-12J1 (LA11)
Site and wellhead conditions: Overcast, cool, cap secure, covered by ice plant.

Static water depth (feet): 5.26
Well depth (feet): 389
Water column (feet): 383.74
Casing diameter (inches): 2"
Minimum purge volume (gal) 187.00
Purge rate (gpm): 1.6
Pumping water level (feet): 11.45
Pump setting (feet): 25'
Minimum purge time (min): 100
Time begin purge: 10:25 AM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 10:24 | 1 | 1,114 | 7.45 | 18.8 | Clear, colorless, odorless |
| 10:26 | 5 | 1,101 | 7.40 | 18.7 | Clear, colorless, odorless |
| 10:29 | 10 | 1,094 | 7.35 | 18.6 | Clear, colorless, odorless |
| 10:34 | 20 | 1,091 | 7.35 | 18.9 | Clear, colorless, odorless |
| 10:49 | 45 | 1,086 | 7.34 | 20.2 | Clear, colorless, odorless |
| 11:05 | 75 | 1,272 | 7.28 | 20.9 | Slightly cloudy, no odor |
| 11:18 | 100 | 1,265 | 7.25 | 21 | Slightly cloudy, no odor |
| 11:29 | 120 | 1,262 | 7.30 | 21 | Clear, colorless, odorless |
| 11:45 | 145 | 1,254 | 7.33 | 20.9 | Clear, colorless, odorless |
| 11:58 | 170 | 1,243 | 7.33 | 20.6 | Clear, colorless, odorless |
| 12:08 | 190 | 1,238 | 7.29 | 20.7 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 12:08 pm |
| | | | | | |
| | | | | | |

*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 4/10/2017
Operator: A.Berge
Well number and location: 30S/11E-7Q3 (LA-12)
Site and wellhead conditions: Sunny warm, gate unlocked and pump turned on at 10:30 am.

| | |
|---|---|
| Static water depth (feet): | 35.30 on 4/13/17 |
| Well depth (feet): | 270' |
| Water column (feet): | 234.7 |
| Casing diameter (inches): | 10" |
| Minimum purge volume (gal) | flush line |
| Purge rate (gpm): | -- |
| Pumping water level (feet): | -- |
| Pump setting (feet): | -- |
| Minimum purge time (min): | flush line |
| Time begin purge: | 10:30 AM |

| Time | Gallons | EC (µS) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 10:34 | 10 | 753 | 7.78 | 21.6 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 10:38 am |
| | | | | | |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 4/12/2017
Operator: A.Berge, W. Forbes
Well number and location: 30S/11E-18K8 (LA18)
Site and wellhead conditions: overcast, cool, gate pre-opened, both monuments and caps secure and in place

Static water depth (feet): 137.83
Well depth (feet): 650
Water column (feet): 512.17
Casing diameter (inches): 2"
Minimum purge volume (gal) 240
Purge rate (gpm): 0.9
Pumping water level (feet): 141.44
Pump setting (feet): 150'
Minimum purge time (min): 240
Time begin purge: 9:28

| Time | Gallons | EC (µS) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 9:29 | 1 | 424.4 | 8.13 | 19.8 | Clear, colorless, odorless |
| 9:34 | 5 | 553.0 | 7.46 | 20.4 | Clear, colorless, odorless |
| 9:40 | 10 | 573.8 | 7.47 | 20.2 | Clear, colorless, odorless |
| 9:52 | 20 | 572.9 | 7.60 | 20.2 | Clear, colorless, odorless |
| 10:04 | 30 | 586.0 | 7.48 | 20.5 | Clear, colorless, odorless |
| 10:27 | 50 | 588.0 | 7.45 | 20.8 | Clear, colorless, odorless |
| 11:05 | 80 | 586.1 | 7.49 | 20.9 | Clear, colorless, odorless |
| 12:11 | 120 | 587.5 | 7.35 | 20.9 | Clear, colorless, odorless |
| 1:10 | 170 | 583.0 | 7.64 | 22.3 | Clear, colorless, odorless |
| 2:14 | 220 | 588.0 | 7.40 | 22.5 | Clear, colorless, odorless |
| 2:38 | 240 | 589.6 | 7.50 | 22.2 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 2:38 pm |
| | | | | | |
| | | | | | |

*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 4/13/2017
Operator: A.Berge, W. Forbes
Well number and location: 30S11E-17E8 (LA22)
Site and wellhead conditions: Sunny- wet, just rained, gate open, cap on & secure.

| | |
|---|---|
| Static water depth (feet): | 123.89 |
| Well depth (feet): | 380 |
| Water column (feet): | 256.11 |
| Casing diameter (inches): | 2" |
| Minimum purge volume (gal) | 124.30 |
| Purge rate (gpm): | 0.83 |
| Pumping water level (feet): | 116.11 |
| Pump setting (feet): | 140 |
| Minimum purge time (min): | 141 |
| Time begin purge: | 9:30 |

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 9:30 | 1 | 414.0 | 8.79 | 18.5 | Slightly cloudy, odorless |
| 9:35 | 5 | 454.3 | 8.60 | 19.2 | Clear, colorless, odorless |
| 9:41 | 10 | 475.3 | 8.23 | 19.1 | Clear, colorless, odorless |
| 9:47 | 15 | 475.9 | 8.04 | 19.2 | Clear, colorless, odorless |
| 9:59 | 25 | 461.5 | 7.60 | 19.4 | Clear, colorless, odorless |
| 10:10 | 35 | 457.6 | 7.51 | 19.6 | Clear, colorless, odorless |
| 10:21 | 45 | 458.8 | 7.40 | 19.7 | Clear, colorless, odorless |
| 10:33 | 55 | 458.5 | 7.43 | 19.6 | Clear, colorless, odorless |
| 10:54 | 75 | 457.8 | 7.34 | 19.6 | Clear, colorless, odorless |
| 11:19 | 95 | 459.4 | 7.38 | 19.8 | Clear, colorless, odorless |
| 11:41 | 115 | 456.6 | 7.34 | 19.9 | Clear, colorless, odorless |
| 11:51 | 125 | 456.2 | 7.52 | 19.3 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled at 11:59 am |
| | | | | | |

*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 4/17/2017
Operator: S. Harris, A.Berge
Well number and location: 30S/10E-13M2 (LA-31)
Site and wellhead conditions: Overcast and misty. Gates secure, plug in place, water inside monument. Well is pumping.

| | |
|---|---|
| Recovering water depth (feet): | 44.3 |
| Well depth (feet): | 292 |
| Water column (feet): | 247.7 |
| Casing diameter (inches): | 6 |
| Minimum purge volume (gal) | flush line |
| Purge rate (gpm): | -- |
| Pumping water level (feet): | -- |
| Pump setting (feet): | -- |
| Minimum purge time (min): | flush line |
| Time begin purge: | 11:04 |

| Time | Gallons | EC (µS) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 11:05 | 1 | 3070 | 7.75 | 19.5 | Clear, colorless, odorless |
| 11:10 | 10 | 3080 | 7.58 | 19.1 | Clear, colorless, odorless |
| 11:15 | 15 | 3090 | 7.47 | 19.2 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 11:20 AM |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 4/10/2017

Operator: A.Berge

Well number and location: 30S/11E-18K9 (LA-32)

Site and wellhead conditions: sunny, warm, secure, gate open. Pump has been on 52 minutes.

Static water depth (feet): 149.3 on 4/13/17

Well depth (feet): 490

Water column (feet): --

Casing diameter (inches): 14

Minimum purge volume (gal) flush line

Purge rate (gpm): --

Pumping water level (feet): --

Pump setting (feet): --

Minimum purge time (min): flush line

Time begin purge: 10:56 AM

| Time | Gallons | EC (µS) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 10:57 | 1 | 437.7 | 7.16 | 22.2 | Clear, Colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 11:00 am |
| | | | | | |
| | | | | | |
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| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

*Turbidity, color, odor, sheen, debris, etc.

April 18, 2017

Lab ID : CC 1781021-001
Customer ID : 8-514

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

Sampled On : April 11, 2017-09:40
Sampled By : Wolfgang Forbes / An
Received On : April 11, 2017-14:45
Matrix : Ground Water

Description : 13N (LA-8) LA-8
Project : Los Osos BMC Monitoring

## Sample Result - Inorganic

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **General Mineral** | | | | | | | | |
| Total Hardness as CaCO3 | 100 | -- | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Calcium | 17 | 1 | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Magnesium | 14 | 1 | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Potassium | 1 | 1 | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Sodium | 38 | 1 | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Total Cations | 3.7 | -- | meq/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Copper | 40 | 10 | ug/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Iron | ND | 30 | ug/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Manganese | ND | 10 | ug/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Zinc | 20 | 20 | ug/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| SAR | 1.7 | -- | -- | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Total Alkalinity (as CaCO3) | 40 | 10 | mg/L | | 2320B | 04/13/17:204281 | 2320B | 04/13/17:205427 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 04/13/17:204281 | 2320B | 04/13/17:205427 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 04/13/17:204281 | 2320B | 04/13/17:205427 |
| Bicarbonate as HCO3 | 50 | 10 | mg/L | | 2320B | 04/13/17:204281 | 2320B | 04/13/17:205427 |
| Sulfate | 12.4 | 0.5 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Chloride | 77 | 1 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Nitrate as NO3 | 32.4 | 0.5 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Nitrate + Nitrite as N | 7.3 | 0.1 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Total Anions | 3.8 | -- | meq/L | | 2320B | 04/13/17:204281 | 2320B | 04/13/17:205427 |
| pH | 7.4 | -- | units | | 4500-H B | 04/12/17:204253 | 4500HB | 04/12/17:205317 |
| Specific Conductance | 434 | 1 | umhos/cm | | 2510B | 04/14/17:204393 | 2510B | 04/14/17:205475 |
| Total Dissolved Solids | 270 | 20 | mg/L | | 2540CE | 04/13/17:204297 | 2540C | 04/14/17:205437 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 04/12/17:204436 | 5540C | 04/12/17:205513 |
| Aggressiveness Index | 10.6 | -- | -- | | 4500-H B | 04/12/17:204253 | 4500HB | 04/12/17:205317 |
| Langelier Index (20°C) | -1.2 | -- | -- | | 4500-H B | 04/12/17:204253 | 4500HB | 04/12/17:205317 |
| Nitrate Nitrogen | 7.3 | -- | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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**Office & Laboratory**
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TEL: (559)734-9473
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CA ELAP Certification No. 2810

April 18, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : Cabrillo LA-9
Project : Los Osos BMC Monitoring

Lab ID : CC 1780991-003
Customer ID : 8-514

Sampled On : April 10, 2017-11:25
Sampled By : Zac Reineke
Received On : April 10, 2017-14:49
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** | | | | | | | | |
| Total Hardness as CaCO3 | 111 | -- | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Calcium | 18 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Magnesium | 16 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Potassium | 1 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Sodium | 43 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Total Cations | 4.1 | -- | meq/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Copper | ND | 10 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Iron | ND | 30 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Manganese | ND | 10 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Zinc | ND | 20 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| SAR | 1.8 | -- | -- | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Total Alkalinity (as CaCO3) | 50 | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Bicarbonate as HCO3 | 70 | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Sulfate | 15.9 | 0.5 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Chloride | 89 | 1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrate as NO3 | 25.1 | 0.5 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrate + Nitrite as N | 5.7 | 0.1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Total Anions | 4.4 | -- | meq/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| pH | 7.0 | -- | units | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Specific Conductance | 490 | 1 | umhos/cm | | 2510B | 04/12/17:204274 | 2510B | 04/12/17:205339 |
| Total Dissolved Solids | 310 | 20 | mg/L | | 2540CE | 04/12/17:204259 | 2540C | 04/13/17:205364 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 04/11/17:204435 | 5540C | 04/17/17:205511 |
| Aggressiveness Index | 10.4 | -- | -- | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Langelier Index (20°C) | -1.5 | -- | -- | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Nitrate Nitrogen | 5.7 | -- | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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April 18, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : Cabrillo LA-9
Project : Los Osos BMC Monitoring

Lab ID : CC 1780991-003
Customer ID : 8-514

Sampled On : April 10, 2017-11:25
Sampled By : Zac Reineke
Received On : April 10, 2017-14:49
Matrix : Ground Water

## Sample Result - Support

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **Field Test** | | | | | | | | |
| Temperature | 65.6 | | °F | | | 04/10/17 11:25 | 2550B | 04/10/17 11:25 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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

April 18, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : Rosina LA-10
Project : Los Osos BMC Monitoring

Lab ID : CC 1780991-004
Customer ID : 8-514

Sampled On : April 10, 2017-12:00
Sampled By : Zac Reineke
Received On : April 10, 2017-14:49
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** | | | | | | | | |
| Total Hardness as CaCO3 | 327 | -- | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Calcium | 52 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Magnesium | 48 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Sodium | 35 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Total Cations | 8.1 | -- | meq/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Copper | ND | 10 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Iron | 300 | 30 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Manganese | ND | 10 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Zinc | 20 | 20 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| SAR | 0.8 | -- | -- | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Total Alkalinity (as CaCO3) | 60 | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Bicarbonate as HCO3 | 80 | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Sulfate | 14.7 | 0.5 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Chloride | 231 | 5* | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrate as NO3 | 11.7 | 0.5 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrate + Nitrite as N | 2.6 | 0.1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Total Anions | 8.3 | -- | meq/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| pH | 6.9 | -- | units | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Specific Conductance | 957 | 1 | umhos/cm | | 2510B | 04/12/17:204274 | 2510B | 04/12/17:205339 |
| Total Dissolved Solids | 720 | 20 | mg/L | | 2540CE | 04/12/17:204259 | 2540C | 04/13/17:205364 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 04/11/17:204435 | 5540C | 04/17/17:205511 |
| Aggressiveness Index | 10.8 | -- | -- | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Langelier Index (20°C) | -1.1 | -- | -- | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Nitrate Nitrogen | 2.6 | -- | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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April 18, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : Rosina LA-10
Project : Los Osos BMC Monitoring

Lab ID : CC 1780991-004
Customer ID : 8-514

Sampled On : April 10, 2017-12:00
Sampled By : Zac Reineke
Received On : April 10, 2017-14:49
Matrix : Ground Water

## Sample Result - Support

| Constituent | Result | PQL | Units | Note | Sample Preparation Method | Sample Preparation Date/ID | Sample Analysis Method | Sample Analysis Date/ID |
|---|---|---|---|---|---|---|---|---|
| **Field Test** | | | | | | | | |
| Temperature | 68.5 | | °F | | | 04/10/17 12:00 | 2550B | 04/10/17 12:00 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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April 18, 2017

Lab ID : CC 1781021-002
Customer ID : 8-514

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

Sampled On : April 11, 2017-12:08
Sampled By : Wolfgang Forbes / An
Received On : April 11, 2017-14:45
Matrix : Ground Water

Description : 12J1 (LA-11) LA-11
Project : Los Osos BMC Monitoring

## Sample Result - Inorganic

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **General Mineral** | | | | | | | | |
| Total Hardness as CaCO3 | 541 | -- | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Calcium | 75 | 1 | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Magnesium | 86 | 1 | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Potassium | 4 | 1 | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Sodium | 81 | 1 | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Total Cations | 14.4 | -- | meq/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Boron | 0.2 | 0.1 | mg/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Copper | ND | 10 | ug/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Iron | 70 | 30 | ug/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Manganese | 40 | 10 | ug/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Zinc | ND | 20 | ug/L | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| SAR | 1.5 | -- | -- | | 200.7 | 04/13/17:204285 | 200.7 | 04/13/17:205430 |
| Total Alkalinity (as CaCO3) | 280 | 10 | mg/L | | 2320B | 04/13/17:204281 | 2320B | 04/13/17:205427 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 04/13/17:204281 | 2320B | 04/13/17:205427 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 04/13/17:204281 | 2320B | 04/13/17:205427 |
| Bicarbonate as HCO3 | 350 | 10 | mg/L | | 2320B | 04/13/17:204281 | 2320B | 04/13/17:205427 |
| Sulfate | 186 | 0.5 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Chloride | 167 | 3* | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Nitrate as NO3 | ND | 0.5 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Nitrate + Nitrite as N | ND | 0.1 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Fluoride | 0.1 | 0.1 | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |
| Total Anions | 14.3 | -- | meq/L | | 2320B | 04/13/17:204281 | 2320B | 04/13/17:205427 |
| pH | 7.5 | -- | units | | 4500-H B | 04/12/17:204253 | 4500HB | 04/12/17:205317 |
| Specific Conductance | 1380 | 1 | umhos/cm | | 2510B | 04/14/17:204393 | 2510B | 04/14/17:205475 |
| Total Dissolved Solids | 880 | 20 | mg/L | | 2540CE | 04/13/17:204297 | 2540C | 04/14/17:205437 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 04/12/17:204436 | 5540C | 04/12/17:205513 |
| Aggressiveness Index | 12.2 | -- | -- | | 4500-H B | 04/12/17:204253 | 4500HB | 04/12/17:205317 |
| Langelier Index (20°C) | 0.3 | -- | -- | | 4500-H B | 04/12/17:204253 | 4500HB | 04/12/17:205317 |
| Nitrate Nitrogen | ND | -- | mg/L | | 300.0 | 04/12/17:204398 | 300.0 | 04/12/17:205598 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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April 18, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 7Q3 (LA12) LA-12
Project : Los Osos BMC Monitoring

Lab ID : CC 1780992-001
Customer ID : 8-514

Sampled On : April 10, 2017-10:38
Sampled By : Andrea Berge
Received On : April 10, 2017-14:48
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** | | | | | | | | |
| Total Hardness as CaCO3 | 294 | -- | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Calcium | 47 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Magnesium | 43 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Sodium | 54 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Total Cations | 8.3 | -- | meq/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Boron | 0.2 | 0.1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Copper | ND | 10 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Iron | 70 | 30 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Manganese | 60 | 10 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Zinc | 80 | 20 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| SAR | 1.4 | -- | -- | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Total Alkalinity (as CaCO3) | 240 | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Bicarbonate as HCO3 | 300 | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Sulfate | 49.5 | 0.5 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Chloride | 91 | 1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrate as NO3 | ND | 0.5 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrate + Nitrite as N | ND | 0.1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Total Anions | 8.5 | -- | meq/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| pH | 7.3 | -- | units | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Specific Conductance | 839 | 1 | umhos/cm | | 2510B | 04/12/17:204274 | 2510B | 04/12/17:205339 |
| Total Dissolved Solids | 480 | 20 | mg/L | | 2540CE | 04/12/17:204259 | 2540C | 04/13/17:205364 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 04/11/17:204435 | 5540C | 04/17/17:205511 |
| Aggressiveness Index | 11.8 | -- | -- | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Langelier Index (20°C) | -0.1 | -- | -- | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Nitrate Nitrogen | ND | -- | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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April 20, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 18K8 (LA18) LA-18
Project : Los Osos BMC Monitoring

Lab ID : CC 1781078-001
Customer ID : 8-514

Sampled On : April 12, 2017-14:38
Sampled By : Wolfgang Forbes
Received On : April 12, 2017-15:12
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** | | | | | | | | |
| Total Hardness as CaCO3 | 274 | -- | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Calcium | 57 | 1 | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Magnesium | 32 | 1 | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Sodium | 27 | 1 | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Total Cations | 6.7 | -- | meq/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Copper | ND | 10 | ug/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Iron | 50 | 30 | ug/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Manganese | 90 | 10 | ug/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Zinc | ND | 20 | ug/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| SAR | 0.7 | -- | -- | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Total Alkalinity (as CaCO3) | 240 | 10 | mg/L | | 2320B | 04/14/17:204355 | 2320B | 04/14/17:205584 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 04/14/17:204355 | 2320B | 04/14/17:205584 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 04/14/17:204355 | 2320B | 04/14/17:205584 |
| Bicarbonate as HCO3 | 290 | 10 | mg/L | | 2320B | 04/14/17:204355 | 2320B | 04/14/17:205584 |
| Sulfate | 38.0 | 0.5 | mg/L | | 300.0 | 04/13/17:204399 | 300.0 | 04/13/17:205601 |
| Chloride | 31 | 1 | mg/L | | 300.0 | 04/13/17:204399 | 300.0 | 04/13/17:205601 |
| Nitrate as NO3 | ND | 0.5 | mg/L | | 300.0 | 04/13/17:204399 | 300.0 | 04/13/17:205601 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 04/13/17:204399 | 300.0 | 04/13/17:205601 |
| Nitrate + Nitrite as N | ND | 0.1 | mg/L | | 300.0 | 04/13/17:204399 | 300.0 | 04/13/17:205601 |
| Fluoride | 0.2 | 0.1 | mg/L | | 300.0 | 04/13/17:204399 | 300.0 | 04/13/17:205601 |
| Total Anions | 6.4 | -- | meq/L | | 2320B | 04/14/17:204355 | 2320B | 04/14/17:205584 |
| pH | 7.5 | -- | units | | 4500-H B | 04/13/17:204309 | 4500HB | 04/13/17:205401 |
| Specific Conductance | 616 | 1 | umhos/cm | | 2510B | 04/14/17:204393 | 2510B | 04/14/17:205475 |
| Total Dissolved Solids | 450 | 20 | mg/L | | 2540CE | 04/14/17:204385 | 2540C | 04/17/17:205522 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 04/13/17:204437 | 5540C | 04/13/17:205514 |
| Aggressiveness Index | 12.0 | -- | -- | | 4500-H B | 04/13/17:204309 | 4500HB | 04/13/17:205401 |
| Langelier Index (20°C) | 0.2 | -- | -- | | 4500-H B | 04/13/17:204309 | 4500HB | 04/13/17:205401 |
| Nitrate Nitrogen | ND | -- | mg/L | | 300.0 | 04/13/17:204399 | 300.0 | 04/13/17:205601 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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April 18, 2017

Lab ID : CC 1780991-001
Customer ID : 8-514

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

Sampled On : April 10, 2017-10:15
Sampled By : Zac Reineke
Received On : April 10, 2017-14:49
Matrix : Ground Water

Description : South Boy Well LA-20
Project : Los Osos BMC 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** | | | | | | | | |
| Total Hardness as CaCO3 | 227 | -- | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Calcium | 35 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Magnesium | 34 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Sodium | 40 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Total Cations | 6.3 | -- | meq/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Boron | 0.1 | 0.1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Copper | ND | 10 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Iron | ND | 30 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Manganese | ND | 10 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Zinc | ND | 20 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| SAR | 1.2 | -- | -- | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Total Alkalinity (as CaCO3) | 230 | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Bicarbonate as HCO3 | 280 | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Sulfate | 26.7 | 0.5 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Chloride | 39 | 1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrate as NO3 | 2.7 | 0.5 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrate + Nitrite as N | 0.6 | 0.1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Fluoride | 0.2 | 0.1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Total Anions | 6.3 | -- | meq/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| pH | 7.2 | -- | units | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Specific Conductance | 624 | 1 | umhos/cm | | 2510B | 04/12/17:204274 | 2510B | 04/12/17:205339 |
| Total Dissolved Solids | 380 | 20 | mg/L | | 2540CE | 04/12/17:204259 | 2540C | 04/13/17:205364 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 04/11/17:204435 | 5540C | 04/17/17:205511 |
| Aggressiveness Index | 11.5 | -- | -- | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Langelier Index (20°C) | -0.3 | -- | -- | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Nitrate Nitrogen | 0.6 | -- | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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April 18, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : South Boy Well LA-20
Project : Los Osos BMC Monitoring

Lab ID : CC 1780991-001
Customer ID : 8-514

Sampled On : April 10, 2017-10:15
Sampled By : Zac Reineke
Received On : April 10, 2017-14:49
Matrix : Ground Water

## Sample Result - Support

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **Field Test** | | | | | | | | |
| Temperature | 68.7 | | °F | | | 04/10/17 10:15 | 2550B | 04/10/17 10:15 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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April 25, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : (30SIIE)17E8-LA22 LA-22
Project : Los Osos BMC Monitoring

Lab ID : CC 1781093-001
Customer ID : 8-514

Sampled On : April 13, 2017-11:59
Sampled By : Wolfgang Forbes
Received On : April 13, 2017-14:24
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** | | | | | | | | |
| Total Hardness as CaCO3 | 164 | -- | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Calcium | 26 | 1 | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Magnesium | 24 | 1 | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Potassium | 1 | 1 | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Sodium | 29 | 1 | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Total Cations | 4.6 | -- | meq/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Copper | ND | 10 | ug/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Iron | ND | 30 | ug/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Manganese | ND | 10 | ug/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Zinc | ND | 20 | ug/L | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| SAR | 1.0 | -- | -- | | 200.7 | 04/17/17:204426 | 200.7 | 04/17/17:205605 |
| Total Alkalinity (as CaCO3) | 120 | 10 | mg/L | | 2320B | 04/18/17:204480 | 2320B | 04/18/17:205660 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 04/18/17:204480 | 2320B | 04/18/17:205660 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 04/18/17:204480 | 2320B | 04/18/17:205660 |
| Bicarbonate as HCO3 | 150 | 10 | mg/L | | 2320B | 04/18/17:204480 | 2320B | 04/18/17:205660 |
| Sulfate | 13.2 | 0.5 | mg/L | | 300.0 | 04/14/17:204400 | 300.0 | 04/14/17:205610 |
| Chloride | 46 | 1 | mg/L | | 300.0 | 04/14/17:204400 | 300.0 | 04/14/17:205610 |
| Nitrate as NO3 | 29.7 | 0.5 | mg/L | | 300.0 | 04/14/17:204400 | 300.0 | 04/14/17:205610 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 04/14/17:204400 | 300.0 | 04/14/17:205610 |
| Nitrate + Nitrite as N | 6.7 | 0.1 | mg/L | | 300.0 | 04/14/17:204400 | 300.0 | 04/14/17:205610 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 04/14/17:204400 | 300.0 | 04/14/17:205610 |
| Total Anions | 4.5 | -- | meq/L | | 2320B | 04/18/17:204480 | 2320B | 04/18/17:205660 |
| pH | 7.3 | -- | units | | 4500-H B | 04/19/17:204556 | 4500HB | 04/19/17:205686 |
| Specific Conductance | 466 | 1 | umhos/cm | | 2510B | 04/18/17:204523 | 2510B | 04/18/17:205642 |
| Total Dissolved Solids | 300 | 20 | mg/L | | 2540CE | 04/18/17:204489 | 2540C | 04/19/17:205677 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 04/14/17:204695 | 5540C | 04/14/17:205850 |
| Aggressiveness Index | 11.2 | -- | -- | | 4500-H B | 04/19/17:204556 | 4500HB | 04/19/17:205686 |
| Langelier Index (20°C) | -0.6 | -- | -- | | 4500-H B | 04/19/17:204556 | 4500HB | 04/19/17:205686 |
| Nitrate Nitrogen | 6.7 | -- | mg/L | | 300.0 | 04/14/17:204400 | 300.0 | 04/14/17:205610 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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ENVIRONMENTAL FGL AGRICULTURAL
Analytical Chemists

April 25, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S10G-13M2 LA-31
Project : Los Osos BMC Monitoring

Lab ID : CC 1781113-001
Customer ID : 8-514

Sampled On : April 17, 2017-11:20
Sampled By : Andrea Berge
Received On : April 17, 2017-14:23
Matrix : Ground Water

## Sample Result - Inorganic

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **General Mineral** | | | | | | | | |
| Total Hardness as CaCO3 | 733 | -- | mg/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| Calcium | 114 | 1 | mg/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| Magnesium | 109 | 1 | mg/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| Potassium | 4 | 1 | mg/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| Sodium | 413 | 2* | mg/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/20/17:205807 |
| Total Cations | 32.7 | -- | meq/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| Boron | 0.2 | 0.1 | mg/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| Copper | ND | 10 | ug/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| Iron | 70 | 30 | ug/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| Manganese | ND | 10 | ug/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| Zinc | ND | 20 | ug/L | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| SAR | 6.6 | -- | -- | | 200.7 | 04/19/17:204569 | 200.7 | 04/19/17:205741 |
| Total Alkalinity (as CaCO3) | 50 | 10 | mg/L | | 2320B | 04/19/17:204542 | 2320B | 04/19/17:205679 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 04/19/17:204542 | 2320B | 04/19/17:205679 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 04/19/17:204542 | 2320B | 04/19/17:205679 |
| Bicarbonate as HCO3 | 60 | 10 | mg/L | | 2320B | 04/19/17:204542 | 2320B | 04/19/17:205679 |
| Sulfate | 178 | 0.5 | mg/L | | 300.0 | 04/18/17:204762 | 300.0 | 04/18/17:205627 |
| Chloride | 907 | 18* | mg/L | | 300.0 | 04/18/17:204762 | 300.0 | 04/19/17:205627 |
| Nitrate as NO3 | 2.6 | 0.5 | mg/L | | 300.0 | 04/18/17:204762 | 300.0 | 04/18/17:205627 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 04/18/17:204762 | 300.0 | 04/18/17:205627 |
| Nitrate + Nitrite as N | 0.6 | 0.1 | mg/L | | 300.0 | 04/18/17:204762 | 300.0 | 04/18/17:205627 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 04/18/17:204762 | 300.0 | 04/18/17:205627 |
| Total Anions | 30.3 | -- | meq/L | | 2320B | 04/19/17:204542 | 2320B | 04/19/17:205679 |
| pH | 6.8 | -- | units | | 4500-H B | 04/19/17:204556 | 4500HB | 04/19/17:205686 |
| Specific Conductance | 3380 | 1 | umhos/cm | | 2510B | 04/19/17:204553 | 2510B | 04/19/17:205682 |
| Total Dissolved Solids | 2060 | 20 | mg/L | | 2540CE | 04/19/17:204563 | 2540C | 04/20/17:205747 |
| MBAS Extraction | ND | 0.1 | mg/L | | 5540C | 04/19/17:204612 | 5540C | 04/19/17:205751 |
| Aggressiveness Index | 11.0 | -- | -- | | 4500-H B | 04/19/17:204556 | 4500HB | 04/19/17:205686 |
| Langelier Index (20°C) | -1.0 | -- | -- | | 4500-H B | 04/19/17:204556 | 4500HB | 04/19/17:205686 |
| Nitrate Nitrogen | 0.6 | -- | mg/L | | 300.0 | 04/18/17:204762 | 300.0 | 04/18/17:205627 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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ENVIRONMENTAL FGL AGRICULTURAL
Analytical Chemists

April 18, 2017

Lab ID : CC 1780992-002
Customer ID : 8-514

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 18K9 (LA32) LA-32
Project : Los Osos BMC Monitoring

Sampled On : April 10, 2017-11:00
Sampled By : Andrea Berge
Received On : April 10, 2017-14:48
Matrix : Ground Water

## Sample Result - Inorganic

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **General Mineral** | | | | | | | | |
| Total Hardness as CaCO3 | 155 | -- | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Calcium | 24 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Magnesium | 23 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Potassium | 1 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Sodium | 31 | 1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Total Cations | 4.5 | -- | meq/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Copper | ND | 10 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Iron | ND | 30 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Manganese | ND | 10 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Zinc | ND | 20 | ug/L | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| SAR | 1.1 | -- | -- | | 200.7 | 04/11/17:204198 | 200.7 | 04/11/17:205280 |
| Total Alkalinity (as CaCO3) | 150 | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Bicarbonate as HCO3 | 190 | 10 | mg/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| Sulfate | 19.1 | 0.5 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Chloride | 35 | 1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrate as NO3 | 8.4 | 0.5 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Nitrate + Nitrite as N | 1.9 | 0.1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Fluoride | 0.1 | 0.1 | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |
| Total Anions | 4.6 | -- | meq/L | | 2320B | 04/12/17:204223 | 2320B | 04/12/17:205361 |
| pH | 7.3 | -- | units | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Specific Conductance | 461 | 1 | umhos/cm | | 2510B | 04/12/17:204274 | 2510B | 04/12/17:205339 |
| Total Dissolved Solids | 270 | 20 | mg/L | | 2540CE | 04/12/17:204259 | 2540C | 04/13/17:205364 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 04/11/17:204435 | 5540C | 04/17/17:205511 |
| Aggressiveness Index | 11.3 | -- | -- | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Langelier Index (20°C) | -0.6 | -- | -- | | 4500-H B | 04/11/17:204216 | 4500HB | 04/11/17:205260 |
| Nitrate Nitrogen | 1.9 | -- | mg/L | | 300.0 | 04/11/17:204397 | 300.0 | 04/11/17:205413 |

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**Fall 2017 Field Logs and Analytical Results**

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/3/2017
Operator: A.Berge, S.J. Harris
Well number and location: 30S/11E-20A2 (FW26)
Site and wellhead conditions: Cloudy, sunny, windy. Covering in place.

Static water depth (feet): 19.27
Well depth (feet): 65
Water column (feet): 45.73
Casing diameter (inches): 6
Minimum purge volume (gal) --
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): --
Time begin purge: 12:24 PM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 12:25 | 1 | 663.5 | 7.17 | 14.3 | Cloudy, odorless. |
| 12:28 | 20 | 651.8 | 6.93 | 13.7 | Initially cloudy, odorless |
| | | | | | |
| | | | | | Sampled @ 12:29 pm |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/3/2017
Operator: A.Berge, S.J. Harris
Well number and location: 30S/11E-20M2 (FW28)
Site and wellhead conditions: Cloudy, windy, warm. Well secure. Active well.

Static water depth (feet): 27.77
Well depth (feet): 102
Water column (feet): 74.23
Casing diameter (inches): --
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 13:20

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 13:21 | 2 | 788 | 7.62 | 21.6 | Slightly brown, odorless. |
| 13:22 | 5 | 798 | 7.70 | 19.6 | Clear, colorless, odorless. |
| | | | | | Sampled @ 13:23 pm |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/12/2017
Operator: A.Berge
Well number and location: 30S/11E-17E10 (UA13)
Site and wellhead conditions: Sunny, clear, gate pre-opened.

Static water depth (feet): (pumping)
Well depth (feet): 220
Water column (feet): --
Casing diameter (inches): --
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 9:24 AM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 9:24 | 1 | 509 | 7.78 | 19 | Clear, colorless, odorless |
| 9:26 | 5 | 516.8 | 6.88 | 18.8 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 9:27 AM |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/2/2017
Operator: A.Berge
Well number and location: 30S/11E-13N (LA8)
Site and wellhead conditions: Sunny warm, cleared waterline for 3 minutes at 200 gpm

Static water depth (feet): 135
Well depth (feet): 350
Water column (feet): 215
Casing diameter (inches): 8
Minimum purge volume (gal): flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 10:05 AM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 10:08 | 600 | 436 | 7.94 | 18.5 | Clear, colorless, odorless |
| | | | | | Sampled @ 10:09 am |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/4/2017
Operator: A.Berge
Well number and location: 30S/11E-12J1 (LA11)
Site and wellhead conditions: Sunny, warm. Cap on and secure, ice plant clear of cap.

Static water depth (feet): 6.99
Well depth (feet): 389
Water column (feet): 382.01
Casing diameter (inches): 2
Minimum purge volume (gal) 188.00
Purge rate (gpm): 1.60
Pumping water level (feet): 12.42
Pump setting (feet): 25
Minimum purge time (min): 120
Time begin purge: 9:46 AM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 9:47 | 1 | 1125 | 8.17 | 18.8 | Clear, colorless, odorless |
| 9:49 | 5 | 1121 | 7.96 | 18.4 | Some plant fragments |
| 9:51 | 10 | 1122 | 7.75 | 18.4 | Clear, colorless, odorless |
| 9:59 | 20 | 1120 | 7.65 | 19 | Clear, colorless, odorless |
| 10:14 | 45 | 1123 | 7.67 | 20.3 | Slightly cloudy, odorless |
| 10:33 | 75 | 1308 | 7.83 | 19.7 | Clear, colorless, odorless |
| 10:48 | 100 | 1288 | 8.05 | 20.3 | Clear, colorless, odorless |
| 10:59 | 120 | 1269 | 8.27 | 20.4 | Clear, colorless, odorless |
| 11:14 | 145 | 1252 | 7.89 | 20.9 | Clear, colorless, odorless |
| 11:29 | 170 | 1251 | 7.99 | 20.8 | Clear, colorless, odorless |
| 11:41 | 190 | 1225 | 7.59 | 20.9 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @11:42 am |
| | | | | | |

*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/4/2017
Operator: A.Berge
Well number and location: 30S/11E-7Q3 (LA12)
Site and wellhead conditions: Secure, pumping. Sampled from spigot.

Static water depth (feet): (pumping)
Well depth (feet): 270
Water column (feet): --
Casing diameter (inches): 10
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 12:39 PM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 12:40 | 5 | 807.8 | 7.76 | 21.5 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 12:41 pm |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/5/2017
Operator: A.Berge
Well number and location: 30S/11E-18L2 (LA15)
Site and wellhead conditions: Secure and pumping since 10:00 am

Static water depth (feet): (pumping)
Well depth (feet): 394
Water column (feet): --
Casing diameter (inches): 12
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 11:03 AM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 11:05 | 3 | 744.3 | 7.75 | 21.2 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 11:06 am |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/9/2017
Operator: A.Berge, W. Forbes
Well number and location: 30S/11E-18K8 (LA18)
Site and wellhead conditions: Sunny, warm. Gate opened

Static water depth (feet): 141.75
Well depth (feet): 630
Water column (feet): 488.25
Casing diameter (inches): 2
Minimum purge volume (gal) 239
Purge rate (gpm): 0.5
Pumping water level (feet): 144.87
Pump setting (feet): 160
Minimum purge time (min): 480
Time begin purge: 9:32 AM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 9:33 | 1 | 523.5 | 6.84 | 20.5 | Some debris, clear, odorless |
| 9:40 | 5 | 608.3 | 7.46 | 20.9 | Clear, colorless, odorless |
| 9:50 | 10 | 611.1 | 7.65 | 21.3 | Clear, colorless, odorless |
| 10:11 | 20 | 616.6 | 7.66 | 21.5 | Clear, colorless, odorless |
| 10:54 | 30 | 595.8 | 7.61 | 22.9 | Pump reset to 145', delay |
| 11:36 | 50 | 615.3 | 7.57 | 21.6 | Clear, colorless, odorless |
| 12:13 | 80 | 614.8 | 7.78 | 21.7 | Clear, colorless, odorless |
| 14:34 | 120 | 610 | 7.71 | 21.6 | Clear, colorless, odorless |
| 17:03 | 170 | 610.5 | 7.80 | 21.5 | Clear, colorless, odorless |
| 19:10 | 220 | 606 | 7.68 | 20.8 | Clear, colorless, odorless |
| 19:28 | 240 | 611 | 7.69 | 21.1 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled at 19:30 |
| | | | | | |
| | | | | | |

*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/11/2017
Operator: A.Berge, W. Forbes
Well number and location: 30S/11E-17E8 (LA22)
Site and wellhead conditions: Sunny, warm cap secure.

Static water depth (feet): 128.17
Well depth (feet): 380
Water column (feet): 251.83
Casing diameter (inches): 2
Minimum purge volume (gal) 123.00
Purge rate (gpm): 0.9
Pumping water level (feet): 129.40
Pump setting (feet): 135
Minimum purge time (min): 120
Time begin purge: 9:25 AM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 9:26 | 1 | 474.1 | 8.89 | 19.3 | Clear, colorless, odorless |
| 9:31 | 5 | 601.2 | 8.82 | 19.6 | Clear, colorless, odorless |
| 11:11 | 10 | 552.3 | 8.63 | 20.1 | Pump down-replaced resumed @ 11:04 |
| 11:17 | 15 | 500.3 | 8.03 | 19.9 | Clear, colorless, odorless |
| 11:32 | 25 | 484.0 | 7.98 | 19.6 | Clear, colorless, odorless |
| 11:45 | 35 | 478.9 | 7.53 | 20.1 | Clear, colorless, odorless |
| 11:59 | 45 | 477.4 | 7.59 | 20.3 | Clear, colorless, odorless |
| 12:15 | 55 | 477.1 | 7.54 | 20.3 | Clear, colorless, odorless |
| 12:42 | 75 | 475.6 | 7.59 | 20.1 | Clear, colorless, odorless |
| 13:14 | 95 | 476.2 | 7.77 | 20.3 | Clear, colorless, odorless |
| 13:43 | 115 | 479.7 | 7.49 | 21 | Clear, colorless, odorless |
| 14:01 | 125 | 480.1 | 7.50 | 21.3 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 14:02 |

*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/3/2017
Operator: A.Berge, S.J. Harris
Well number and location: 30S/11E-20H1 (LA30)
Site and wellhead conditions: Slightly overcast, windy. Active well.

Static water depth (feet): 19.72
Well depth (feet): 140
Water column (feet): 120.28
Casing diameter (inches): 6
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 14:39

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 14:40 | 3 | 832 | 7.78 | 18.9 | Slight odor, slightly cloudy |
| 14:42 | 5 | 808 | 7.69 | 18.3 | Slightly cloudy, bubbles |
| | | | | | |
| | | | | | Sampled @ 14:43 pm |
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| | | | | | |

*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/5/2017
Operator: A.Berge
Well number and location: 30S/11E-13M2 (LA 31)
Site and wellhead conditions: Sunny, breezy. Plug in place

Static water depth (feet): 38.23
Well depth (feet): 292
Water column (feet): 253.77
Casing diameter (inches): 6
Minimum purge volume (gal): flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 12:07 AM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 12:08 | 1 | 3.33 | 7.68 | 20.9 | Clear, colorless, odorless |
| 12:10 | 5 | 3.33 | 7.66 | 19.3 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 12:11 pm |
| | | | | | |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/9/2017
Operator: W. Forbes
Well number and location: 30S/11E-18K9 (LA32)
Site and wellhead conditions: Sunny, warm, secure and locked.

Static water depth (feet): (pumping)
Well depth (feet): 490
Water column (feet): --
Casing diameter (inches): 14
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 11:15 AM

| Time | Gallons | EC (µS/cm) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 11:14 | 2 | 493.2 | 7.51 | 21.1 | Clear, colorless, odorless |
| | | | | | |
| | | | | | Sampled @ 11:20 am |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
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| | | | | | |
| | | | | | |

*Turbidity, color, odor, sheen, debris, etc.

October 23, 2017

Lab ID : CC 1783799-001
Customer ID : 8-514

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

Sampled On : October 3, 2017-12:29
Sampled By : Spencer Harris / And
Received On : October 3, 2017-15:11
Matrix : Ground Water

Description : 20A2 (FW26)
Project : Los Osos BMC 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** | | | | | | | | |
| Total Hardness as CaCO3 | 231 | -- | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Calcium | 35 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Magnesium | 35 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Potassium | ND | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Sodium | 35 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Total Cations | 6.1 | -- | meq/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Iron | 500 | 30 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Zinc | 60 | 20 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| SAR | 1.0 | -- | -- | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Total Alkalinity (as CaCO3) | 170 | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Bicarbonate as HCO3 | 210 | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Sulfate | 41.2 | 0.5 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Chloride | 82 | 1 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Nitrate as NO3 | ND | 1.8 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Nitrate + Nitrite as N | ND | 0.5 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Total Anions | 6.6 | -- | meq/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| pH | 6.7 | -- | units | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Specific Conductance | 673 | 1 | umhos/cm | | 2510B | 10/05/17:211979 | 2510B | 10/05/17:214992 |
| Total Dissolved Solids | 370 | 20 | mg/L | | 2540CE | 10/05/17:211995 | 2540C | 10/06/17:215055 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/04/17:211935 | 5540C | 10/04/17:214939 |
| Aggressiveness Index | 10.9 | -- | -- | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Langelier Index (20°C) | -1.0 | -- | -- | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Nitrate Nitrogen | ND | -- | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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October 23, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 20M2 (FW28)
Project : Los Osos BMC Monitoring

Lab ID : CC 1783799-002
Customer ID : 8-514

Sampled On : October 3, 2017-11:23
Sampled By : Spencer Harris / And
Received On : October 3, 2017-15:11
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** | | | | | | | | |
| Total Hardness as CaCO3 | 355 | -- | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Calcium | 63 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Magnesium | 48 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Potassium | ND | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Sodium | 30 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Total Cations | 8.4 | -- | meq/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Boron | 0.1 | 0.1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Zinc | 20 | 20 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| SAR | 0.7 | -- | -- | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Total Alkalinity (as CaCO3) | 200 | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Bicarbonate as HCO3 | 240 | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Sulfate | 89.9 | 0.5 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Chloride | 47 | 1 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Nitrate as NO3 | ND | 1.8 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Nitrate + Nitrite as N | ND | 0.5 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Fluoride | 0.2 | 0.1 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Total Anions | 7.1 | -- | meq/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| pH | 7.4 | -- | units | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Specific Conductance | 836 | 1 | umhos/cm | | 2510B | 10/05/17:211979 | 2510B | 10/05/17:214992 |
| Total Dissolved Solids | 490 | 20 | mg/L | | 2540CE | 10/05/17:211995 | 2540C | 10/06/17:215055 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/04/17:211935 | 5540C | 10/04/17:214939 |
| Aggressiveness Index | 11.9 | -- | -- | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Langelier Index (20°C) | 0.03 | -- | -- | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Nitrate Nitrogen | ND | -- | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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October 30, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : Skyline Well 13F4 UA 3
Project : Los Osos BMC Monitoring

Lab ID : CC 1783961-005
Customer ID : 8-514

Sampled On : October 12, 2017-12:40
Sampled By : Zac Remeke
Received On : October 12, 2017-14:10
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** | | | | | | | | |
| Total Hardness as CaCO3 | 143 | -- | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Calcium | 26 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Magnesium | 19 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Sodium | 64 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Cations | 5.7 | -- | meq/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Iron | 70 | 30 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| SAR | 2.3 | -- | -- | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Alkalinity (as CaCO3) | 80 | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Bicarbonate as HCO3 | 100 | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Sulfate | 29.5 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Chloride | 73 | 1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate as NO3 | 85.2 | 1.8 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate + Nitrite as N | 19.2 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Total Anions | 5.7 | -- | meq/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| pH | 7.0 | -- | units | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Specific Conductance | 607 | 1 | umhos/cm | | 2510B | 10/16/17:212403 | 2510B | 10/16/17:215558 |
| Total Dissolved Solids | 390 | 20 | mg/L | | 2540CE | 10/17/17:212488 | 2540C | 10/18/17:215749 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/13/17:212622 | 5540C | 10/13/17:215838 |
| Aggressiveness Index | 10.7 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Langelier Index (20°C) | -1.1 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Nitrate Nitrogen | 19.2 | -- | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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October 30, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : Los Olivos #3 18K3 UA 9
Project : Los Osos BMC Monitoring

Lab ID : CC 1783961-003
Customer ID : 8-514

Sampled On : October 12, 2017-10:25
Sampled By : Zac Remeke
Received On : October 12, 2017-14:10
Matrix : Ground Water

## Sample Result - Inorganic

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **General Mineral** | | | | | | | | |
| Total Hardness as CaCO3 | 82.7 | -- | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Calcium | 15 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Magnesium | 11 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Potassium | ND | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Sodium | 27 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Cations | 2.8 | -- | meq/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| SAR | 1.3 | -- | -- | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Alkalinity (as CaCO3) | 50 | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Bicarbonate as HCO3 | 60 | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Sulfate | 7.6 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Chloride | 42 | 1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate as NO3 | 41.1 | 1.8 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate + Nitrite as N | 9.3 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Total Anions | 3.0 | -- | meq/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| pH | 7.1 | -- | units | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Specific Conductance | 319 | 1 | umhos/cm | | 2510B | 10/16/17:212403 | 2510B | 10/16/17:215558 |
| Total Dissolved Solids | 220 | 20 | mg/L | | 2540CE | 10/17/17:212488 | 2540C | 10/18/17:215749 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/13/17:212622 | 5540C | 10/13/17:215838 |
| Aggressiveness Index | 10.4 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Langelier Index (20°C) | -1.5 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Nitrate Nitrogen | 9.3 | -- | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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CA ELAP Certification No. 2810

October 23, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 17E10 (VA-13) UA 13
Project : Los Osos BMC Monitoring

Lab ID : CC 1783960-001
Customer ID : 8-514

Sampled On : October 12, 2017-09:27
Sampled By : Andrea Berge
Received On : October 12, 2017-14:04
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** | | | | | | | | |
| Total Hardness as CaCO3 | 155 | -- | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Calcium | 24 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Magnesium | 23 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Potassium | 1 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Sodium | 40 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Cations | 4.9 | -- | meq/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| SAR | 1.4 | -- | -- | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Alkalinity (as CaCO3) | 90 | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Bicarbonate as HCO3 | 110 | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Sulfate | 23.3 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Chloride | 58 | 1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate as NO3 | 61.8 | 1.8 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate + Nitrite as N | 14.0 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Total Anions | 4.9 | -- | meq/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| pH | 6.8 | -- | units | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Specific Conductance | 506 | 1 | umhos/cm | | 2510B | 10/16/17:212403 | 2510B | 10/16/17:215558 |
| Total Dissolved Solids | 310 | 20 | mg/L | | 2540CE | 10/17/17:212488 | 2540C | 10/18/17:215749 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/13/17:212622 | 5540C | 10/13/17:215838 |
| Aggressiveness Index | 10.5 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Langelier Index (20°C) | -1.3 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Nitrate Nitrogen | 14.0 | -- | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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CA ELAP Certification No. 2810

October 17, 2017

Lab ID : CC 1783747-001
Customer ID : 8-514

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 13N (LA8)
Project : Los Osos BMC Monitoring

Sampled On : October 2, 2017-10:09
Sampled By : Andrea Berge
Received On : October 2, 2017-11:49
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** | | | | | | | | |
| Total Hardness as CaCO3 | 95.0 | -- | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Calcium | 15 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Magnesium | 14 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Potassium | 1 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Sodium | 36 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Total Cations | 3.5 | -- | meq/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Copper | 70 | 10 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Zinc | 30 | 20 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| SAR | 1.6 | -- | -- | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Total Alkalinity (as CaCO3) | 30 | 10 | mg/L | | 2320B | 10/04/17:211890 | 2320B | 10/04/17:214976 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/04/17:211890 | 2320B | 10/04/17:214976 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/04/17:211890 | 2320B | 10/04/17:214976 |
| Bicarbonate as HCO3 | 30 | 10 | mg/L | | 2320B | 10/04/17:211890 | 2320B | 10/04/17:214976 |
| Sulfate | 13.2 | 0.5 | mg/L | | 300.0 | 10/03/17:211960 | 300.0 | 10/03/17:214963 |
| Chloride | 78 | 1 | mg/L | | 300.0 | 10/03/17:211960 | 300.0 | 10/03/17:214963 |
| Nitrate as NO3 | 33.5 | 1.8 | mg/L | | 300.0 | 10/03/17:211960 | 300.0 | 10/03/17:214963 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/03/17:211960 | 300.0 | 10/03/17:214963 |
| Nitrate + Nitrite as N | 7.6 | 0.5 | mg/L | | 300.0 | 10/03/17:211960 | 300.0 | 10/03/17:214963 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/03/17:211960 | 300.0 | 10/03/17:214963 |
| Total Anions | 3.5 | -- | meq/L | | 2320B | 10/04/17:211890 | 2320B | 10/04/17:214976 |
| pH | 7.2 | -- | units | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Specific Conductance | 438 | 1 | umhos/cm | | 2510B | 10/04/17:211920 | 2510B | 10/04/17:214919 |
| Total Dissolved Solids | 290 | 20 | mg/L | | 2540CE | 10/03/17:211856 | 2540C | 10/04/17:214920 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/03/17:211868 | 5540C | 10/03/17:214875 |
| Aggressiveness Index | 10.3 | -- | -- | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Langelier Index (20°C) | -1.6 | -- | -- | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Nitrate Nitrogen | 7.6 | -- | mg/L | | 300.0 | 10/03/17:211960 | 300.0 | 10/03/17:214963 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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October 30, 2017

Lab ID : CC 1783961-002
Customer ID : 8-514

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

Sampled On : October 12, 2017-11:20
Sampled By : Zac Remeke
Received On : October 12, 2017-14:10
Matrix : Ground Water

Description : Cabrillo Well 24C1 LA 9
Project : Los Osos BMC Monitoring

## Sample Result - Inorganic

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **General Mineral** | | | | | | | | |
| Total Hardness as CaCO3 | 117 | -- | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Calcium | 19 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Magnesium | 17 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Sodium | 46 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Cations | 4.4 | -- | meq/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| SAR | 1.8 | -- | -- | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Alkalinity (as CaCO3) | 60 | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Bicarbonate as HCO3 | 70 | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Sulfate | 16.3 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Chloride | 89 | 1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate as NO3 | 26.7 | 1.8 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate + Nitrite as N | 6.0 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Total Anions | 4.4 | -- | meq/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| pH | 7.0 | -- | units | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Specific Conductance | 484 | 1 | umhos/cm | | 2510B | 10/16/17:212403 | 2510B | 10/16/17:215558 |
| Total Dissolved Solids | 270 | 20 | mg/L | | 2540CE | 10/17/17:212488 | 2540C | 10/18/17:215749 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/13/17:212622 | 5540C | 10/13/17:215838 |
| Aggressiveness Index | 10.5 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Langelier Index (20°C) | -1.4 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Nitrate Nitrogen | 6.0 | -- | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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CA ELAP Certification No. 2810

October 30, 2017

Lab ID : CC 1783961-004
Customer ID : 8-514

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

Sampled On : October 12, 2017-12:01
Sampled By : Zac Remeke
Received On : October 12, 2017-14:10
Matrix : Ground Water

Description : Rosina Well 13J1 LA 10
Project : Los Osos BMC 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** | | | | | | | | |
| Total Hardness as CaCO3 | 245 | -- | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Calcium | 39 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Magnesium | 36 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Sodium | 33 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Cations | 6.4 | -- | meq/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Iron | 430 | 30 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Manganese | 10 | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Zinc | 20 | 20 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| SAR | 0.9 | -- | -- | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Alkalinity (as CaCO3) | 60 | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Bicarbonate as HCO3 | 80 | 10 | mg/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| Sulfate | 12.5 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Chloride | 164 | 3* | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate as NO3 | 15.0 | 1.8 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate + Nitrite as N | 3.4 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Total Anions | 6.4 | -- | meq/L | | 2320B | 10/16/17:212474 | 2320B | 10/16/17:215667 |
| pH | 6.9 | -- | units | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Specific Conductance | 702 | 1 | umhos/cm | | 2510B | 10/16/17:212403 | 2510B | 10/16/17:215558 |
| Total Dissolved Solids | 510 | 20 | mg/L | | 2540CE | 10/17/17:212488 | 2540C | 10/18/17:215749 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/13/17:212622 | 5540C | 10/13/17:215838 |
| Aggressiveness Index | 10.7 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Langelier Index (20°C) | -1.2 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Nitrate Nitrogen | 3.4 | -- | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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

October 30, 2017

Lab ID : CC 1783810-001
Customer ID : 8-514

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 12J1 (La11)
Project : Los Osos BMC Monitoring

Sampled On : October 4, 2017-11:42
Sampled By : Andrea Berge
Received On : October 4, 2017-14:37
Matrix : Ground Water

## Sample Result - Inorganic

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **General Mineral** | | | | | | | | |
| Total Hardness as CaCO3 | 543 | -- | mg/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Calcium | 76 | 1 | mg/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Magnesium | 86 | 1 | mg/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Potassium | 5 | 1 | mg/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Sodium | 90 | 1 | mg/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Total Cations | 14.9 | -- | meq/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Boron | 0.3 | 0.1 | mg/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Iron | 110 | 30 | ug/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Manganese | 40 | 10 | ug/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| SAR | 1.7 | -- | -- | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Total Alkalinity (as CaCO3) | 250 | 10 | mg/L | | 2320B | 10/06/17:212025 | 2320B | 10/06/17:215111 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/06/17:212025 | 2320B | 10/06/17:215111 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/06/17:212025 | 2320B | 10/06/17:215111 |
| Bicarbonate as HCO3 | 300 | 10 | mg/L | | 2320B | 10/06/17:212025 | 2320B | 10/06/17:215111 |
| Sulfate | 191 | 0.5 | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |
| Chloride | 162 | 3* | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/06/17:215544 |
| Nitrate as NO3 | ND | 1.8 | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |
| Nitrate + Nitrite as N | ND | 0.5 | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |
| Fluoride | 0.1 | 0.1 | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |
| Total Anions | 13.5 | -- | meq/L | | 2320B | 10/06/17:212025 | 2320B | 10/06/17:215111 |
| pH | 7.0 | -- | units | | 4500-H B | 10/09/17:212124 | 4500HB | 10/09/17:215184 |
| Specific Conductance | 1370 | 1 | umhos/cm | | 2510B | 10/06/17:212027 | 2510B | 10/06/17:215058 |
| Total Dissolved Solids | 850 | 20 | mg/L | | 2540CE | 10/06/17:212050 | 2540C | 10/09/17:215157 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/05/17:212118 | 5540C | 10/05/17:215166 |
| Aggressiveness Index | 11.7 | -- | -- | | 4500-H B | 10/09/17:212124 | 4500HB | 10/09/17:215184 |
| Langelier Index (20°C) | -0.2 | -- | -- | | 4500-H B | 10/09/17:212124 | 4500HB | 10/09/17:215184 |
| Nitrate Nitrogen | ND | -- | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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October 30, 2017

Lab ID : CC 1783810-002
Customer ID : 8-514

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 7Q3 (LA12)
Project : Los Osos BMC Monitoring

Sampled On : October 4, 2017-12:41
Sampled By : Andrea Berge
Received On : October 4, 2017-14:37
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** | | | | | | | | |
| Total Hardness as CaCO3 | 305 | -- | mg/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Calcium | 48 | 1 | mg/L | | 200.7 | 10/27/17:212976 | 200.7 | 10/27/17:216353 |
| Magnesium | 45 | 1 | mg/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Sodium | 56 | 1 | mg/L | | 200.7 | 10/27/17:212976 | 200.7 | 10/27/17:216353 |
| Total Cations | 8.6 | -- | meq/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Boron | 0.2 | 0.1 | mg/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Iron | 70 | 30 | ug/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Manganese | 60 | 10 | ug/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| SAR | 1.4 | -- | -- | | 200.7 | 10/06/17:212031 | 200.7 | 10/06/17:215156 |
| Total Alkalinity (as CaCO3) | 180 | 10 | mg/L | | 2320B | 10/06/17:212025 | 2320B | 10/06/17:215111 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/06/17:212025 | 2320B | 10/06/17:215111 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/06/17:212025 | 2320B | 10/06/17:215111 |
| Bicarbonate as HCO3 | 220 | 10 | mg/L | | 2320B | 10/06/17:212025 | 2320B | 10/06/17:215111 |
| Sulfate | 45 | 1* | mg/L | | 300.0 | 10/27/17:213023 | 300.0 | 10/27/17:216413 |
| Chloride | 92 | 2* | mg/L | | 300.0 | 10/27/17:213023 | 300.0 | 10/27/17:216413 |
| Nitrate as NO3 | ND | 1.8 | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |
| Nitrate + Nitrite as N | ND | 0.5 | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |
| Total Anions | 7.1 | -- | meq/L | | 2320B | 10/06/17:212025 | 2320B | 10/06/17:215111 |
| pH | 6.5 | -- | units | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Specific Conductance | 826 | 1 | umhos/cm | | 2510B | 10/06/17:212027 | 2510B | 10/06/17:215058 |
| Total Dissolved Solids | 470 | 20 | mg/L | | 2540CE | 10/06/17:212050 | 2540C | 10/09/17:215157 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/05/17:212118 | 5540C | 10/05/17:215166 |
| Aggressiveness Index | 10.8 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Langelier Index (20°C) | -1.0 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Nitrate Nitrogen | ND | -- | mg/L | | 300.0 | 10/05/17:212138 | 300.0 | 10/05/17:215544 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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October 30, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 18L2 (LA15)
Project : Los Osos BMC Monitoring

Lab ID : CC 1783861-001
Customer ID : 8-514

Sampled On : October 5, 2017-11:06
Sampled By : Andrea Berge
Received On : October 5, 2017-14:38
Matrix : Ground Water

## Sample Result - Inorganic

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **General Mineral** | | | | | | | | |
| Total Hardness as CaCO3 | 306 | -- | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Calcium | 50 | 1 | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Magnesium | 44 | 1 | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Sodium | 40 | 1 | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Total Cations | 7.9 | -- | meq/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| SAR | 1.0 | -- | -- | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Total Alkalinity (as CaCO3) | 150 | 10 | mg/L | | 2320B | 10/07/17:212076 | 2320B | 10/07/17:215142 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/07/17:212076 | 2320B | 10/07/17:215142 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/07/17:212076 | 2320B | 10/07/17:215142 |
| Bicarbonate as HCO3 | 180 | 10 | mg/L | | 2320B | 10/07/17:212076 | 2320B | 10/07/17:215142 |
| Sulfate | 27 | 1* | mg/L | | 300.0 | 10/27/17:213023 | 300.0 | 10/27/17:216413 |
| Chloride | 102 | 2* | mg/L | | 300.0 | 10/27/17:213023 | 300.0 | 10/27/17:216413 |
| Nitrate as NO3 | 3.3 | 1.8 | mg/L | | 300.0 | 10/06/17:212139 | 300.0 | 10/06/17:215545 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/06/17:212139 | 300.0 | 10/06/17:215545 |
| Nitrate + Nitrite as N | 0.7 | 0.5 | mg/L | | 300.0 | 10/06/17:212139 | 300.0 | 10/06/17:215545 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/06/17:212139 | 300.0 | 10/06/17:215545 |
| Total Anions | 6.4 | -- | meq/L | | 2320B | 10/07/17:212076 | 2320B | 10/07/17:215142 |
| pH | 7.6 | -- | units | | 4500-H B | 10/09/17:212124 | 4500HB | 10/09/17:215184 |
| Specific Conductance | 768 | 1 | umhos/cm | | 2510B | 10/09/17:212100 | 2510B | 10/09/17:215144 |
| Total Dissolved Solids | 400 | 20 | mg/L | | 2540CE | 10/10/17:212174 | 2540C | 10/11/17:215338 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/06/17:212119 | 5540C | 10/06/17:215167 |
| Aggressiveness Index | 11.9 | -- | -- | | 4500-H B | 10/09/17:212124 | 4500HB | 10/09/17:215184 |
| Langelier Index (20°C) | 0.02 | -- | -- | | 4500-H B | 10/09/17:212124 | 4500HB | 10/09/17:215184 |
| Nitrate Nitrogen | 0.7 | -- | mg/L | | 300.0 | 10/06/17:212139 | 300.0 | 10/06/17:215545 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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October 30, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 18K8 (LA 18)
Project : Los Osos BMC Monitoring

Lab ID : CC 1783901-001
Customer ID : 8-514

Sampled On : October 9, 2017-19:30
Sampled By : Spencer Harris
Received On : October 10, 2017-09:11
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** | | | | | | | | |
| Total Hardness as CaCO3 | 271 | -- | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Calcium | 56 | 1 | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Magnesium | 32 | 1 | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Sodium | 27 | 1 | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Total Cations | 6.7 | -- | meq/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Manganese | 90 | 10 | ug/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| SAR | 0.7 | -- | -- | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Total Alkalinity (as CaCO3) | 180 | 10 | mg/L | | 2320B | 10/12/17:212280 | 2320B | 10/12/17:215474 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/12/17:212280 | 2320B | 10/12/17:215474 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/12/17:212280 | 2320B | 10/12/17:215474 |
| Bicarbonate as HCO3 | 220 | 10 | mg/L | | 2320B | 10/12/17:212280 | 2320B | 10/12/17:215474 |
| Sulfate | 35.5 | 0.5 | mg/L | | 300.0 | 10/27/17:213023 | 300.0 | 10/27/17:216413 |
| Chloride | 30 | 1 | mg/L | | 300.0 | 10/27/17:213023 | 300.0 | 10/27/17:216413 |
| Nitrate as NO3 | ND | 1.8 | mg/L | | 300.0 | 10/11/17:212382 | 300.0 | 10/11/17:215549 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/11/17:212382 | 300.0 | 10/11/17:215549 |
| Nitrate + Nitrite as N | ND | 0.5 | mg/L | | 300.0 | 10/11/17:212382 | 300.0 | 10/11/17:215549 |
| Fluoride | 0.3 | 0.1 | mg/L | | 300.0 | 10/11/17:212382 | 300.0 | 10/11/17:215549 |
| Total Anions | 5.2 | -- | meq/L | | 2320B | 10/12/17:212280 | 2320B | 10/12/17:215474 |
| pH | 7.8 | -- | units | | 4500-H B | 10/12/17:212281 | 4500HB | 10/12/17:215398 |
| Specific Conductance | 619 | 1 | umhos/cm | | 2510B | 10/12/17:212286 | 2510B | 10/12/17:215401 |
| Total Dissolved Solids | 350 | 20 | mg/L | | 2540CE | 10/12/17:212314 | 2540C | 10/13/17:215430 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/11/17:212270 | 5540C | 10/12/17:215433 |
| Aggressiveness Index | 12.2 | -- | -- | | 4500-H B | 10/12/17:212281 | 4500HB | 10/12/17:215398 |
| Langelier Index (20°C) | 0.4 | -- | -- | | 4500-H B | 10/12/17:212281 | 4500HB | 10/12/17:215398 |
| Nitrate Nitrogen | ND | -- | mg/L | | 300.0 | 10/11/17:212382 | 300.0 | 10/11/17:215549 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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CA ELAP Certification No. 2810

October 30, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : South Bay #1 17N10 LA 20
Project : Los Osos BMC Monitoring

Lab ID : CC 1783961-001
Customer ID : 8-514

Sampled On : October 12, 2017-10:40
Sampled By : Zac Remeke
Received On : October 12, 2017-14:10
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** | | | | | | | | |
| Total Hardness as CaCO3 | 240 | -- | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Calcium | 37 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Magnesium | 36 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Potassium | 2 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Sodium | 43 | 1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Cations | 6.7 | -- | meq/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Boron | 0.2 | 0.1 | mg/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| SAR | 1.2 | -- | -- | | 200.7 | 10/13/17:212369 | 200.7 | 10/13/17:215529 |
| Total Alkalinity (as CaCO3) | 210 | 10 | mg/L | | 2320B | 10/14/17:212388 | 2320B | 10/14/17:215664 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/14/17:212388 | 2320B | 10/14/17:215664 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/14/17:212388 | 2320B | 10/14/17:215664 |
| Bicarbonate as HCO3 | 260 | 10 | mg/L | | 2320B | 10/14/17:212388 | 2320B | 10/14/17:215664 |
| Sulfate | 27.9 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Chloride | 41 | 1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate as NO3 | 2.9 | 1.8 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Nitrate + Nitrite as N | 0.7 | 0.5 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Fluoride | 0.2 | 0.1 | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |
| Total Anions | 6.1 | -- | meq/L | | 2320B | 10/14/17:212388 | 2320B | 10/14/17:215664 |
| pH | 6.6 | -- | units | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Specific Conductance | 583 | 1 | umhos/cm | | 2510B | 10/16/17:212403 | 2510B | 10/16/17:215558 |
| Total Dissolved Solids | 320 | 20 | mg/L | | 2540CE | 10/17/17:212488 | 2540C | 10/18/17:215749 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/13/17:212622 | 5540C | 10/13/17:215838 |
| Aggressiveness Index | 10.9 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Langelier Index (20°C) | -1.0 | -- | -- | | 4500-H B | 10/16/17:212434 | 4500HB | 10/16/17:215597 |
| Nitrate Nitrogen | 0.7 | -- | mg/L | | 300.0 | 10/13/17:212399 | 300.0 | 10/13/17:215551 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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CA ELAP Certification No. 2810

October 27, 2017

Lab ID : CC 1783936-001
Customer ID : 8-514

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 17E8 (LA22)
Project : Los Osos BMC Monitoring

Sampled On : October 11, 2017-14:02
Sampled By : Andrea Berge
Received On : October 11, 2017-14:57
Matrix : Ground Water

## Sample Result - Inorganic

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **General Mineral** | | | | | | | | |
| Total Hardness as CaCO3 | 168 | -- | mg/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Calcium | 26 | 1 | mg/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Magnesium | 25 | 1 | mg/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Potassium | 1 | 1 | mg/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Sodium | 29 | 1 | mg/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Total Cations | 4.6 | -- | meq/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| SAR | 1.0 | -- | -- | | 200.7 | 10/13/17:212366 | 200.7 | 10/13/17:215529 |
| Total Alkalinity (as CaCO3) | 120 | 10 | mg/L | | 2320B | 10/16/17:212424 | 2320B | 10/16/17:215665 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/16/17:212424 | 2320B | 10/16/17:215665 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/16/17:212424 | 2320B | 10/16/17:215665 |
| Bicarbonate as HCO3 | 150 | 10 | mg/L | | 2320B | 10/16/17:212424 | 2320B | 10/16/17:215665 |
| Sulfate | 14.0 | 0.5 | mg/L | | 300.0 | 10/12/17:212383 | 300.0 | 10/12/17:215550 |
| Chloride | 47 | 1 | mg/L | | 300.0 | 10/12/17:212383 | 300.0 | 10/12/17:215550 |
| Nitrate as NO3 | 32.0 | 1.8 | mg/L | | 300.0 | 10/12/17:212383 | 300.0 | 10/12/17:215550 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/12/17:212383 | 300.0 | 10/12/17:215550 |
| Nitrate + Nitrite as N | 7.2 | 0.5 | mg/L | | 300.0 | 10/12/17:212383 | 300.0 | 10/12/17:215550 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/12/17:212383 | 300.0 | 10/12/17:215550 |
| Total Anions | 4.6 | -- | meq/L | | 2320B | 10/16/17:212424 | 2320B | 10/16/17:215665 |
| pH | 7.7 | -- | units | | 4500-H B | 10/19/17:212596 | 4500HB | 10/19/17:215812 |
| Specific Conductance | 476 | 1 | umhos/cm | | 2510B | 10/13/17:212345 | 2510B | 10/13/17:215476 |
| Total Dissolved Solids | 260 | 20 | mg/L | | 2540CE | 10/16/17:212445 | 2540C | 10/17/17:215662 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/12/17:212977 | 5540C | 10/27/17:210686 |
| Aggressiveness Index | 11.6 | -- | -- | | 4500-H B | 10/19/17:212596 | 4500HB | 10/19/17:215812 |
| Langelier Index (20°C) | -0.2 | -- | -- | | 4500-H B | 10/19/17:212596 | 4500HB | 10/19/17:215812 |
| Nitrate Nitrogen | 7.2 | -- | mg/L | | 300.0 | 10/12/17:212383 | 300.0 | 10/12/17:215550 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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October 23, 2017

Lab ID : CC 1783799-005
Customer ID : 8-514

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

Sampled On : October 3, 2017-00:00
Sampled By : Spencer Harris / And
Received On : October 3, 2017-15:11
Matrix : Ground Water

Description : 20H1 (LA30)
Project : Los Osos BMC 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** | | | | | | | | |
| Total Hardness as CaCO3 | 364 | -- | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Calcium | 60 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Magnesium | 52 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Potassium | 1 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Sodium | 36 | 1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Total Cations | 8.9 | -- | meq/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Boron | 0.1 | 0.1 | mg/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Iron | 460 | 30 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Manganese | 230 | 10 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| SAR | 0.8 | -- | -- | | 200.7 | 10/04/17:211939 | 200.7 | 10/04/17:214974 |
| Total Alkalinity (as CaCO3) | 280 | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Bicarbonate as HCO3 | 350 | 10 | mg/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| Sulfate | 74.5 | 0.5 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Chloride | 56 | 1 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Nitrate as NO3 | ND | 1.8 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Nitrate + Nitrite as N | ND | 0.5 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Fluoride | 0.3 | 0.1 | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |
| Total Anions | 8.9 | -- | meq/L | | 2320B | 10/05/17:211964 | 2320B | 10/05/17:214994 |
| pH | 7.5 | -- | units | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Specific Conductance | 876 | 1 | umhos/cm | | 2510B | 10/05/17:211979 | 2510B | 10/05/17:214992 |
| Total Dissolved Solids | 500 | 20 | mg/L | | 2540CE | 10/05/17:211995 | 2540C | 10/06/17:215055 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/04/17:211935 | 5540C | 10/04/17:214939 |
| Aggressiveness Index | 12.1 | -- | -- | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Langelier Index (20°C) | 0.3 | -- | -- | | 4500-H B | 10/05/17:211988 | 4500HB | 10/05/17:214954 |
| Nitrate Nitrogen | ND | -- | mg/L | | 300.0 | 10/04/17:212137 | 300.0 | 10/04/17:215344 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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October 30, 2017

Lab ID : CC 1783861-002
Customer ID : 8-514

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

Sampled On : October 5, 2017-12:11
Sampled By : Andrea Berge
Received On : October 5, 2017-14:38
Matrix : Ground Water

Description : 13M2 (LA31)
Project : Los Osos BMC 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** | | | | | | | | |
| Total Hardness as CaCO3 | 738 | -- | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Calcium | 116 | 1 | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Magnesium | 109 | 1 | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Potassium | 5 | 1 | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Sodium | 411 | 2* | mg/L | | 200.7 | 10/28/17:213025 | 200.7 | 10/28/17:216375 |
| Total Cations | 32.8 | -- | meq/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Boron | 0.2 | 0.1 | mg/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| SAR | 6.6 | -- | -- | | 200.7 | 10/10/17:212148 | 200.7 | 10/10/17:215321 |
| Total Alkalinity (as CaCO3) | 50 | 10 | mg/L | | 2320B | 10/07/17:212076 | 2320B | 10/07/17:215142 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/07/17:212076 | 2320B | 10/07/17:215142 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/07/17:212076 | 2320B | 10/07/17:215142 |
| Bicarbonate as HCO3 | 60 | 10 | mg/L | | 2320B | 10/07/17:212076 | 2320B | 10/07/17:215142 |
| Sulfate | 160 | 10* | mg/L | | 300.0 | 10/27/17:213023 | 300.0 | 10/27/17:216413 |
| Chloride | 960 | 20* | mg/L | | 300.0 | 10/27/17:213023 | 300.0 | 10/27/17:216413 |
| Nitrate as NO3 | 3.1 | 1.8 | mg/L | | 300.0 | 10/06/17:212139 | 300.0 | 10/06/17:215545 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/06/17:212139 | 300.0 | 10/06/17:215545 |
| Nitrate + Nitrite as N | 0.7 | 0.5 | mg/L | | 300.0 | 10/06/17:212139 | 300.0 | 10/06/17:215545 |
| Fluoride | ND | 0.1 | mg/L | | 300.0 | 10/06/17:212139 | 300.0 | 10/06/17:215545 |
| Total Anions | 31.4 | -- | meq/L | | 2320B | 10/07/17:212076 | 2320B | 10/07/17:215142 |
| pH | 7.5 | -- | units | | 4500-H B | 10/09/17:212124 | 4500HB | 10/09/17:215184 |
| Specific Conductance | 3350 | 1 | umhos/cm | | 2510B | 10/09/17:212100 | 2510B | 10/09/17:215144 |
| Total Dissolved Solids | 2190 | 20 | mg/L | | 2540CE | 10/11/17:212244 | 2540C | 10/12/17:215414 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/06/17:212119 | 5540C | 10/06/17:215167 |
| Aggressiveness Index | 11.7 | -- | -- | | 4500-H B | 10/09/17:212124 | 4500HB | 10/09/17:215184 |
| Langelier Index (20°C) | -0.3 | -- | -- | | 4500-H B | 10/09/17:212124 | 4500HB | 10/09/17:215184 |
| Nitrate Nitrogen | 0.7 | -- | mg/L | | 300.0 | 10/06/17:212139 | 300.0 | 10/06/17:215545 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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October 19, 2017

**Cleath-Harris Geologists**
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 18K9 (LA32)
Project : Los Osos BMC Monitoring

Lab ID : CC 1783885-001
Customer ID : 8-514

Sampled On : October 9, 2017-11:20
Sampled By : Wolfgang Forbes
Received On : October 9, 2017-12:36
Matrix : Ground Water

## Sample Result - Inorganic

| Constituent | Result | PQL | Units | Note | Sample Preparation | | Sample Analysis | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Method | Date/ID | Method | Date/ID |
| **General Mineral** | | | | | | | | |
| Total Hardness as CaCO3 | 168 | -- | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Calcium | 26 | 1 | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Magnesium | 25 | 1 | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Potassium | 1 | 1 | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Sodium | 33 | 1 | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Total Cations | 4.8 | -- | meq/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Boron | ND | 0.1 | mg/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Copper | ND | 10 | ug/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Iron | ND | 30 | ug/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Manganese | ND | 10 | ug/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Zinc | ND | 20 | ug/L | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| SAR | 1.1 | -- | -- | | 200.7 | 10/12/17:212307 | 200.7 | 10/12/17:215483 |
| Total Alkalinity (as CaCO3) | 160 | 10 | mg/L | | 2320B | 10/11/17:212218 | 2320B | 10/11/17:215395 |
| Hydroxide as OH | ND | 10 | mg/L | | 2320B | 10/11/17:212218 | 2320B | 10/11/17:215395 |
| Carbonate as CO3 | ND | 10 | mg/L | | 2320B | 10/11/17:212218 | 2320B | 10/11/17:215395 |
| Bicarbonate as HCO3 | 200 | 10 | mg/L | | 2320B | 10/11/17:212218 | 2320B | 10/11/17:215395 |
| Sulfate | 23.1 | 0.5 | mg/L | | 300.0 | 10/10/17:212398 | 300.0 | 10/10/17:215548 |
| Chloride | 36 | 1 | mg/L | | 300.0 | 10/10/17:212398 | 300.0 | 10/10/17:215548 |
| Nitrate as NO3 | 6.3 | 1.8 | mg/L | | 300.0 | 10/10/17:212398 | 300.0 | 10/10/17:215548 |
| Nitrite as N | ND | 0.2 | mg/L | | 300.0 | 10/10/17:212398 | 300.0 | 10/10/17:215548 |
| Nitrate + Nitrite as N | 1.4 | 0.5 | mg/L | | 300.0 | 10/10/17:212398 | 300.0 | 10/10/17:215548 |
| Fluoride | 0.1 | 0.1 | mg/L | | 300.0 | 10/10/17:212398 | 300.0 | 10/10/17:215548 |
| Total Anions | 4.9 | -- | meq/L | | 2320B | 10/11/17:212218 | 2320B | 10/11/17:215395 |
| pH | 7.6 | -- | units | | 4500-H B | 10/11/17:212245 | 4500HB | 10/11/17:215355 |
| Specific Conductance | 493 | 1 | umhos/cm | | 2510B | 10/11/17:212220 | 2510B | 10/11/17:215320 |
| Total Dissolved Solids | 270 | 20 | mg/L | | 2540CE | 10/12/17:212314 | 2540C | 10/13/17:215430 |
| MBAS Screen | Negative | 0.1 | mg/L | | 5540C | 10/10/17:212319 | 5540C | 10/10/17:215441 |
| Aggressiveness Index | 11.6 | -- | -- | | 4500-H B | 10/11/17:212245 | 4500HB | 10/11/17:215355 |
| Langelier Index (20°C) | -0.2 | -- | -- | | 4500-H B | 10/11/17:212245 | 4500HB | 10/11/17:215355 |
| Nitrate Nitrogen | 1.4 | -- | mg/L | | 300.0 | 10/10/17:212398 | 300.0 | 10/10/17:215548 |

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.



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**CEC Testing**

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/18/2017
Operator: A. Berge and S.J. Harris
Well number and location: 30S/11E-13Q2 (FW5)
Site and wellhead conditions: Cloudy and cool. Monument and lock intact

Static water depth (feet): 86.35
Well depth (feet): 105
Water column (feet): 18.65
Casing diameter (inches): 2
Minimum purge volume (gal) 9.12
Purge rate (gpm): 1
Pumping water level (feet): --
Pump setting (feet): 100
Minimum purge time (min): 30
Time begin purge: 10:03 AM

| Time | Gallons | EC (µS) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 10:03 | 1 | 872.4 | 6.60 | 18.5 | Turbid, cloudy orange, rusty odor |
| 10:08 | 5 | 868.8 | 6.55 | 18.6 | Slight yellow tinge, odorless |
| 10:13 | 10 | 873.9 | 6.31 | 18.6 | Slight yellowish tinge, odorless |
| 10:18 | 15 | 877.9 | 6.33 | 18.7 | Clear, colorless, odorless |
| 10:23 | 20 | 881.6 | 6.35 | 18.6 | Clear, colorless, odorless |
| 10:28 | 25 | 884.5 | 6.35 | 18.6 | Clear, colorless, odorless |
| 10:33 | 30 | 884.8 | 6.25 | 18.5 | Clear, colorless, odorless |
| | | | | | Sampled @ 10:33 |
| | | | | | |
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*Turbidity, color, odor, sheen, debris, etc.

# Groundwater Monitoring Field Log
# LOBP Monitoring Program

Date: 10/18/2017
Operator: A. Berge and S.J. Harris
Well number and location: 30S/11E-20A2 (FW-26)
Sunny and breezy. Wood covering intact and in place

Static water depth (feet): 19.73
Well depth (feet): 65
Water column (feet): 45.27
Casing diameter (inches): 6
Minimum purge volume (gal) flush line
Purge rate (gpm): 15
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): --
Time begin purge: 11:22 AM

| Time | Gallons | EC (µS) | pH | Temp. (°C) | Comments* |
|---|---|---|---|---|---|
| 11:22 | 1 | 678.8 | 7.26 | 16.8 | Slight gray color, sulfor odor |
| 11:25 | 50 | 651.2 | 7.27 | 16.5 | Clear, colorless, sulfur odor |
| 11:27 | 80 | 645 | 7.26 | 16.9 | Clear, colorless, faint sulfur odor |
| 11:29 | 110 | 642.7 | 7.21 | 16.9 | Clear, colorless, faint sulfur odor |
| 11:31 | 140 | 638.6 | 7.20 | 16.9 | Clear, colorless, very faint sulfur odor |
| 11:33 | 170 | 636.5 | 7.18 | 16.9 | Clear, colorless, very faint sulfur odor |
| 11:35 | 200 | 637.2 | 7.16 | 16.6 | Clear, colorless, very faint sulfur odor |
| | | | | | |
| | | | | | Sampled @ 11:40 |
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*Turbidity, color, odor, sheen, debris, etc.

WECK LABORATORIES, INC.

# Certificate of Analysis

FINAL REPORT

| | | | |
|---|---|---|---|
| **Work Orders:** | 7J19007 | **Report Date:** | 12/11/2017 |
| | | **Received Date:** | 10/19/2017 |
| **Project:** | LOS OSOS CEC MONITORING | **Turnaround Time:** | Normal |
| | | **Phones:** | (805) 543-1413 |
| | | **Fax:** | - |
| **Attn:** | Spencer Harris | **P.O. #:** | |
| **Client:** | Cleath-Harris Geologists, Inc.<br>71 Zaca Lane, Suite 140<br>San Luis Obispo, CA 93401 | **Billing Code:** | |

**DoD-ELAP #L2457 • ELAP-CA #1132 • EPA-UCMR #CA00211 • Guam-EPA #17-008R • HW-DOH # • ISO 17025 #L2457.01 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015**

*This is a complete final report. The information in this report applies to the samples analyzed in accordance with the chain-of-custody document. Weck Laboratories certifies that the test results meet all requirements of TNI unless noted by qualifiers or written in the Case Narrative. This analytical report must be reproduced in its entirety.*

Dear Spencer Harris,

Enclosed are the results of analyses for samples received 10/19/17 with the Chain-of-Custody document. The samples were received in good condition, at 4.8 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

**Reviewed by:**

Brandon Gee
Operations Manager/Senior PM



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WECK LABORATORIES, INC.

# Certificate of Analysis

FINAL REPORT

Cleath-Harris Geologists, Inc.
71 Zaca Lane, Suite 140
San Luis Obispo, CA 93401

**Project Number:** LOS OSOS CEC MONITORING

**Project Manager:** Spencer Harris

**Reported:** 12/11/2017 16:19

## Sample Summary

| Sample Name | Sampled By | Lab ID | Matrix | Sampled | Qualifiers |
|---|---|---|---|---|---|
| QA1 - Clean Water/Travel Blank | S.HARRIS | 7J19007-01 | Water | 10/18/17 09:30 | |
| QA2 - Equipment Blank | S.HARRIS | 7J19007-02 | Water | 10/18/17 09:40 | |
| FW5 (13Q2) | S.HARRIS | 7J19007-03 | Water | 10/18/17 10:33 | |
| FW26 (20A1) | S.HARRIS | 7J19007-04 | Water | 10/18/17 11:40 | |

## Not Certified Analyses Summary

| Analyte | CAS # | Not Accredited By |
|---|---|---|
| ***SM 5910B in Water*** | | |
| UV 254 | | NELAP |



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71 Zaca Lane, Suite 140
San Luis Obispo, CA 93401

**Project Number:** LOS OSOS CEC MONITORING

**Project Manager:** Spencer Harris

**Reported:** 12/11/2017 16:19

## Sample Results

Sample: QA1 - Clean Water/Travel Blank — 7J19007-01 (Water) — Sampled: 10/18/17 9:30 by S.HARRIS

| Analyte | Result | MRL | Units | Dil | Analyzed | Qualifier |
|---|---|---|---|---|---|---|
| **PPCPs - Hormones by LC/MSMS-APCI** | | | | | | |
| **Method:** EPA 1694M-APCI | **Batch ID:** W7K0029 | **Prepared:** 11/01/17 10:31 | | | | **Analyst:** kan |
| 17-b-Estradiol | ND | 1.0 | ng/l | 1 | 11/20/17 18:22 | |
| **PPCPs - Pharmaceuticals by LC/MSMS-ESI-** | | | | | | |
| **Method:** EPA 1694M-ESI- | **Batch ID:** W7K0030 | **Prepared:** 11/01/17 10:33 | | | | **Analyst:** kan |
| Gemfibrozil | ND | 1.0 | ng/l | 1 | 11/16/17 21:51 | |
| Iopromide | ND | 5.0 | ng/l | 1 | 11/16/17 21:51 | |
| Triclosan | ND | 2.0 | ng/l | 1 | 11/16/17 21:51 | |
| **PPCPs - Pharmaceuticals by LC/MSMS-ESI+** | | | | | | |
| **Method:** EPA 1694M-ESI+ | **Batch ID:** W7L0476 | **Prepared:** 11/01/17 10:28 | | | | **Analyst:** kan |
| **Caffeine** | **2.5** | 1.0 | ng/l | 1 | 12/07/17 21:17 | B |
| **DEET** | **2.0** | 1.0 | ng/l | 1 | 12/07/17 21:17 | |
| **Sucralose** | **17** | 5.0 | ng/l | 1 | 12/07/17 21:17 | |

Sample: QA2 - Equipment Blank — 7J19007-02 (Water) — Sampled: 10/18/17 9:40 by S.HARRIS

| Analyte | Result | MRL | Units | Dil | Analyzed | Qualifier |
|---|---|---|---|---|---|---|
| **PPCPs - Hormones by LC/MSMS-APCI** | | | | | | |
| **Method:** EPA 1694M-APCI | **Batch ID:** W7K0029 | **Prepared:** 11/01/17 10:31 | | | | **Analyst:** kan |
| 17-b-Estradiol | ND | 1.0 | ng/l | 1 | 11/20/17 18:42 | |
| **PPCPs - Pharmaceuticals by LC/MSMS-ESI-** | | | | | | |
| **Method:** EPA 1694M-ESI- | **Batch ID:** W7K0030 | **Prepared:** 11/01/17 10:33 | | | | **Analyst:** kan |
| Gemfibrozil | ND | 1.0 | ng/l | 1 | 11/16/17 22:06 | |
| Iopromide | ND | 5.0 | ng/l | 1 | 11/16/17 22:06 | |
| Triclosan | ND | 2.0 | ng/l | 1 | 11/16/17 22:06 | |
| **PPCPs - Pharmaceuticals by LC/MSMS-ESI+** | | | | | | |
| **Method:** EPA 1694M-ESI+ | **Batch ID:** W7L0476 | **Prepared:** 11/01/17 10:28 | | | | **Analyst:** kan |
| **Caffeine** | **2.1** | 1.0 | ng/l | 1 | 12/07/17 21:33 | B |
| **DEET** | **1.4** | 1.0 | ng/l | 1 | 12/07/17 21:33 | |
| **Sucralose** | **8.2** | 5.0 | ng/l | 1 | 12/07/17 21:33 | |

WECK LABORATORIES, INC.

# Certificate of Analysis

FINAL REPORT

Cleath-Harris Geologists, Inc.
71 Zaca Lane, Suite 140
San Luis Obispo, CA 93401

**Project Number:** LOS OSOS CEC MONITORING

**Project Manager:** Spencer Harris

**Reported:** 12/11/2017 16:19

## Sample Results

(Continued)

Sample: FW5 (13Q2)
7J19007-03 (Water)

Sampled: 10/18/17 10:33 by S.HARRIS

| Analyte | Result | MRL | Units | Dil | Analyzed | Qualifier |
|---|---|---|---|---|---|---|
| **Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods** | | | | | | |
| **Method:** EPA 350.1 | **Batch ID:** W7J1388 | **Prepared:** 10/24/17 10:14 | | | | **Analyst:** ymt |
| Ammonia as N | ND | 0.10 | mg/l | 1 | 10/26/17 18:15 | |
| **Method:** EPA 353.2 | **Batch ID:** W7J1152 | **Prepared:** 10/19/17 12:58 | | | | **Analyst:** AJK |
| **Nitrate as N** | **40** | 2.0 | mg/l | 10 | 10/19/17 15:48 | |
| **Method:** SM 2510B | **Batch ID:** W7J1285 | **Prepared:** 10/23/17 10:45 | | | | **Analyst:** stg |
| **Specific Conductance (EC)** | **960** | 2.0 | umhos/cm | 1 | 10/23/17 14:17 | |
| **Method:** SM 5310B | **Batch ID:** W7J1195 | **Prepared:** 10/20/17 06:42 | | | | **Analyst:** jlp |
| **Total Organic Carbon (TOC)** | **0.57** | 0.10 | mg/l | 1 | 10/20/17 12:44 | |
| **Method:** SM 5910B | **Batch ID:** W7J1209 | **Prepared:** 10/20/17 09:32 | | | | **Analyst:** ajk |
| **UV 254** | **0.028** | 0.009 | 1/cm | 1 | 10/20/17 10:28 | |
| **Nitrosamines by isotopic dilution GC/MS CI Mode** | | | | | | |
| **Method:** EPA 1625M | **Batch ID:** W7J1397 | **Prepared:** 10/24/17 11:40 | | | | **Analyst:** smr |
| N-Nitrosodimethylamine | ND | 2.0 | ng/l | 1 | 10/25/17 18:15 | |
| **PPCPs - Hormones by LC/MSMS-APCI** | | | | | | |
| **Method:** EPA 1694M-APCI | **Batch ID:** W7K0029 | **Prepared:** 11/01/17 10:31 | | | | **Analyst:** kan |
| 17-b-Estradiol | ND | 1.0 | ng/l | 1 | 11/20/17 19:02 | |
| **PPCPs - Pharmaceuticals by LC/MSMS-ESI-** | | | | | | |
| **Method:** EPA 1694M-ESI- | **Batch ID:** W7K0030 | **Prepared:** 11/01/17 10:33 | | | | **Analyst:** kan |
| Gemfibrozil | ND | 1.0 | ng/l | 1 | 11/16/17 22:22 | |
| Iopromide | ND | 5.0 | ng/l | 1 | 11/16/17 22:22 | |
| Triclosan | ND | 2.0 | ng/l | 1 | 11/16/17 22:22 | |
| **PPCPs - Pharmaceuticals by LC/MSMS-ESI+** | | | | | | |
| **Method:** EPA 1694M-ESI+ | **Batch ID:** W7L0476 | **Prepared:** 11/01/17 10:28 | | | | **Analyst:** kan |
| **Caffeine** | **1.6** | 1.0 | ng/l | 1 | 12/07/17 21:50 | B |
| **DEET** | **1.3** | 1.0 | ng/l | 1 | 12/07/17 21:50 | |
| **Sucralose** | **260** | 5.0 | ng/l | 1 | 12/07/17 21:50 | |



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# Certificate of Analysis

FINAL REPORT

Cleath-Harris Geologists, Inc.
71 Zaca Lane, Suite 140
San Luis Obispo, CA 93401

**Project Number:** LOS OSOS CEC MONITORING

**Project Manager:** Spencer Harris

**Reported:** 12/11/2017 16:19

## Sample Results

(Continued)

Sample: FW26 (20A1)
7J19007-04 (Water)

Sampled: 10/18/17 11:40 by S.HARRIS

| Analyte | Result | MRL | Units | Dil | Analyzed | Qualifier |
|---|---|---|---|---|---|---|
| **Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods** | | | | | | |
| **Method:** EPA 350.1 | **Batch ID:** W7J1388 | **Prepared:** 10/24/17 10:14 | | | | **Analyst:** ymt |
| **Ammonia as N** | **0.19** | 0.10 | mg/l | 1 | 10/26/17 18:15 | |
| **Method:** EPA 353.2 | **Batch ID:** W7J1152 | **Prepared:** 10/19/17 12:58 | | | | **Analyst:** AJK |
| Nitrate as N | ND | 0.20 | mg/l | 1 | 10/19/17 15:19 | |
| **Method:** SM 2510B | **Batch ID:** W7J1285 | **Prepared:** 10/23/17 10:45 | | | | **Analyst:** stg |
| **Specific Conductance (EC)** | **680** | 2.0 | umhos/cm | 1 | 10/23/17 14:17 | |
| **Method:** SM 5310B | **Batch ID:** W7J1195 | **Prepared:** 10/20/17 06:42 | | | | **Analyst:** jlp |
| **Total Organic Carbon (TOC)** | **1.2** | 0.10 | mg/l | 1 | 10/20/17 12:44 | |
| **Method:** SM 5910B | **Batch ID:** W7J1209 | **Prepared:** 10/20/17 09:32 | | | | **Analyst:** ajk |
| **UV 254** | **0.026** | 0.009 | 1/cm | 1 | 10/20/17 10:28 | |
| **Nitrosamines by isotopic dilution GC/MS CI Mode** | | | | | | |
| **Method:** EPA 1625M | **Batch ID:** W7J1397 | **Prepared:** 10/24/17 11:40 | | | | **Analyst:** smr |
| N-Nitrosodimethylamine | ND | 2.0 | ng/l | 1 | 10/25/17 18:43 | |
| **PPCPs - Hormones by LC/MSMS-APCI** | | | | | | |
| **Method:** EPA 1694M-APCI | **Batch ID:** W7K0029 | **Prepared:** 11/01/17 10:31 | | | | **Analyst:** kan |
| 17-b-Estradiol | ND | 1.0 | ng/l | 1 | 11/20/17 19:23 | |
| **PPCPs - Pharmaceuticals by LC/MSMS-ESI-** | | | | | | |
| **Method:** EPA 1694M-ESI- | **Batch ID:** W7K0030 | **Prepared:** 11/01/17 10:33 | | | | **Analyst:** kan |
| Gemfibrozil | ND | 1.0 | ng/l | 1 | 11/16/17 22:37 | |
| Iopromide | ND | 5.0 | ng/l | 1 | 11/16/17 22:37 | |
| Triclosan | ND | 2.0 | ng/l | 1 | 11/16/17 22:37 | |
| **PPCPs - Pharmaceuticals by LC/MSMS-ESI+** | | | | | | |
| **Method:** EPA 1694M-ESI+ | **Batch ID:** W7L0476 | **Prepared:** 11/01/17 10:28 | | | | **Analyst:** kan |
| **Caffeine** | **1.0** | 1.0 | ng/l | 1 | 12/07/17 22:06 | B |
| **DEET** | **1.7** | 1.0 | ng/l | 1 | 12/07/17 22:06 | |
| **Sucralose** | **16** | 5.0 | ng/l | 1 | 12/07/17 22:06 | |



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San Luis Obispo, CA 93401

**Project Number:** LOS OSOS CEC MONITORING
**Project Manager:** Spencer Harris

**Reported:** 12/11/2017 16:19

## Quality Control Results

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods

| Analyte | Result | MRL | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Qualifier |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch: W7J1152 - EPA 353.2** | | | | | | | | | | |
| **Blank (W7J1152-BLK1)** | | | | **Prepared & Analyzed: 10/19/17** | | | | | | |
| Nitrate as N | ND | 0.20 | mg/l | | | | | | | |
| **LCS (W7J1152-BS1)** | | | | **Prepared & Analyzed: 10/19/17** | | | | | | |
| Nitrate as N | 1.08 | 0.20 | mg/l | 1.00 | | 108 | 90-110 | | | |
| **Matrix Spike (W7J1152-MS1)** | **Source: 7J18081-01** | | | **Prepared & Analyzed: 10/19/17** | | | | | | |
| Nitrate as N | 4.75 | 0.20 | mg/l | 2.00 | 2.76 | 100 | 90-110 | | | |
| **Matrix Spike (W7J1152-MS2)** | **Source: 7J18082-04** | | | **Prepared & Analyzed: 10/19/17** | | | | | | |
| Nitrate as N | 6.12 | 0.20 | mg/l | 2.00 | 4.10 | 101 | 90-110 | | | |
| **Matrix Spike Dup (W7J1152-MSD1)** | **Source: 7J18081-01** | | | **Prepared & Analyzed: 10/19/17** | | | | | | |
| Nitrate as N | 4.78 | 0.20 | mg/l | 2.00 | 2.76 | 101 | 90-110 | 0.7 | 20 | |
| **Matrix Spike Dup (W7J1152-MSD2)** | **Source: 7J18082-04** | | | **Prepared & Analyzed: 10/19/17** | | | | | | |
| Nitrate as N | 6.12 | 0.20 | mg/l | 2.00 | 4.10 | 101 | 90-110 | 0.02 | 20 | |
| **Batch: W7J1195 - SM 5310B** | | | | | | | | | | |
| **Blank (W7J1195-BLK1)** | | | | **Prepared & Analyzed: 10/20/17** | | | | | | |
| Total Organic Carbon (TOC) | ND | 0.10 | mg/l | | | | | | | |
| **LCS (W7J1195-BS1)** | | | | **Prepared & Analyzed: 10/20/17** | | | | | | |
| Total Organic Carbon (TOC) | 1.12 | 0.10 | mg/l | 1.00 | | 112 | 85-115 | | | |
| **Duplicate (W7J1195-DUP1)** | **Source: 7J09080-01** | | | **Prepared & Analyzed: 10/20/17** | | | | | | |
| Total Organic Carbon (TOC) | 1.92 | 0.10 | mg/l | | 2.25 | | | 16 | 20 | |
| **Matrix Spike (W7J1195-MS1)** | **Source: 7J09080-01** | | | **Prepared & Analyzed: 10/20/17** | | | | | | |
| Total Organic Carbon (TOC) | 7.22 | 0.10 | mg/l | 5.00 | 2.25 | 99 | 76-115 | | | |
| **Matrix Spike Dup (W7J1195-MSD1)** | **Source: 7J09080-01** | | | **Prepared & Analyzed: 10/20/17** | | | | | | |
| Total Organic Carbon (TOC) | 7.23 | 0.10 | mg/l | 5.00 | 2.25 | 100 | 76-115 | 0.2 | 20 | |
| **Batch: W7J1209 - SM 5910B** | | | | | | | | | | |
| **Blank (W7J1209-BLK1)** | | | | **Prepared & Analyzed: 10/20/17** | | | | | | |
| UV 254 | ND | 0.009 | 1/cm | | | | | | | |
| **LCS (W7J1209-BS1)** | | | | **Prepared & Analyzed: 10/20/17** | | | | | | |
| UV 254 | 0.089 | 0.009 | 1/cm | 0.0880 | | 101 | 90-110 | | | |
| **Duplicate (W7J1209-DUP1)** | **Source: 7J19007-03** | | | **Prepared & Analyzed: 10/20/17** | | | | | | |
| UV 254 | 0.027 | 0.009 | 1/cm | | 0.028 | | | 4 | 10 | |
| **Duplicate (W7J1209-DUP2)** | **Source: 7J19007-04** | | | **Prepared & Analyzed: 10/20/17** | | | | | | |
| UV 254 | 0.025 | 0.009 | 1/cm | | 0.026 | | | 4 | 10 | |
| **Batch: W7J1285 - SM 2510B** | | | | | | | | | | |
| **Blank (W7J1285-BLK1)** | | | | **Prepared & Analyzed: 10/23/17** | | | | | | |
| Specific Conductance (EC) | ND | 2.0 | umhos/cm | | | | | | | |
| **LCS (W7J1285-BS1)** | | | | **Prepared & Analyzed: 10/23/17** | | | | | | |
| Specific Conductance (EC) | 206 | 2.0 | umhos/cm | 200 | | 103 | 95-105 | | | |



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**Project Number:** LOS OSOS CEC MONITORING

**Project Manager:** Spencer Harris

**Reported:** 12/11/2017 16:19

## Quality Control Results

(Continued)

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods (Continued)

| Analyte | Result | MRL | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Qualifier |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch: W7J1285 - SM 2510B (Continued)** | | | | | | | | | | |
| **Duplicate (W7J1285-DUP1)** | **Source: 7J19007-03** | | | **Prepared & Analyzed: 10/23/17** | | | | | | |
| Specific Conductance (EC) | 960 | 2.0 | umhos/cm | | 960 | | | 0 | 5 | |
| **Batch: W7J1388 - EPA 350.1** | | | | | | | | | | |
| **Blank (W7J1388-BLK1)** | | | | **Prepared: 10/24/17 Analyzed: 10/26/17** | | | | | | |
| Ammonia as N | ND | 0.10 | mg/l | | | | | | | |
| **Blank (W7J1388-BLK2)** | | | | **Prepared: 10/24/17 Analyzed: 10/26/17** | | | | | | |
| Ammonia as N | ND | 0.10 | mg/l | | | | | | | |
| **LCS (W7J1388-BS1)** | | | | **Prepared: 10/24/17 Analyzed: 10/26/17** | | | | | | |
| Ammonia as N | 0.263 | 0.10 | mg/l | 0.250 | | 105 | 90-110 | | | |
| **LCS (W7J1388-BS2)** | | | | **Prepared: 10/24/17 Analyzed: 10/26/17** | | | | | | |
| Ammonia as N | 0.264 | 0.10 | mg/l | 0.250 | | 105 | 90-110 | | | |
| **Matrix Spike (W7J1388-MS1)** | **Source: 7J17115-06** | | | **Prepared: 10/24/17 Analyzed: 10/26/17** | | | | | | |
| Ammonia as N | 0.263 | 0.10 | mg/l | 0.250 | ND | 105 | 90-110 | | | |
| **Matrix Spike (W7J1388-MS2)** | **Source: 7J18033-01** | | | **Prepared: 10/24/17 Analyzed: 10/26/17** | | | | | | |
| Ammonia as N | 0.259 | 0.10 | mg/l | 0.250 | ND | 104 | 90-110 | | | |
| **Matrix Spike Dup (W7J1388-MSD1)** | **Source: 7J17115-06** | | | **Prepared: 10/24/17 Analyzed: 10/26/17** | | | | | | |
| Ammonia as N | 0.267 | 0.10 | mg/l | 0.250 | ND | 107 | 90-110 | 1 | 15 | |
| **Matrix Spike Dup (W7J1388-MSD2)** | **Source: 7J18033-01** | | | **Prepared: 10/24/17 Analyzed: 10/26/17** | | | | | | |
| Ammonia as N | 0.260 | 0.10 | mg/l | 0.250 | ND | 104 | 90-110 | 0.06 | 15 | |

Nitrosamines by isotopic dilution GC/MS CI Mode

| Analyte | Result | MRL | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Qualifier |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch: W7J1397 - EPA 1625M** | | | | | | | | | | |
| **Blank (W7J1397-BLK1)** | | | | **Prepared: 10/24/17 Analyzed: 10/25/17** | | | | | | |
| N-Nitrosodimethylamine | ND | 2.0 | ng/l | | | | | | | |
| **LCS (W7J1397-BS1)** | | | | **Prepared: 10/24/17 Analyzed: 10/25/17** | | | | | | |
| N-Nitrosodimethylamine | 2.53 | 2.0 | ng/l | 3.00 | | 84 | 50-150 | | | |
| **LCS Dup (W7J1397-BSD1)** | | | | **Prepared: 10/24/17 Analyzed: 10/25/17** | | | | | | |
| N-Nitrosodimethylamine | 3.05 | 2.0 | ng/l | 3.00 | | 102 | 50-150 | 19 | 50 | |

## Quality Control Results

(Continued)

### PPCPs - Hormones by LC/MSMS-APCI

| Analyte | Result | MRL | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Qualifier |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch: W7K0029 - EPA 1694M-APCI** | | | | | | | | | | |
| **Blank (W7K0029-BLK1)** | | | | **Prepared: 11/01/17 Analyzed: 11/20/17** | | | | | | |
| 17-a-Ethynylestradiol | ND | 1.0 | ng/l | | | | | | | |
| 17-b-Estradiol | ND | 1.0 | ng/l | | | | | | | |
| Estrone | ND | 1.0 | ng/l | | | | | | | |
| Progesterone | ND | 1.0 | ng/l | | | | | | | |
| Testosterone | ND | 1.0 | ng/l | | | | | | | |
| **LCS (W7K0029-BS1)** | | | | **Prepared: 11/01/17 Analyzed: 11/20/17** | | | | | | |
| 17-a-Ethynylestradiol | 8.23 | 1.0 | ng/l | 10.0 | | 82 | 68-159 | | | |
| 17-b-Estradiol | 9.02 | 1.0 | ng/l | 10.0 | | 90 | 65-146 | | | |
| Estrone | 8.65 | 1.0 | ng/l | 10.0 | | 86 | 59-141 | | | |
| Progesterone | 9.18 | 1.0 | ng/l | 10.0 | | 92 | 58-154 | | | |
| Testosterone | 17.5 | 1.0 | ng/l | 10.0 | | 175 | 60-172 | | | Q-08 |
| **LCS Dup (W7K0029-BSD1)** | | | | **Prepared: 11/01/17 Analyzed: 11/20/17** | | | | | | |
| 17-a-Ethynylestradiol | 9.27 | 1.0 | ng/l | 10.0 | | 93 | 68-159 | 12 | 30 | |
| 17-b-Estradiol | 12.2 | 1.0 | ng/l | 10.0 | | 122 | 65-146 | 30 | 30 | |
| Estrone | 10.3 | 1.0 | ng/l | 10.0 | | 103 | 59-141 | 17 | 30 | |
| Progesterone | 11.3 | 1.0 | ng/l | 10.0 | | 113 | 58-154 | 21 | 30 | |
| Testosterone | 20.5 | 1.0 | ng/l | 10.0 | | 205 | 60-172 | 16 | 30 | Q-08 |

### PPCPs - Pharmaceuticals by LC/MSMS-ESI-

| Analyte | Result | MRL | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Qualifier |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch: W7K0030 - EPA 1694M-ESI-** | | | | | | | | | | |
| **Blank (W7K0030-BLK1)** | | | | **Prepared: 11/01/17 Analyzed: 11/16/17** | | | | | | |
| Gemfibrozil | ND | 1.0 | ng/l | | | | | | | |
| Iopromide | ND | 5.0 | ng/l | | | | | | | |
| Triclosan | ND | 2.0 | ng/l | | | | | | | |
| **LCS (W7K0030-BS1)** | | | | **Prepared: 11/01/17 Analyzed: 11/16/17** | | | | | | |
| Gemfibrozil | 9.50 | 1.0 | ng/l | 10.0 | | 95 | 76-122 | | | |
| Iopromide | 59.5 | 5.0 | ng/l | 50.0 | | 119 | 0.1-163 | | | |
| Triclosan | 8.94 | 2.0 | ng/l | 10.0 | | 89 | 76-139 | | | |
| **LCS Dup (W7K0030-BSD1)** | | | | **Prepared: 11/01/17 Analyzed: 11/16/17** | | | | | | |
| Gemfibrozil | 11.3 | 1.0 | ng/l | 10.0 | | 113 | 76-122 | 17 | 30 | |
| Iopromide | 69.8 | 5.0 | ng/l | 50.0 | | 140 | 0.1-163 | 16 | 30 | |
| Triclosan | 12.1 | 2.0 | ng/l | 10.0 | | 121 | 76-139 | 30 | 30 | |

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## Quality Control Results

(Continued)

PPCPs - Pharmaceuticals by LC/MSMS-ESI+

| Analyte | Result | MRL | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Qualifier |
|---|---|---|---|---|---|---|---|---|---|---|
| **Batch: W7L0476 - EPA 1694M-ESI+** | | | | | | | | | | |
| **Blank (W7L0476-BLK1)** | | | | **Prepared: 11/01/17 Analyzed: 12/07/17** | | | | | | |
| Caffeine | 5.98 | 1.0 | ng/l | | | | | | | B |
| DEET | ND | 1.0 | ng/l | | | | | | | |
| Sucralose | ND | 5.0 | ng/l | | | | | | | |
| **LCS (W7L0476-BS1)** | | | | **Prepared: 11/01/17 Analyzed: 12/07/17** | | | | | | |
| Caffeine | 11.6 | 1.0 | ng/l | 10.0 | | 116 | 55-152 | | | |
| DEET | 10.2 | 1.0 | ng/l | 10.0 | | 102 | 45-135 | | | |
| Sucralose | 50.2 | 5.0 | ng/l | 50.0 | | 100 | 50-150 | | | |
| **LCS Dup (W7L0476-BSD1)** | | | | **Prepared: 11/01/17 Analyzed: 12/07/17** | | | | | | |
| Caffeine | 11.5 | 1.0 | ng/l | 10.0 | | 115 | 55-152 | 0.9 | 30 | |
| DEET | 12.4 | 1.0 | ng/l | 10.0 | | 124 | 45-135 | 19 | 30 | |
| Sucralose | 57.0 | 5.0 | ng/l | 50.0 | | 114 | 50-150 | 13 | 30 | |



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## Notes and Definitions

| Item | Definition |
|---|---|
| B | Blank contamination. The analyte was found in the associated blank as well as in the sample. |
| Q-08 | High bias in the QC sample does not affect sample result since analyte was not detected or below the reporting limit. |
| ND | NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL. |
| Dil | Dilution |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |
| % Rec | Percent Recovery |
| Source | Sample that was matrix spiked or duplicated. |
| MDL | Method Detection Limit |
| MRL | The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ) and Detection Limit for Reporting (DLR) |
| MDA | Minimum Detectable Activity |
| NR | Not Reportable |
| TIC | Tentatively Identified Compound (TIC) using mass spectrometry. The reported concentration is relative concentration based on the nearest internal standard. If the library search produces no matches at, or above 85%, the compound is reported as unknown. |

Any remaining sample(s) will be disposed of one month from the final report date unless other arrangements are made in advance.
An Absence of Total Coliform meets the drinking water standards as established by the California State Water Resources Control Board (SWRCB)
All results are expressed on wet weight basis unless otherwise specified.
All samples collected by Weck Laboratories have been sampled in accordance to laboratory SOP Number MIS 002.

# APPENDIX D

# 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%20Guidelines%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.

Graduated Steel Tape
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.

<u>Electric Tape</u>

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: **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 E

# Land Use and Water Use Areas
# (from LOBP)

## Figure 5. Land Uses in the Plan Area

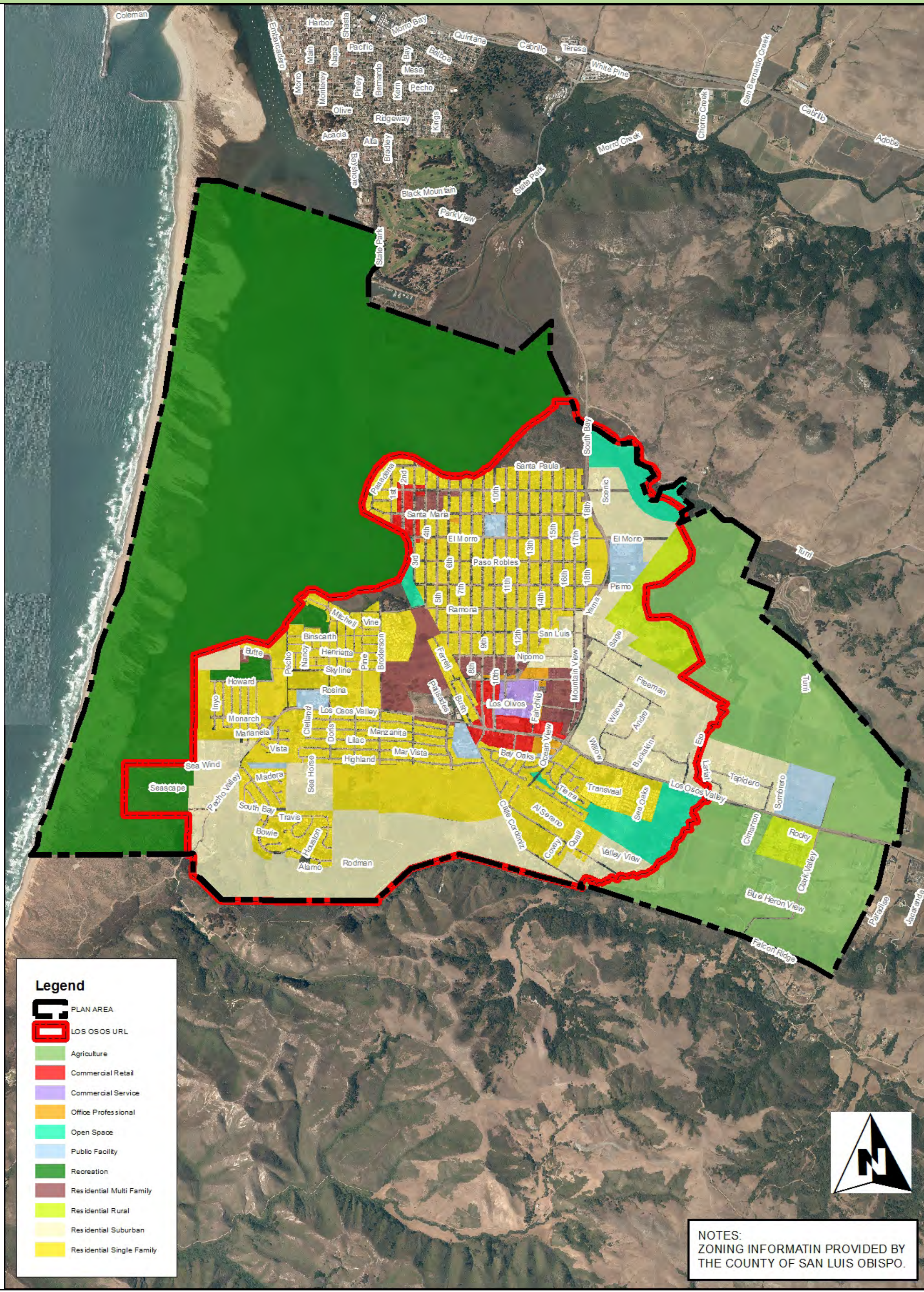
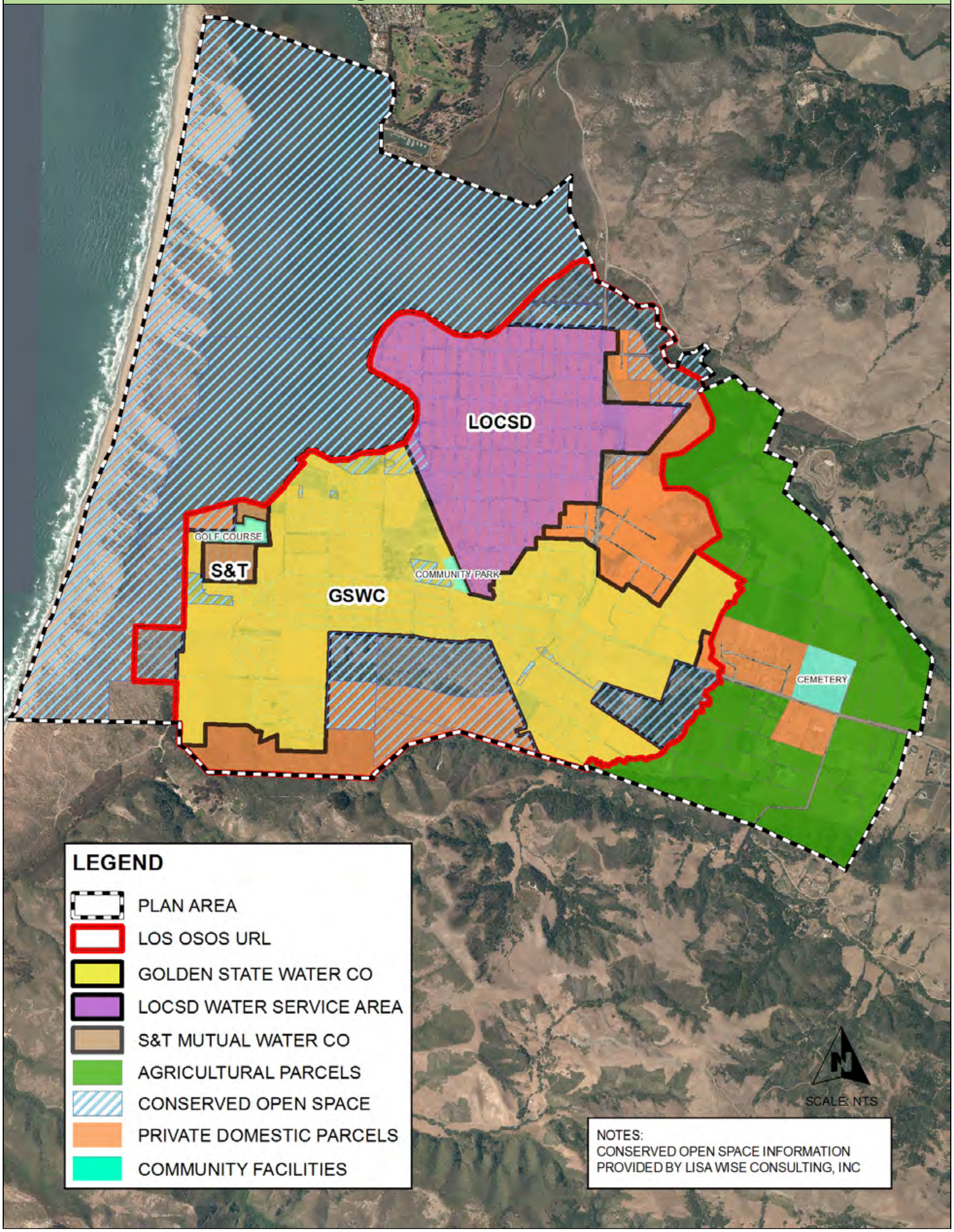


**Figure 10. Water Use Areas**



# APPENDIX F

## Agricultural and Turf Applied Irrigation Estimates

**Agriculture and Turf Applied Irrigation Water Estimate - 2017**

Groundwater production estimates for agriculture and turf irrigation were developed using a daily soil-moisture budget with local data input. Sources of data included:

- The most recent land use survey by the County for estimating irrigated acreages (2016).
- Daily rainfall from County rain gage 727 (former Los Osos Landfill).
- Daily reference evapotranspiration from the California Irrigated Management Information System (CIMIS) Station 160 (San Luis Obispo West - Chorro Valley) located in DWR Climate Zone 6, which is the same climate zone as the Los Osos Valley.
- Water holding capacity and rooting depths from UC Davis Cooperative Extension at http://UCManageDrought.ucdavis.edu
- Crop Coefficients (Kc) from prior work in the Los Osos basin.

The soil-moisture budget methodology used accounts for soil holding capacity, crop rooting depth, leaching fraction, irrigation efficiency, local precipitation, and local reference evapotranspiration. The following equation was used for the soil-moisture budget (Carollo, 2012 County Master Water Plan, modified from Burt et al., 2002):

Applied Irrigation Water = (ETc - ER) / (EF)

Where:

ETc [Crop evapotranspiration] = ETo [reference evapotranspiration] x Kc [crop coefficient]
ER [effective rainfall] = rainfall stored in soil and available to crop
EF [efficiency factor] = (1-LF[leaching fraction]) x IE [irrigation efficiency]
Assumes no frost protection for crops in the Los Osos Creek Valley.

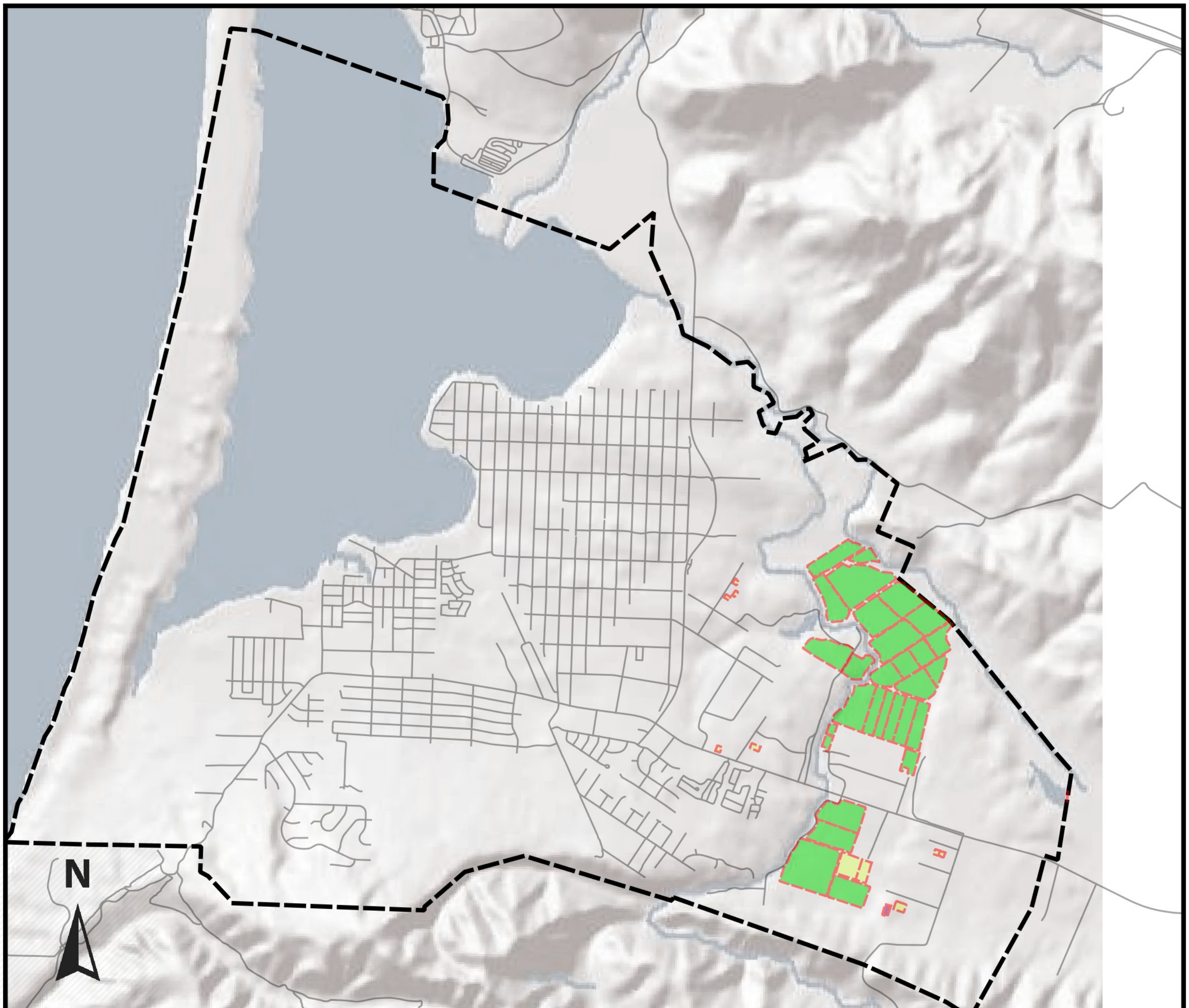
A land use survey map for 2016 is shown in Figure F-1. Irrigated acreages for 2017 will not be available until October 2018. Tabulation of the irrigated acreages is presented in Table F-1 below.

**Table F-1**
**2016 County Crop Survey**
**Eastern Area**

| Crop Type | Acres |
|---|---|
| Nursery | 1.8 |
| Pasture[1] | 8.7 |
| Vegetables | 279.5 |
| Vineyard | 0.8 |
| Total | 291.3 |

[1]Listed as nursery in survey

Crop acreages listed in Table F-1 are in the Eastern Area (Los Osos Creek valley and Cemetery Mesa). In addition, the turf areas for community facilities were calculated from areal images. Table F-2 presents these areas below.




Base Image: ESRI Shaded Relief

## Explanation

**Crop Type (2016 County of San Luis Obispo)**

- Nursery
- Pasture
- Vegetable
- Vineyard

- Adjudicated Plan Area

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

**Figure F1**

**Crop Types**
**County of San Luis Obispo**
**2016 Data**
**Los Osos Groundwater Basin**

**2017 Annual Report**

**Cleath-Harris Geologists**

**Table F-2**
**Community Irrigated Turf Areas**

| Location | Acres |
|---|---|
| Memorial Park | 12.5 |
| Community Park | 1.2 |
| Sea Pines | 24 |

The soil-moisture budget was constructed as a spreadsheet. Irrigation was applied as needed to offset soil moisture deficits after accounting for crop evapotranspiration, rainfall, rooting depths, and soil holding capacities. An efficiency factor of 92 percent was estimated by calibrating the average annual irrigation requirement from a daily soil-moisture budget prepared for 2006-2008 to the irrigation estimate from prior work, which was also based on the 2006-2008 period (CHG, 2009b). Results of the soil-moisture budget method for estimating applied irrigation for agriculture and community facilities are included in tables below.

**Table F-3**
**Soil-Moisture Budget Results (Vegetables)**

| Year | Irrigation demand | ETo | ETc | Precip* |
|---|---|---|---|---|
| | (inches) | | | |
| 2006 | 17.34 | 46.45 | 30.06 | 21.23 |
| 2007 | 25.14 | 50.78 | 32.79 | 7.93 |
| 2008 | 25.12 | 49.64 | 31.51 | 14.55 |
| 2017 | 24.92 | 51.19 | 33.18 | 19.74 |

*calendar year

**Table F-4**
**Soil-Moisture Budget Results (Pasture/Turf)**

| Year | Irrigation demand | ETo | ETc | Precip* |
|---|---|---|---|---|
| | (inches) | | | |
| 2006 | 27.77 | 46.45 | 46.45 | 21.23 |
| 2007 | 43.45 | 50.78 | 50.78 | 7.93 |
| 2008 | 40.49 | 49.64 | 49.64 | 14.55 |
| 2017 | 41.27 | 51.19 | 51.19 | 19.74 |

*calendar year

**Table F-5**
**Applied Irrigation for Agriculture**

| Description | Units | Average 2006-2008 | 2017 |
|---|---|---|---|
| Irrigation demand vegetables | inches | 22.53 | 24.92 |
| Irrigation demand pasture | inches | 37.24 | 41.27 |
| Irrigaton Efficiency Factor[1] | factor | 0.92 | 0.92 |
| Applied irrigation vegetables | feet | 2.04 | 2.26 |
| Applied irrigation pasture | feet | 3.37 | 3.74 |
| | | | |
| Vegetables acreage[2] | acres | 339 | 282.2 |
| Vegetables applied water | acre-feet | 692 | 637.8 |
| | | | |
| Pasture acreage[2] | acres | 18.3 | 8.7 |
| Pasture applied water | acre-feet | 61.7 | 32.5 |
| | | | |
| TOTAL applied ag irrigation | acre-feet | 754 | 670 |
| TOTAL from CHG (2009b) | acre-feet | 750 | |

[1]Efficiency factor used to calibrate 2006-2008 total.

[2]2006-2008 acreage from CHG, 2009b (excludes memorial park);
2017 acreage from County GIS 2016 ( 1 vineyard and 1.8 nursery acres counted as 2.2 acres in vegetables, based on 2012 County Master Water Plan Table A1).

**Table F-6**
**2017 Applied Irrigation for Community Facilities**

| Description | Units | Memorial Park | Sea Pines Golf* | Community Park |
|---|---|---|---|---|
| Turf Area | acres | 12.5 | 24 | 1.2 |
| Applied Irrigation | feet | 3.74 | 3.74 | 3.74 |
| TOTAL Applied Irrigation | acre-feet | 46.8 | 89.8 | 4.5 |

*includes estimated 15 acre-feet of recycled water (75 acre-feet net production)

Results of the soil-moisture budget shows that both the quantity and timing of rainfall during the year affects the applied irrigation estimates. Tables F-3 and F-4 present irrigation demand for two above-normal rainfall years (2006 and 2017) and two below-normal rainfall years (2007 and 2008). While the below-normal rainfall years (2007 and 2008) have the highest irrigation demand (as expected), 2017 also has an irrigation demand similar to the below-normal rainfall years, despite being an above-normal rainfall year. This is due to the timing of rainfall during the year.

In 2017, the majority of rainfall (16.7 inches) fell in January and February, when crop evapotranspiration (ETc) is at the lowest level of the year, leaving only 3 inches to offset irrigation demand in other high ETc months. By comparison, 8.2 inches of rain was measured in January and February 2006, leaving 13 inches to help meet irrigation demand in months with higher ETc values. The soil-moisture budget shows that effective rainfall was much greater in 2006 than 2017.

A portion of the soil-moisture budget spreadsheet covering the month of November 2017 is attached, along with sample calculations. November 2017 included days with effective rainfall and with irrigation demand.

**Sample Calculations:**
**Daily Soil-Moisture Budget**

NOTE: Wilting point (maximum allowable deficit), irrigation efficiencies, leaching fraction, and specific growing season dates are collectively approximated with the Efficiency Factor (EF), which calibrates the soil-moisture budget results to the prior estimates for 2006-2008 (CHG, 2009b). The soil-moisture budget is a tool developed to assist basin management and is not an irrigation schedule.

**[A], [B]:** Day and month used for sample calculation: November 9, 2017
**[C]:** ETo = 0.06 inches
**[D]:** Kc = 0.46
**[E]:** ETc = ETo*Kc = 0.028 inches
**[F]**: Precipitation + Irrigation = **[N]** + **[M]** = 0.12 inches + 0 inches = 0.12 inches
**[G]:** Water Available from Soil Profile = WHC of active root zone (4 inches) + soil moisture deficit on November 8 (-3.99 inches )= 0.01 inches
**[H]:** ETc Met by Precipitation + Irrigation = **[E]** *OR* **[F],** whichever is smaller. In this case both are equal, so **[H]** = 0.12 inches
**[I]:** ETc Met by Profile = **[G]** *OR* (**[E]** - **[H]**), whichever is smaller, in this case **[E]** - **[H]** = 0 inches
**[J]** Precip Available for Profile = **[F]** - **[H]** = 0.12 inches -0.03 inches = 0.09 inches
**[K]** Soil Moisture Deficit = whichever is greater between (a) -WHC (-4.0 inches) and (b) minimum of either (c) 0 inches or (d) November 8 Soil Moisture Deficit (-3.99 inches) - **[I] (**0 inches) + **[J]** (0.09 inches) = -3.90 inches. In this case (d) is less than (c) and greater than (a), therefore **[K]** = (d) = -3.90 inches
**[L]** Monthly Deep Percolation and Runoff = whichever is greater between (a) 0 inches and (b) Nov 8 Soil Moisture Deficit (-3.99 inches) + **[J]** (0.09 inches) = -3.90 inches, therefore **[L]** = 0 inches
**[M]** Irrigation Demand = **[E]** - **[N]** - **[G]** if greater than zero, otherwise 0 inches. In this case [M]= 0 inches
**[N]** Precipitation = 0.12 inches

**[A], [B]:** Day and month used for sample calculation: November 17, 2017
**[C]:** ETo = 0.08 inches
**[D]:** Kc = 0.46
**[E]:** ETc = ETo*Kc = 0.037 inches
**[F]**: Precipitation + Irrigation = **[N]** + **[M]** = 0 inches + 0.015 inches = 0.015 inches
**[G]:** Water Available from Soil Profile = WHC of active root zone (4 inches) + soil moisture deficit on November 16 (-3.978 inches )= 0.022 inches
**[H]:** ETc Met by Precipitation + Irrigation = **[E]** *OR* **[F],** whichever is smaller. In this case **[E]** is greater, so **[H]** = 0.037 inches
**[I]:** ETc Met by Profile = **[G]** *OR* (**[E]** - **[H]**), whichever is smaller. In this case both are equal, so **[I]** = 0.022 inches
**[J]** Precip Available for Profile = **[F]** - **[H]** = 0.015 inches - 0.015 inches = 0 inches
**[K]** Soil Moisture Deficit = whichever is greater between (a) -WHC (-4.0 inches) and (b) minimum of either (c) 0 inches or (d) November 16 Soil Moisture Deficit (-3.978 inches) - **[I] (**0.022 inches) + **[J]** (0 inches) = -4.00 inches. In this case (d) is less than (c) and equal to (a), therefore **[K]** = (a,d) = -4.00 inches
**[L]** Monthly Deep Percolation and Runoff = whichever is greater between (a) 0 inches and (b) Nov 16 Soil Moisture Deficit (-3.978 inches) + **[J]** (0 inches) = -3.978 inches, therefore **[L]** = 0 inches
**[M]** Irrigation Demand = **[E]** (0.037 inches) - **[N]** (0 inches) - **[G]** (0.022 inches) if greater than zero, otherwise 0 inches. On this date **[M]** = 0.015 inches
**[N]** Precipitation = 0 inches

| | |
|---|---|
| Water Holding Capacity (WHC) (in/ft) | **2** |
| Active Root Zone Depth (ft) | **2.0** |
| WHC of Active Root Zone (in) | **4.0** |
| Crop Coeficient (Kc) | **Variable** |

| [ A ] | [ B ] | [ C ] | [ D ] | [ E ] | [ F ] | [ G ] | [ H ] | [ I ] | [ J ] | [ K ] | [ L ] | [ M ] | [ N ] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | Month | Refernce ET (ETo) CIMIS Sta. 160 | Crop Coefficient (Kc) | Crop ET (ETc) | Precipitation + Irrigation | Water Available from Soil Profile | ETc met by Precipitation + Irrigation | ETc met by Profile | Precip Available for Profile | Soil Moisture Deficit | Monthly Deep Percolation and Runoff | Irrigation Demand | Precip Sta. 727 |
| 2017 | | (in) | (in) | (in) | (in) | (in) | (in) | (in) | (in) | (in) | (in) | (in) | (in) |
| 1 | November | 0.100 | 0.460 | 0.046 | 0.040 | 0.006 | 0.040 | 0.006 | 0.000 | -4.000 | 0.000 | 0.040 | 0.000 |
| 2 | | 0.070 | 0.460 | 0.032 | 0.032 | 0.000 | 0.032 | 0.000 | 0.000 | -4.000 | 0.000 | 0.032 | 0.000 |
| 3 | | 0.040 | 0.460 | 0.018 | 0.030 | 0.000 | 0.018 | 0.000 | 0.012 | -3.988 | 0.000 | 0.000 | 0.030 |
| 4 | | 0.050 | 0.460 | 0.023 | 0.011 | 0.012 | 0.011 | 0.012 | 0.000 | -4.000 | 0.000 | 0.011 | 0.000 |
| 5 | | 0.100 | 0.460 | 0.046 | 0.046 | 0.000 | 0.046 | 0.000 | 0.000 | -4.000 | 0.000 | 0.046 | 0.000 |
| 6 | | 0.100 | 0.460 | 0.046 | 0.046 | 0.000 | 0.046 | 0.000 | 0.000 | -4.000 | 0.000 | 0.046 | 0.000 |
| 7 | | 0.110 | 0.460 | 0.051 | 0.051 | 0.000 | 0.051 | 0.000 | 0.000 | -4.000 | 0.000 | 0.051 | 0.000 |
| 8 | | 0.070 | 0.460 | 0.032 | 0.040 | 0.000 | 0.032 | 0.000 | 0.008 | -3.992 | 0.000 | 0.000 | 0.040 |
| 9 | | 0.060 | 0.460 | 0.028 | 0.120 | 0.008 | 0.028 | 0.000 | 0.092 | -3.900 | 0.000 | 0.000 | 0.120 |
| 10 | | 0.100 | 0.460 | 0.046 | 0.000 | 0.100 | 0.000 | 0.046 | 0.000 | -3.946 | 0.000 | 0.000 | 0.000 |
| 11 | | 0.100 | 0.460 | 0.046 | 0.000 | 0.054 | 0.000 | 0.046 | 0.000 | -3.992 | 0.000 | 0.000 | 0.000 |
| 12 | | 0.060 | 0.460 | 0.028 | 0.019 | 0.008 | 0.019 | 0.008 | 0.000 | -4.000 | 0.000 | 0.019 | 0.000 |
| 13 | | 0.100 | 0.460 | 0.046 | 0.046 | 0.000 | 0.046 | 0.000 | 0.000 | -4.000 | 0.000 | 0.046 | 0.000 |
| 14 | | 0.100 | 0.460 | 0.046 | 0.046 | 0.000 | 0.046 | 0.000 | 0.000 | -4.000 | 0.000 | 0.046 | 0.000 |
| 15 | | 0.100 | 0.460 | 0.046 | 0.046 | 0.000 | 0.046 | 0.000 | 0.000 | -4.000 | 0.000 | 0.046 | 0.000 |
| 16 | | 0.040 | 0.460 | 0.018 | 0.040 | 0.000 | 0.018 | 0.000 | 0.022 | -3.978 | 0.000 | 0.000 | 0.040 |
| 17 | | 0.080 | 0.460 | 0.037 | 0.015 | 0.022 | 0.015 | 0.022 | 0.000 | -4.000 | 0.000 | 0.015 | 0.000 |
| 18 | | 0.100 | 0.460 | 0.046 | 0.046 | 0.000 | 0.046 | 0.000 | 0.000 | -4.000 | 0.000 | 0.046 | 0.000 |
| 19 | | 0.080 | 0.460 | 0.037 | 0.037 | 0.000 | 0.037 | 0.000 | 0.000 | -4.000 | 0.000 | 0.037 | 0.000 |
| 20 | | 0.090 | 0.460 | 0.041 | 0.041 | 0.000 | 0.041 | 0.000 | 0.000 | -4.000 | 0.000 | 0.041 | 0.000 |
| 21 | | 0.120 | 0.460 | 0.055 | 0.055 | 0.000 | 0.055 | 0.000 | 0.000 | -4.000 | 0.000 | 0.055 | 0.000 |
| 22 | | 0.100 | 0.460 | 0.046 | 0.046 | 0.000 | 0.046 | 0.000 | 0.000 | -4.000 | 0.000 | 0.046 | 0.000 |
| 23 | | 0.100 | 0.460 | 0.046 | 0.046 | 0.000 | 0.046 | 0.000 | 0.000 | -4.000 | 0.000 | 0.046 | 0.000 |
| 24 | | 0.140 | 0.460 | 0.064 | 0.064 | 0.000 | 0.064 | 0.000 | 0.000 | -4.000 | 0.000 | 0.064 | 0.000 |
| 25 | | 0.100 | 0.460 | 0.046 | 0.046 | 0.000 | 0.046 | 0.000 | 0.000 | -4.000 | 0.000 | 0.046 | 0.000 |
| 26 | | 0.060 | 0.460 | 0.028 | 0.160 | 0.000 | 0.028 | 0.000 | 0.132 | -3.868 | 0.000 | 0.000 | 0.160 |
| 27 | | 0.090 | 0.460 | 0.041 | 0.080 | 0.132 | 0.041 | 0.000 | 0.039 | -3.829 | 0.000 | 0.000 | 0.080 |
| 28 | | 0.110 | 0.460 | 0.051 | 0.000 | 0.171 | 0.000 | 0.051 | 0.000 | -3.880 | 0.000 | 0.000 | 0.000 |
| 29 | | 0.150 | 0.460 | 0.069 | 0.000 | 0.120 | 0.000 | 0.069 | 0.000 | -3.949 | 0.000 | 0.000 | 0.000 |
| 30 | | 0.100 | 0.460 | 0.046 | 0.000 | 0.051 | 0.000 | 0.046 | 0.000 | -3.995 | 0.000 | 0.000 | 0.000 |

# APPENDIX G

# Precipitation and Streamflow Data

## 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 -** 2017-2018

**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** | 0.15 | 0.02 | 0.08 | 1.00 | 0.93 | 2.77 | 3.92 | 3.02 | 2.14 | 0.95 | 0.33 | 0.12 | 15.79 |
| **Maximum** | 1.93 | 0.20 | 0.63 | 6.22 | 2.76 | 11.46 | 10.47 | 7.65 | 8.03 | 3.70 | 2.64 | 1.10 | 31.77 |

**Notes -**

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

# 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017-2018 | 0.00 | 0.00 | 0.16 | 0.16 | 0.47 | 0.12 | 3.78 | | | | | | |
| 2016-2017 | 0.00 | 0.00 | 0.00 | 1.65 | 2.76 | 3.39 | 9.02 | 7.65 | 1.34 | 0.55 | 0.27 | 0.00 | 26.63 |
| 2015-2016 | 1.93 | 0.00 | 0.08 | 0.08 | 1.26 | 1.85 | 5.04 | 0.86 | 4.85 | 0.20 | 0.00 | 0.00 | 16.15 |
| 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 **2017-2018**

| Day | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | 1 |
| 2 | | | | | | | | | | | | | 2 |
| 3 | | | | | 0.03 | | | | | | | | 3 |
| 4 | | | | | | | 0.19 | | | | | | 4 |
| 5 | | | | | | | | | | | | | 5 |
| 6 | | | | | | | | | | | | | 6 |
| 7 | | | | | | | | | | | | | 7 |
| 8 | | | | | 0.04 | | 1.42 | | | | | | 8 |
| 9 | | | | | 0.12 | | 1.77 | | | | | | 9 |
| 10 | | | 0.08 | | | | | | | | | | 10 |
| 11 | | | 0.08 | | | | | | | | | | 11 |
| 12 | | | | | | | | | | | | | 12 |
| 13 | | | | | | | | | | | | | 13 |
| 14 | | | | | | | | | | | | | 14 |
| 15 | | | | | | | | | | | | | 15 |
| 16 | | | | | 0.04 | | | | | | | | 16 |
| 17 | | | | | | | | | | | | | 17 |
| 18 | | | | | | | 0.08 | | | | | | 18 |
| 19 | | | | | | | 0.08 | | | | | | 19 |
| 20 | | | | 0.12 | | 0.12 | | | | | | | 20 |
| 21 | | | | | | | | | | | | | 21 |
| 22 | | | | | | | | | | | | | 22 |
| 23 | | | | | | | | | | | | | 23 |
| 24 | | | | | | | | | | | | | 24 |
| 25 | | | | | | | 0.24 | | | | | | 25 |
| 26 | | | | | 0.16 | | | | | | | | 26 |
| 27 | | | | | 0.08 | | | | | | | | 27 |
| 28 | | | | | | | | | | | | | 28 |
| 29 | | | | | | | | | | | | | 29 |
| 30 | | | | | | | | | | | | | 30 |
| 31 | | | | 0.04 | | | | | | | | | 31 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total** | 0.00 | 0.00 | 0.16 | 0.16 | 0.47 | 0.12 | 3.78 | | | | | | |
| **Cum. Total** | 0.00 | 0.00 | 0.16 | 0.32 | 0.79 | 0.91 | 4.69 | 4.69 | 4.69 | 4.69 | 4.69 | 4.69 | |

**Season Total** **4.69**

## San Luis Obispo County Public Works

**DAILY PRECIPITATION**
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2016-2017**

| Day | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | 1 |
| 2 | | | | | | | | 0.24 | | | | | 2 |
| 3 | | | | | | | | 0.16 | | | | | 3 |
| 4 | | | | | | | 2.25 | | | | | | 4 |
| 5 | | | | | | | 0.23 | 0.55 | 0.35 | | | | 5 |
| 6 | | | | | | | | 0.51 | | | | | 6 |
| 7 | | | | | | | 0.52 | 0.63 | | 0.15 | 0.27 | | 7 |
| 8 | | | | | | 1.18 | 1.10 | 0.04 | | 0.04 | | | 8 |
| 9 | | | | | | 0.08 | 0.12 | 0.28 | | | | | 9 |
| 10 | | | | | | 0.12 | 0.23 | 0.43 | | | | | 10 |
| 11 | | | | | | | 0.04 | 0.04 | | | | | 11 |
| 12 | | | | | | | 0.59 | | | | | | 12 |
| 13 | | | | | | | | | | 0.08 | | | 13 |
| 14 | | | | | | | | | | 0.04 | | | 14 |
| 15 | | | | 0.08 | | 1.07 | | | | | | | 15 |
| 16 | | | | 0.08 | | 0.55 | | 0.31 | | | | | 16 |
| 17 | | | | 0.08 | | | | 3.27 | | 0.08 | | | 17 |
| 18 | | | | | | | 0.56 | 0.32 | | 0.16 | | | 18 |
| 19 | | | | | | | 0.27 | 0.08 | | | | | 19 |
| 20 | | | | | 1.90 | | 1.22 | 0.51 | | | | | 20 |
| 21 | | | | | 0.04 | | 0.16 | 0.24 | 0.20 | | | | 21 |
| 22 | | | | | | | 1.26 | | 0.47 | | | | 22 |
| 23 | | | | | | 0.35 | 0.43 | | | | | | 23 |
| 24 | | | | | | | 0.04 | | 0.12 | | | | 24 |
| 25 | | | | | | | | | 0.20 | | | | 25 |
| 26 | | | | | 0.67 | | | 0.04 | | | | | 26 |
| 27 | | | | 0.67 | 0.15 | | | | | | | | 27 |
| 28 | | | | 0.71 | | | | | | | | | 28 |
| 29 | | | | | | | | | | | | | 29 |
| 30 | | | | 0.03 | | 0.04 | | | | | | | 30 |
| 31 | | | | | | | | | | | | | 31 |

| | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total** | 0.00 | 0.00 | 0.00 | 1.65 | 2.76 | 3.39 | 9.02 | 7.65 | 1.34 | 0.55 | 0.27 | 0.00 | |
| **Cum. Total** | 0.00 | 0.00 | 0.00 | 1.65 | 4.41 | 7.80 | 16.82 | 24.47 | 25.81 | 26.36 | 26.63 | 26.63 | |

**Season Total** **26.63**

## 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 | | | | | | | 3 |
| 4 | | | | 0.04 | | | | | | | | | 4 |
| 5 | | | | | | | 1.02 | | 1.54 | | | | 5 |
| 6 | | | | | | | 0.75 | | 0.35 | | | | 6 |
| 7 | | | | | | | 0.23 | | 1.06 | | | | 7 |
| 8 | | | | | 0.23 | | | | | 0.08 | | | 8 |
| 9 | | | | | 0.04 | | 0.04 | | | | | | 9 |
| 10 | | | | | 0.04 | 0.04 | 0.08 | | 0.04 | | | | 10 |
| 11 | | | | | | 0.39 | | | 1.22 | | | | 11 |
| 12 | | | | | | | | | | | | | 12 |
| 13 | | | | | | 0.08 | 0.04 | | 0.36 | | | | 13 |
| 14 | | | 0.08 | | | | | | 0.20 | | | | 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 | | | | | | | | 0.04 | | | | 20 |
| 21 | | | | | | 0.28 | | | 0.04 | | | | 21 |
| 22 | | | | | | 0.47 | 0.16 | | | 0.12 | | | 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 | 4.85 | 0.20 | 0.00 | 0.00 | |
| Cum. Total | 1.93 | 1.93 | 2.01 | 2.09 | 3.35 | 5.20 | 10.24 | 11.10 | 15.95 | 16.15 | 16.15 | 16.15 | |

**Season Total** **16.15**

## 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 |
| **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 |

| | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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**

**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**

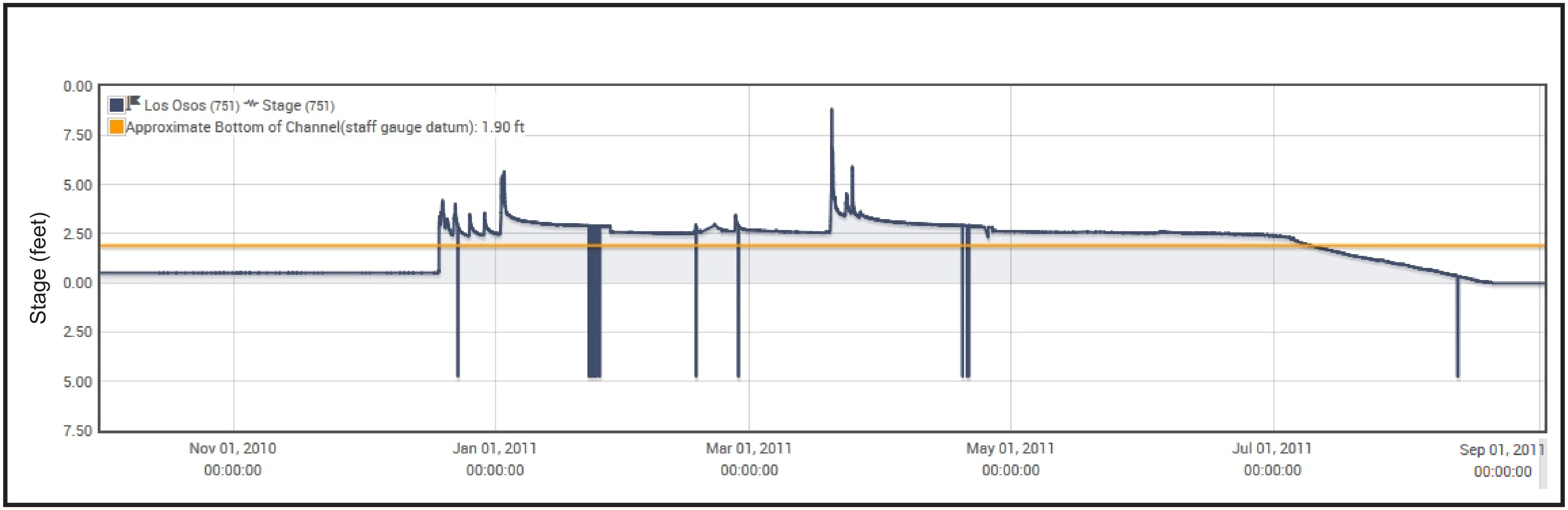
**DAILY PRECIPITATION**

(inches)

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

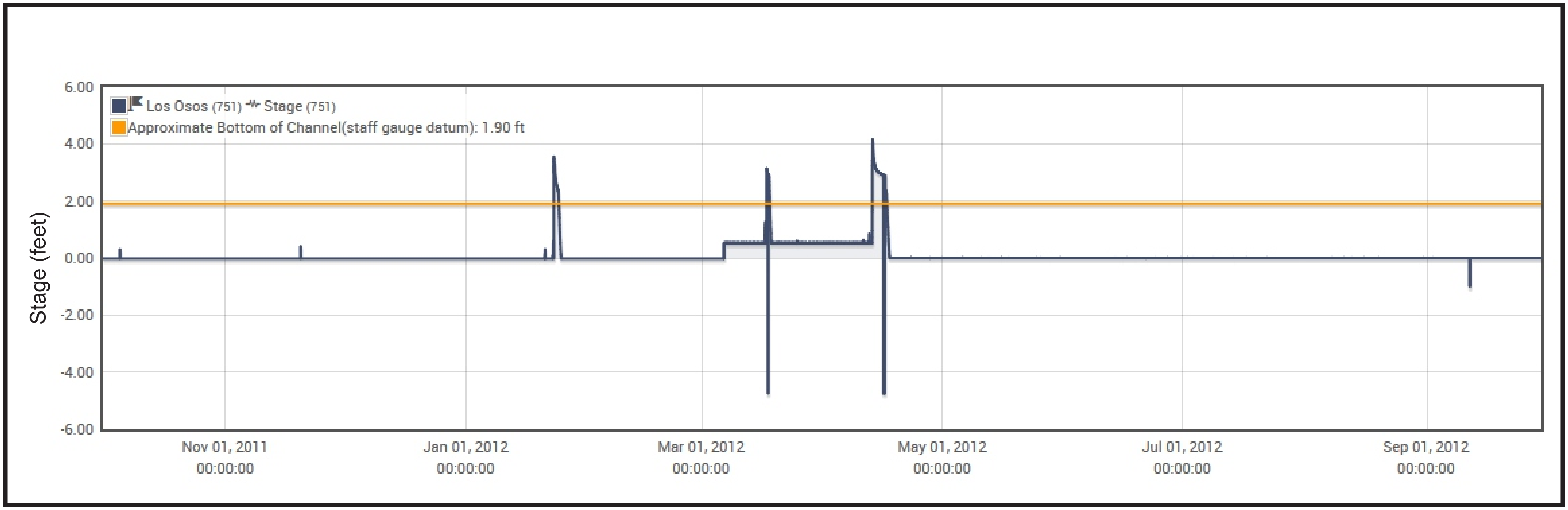
| Day | JUL | AUG | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | 1.61 | | | | | | 1 |
| 2 | | | 0.63 | | | 0.55 | 2.32 | | | 0.24 | | | 2 |
| 3 | | | | | | | | 0.04 | | 1.18 | | | 3 |
| 4 | | | | | | | | | | 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**



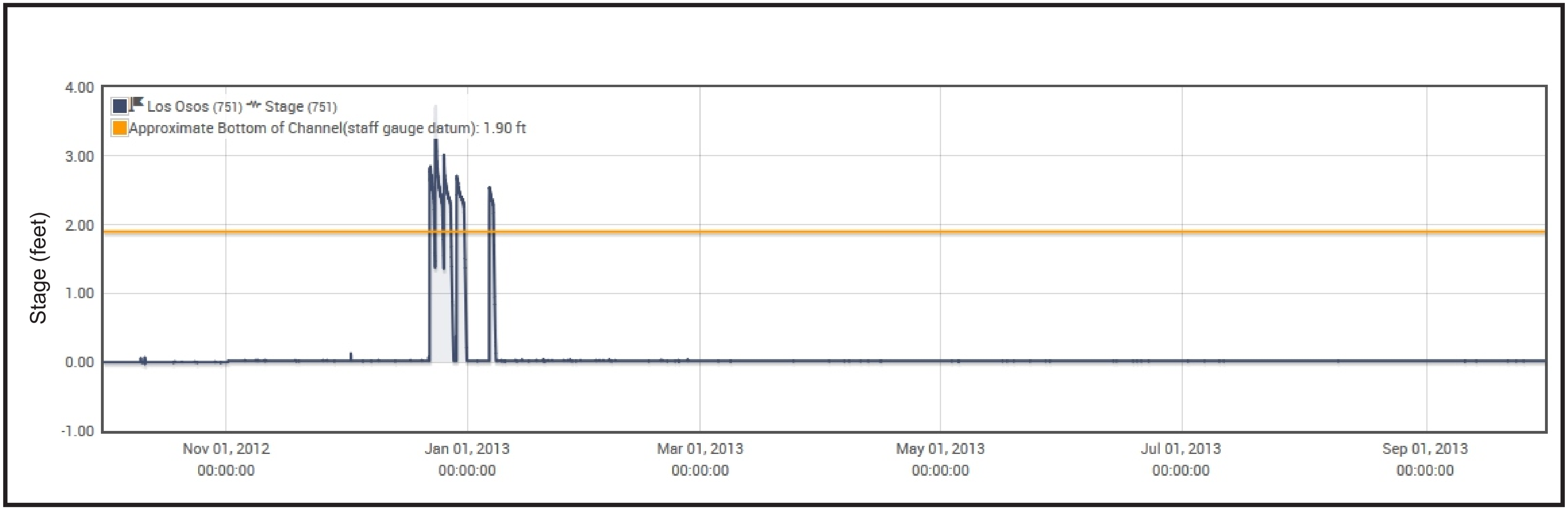

Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E1
Stream Stage for 2011 Water Year
Los Osos Creek, Gage #751



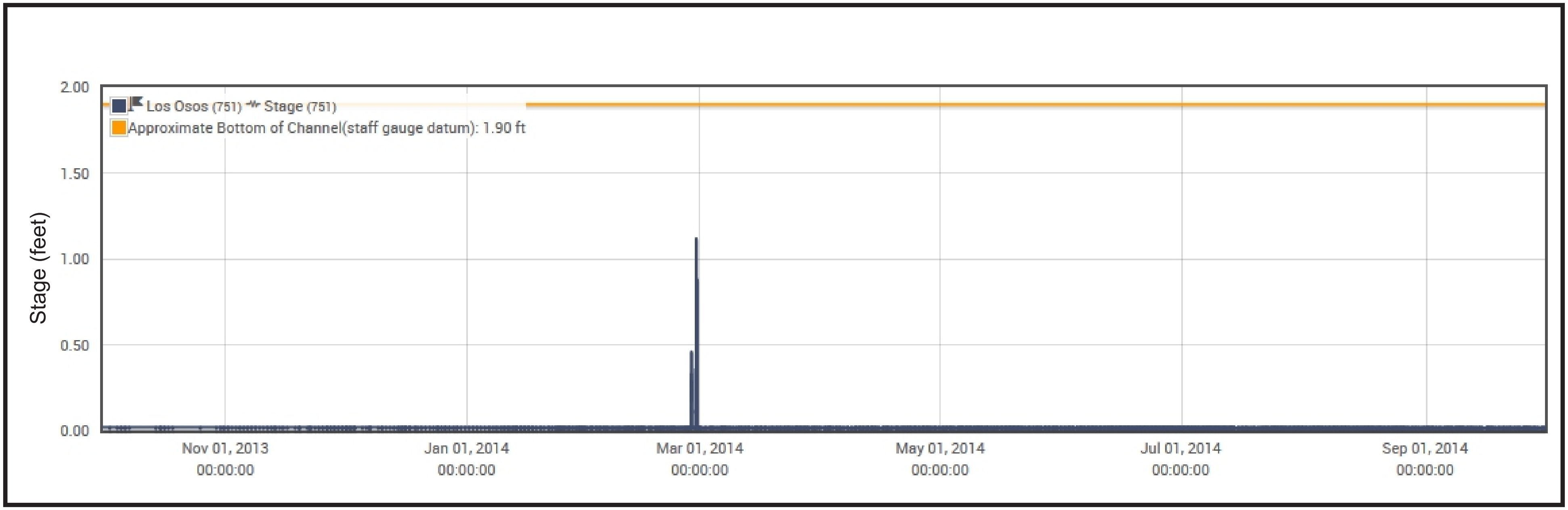

Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E2
Stream Stage for 2012 Water Year
Los Osos Creek, Gage #751



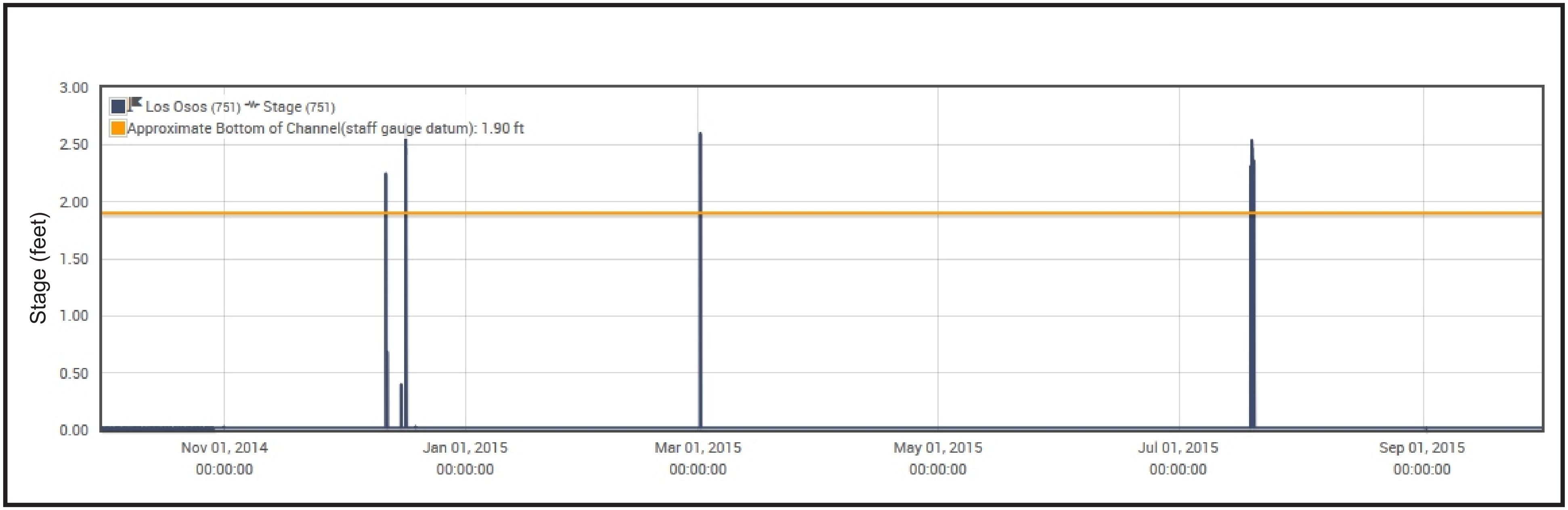

Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E3
Stream Stage for 2013 Water Year
Los Osos Creek, Gage #751



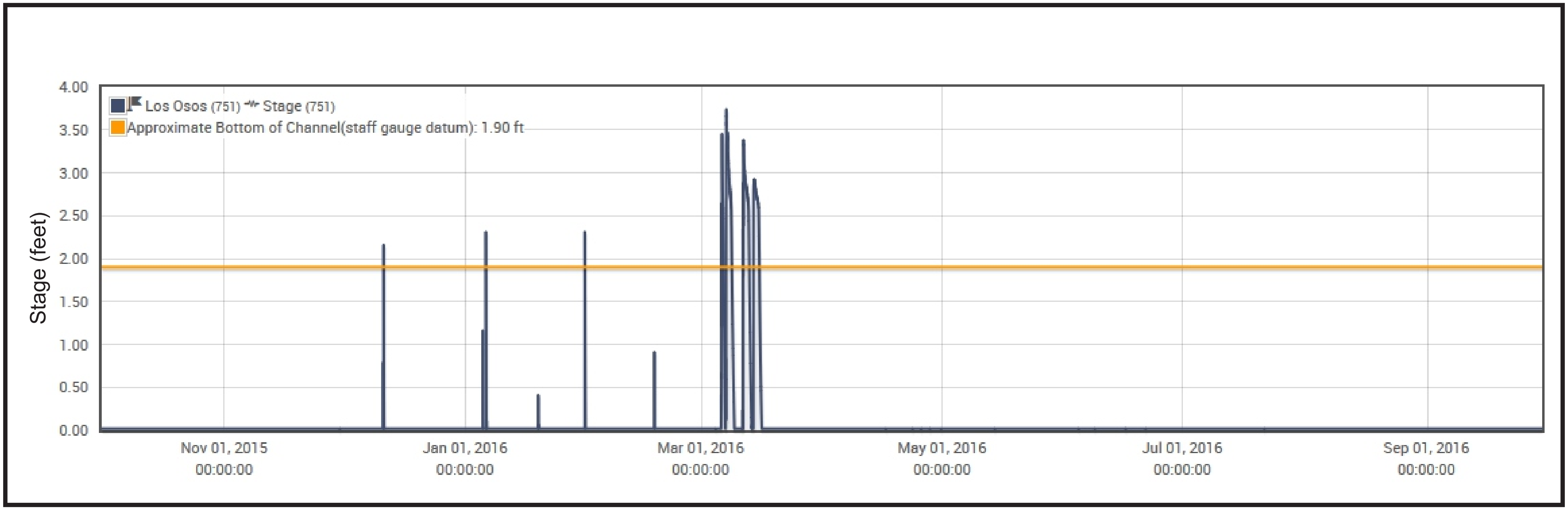

Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E4
Stream Stage for 2014 Water Year
Los Osos Creek, Gage #751



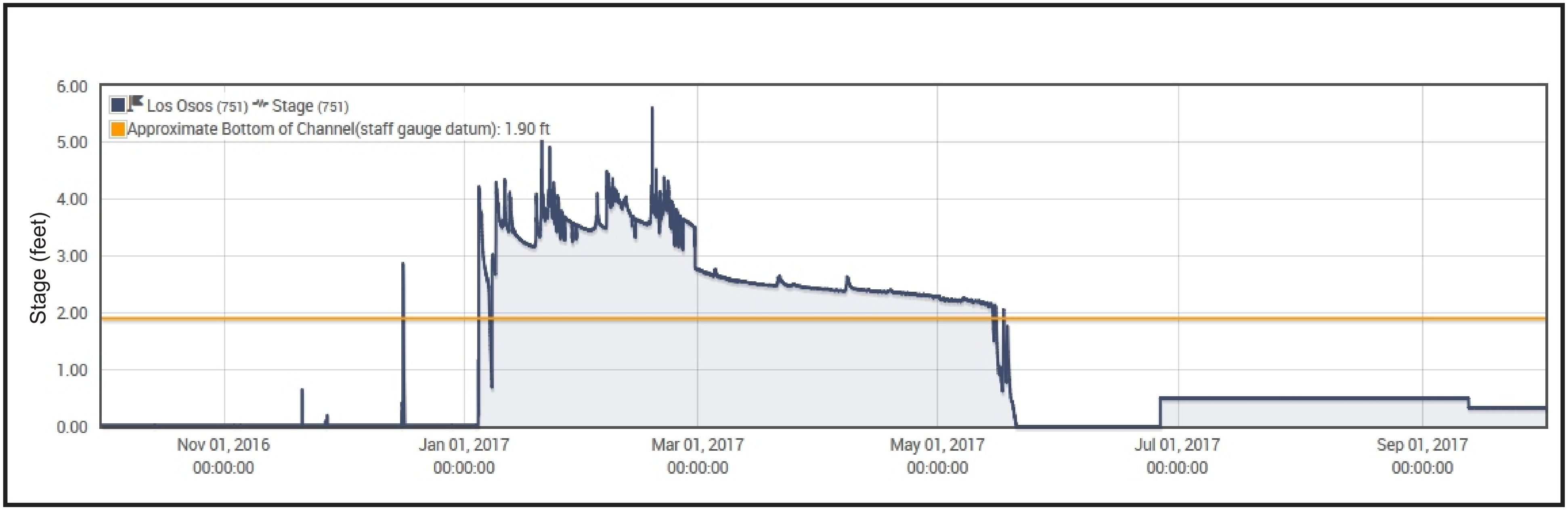

Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E5
Stream Stage for 2015 Water Year
Los Osos Creek, Gage #751




Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E6
Stream Stage for 2016 Water Year
Los Osos Creek, Gage #751




Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E7
Stream Stage for 2017 Water Year
Los Osos Creek, Gage #751

# APPENDIX H

## Transducer Hydrographs

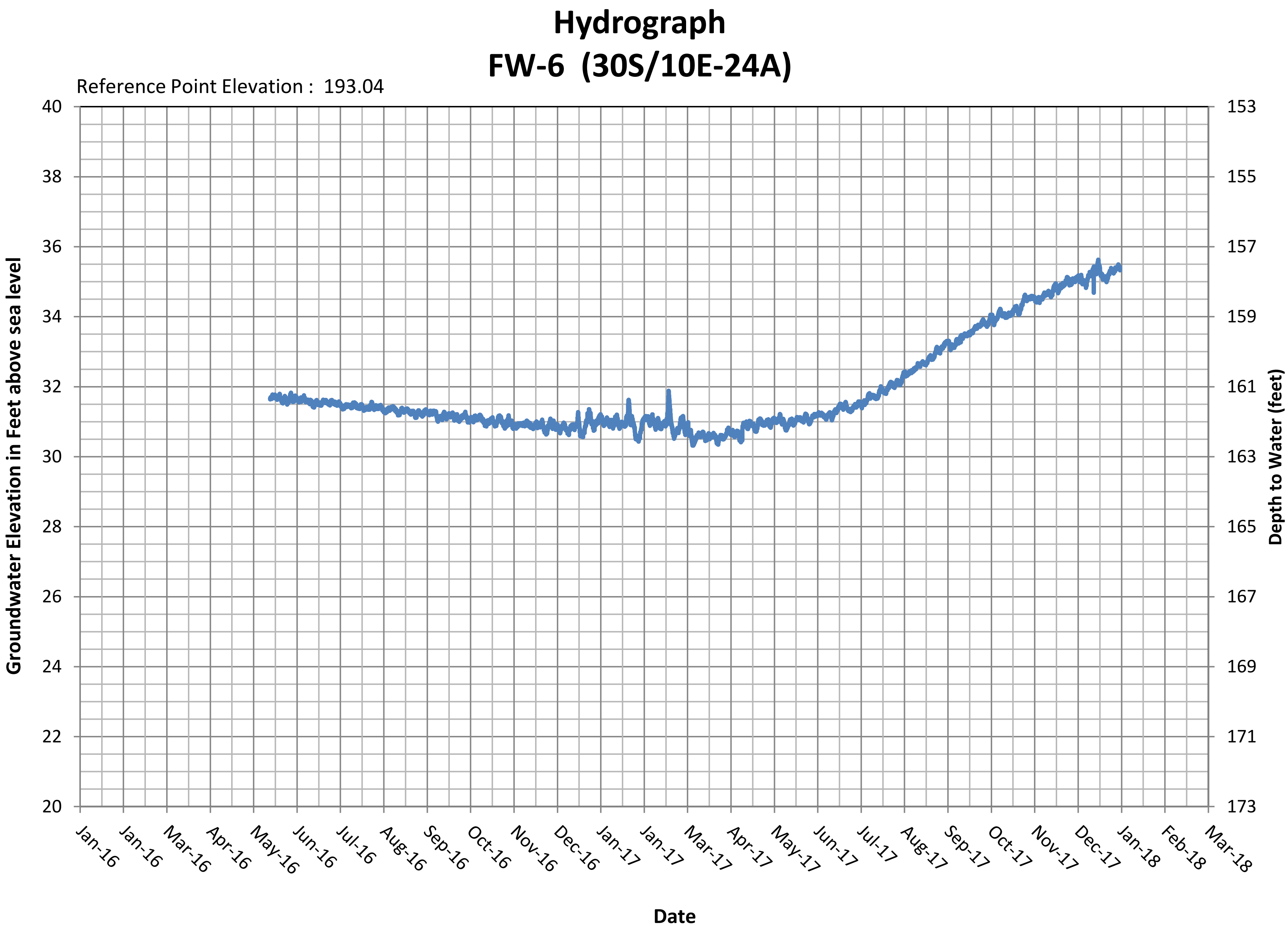
# Table H-1

Transducer Well Information

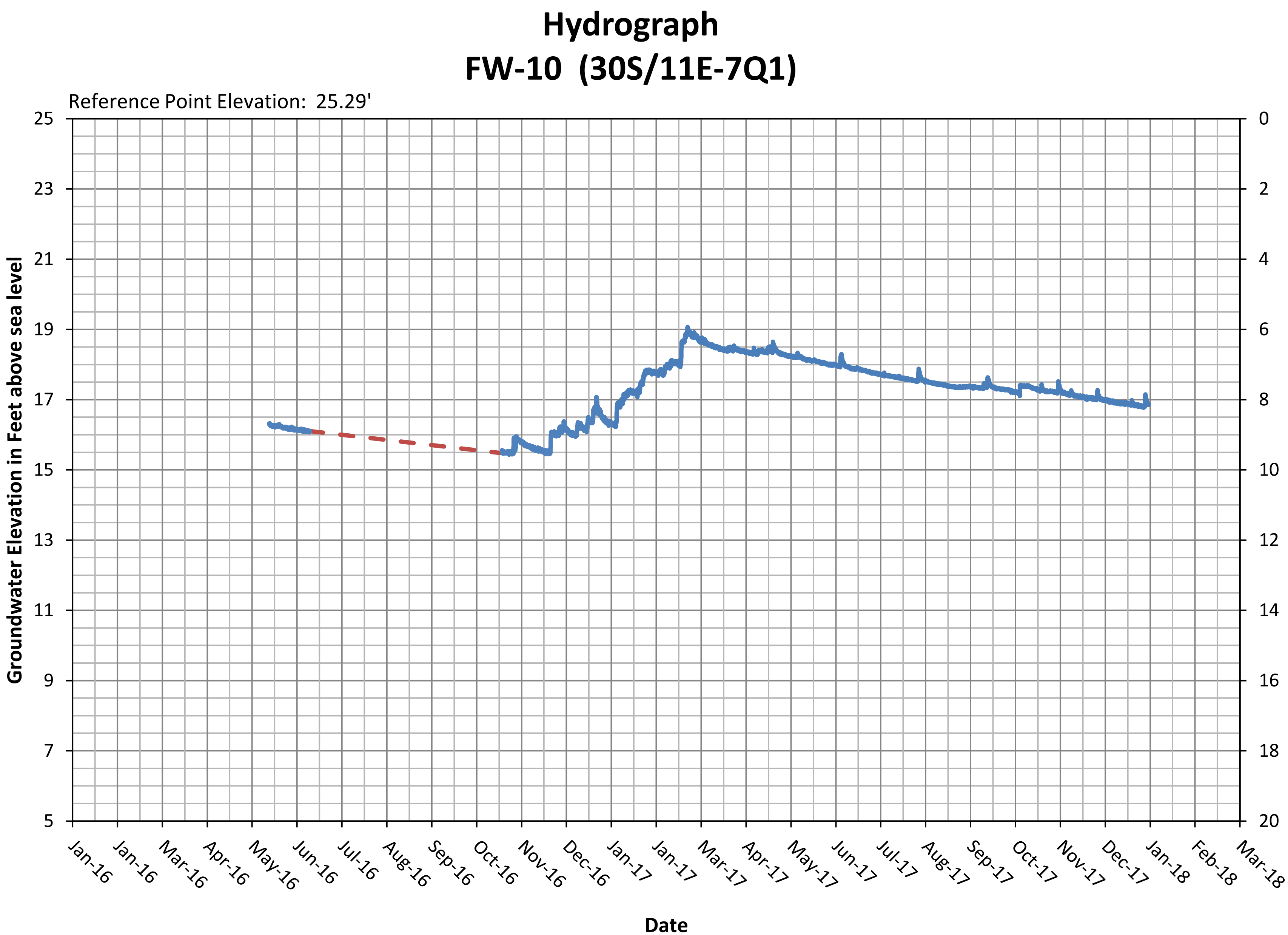
| **Well** | **GSE** (ft) | **TD** (ft) | **Casing** | **Screened interval** (ft) |
|---|---|---|---|---|
| FW-6 (30S/10E-24A) | 193.04 | 165 | 2-inch pvc | 154-164 |
| FW-10 (30S/11E-7Q1) | 25.29 | 75 | 8-inch steel | 29-53; 54-75 |
| FW-27 (30S/10E-20L1) | 134.07 | 119 | 8-inch steel | -- |
| UA-4 (30S/10E-13L1) | 39 | 140 | 8-inch steel | 80-140 |
| UA-10 (30S/11E-18H1) | 107.1 | 233 | 10-inch steel | 112-125; 145-159; 172-186; 216-231 |
| LA-13 (30S/11E-18F2) | 100 | 625 | 12-3/4-inch steel | 425-620 |
| LA-37 (30S/11E-21B1) | 81 | 140 | 6-inch steel | -- |

GSE = Ground Surface Elevation

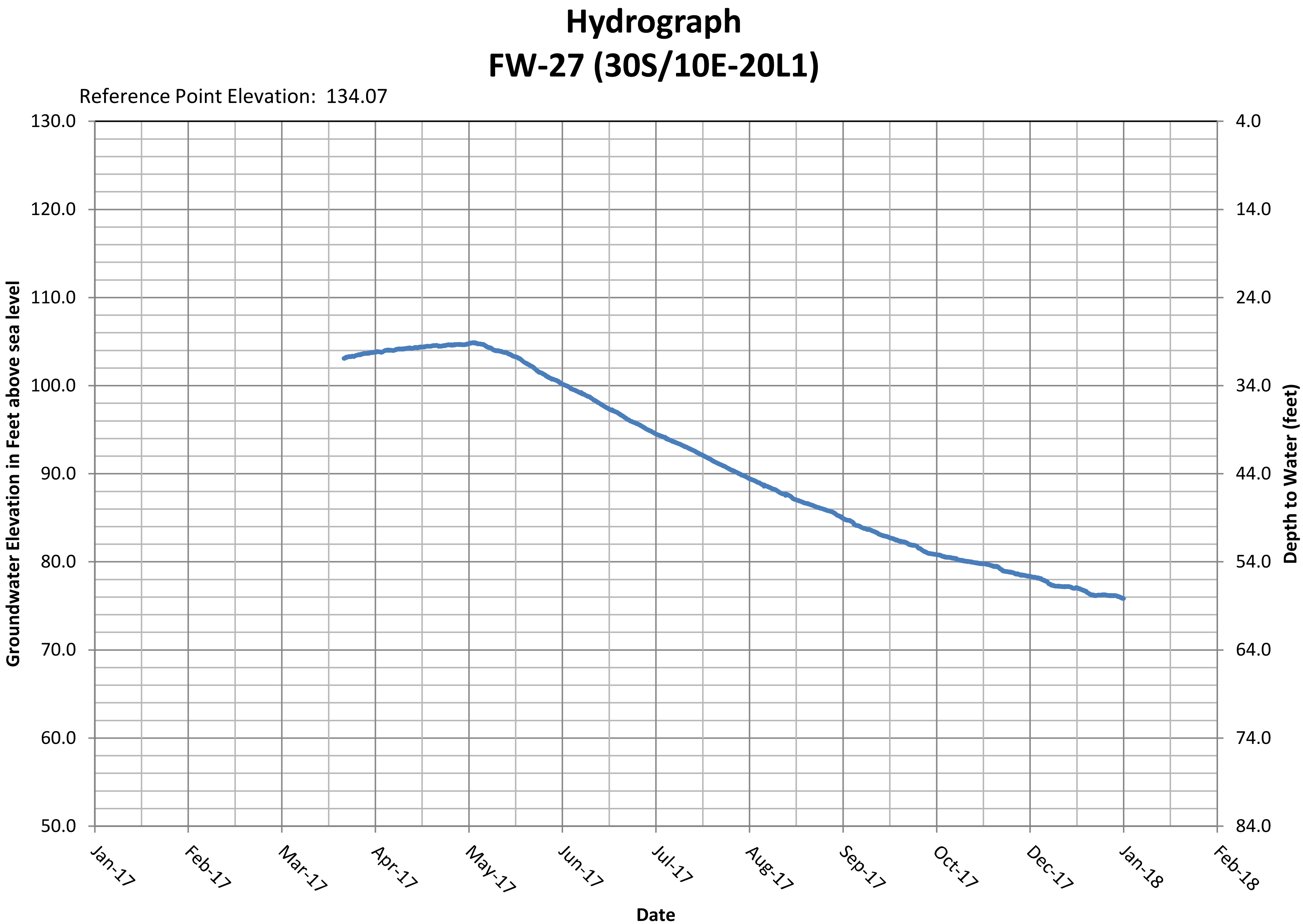
TD = Total Depth



Hydrograph
FW-6 (30S/10E-24A)
Reference Point Elevation : 193.04
Groundwater Elevation in Feet above sea level
Depth to Water (feet)
Date
40
38
36
34
32
30
28
26
24
22
20
153
155
157
159
161
163
165
167
169
171
173
Jan-16
Jan-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Jan-17
Jan-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18
Mar-18

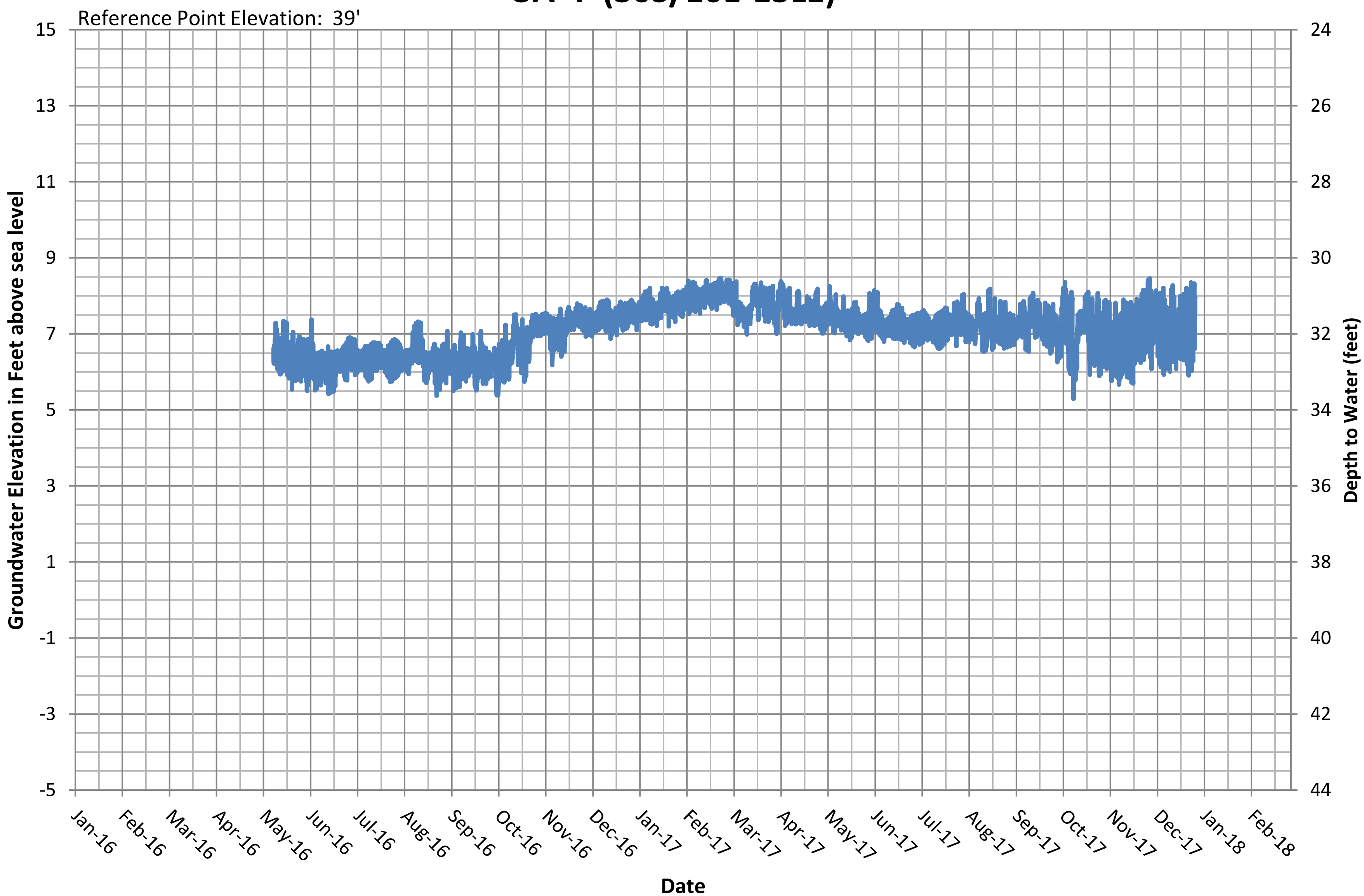


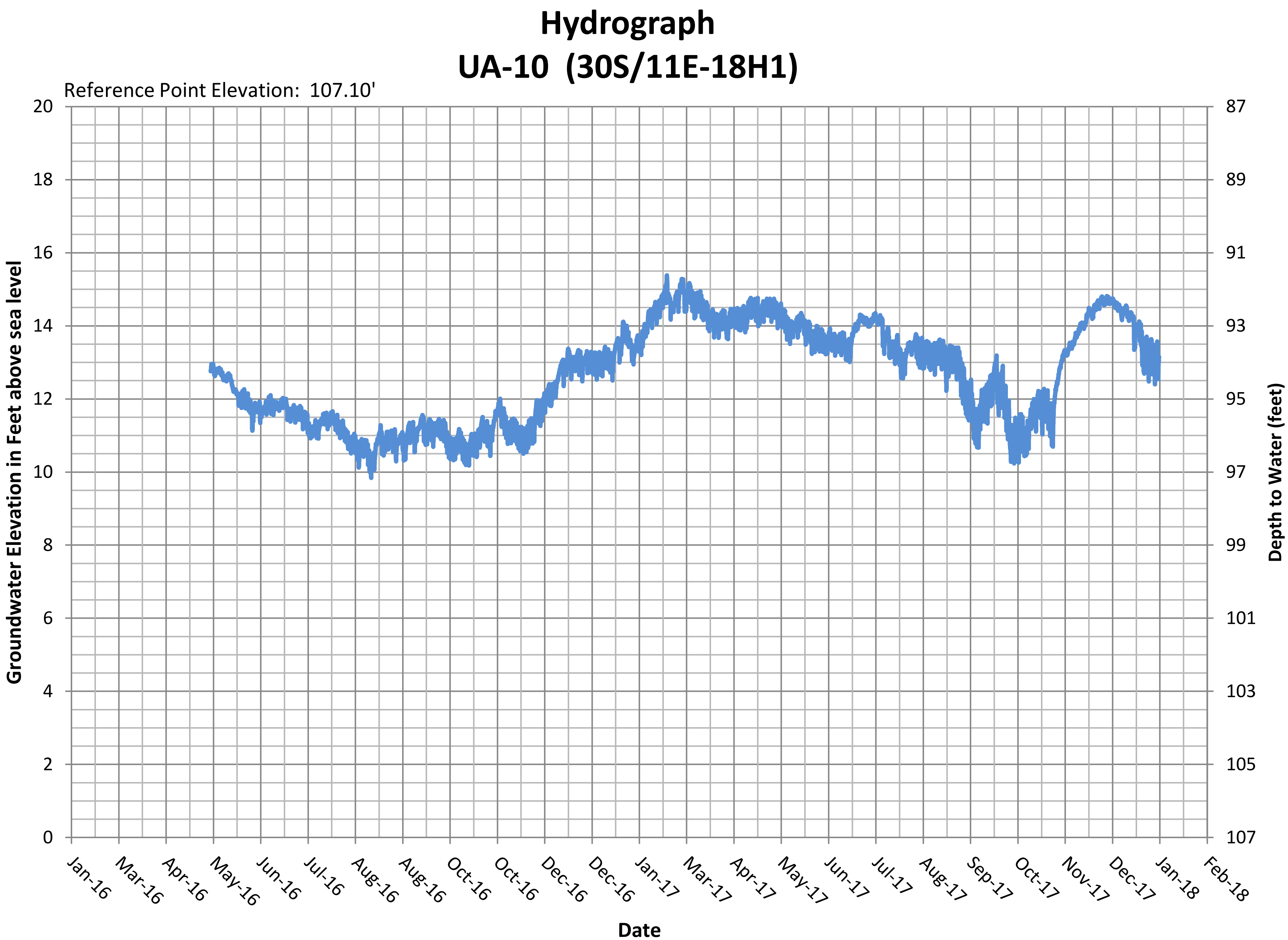
Hydrograph
FW-10 (30S/11E-7Q1)
Reference Point Elevation: 25.29'
Groundwater Elevation in Feet above sea level
Depth to Water (feet)
Date
25
23
21
19
17
15
13
11
9
7
5
0
2
4
6
8
10
12
14
16
18
20
Jan-16
Jan-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Jan-17
Jan-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18
Mar-18



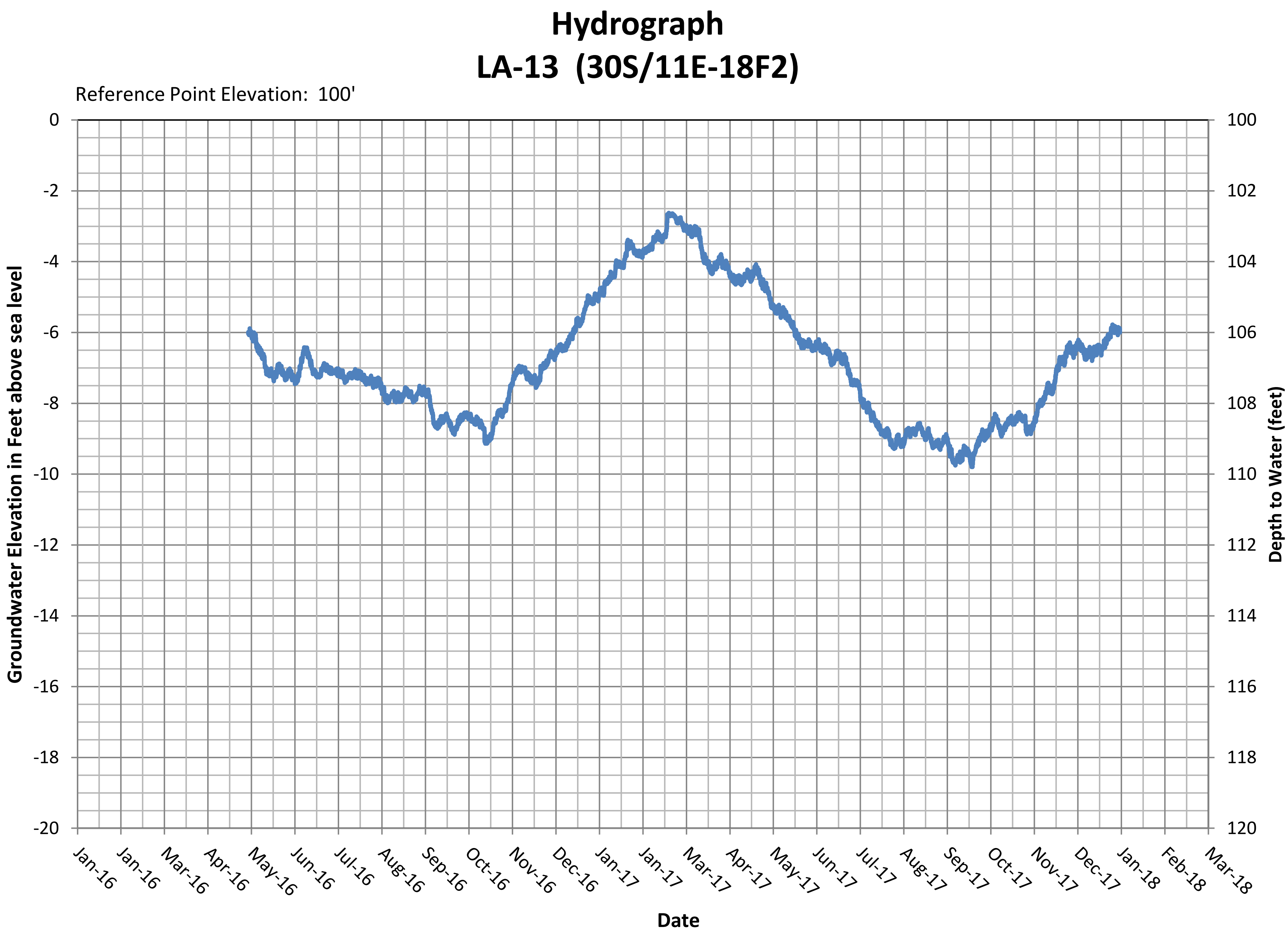
Hydrograph
FW-27 (30S/10E-20L1)
Reference Point Elevation: 134.07
Groundwater Elevation in Feet above sea level
Depth to Water (feet)
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
4.0
14.0
24.0
34.0
44.0
54.0
64.0
74.0
84.0
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Dec-17
Jan-18
Feb-18
Date

# Hydrograph
# UA-4 (30S/10E-13L1)



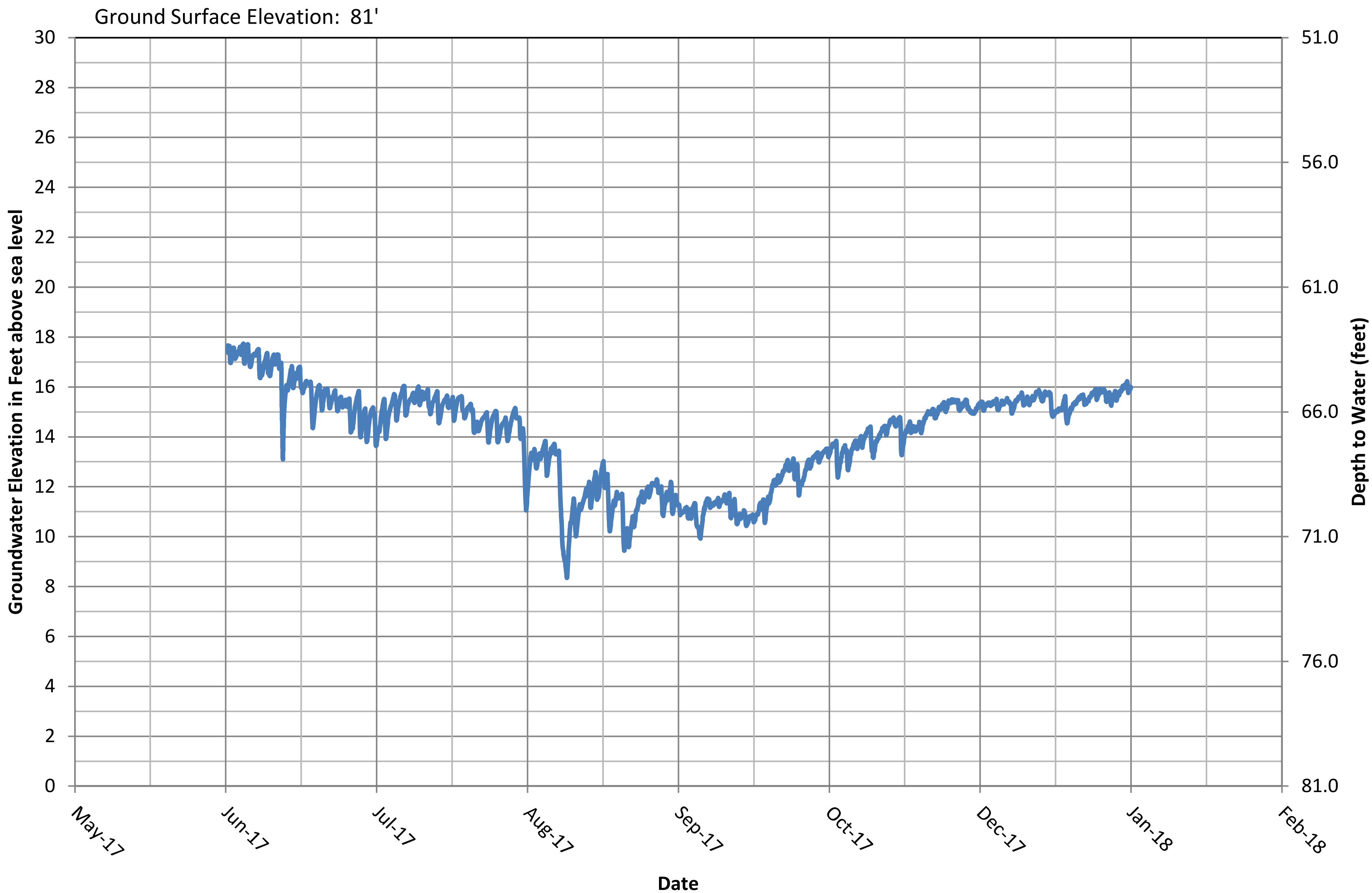


Hydrograph
UA-10 (30S/11E-18H1)
Reference Point Elevation: 107.10'
Groundwater Elevation in Feet above sea level
Depth to Water (feet)
Date
20
18
16
14
12
10
8
6
4
2
0
87
89
91
93
95
97
99
101
103
105
107
Jan-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Aug-16
Oct-16
Oct-16
Dec-16
Dec-16
Jan-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18



Hydrograph
LA-13 (30S/11E-18F2)
Reference Point Elevation: 100'
Groundwater Elevation in Feet above sea level
Depth to Water (feet)
Date
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
100
102
104
106
108
110
112
114
116
118
120
Jan-16
Jan-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Jan-17
Jan-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18
Mar-18

# Hydrograph
# LA-37 (30S/11E-21B1)



# APPENDIX I

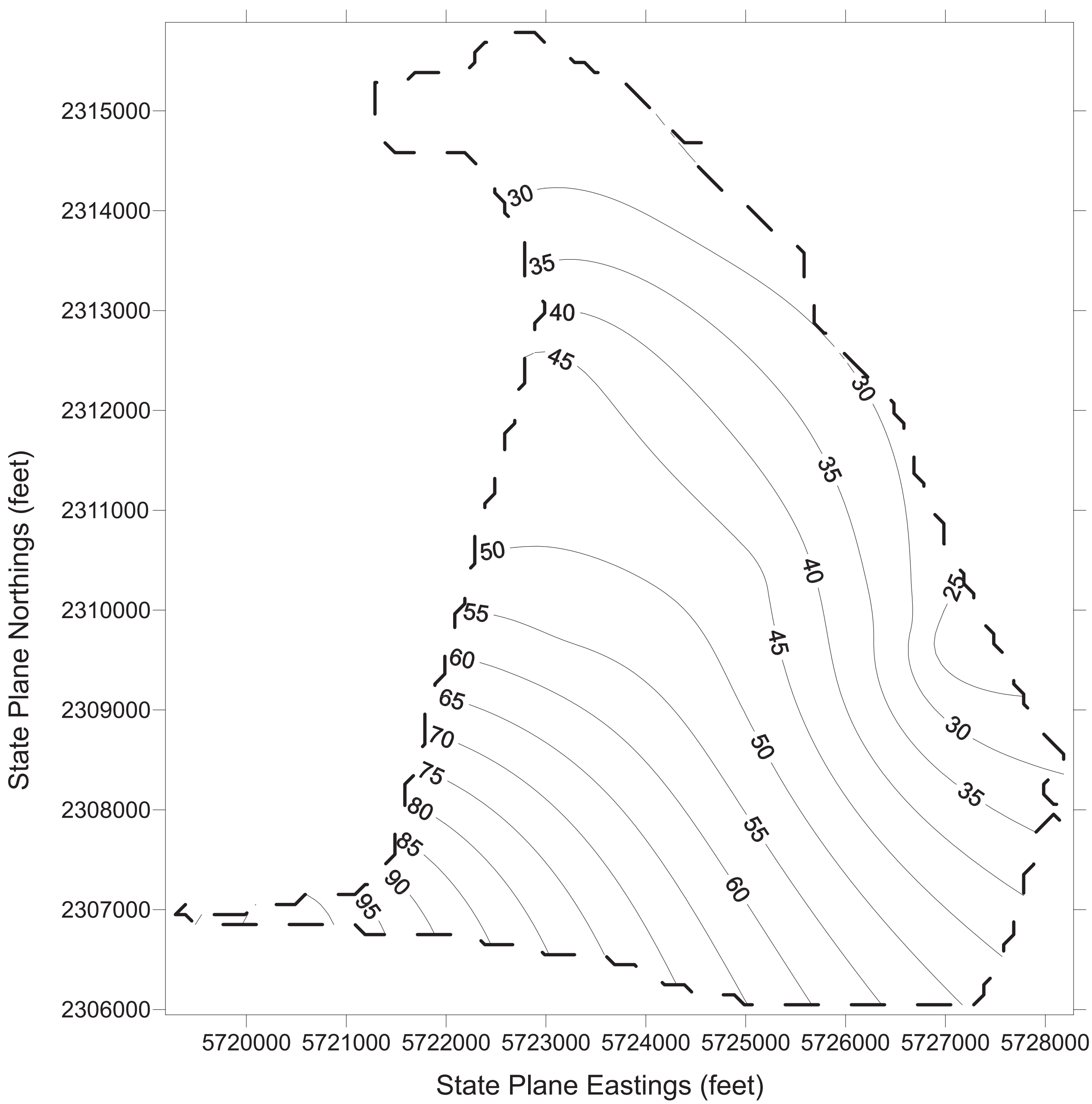
## Groundwater Storage Calculation Example and Specific Yield Estimates

**WELLS USED FOR GROUNDWATER ELEVATION CONTOURS**
**2017 GROUNDWATER STORAGE CALCULATIONS**

| FIRST WATER | | UPPER AQUIFER | | LOWER AQUIFER | |
|---|---|---|---|---|---|
| SPRING | FALL | SPRING | FALL | SPRING | FALL |
| FW2 | FW2 | UA1 | UA1 | LA1 | LA1 |
| FW3 | FW3 | UA2 | UA2 | LA2 | LA2 |
| FW4 | FW4 | UA3 | UA3 | LA3 | LA3 |
| FW5 | FW5 | UA4 | UA4 | LA4 | LA4 |
| FW6 | FW6 | UA5 | UA5 | LA5 | LA5 |
| FW8 | FW8 | UA6 | UA6 | LA6 | LA6 |
| FW9 | FW9 | UA8 | UA8 | LA8 | LA8 |
| FW10 | FW10 | UA9 | UA9 | LA9 | LA9 |
| FW11 | FW11 | UA10 | UA10 | LA10 | LA10 |
| FW12 | FW12 | UA12 | UA12 | LA11 | LA11 |
| FW13 | FW13 | UA16 | UA16 | LA12 | LA12 |
| FW14 | FW14 | UA17 | UA17 | LA13 | LA13 |
| FW15 | FW15 | UA18 | UA18 | LA14 | LA14 |
| FW17 | FW17 | FW2 | FW2 | LA15 | LA15 |
| FW18 | FW18 | FW3 | FW3 | LA16 | LA16 |
| FW19 | FW19 | FW4 | FW4 | LA18 | LA18 |
| FW20 | FW20 | FW5 | FW5 | LA19 | LA19 |
| FW21 | FW21 | FW6 | FW6 | LA20 | LA20 |
| FW22 | FW22 | FW8 | FW8 | LA21 | LA21 |
| FW23 | FW23 | FW9 | FW9 | LA24 | LA24 |
| FW24 | FW24 | FW10 | FW10 | LA26 | LA25 |
| FW27 | FW26 | FW11 | FW11 | LA27 | LA26 |
| FW28 | FW27 | FW12 | FW12 | LA29 | LA27 |
| FW29 | FW28 | FW14 | FW14 | LA33 | LA29 |
| FW30 | FW29 | FW15 | FW15 | LA34 | LA30 |
| FW31 | FW30 | FW24 | FW24 | LA35 | LA33 |
| LA34 | FW31 | FW27 | FW26 | LA37 | LA34 |
| LA35 | LA34 | FW29 | FW27 | FW27 | LA35 |
| LA37 | LA35 | FW32 | FW29 | | LA37 |
| | LA37 | LA34 | FW32 | | LA38 |
| | LA38 | LA35 | LA34 | | FW27 |
| | | LA37 | LA35 | | |
| | | | LA37 | | |
| | | | LA38 | | |
| | | | | | |
| | | | | | |
| | | | | | |

EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

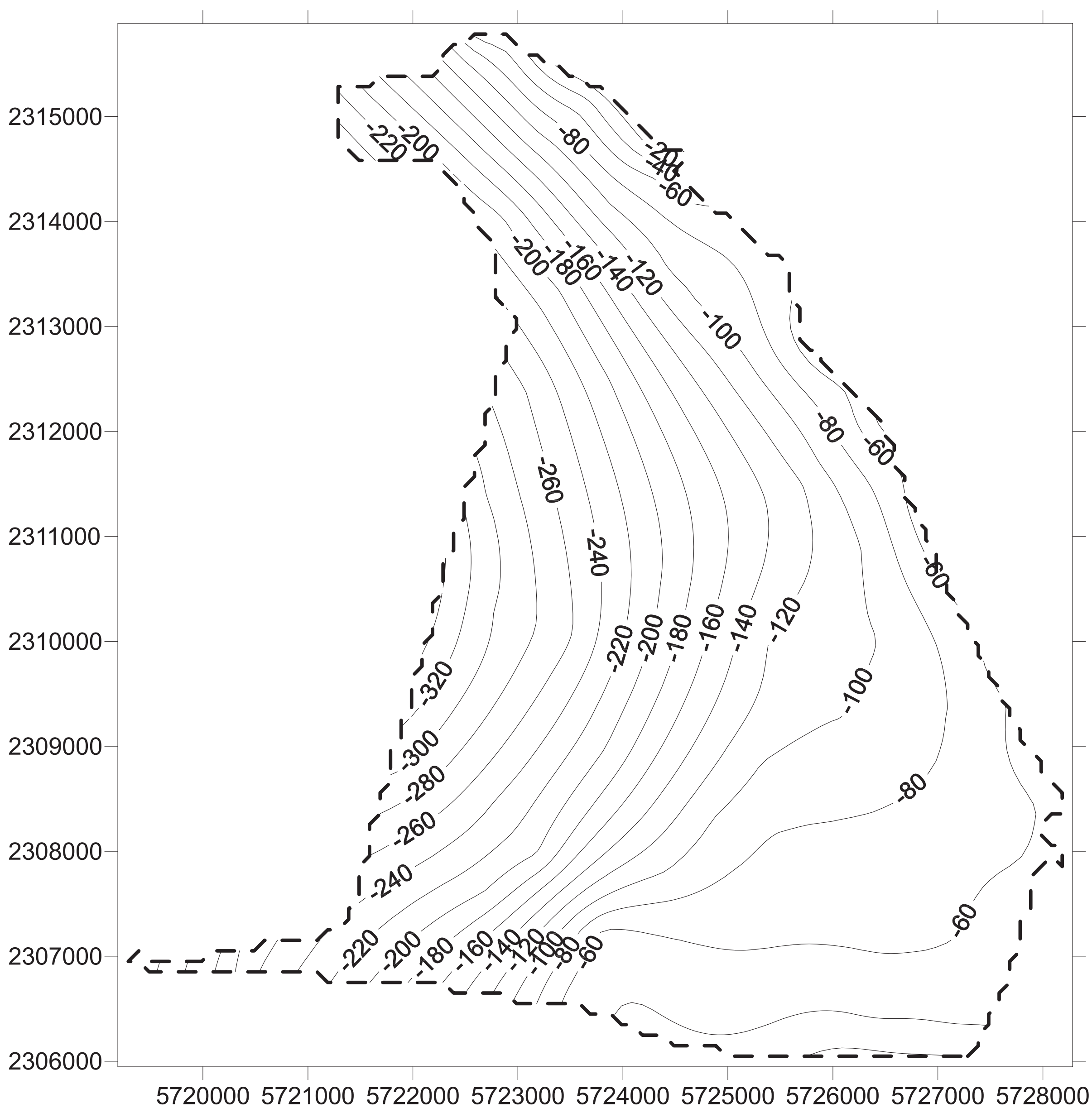
STEP 1: GRID AND TRIM WATER LEVEL CONTOURS




Spring 2017
Eastern Area Water Levels
Alluvial Aquifer and Lower Aquifer

EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

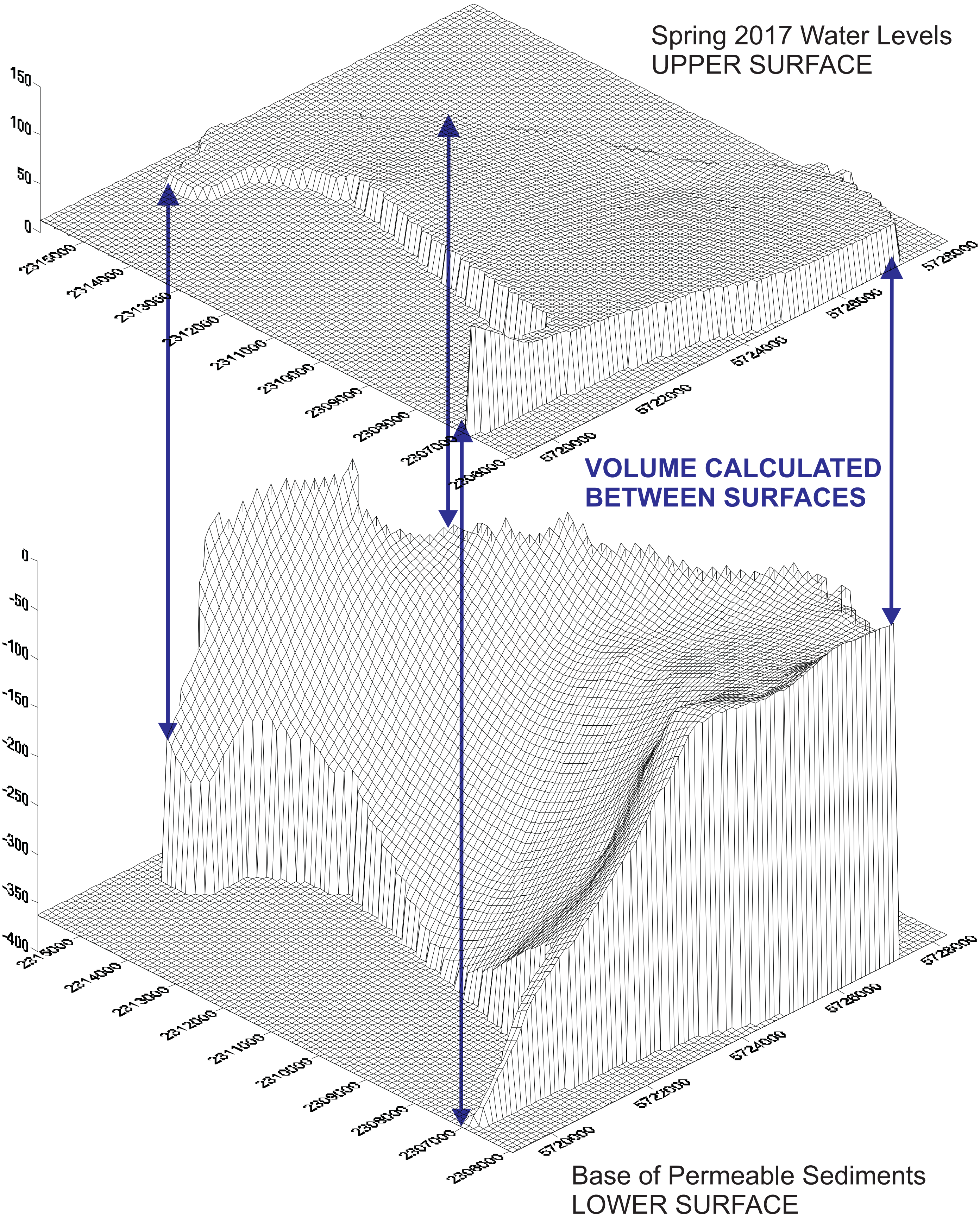
STEP 2: GRID AND TRIM BASE OF PERMEABLE SEDIMENTS




Eastern Area
Base of Permeable Sediments

EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 3: MATCH UPPER AND LOWER SURFACE GRIDS



EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 4: VOLUME COMPUTATION

# Grid Volume Computations

Wed May 02 17:11:38 2018

## Upper Surface

Grid File Name: C:\CHG 2018\Projects\Los Osos BMC 2018\2017 Annual Report\Surfer 2017 QAQC\BLANKED FILES\EASTERN\upper eastern spring 2017 blanked qaqc.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: 21.546183725484
Z Maximum: 104.24928798201

## Lower Surface

Grid File Name: C:\CHG 2018\Projects\Los Osos BMC 2018\2017 Annual Report\Surfer 2017 QAQC\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: 8260011367.3533
Simpson's Rule: 8255601348.679
Simpson's 3/8 Rule: 8251857104.0689

EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 5: CALCULATE GROUNDWATER IN STORAGE

**Cut & Fill Volumes**

| | |
|---|---|
| Positive Volume [Cut]: | 8260011367.3533 |
| Negative Volume [Fill]: | 0 |
| Net Volume [Cut-Fill]: | 8260011367.3533 |

## 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]: | 41782756.835343 |
| Negative Surface Area [Fill]: | 0 |

**STORAGE CALCULATION**

**Positive Volume: 8,260,011,367 $ft^3$ * 0.1 specific yield ÷ 43,560 acre-feet per $ft^3$ = 18,962 acre-feet**

# 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*

| 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*

| 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*

| 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*

| 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*

## 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*

| 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*

| 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*

# APPENDIX J

## Groundwater Storage Sensitivity Analysis

**APPENDIX J**

**Groundwater Storage Sensitivity Analysis**

Groundwater in storage for basin areas and aquifers has been estimated through 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 and is described in report Section 7.4 and Appendix I.

**Description of Analysis**

This Appendix J presents 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. Three sources of potential error were considered:

- Tape Bias/Survey Error
- Specific Yield Error
- Data Gaps

Sources of error associated with storage calculations include those that produce random (precision) error and those that introduce systematic (bias) error. Random error results in data scatter, while systematic error moves data uniformly.

The sensitivity analysis evaluates how storage calculations are affected by variables (elevation, specific yield, and spatial data) associated with the above source of error. Storage volumes calculated after applying changes to the variables are compared to baseline volumes for each storage compartment, which are the volumes used in the annual report. Storage compartments are secribed in report Section 7.4 and shown in Figure 19.

Tape Bias/Survey Error

The sounder tapes used for groundwater monitoring are accurate to within a few hundredths of a foot when compared to a steel reference tape. Error associate with a tape being too short or too long would be systematic. Surveyed elevations for reference points are also generally accurate within a few hundredths of a foot when tied to a benchmark. Error associated with a particular survey could be systematic or random. Not all of the wells in the monitoring network have surveyed elevations, and some are estimated based on topographic maps, where the potential error in estimating wellhead reference elevations may be a few feet. For the sensitivity analysis, a systematic error of two feet was assumed, which would be expected to exceed the actual error for most elevations. All elevations were increased by two feet and decreased by two feet from the baseline for the Tape Bias/Survey Error analysis.

Specific Yield Error

Specific yield is used by convention to calculate the volume of water contained in a given volume of saturated aquifer. The average specific yield of basin sediments was estimated at 10 percent based on correlating the lithology of nine boreholes covering 4,200 feet. Average specific yield for each borehole ranged from 7.7 percent to 11.9 percent, or roughly +/- 20 percent of the basin average. The sensitivity analysis was performed using +/- 20 percent of baseline specific yield.

A sensitivity analysis was also performed using the specific yields calculated for each individual aquifer, rather than the basin average. This aquifer-specific analysis shows the range of potential error from assuming a uniform basin with respect to specific yield, rather than discrete zones.

Data Gaps

The Data Gaps analysis evaluates mostly random error sources associated with the spatial coverage used for water level contouring. Two examples of data gaps from the 2017 data set were used, one from the spring and one from the fall. The spring data gap involved two wells where water levels were measured in the fall but which had no corresponding spring levels. These wells (private wells FW26 and UA38) were not previously accessible to the program, and normal procedure would be to add the new data points in the fall, when they were measured. For the sensitivity analysis, however, elevations from Spring 2018 for these two wells were added to the prior Spring 2017 data set to see how sensitive these point were to storage estimates.

There was also a fall data gap where a well (private well FW22) was measured in the spring but not in the fall. This well has a long history of water levels and normal procedure would be to evaluate the need for adding a substitute water level for fall storage calculations (effectively a point-specific sensitivity analysis). In the case of FW22, the missing fall water level does affect perched aquifer storage significantly, therefore, a substitute fall water level was added while preparing the annual report. For the sensitivity analysis, the substitute fall water level (which is used for the baseline) was removed in order to show the impact on storage.

**Results of Analysis**

Tables J-1 and J-2 below show the results of the sensitivity analysis for Spring 2017 storage calculations.

**TABLE J-1**

**Storage Sensitivity Analysis - Spring 2017 Storage Comparison**

| Variables | | Western and Central | | Western | Central | Eastern | TOTAL |
|---|---|---|---|---|---|---|---|
| | | Perched | Upper | Lower | Lower | Alluvial/Lower | |
| | | Groundwater Storage in Acre-Feet | | | | | |
| Baseline (reported) | | 4,680 | 27,730 | 15,730 | 56,220 | 18,960 | 123,310 |
| Elevation | Elev +2 feet | 4,910 | 28,260 | 15,730 | 56,230 | 19,160 | 124,280 |
| | Elev -2 feet | 4,450 | 27,210 | 15,730 | 56,220 | 18,760 | 122,360 |
| Specific Yield (Sy) | Sy +20% | 5,616 | 33,276 | 18,876 | 67,464 | 22,752 | 147,972 |
| | Sy -20% | 3,744 | 22,184 | 12,584 | 44,976 | 15,168 | 98,648 |
| | Aquifer Sy | 7,390 | 31,330 | 15,580 | 53,970 | 18,960 | 127,220 |
| Data Gap | Spring Gap | 4,680 | 27,780 | 15,730 | 56,220 | 18,880 | 123,290 |

**TABLE J-2**

**Storage Sensitivity Analysis - Spring 2017 Percent of Baseline**

| Variables | | Western and Central | | Western | Central | Eastern | TOTAL |
|---|---|---|---|---|---|---|---|
| | | Perched | Upper | Lower | Lower | Alluvial/Lower | |
| | | Percent of Baseline Storage | | | | | |
| Elevation | Elev +2 feet | 105% | 102% | 100% | 100% | 101% | 101% |
| | Elev -2 feet | 95% | 98% | 100% | 100% | 99% | 99% |
| Specific Yield (Sy) | Sy +20% | 120% | 120% | 120% | 120% | 120% | 120% |
| | Sy -20% | 80% | 80% | 80% | 80% | 80% | 80% |
| | Aquifer Sy | 158% | 113% | 99% | 96% | 100% | 103% |
| Data Gap | Spring Gap | 100% | 100% | 100% | 100% | 100% | 100% |

The elevation (Tape Bias/Survey Error) sensitivity results for Spring 2017 show up to 5 percent change from the baseline storage due to raising or lowering water levels two feet. The greatest potential error would be for the perched aquifer, which is the smallest storage compartment. The relatively minor sensitivity to Tape Bias/Survey Error is to be expected, given the much greater thickness of the aquifers themselves.

Storage volume is directly correlated to changes in specific yield. A range of 20 percent potential error is considered appropriate, given the range of variability seen in the basin averages.

For the aquifer-specific sensitivity, there is a much greater range in potential error for individual aquifer storage estimates, compared to the basin-wide estimate. The perched aquifer in particular, which is mainly dune sand, has an estimated specific yield of close to 16 percent, compared to the basin average of 10 percent. Data gap sensitivity shows that storage does not change significantly when adding substitute water levels for the two data points missing in the spring.

Tables J-1 and J-2 below show the results of the sensitivity analysis for Fall 2017 storage calculations.

**TABLE J-3**

**Storage Sensitivity Analysis -Fall 2017 Storage Comparison**

| Variables | | Western and Central Perched | Western and Central Upper | Western Lower | Central Lower | Eastern Alluvial/Lower | TOTAL |
|---|---|---|---|---|---|---|---|
| | | Groundwater Storage in Acre-Feet | | | | | |
| Baseline (reported) | | 4,460 | 26,980 | 16,350 | 56,210 | 18,150 | 122,140 |
| Elevation | Elev +2 feet | 4,690 | 27,500 | 16,350 | 56,220 | 18,340 | 123,090 |
| | Elev -2 feet | 4,230 | 26,450 | 16,350 | 56,210 | 17,950 | 121,180 |
| Specific Yield (Sy) | Sy +20% | 5,352 | 32,376 | 19,620 | 67,452 | 21,780 | 146,568 |
| | Sy -20% | 3,568 | 21,584 | 13,080 | 44,968 | 14,520 | 97,712 |
| | Aquifer Sy | 7,050 | 30,478 | 16,190 | 53,960 | 18,150 | 125,820 |
| Data Gap | Fall Gap | 5,160 | 26,980 | 16,350 | 56,210 | 18,150 | 122,840 |

**TABLE J-4**

**Storage Sensitivity Analysis - Fall 2017 Percent of Baseline**

| Variables | | Western and Central Perched | Western and Central Upper | Western Lower | Central Lower | Eastern Alluvial/Lower | TOTAL |
|---|---|---|---|---|---|---|---|
| | | Percent of Baseline Storage | | | | | |
| Elevation | Elev +2 | 105% | 102% | 100% | 100% | 101% | 101% |
| | Elev -2 | 95% | 98% | 100% | 100% | 99% | 99% |
| Specific Yield (Sy) | Sy +20% | 120% | 120% | 120% | 120% | 120% | 120% |
| | Sy -20% | 80% | 80% | 80% | 80% | 80% | 80% |
| | Aquifer Sy | 158% | 113% | 99% | 96% | 100% | 103% |
| Data Gap | Fall Gap | 116% | 100% | 100% | 100% | 100% | 101% |

Storage volumes are generally lower in Fall 2017, except for the western area lower aquifer, where seawater is in retreat. The percent of baseline sensitivity is virtually the same as in Spring 2017 for elevation and specific yield variables. The only difference between spring and fall is the data gap sensitivity, which for the fall analysis removed a substitute data point from the baseline (i.e. re-inserted the data gap), resulting in a 16 percent change from the baseline.

Tables J-1 and J-2 below show the results of the sensitivity analysis for Spring to Fall 2017 change in groundwater storage calculations.

**TABLE J-5**

**Storage Sensitivity Analysis -Spring to Fall 2017 Change in Storage Comparison**

| Variables | | Western and Central Perched | Western and Central Upper | Western Lower | Central Lower | Eastern Alluvial/Lower | TOTAL |
|---|---|---|---|---|---|---|---|
| | | Groundwater Storage Change in Acre-Feet | | | | | |
| Baseline (reported) | | -220 | -750 | 620 | -10 | -810 | -1,170 |
| Elevation | Elev +2 | -220 | -760 | 620 | -10 | -820 | -1,190 |
| | Elev -2 | -220 | -760 | 620 | -10 | -810 | -1,180 |
| Specific Yield (Sy) | Sy +20% | -264 | -900 | 744 | -12 | -972 | -1,404 |
| | Sy -20% | -176 | -600 | 496 | -8 | -648 | -936 |
| | Aquifer Sy | -340 | -850 | 610 | -10 | -810 | -1,400 |
| Data Gap | Data Gaps | 480 | -810 | 620 | -10 | -730 | -450 |

**TABLE J-6**

**Storage Sensitivity Analysis - Spring to Fall 2017 Change in Storage Percent of Baseline**

| Variables | | Western and Central Perched | Western and Central Upper | Western Lower | Central Lower | Eastern Alluvial/Lower | TOTAL |
|---|---|---|---|---|---|---|---|
| | | Percent of Baseline Change in Storage | | | | | |
| Elevation | Elev +2 | 100% | 101% | 100% | 100% | 101% | 102% |
| | Elev -2 | 100% | 101% | 100% | 100% | 100% | 101% |
| Specific Yield (Sy) | Sy +20% | 120% | 120% | 120% | 120% | 120% | 120% |
| | Sy -20% | 80% | 80% | 80% | 80% | 80% | 80% |
| | Aquifer Sy | 155% | 113% | 98% | 100% | 100% | 120% |
| Data Gap | Data Gaps | -218% | 108% | 100% | 100% | 90% | 38% |

Potential error for storage estimates and change in storage estimates are within 20 percent of baseline for most variables and storage compartments. The data gap sensitivity shows the greatest range in potential error due to the missing fall water level which resulted in a gain in storage from spring to fall in the perched aquifer, rather than a decline. That type of error, however, is screened for during report preparations and was mitigated with a substitute value.

One potential improvement to storage calculations would be to utilize an aquifer-specific methodology for assigning the specific yields. If this approach is pursued, however, correlating specific yields to a more robust sample set of logs for the individual aquifers would be recommended.

# APPENDIX K

## Nitrate-Nitrogen Monitoring Data 2002-2017

# TABLE K-1
## NITRATE-NITOGEN RESULTS 2002-2017

| YEAR | 2002 | 2002 | 2003 | 2003 | 2003 | 2003-04 | 2004 | 2004 | 2004 | 2005 | 2005 | 2006 | 2006 | 2012 | 2013 | 2014 | 2014 | 2014 | 2015 | 2015 | 2016 | 2016 | 2017 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SEASON CODE** | **2** | **4** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **1** | **3** | **1** | **3** | **2** | **2** | **4** | **1** | **3** | **1** | **3** | **1** | **4** | **2** | **4** |
| **WELL ID** | **--nitrate-nitrogen (mg/L)--** | | | | | | | | | | | | | | | | | | | | | | | |
| 30S/10E-13A7 | 12 | 9.8 | 10 | 12 | 13 | 11 | 11 | 12 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 30S/10E-13G | 9.3 | 8.6 | 9.1 | 9.4 | 11 | 9.7 | 9.4 | 7.1 | 11 | 8.9 | 9.6 | 11 | 10 | 11.7 | 9.7 | 13 | 15.3 | 12 | 13.1 | 10 | 13.3 | 8.7 | 16 | 18 |
| 30S/10E-13H | 1 | 1 | 1.5 | 1.9 | 1.8 | 1.5 | 2 | 2.9 | 3.2 | 1.3 | 14 | 8.7 | 2.6 | 2.3 | 2.2 | 3.6 | 4 | 3.7 | 3.4 | 5.1 | 4.2 | 5.3 | 6.3 | 3.1 |
| **30S/10E-13L8** | **19** | **28** | **23** | **36** | **40** | **46** | **35** | **24** | **26** | **28** | **22** | **23** | **11** | **17.5** | **16** | **10** | **17.2** | **22** | **26** | **27.8** | **30.3** | **28** | **20** | **44** |
| 30S/10E-13Q1 | 20 | 19 | 20 | 20 | 21 | 20 | 20 | 19 | 21 | 21 | 20 | 22 | 18 | 30.4 | 25.7 | 19 | 29.9 | 29 | 28.8 | 28.8 | 30.8 | 25 | 28 | 29 |
| **30S/10E-24A** | **11** | **10** | **12** | **11** | **12** | **11** | **12** | **11** | **11** | **11** | **12** | **12** | **11** | **17** | **15.9** | **15** | **17.4** | **--** | **13.4** | **18.6** | **15.5** | **15** | **--** | **10** |
| 30S/11E-7K3r | 12 | 8.5 | 14 | 16 | 13 | 12 | 15 | 11 | 14 | 14 | 6.1 | 12 | 11 | 14.4 | 17.3 | 15 | 19.2 | 20 | 24 | 21.9 | 19.6 | 28 | -- | -- |
| 30S/11E-7L3 | 15 | 14 | 15 | 16 | 16 | 28 | 17 | 18 | 16 | 19 | 52 | 21 | 23 | 19 | 18.7 | 21 | 22 | 21 | 19.4 | 21.6 | 15 | 15 | -- | -- |
| 30S/11E-7N1 | 3 | 3.1 | 2.7 | 2.2 | 2.5 | 2.4 | 2.3 | 2.3 | 2.4 | 2.2 | 2.1 | 2.6 | 2.9 | 3.8 | 5.2 | 5.5 | 6.3 | 6 | 6.4 | 7.2 | 4.7 | -- | -- | -- |
| **30S/11E-7Q1** | **16** | **18** | **15** | **17** | **17** | **17** | **19** | **19** | **16** | **18** | **20** | **22** | **21** | **15.7** | **18.4** | **18** | **10.8** | **25** | **26.5** | **23.4** | **21.4** | **29** | **--** | **--** |
| 30S/11E-7R1 | 12 | 14 | 9.6 | 13 | 14 | 14 | 14 | 12 | 15 | 12 | 14 | 17 | 13 | 13.1 | 16.3 | 18 | 21.9 | 18 | 17.6 | 19.5 | 11.6 | 21 | -- | -- |
| 30S/11E-8Ma | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4.9 | 4.2 | 2.5 | 2.8 | 2.5 | 2.3 | -- | -- | -- | -- | -- | -- | -- |
| 30S/11E-8Mb | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 19 | 18 | 32.5 | 77.6 | 57 | -- | -- | -- | -- | -- | -- | -- | -- |
| 30S/11E-8N2 | 2.4 | 2.7 | 2.9 | 1 | 0.7 | 0.7 | 0.8 | 0.6 | 0.8 | 0 | 0.8 | 2.4 | 1.2 | 2.1 | 2.8 | 2.8 | 3.5 | 4.5 | 8.3 | 9.2 | 4.8 | 2.5 | -- | -- |
| 30S/11E-17D | 17 | 17 | 21 | 20 | 19 | 19 | 19 | 17 | 17 | 20 | 17 | 18 | 17 | 19.1 | 19.8 | 19 | 19.6 | 18 | 24.2 | 22.7 | 30 | -- | 32 | -- |
| 30S/11E-18E9 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 14 | 13 | -- | -- | -- | -- | | -- | -- | -- | -- | -- | -- |
| 30S/11E-17F4 | 3 | 2.4 | 0 | 2 | 1.5 | 1.3 | 1.1 | 0.8 | 0.7 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.7 | 0.92 | 1 | 1.1 | 0.9 | 1 | 1.1 | 1.1 | 0.94 | 1.3 |
| 30S/11E-17N4 | 7.6 | 7.5 | 7.3 | 7.5 | 7.4 | 6.3 | 6.3 | 6.1 | 6.3 | 5.1 | 5.6 | 6.2 | 5.6 | -- | -- | 7.4 | 7.9 | 8.2 | 7.7 | 7.1 | 7.8 | 3.7 | 7.7 | 8.4 |
| 30S/11E-18A | -- | -- | -- | -- | -- | 14 | 15 | 14 | 15 | 14 | 14 | 13 | 11 | 10.9 | 13.1 | 16 | -- | -- | -- | -- | -- | -- | -- | -- |
| 30S/11E-18B1 | 6.9 | 8.6 | 10 | 7.9 | 10 | 11 | 11 | 9.8 | 7.4 | 2.4 | 12 | 8.6 | 7 | 7.1 | 11.7 | 20 | 18.3 | 22 | 14.5 | 22 | 11.4 | 14 | -- | -- |
| 30S/11E-18C1 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 14 | 15 | 10 | 17 | 16 | 14 | 16.1 | 17.3 | 18 | 18.7 | 17 | 16.8 | 17.5 | 18 | 12 | -- | -- |
| 30S/11E-18E1 | 11 | 11 | 11 | 11 | 11 | 9.1 | 9.7 | 7.9 | 7.9 | 7.9 | 6.9 | 6.2 | 7.9 | 8.7 | 9.9 | 8.9 | 10.9 | 8.3 | 10.6 | 11.1 | 11.9 | 10 | 11 | 11 |
| 30S/11E-18H3 | 11 | 10 | 9.8 | 11 | -- | 10 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 30S/11E-18J6 | 6.9 | 4.6 | 5.4 | 5.4 | 3.5 | 3.7 | 2.8 | 3.5 | 4.9 | 4.4 | 6.2 | 4.4 | 1.9 | 3.5 | 3.6 | 12 | 10.8 | 9.3 | 10.4 | 11.3 | 8.7 | 12 | 16 | 15 |
| 30S/11E-18L3 | 9.2 | 9.8 | 8.8 | 11 | 11 | 11 | 9.3 | 8.6 | 9.4 | 13 | 10 | 9.1 | 5.9 | 4.2 | 5 | 9.4 | 5.6 | 8.4 | 10.8 | 7.9 | 13.5 | 21 | 16 | 16 |
| **30S/11E-18L12** | **19** | **20** | **19** | **20** | **23** | **22** | **18** | **15** | **16** | **9.6** | **15** | **15** | **14** | **18.2** | **27.4** | **18** | **19.6** | **29** | **29.6** | **32.6** | **32.3** | **36** | **20** | **48** |
| **30S/11E-18N2** | **18** | **15** | **16** | **16** | **16** | **15** | **14** | **13** | **15** | **12** | **21** | **22** | **20** | **25.9** | **27.9** | **28** | **27.8** | **23** | **25.4** | **24.8** | **21.1** | **22** | **23** | **27** |
| 30S/11E-18R1 | 14 | 14 | 15 | 16 | 17 | 15 | 15 | 15 | 17 | 15 | 17 | 18 | 18 | 21.1 | 20 | 18 | 18.3 | 18 | 17.2 | -- | 18.8 | 15 | 8 | 13 |
| 30S/11E-20B | 5.7 | 5.6 | 4.4 | 3.7 | 4.6 | 4.6 | 3.7 | 2.8 | 3.8 | 2.5 | 6.2 | 7 | 6 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 30S/11E-21D | -- | -- | -- | -- | -- | -- | 11 | 4.9 | 3 | 9.2 | 6 | 7.3 | 4.8 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **METRIC WELL AVE.** | **16.6** | **18.2** | **17** | **20** | **21.6** | **22.2** | **19.6** | **16.4** | **16.8** | **15.7** | **18** | **18.8** | **15.4** | **18.9** | **21.1** | **17.8** | **18.6** | **24.8** | **24.2** | **25.4** | **24.1** | **26** | **21** | **32.3** |
| AVERAGE ALL | 11.1 | 11.1 | 11.1 | 12.1 | 12.5 | 12.7 | 11.9 | 10.4 | 11 | 10.4 | 13.1 | 12.3 | 10.5 | 13.2 | 16 | 15 | 14.3 | 15.4 | 16.1 | 16.7 | 15.7 | 16.2 | 15.8 | 18.8 |

**SEASON CODES:**

**1 SPRING (MAR-APR-MAY)**
**2 SUMMER (JUN-JUL-AUG)**
**3 FALL (SEP-OCT-NOV)**
**4 WINTER (DEC-JAN-FEB)**

DATA SOURCES: Quarterly and Semi-Annual Groundwater Monitoring Reports for the Los Osos Nitrate Monitoring Program (C&A, 2002-2006)
Semi-Annual Groundwater Monitoring Reports for Los Osos Water Recycling Facility (CHG, 2012-2013; 2015)
Semi-Annual Groundwater Monitoring Reports for Los Osos Water Recycling Facility (Rincon, 2014; 2017)

**TO:** Los Osos Basin Management Committee

**FROM:** Rob Miller, Interim Executive Director

**DATE:** May 16, 2018

**SUBJECT:** Item 7c – Water Conservation Program Update

## Recommendations

Recommendation: Receive update and confirm date for community conservation forum (preliminary date Thursday, June 21, 2018 at 7 pm at SBCC).

## Discussion

In November 2016, the BMC reviewed and endorsed an Addendum to the Water Conservation Implementation Plan for the Los Osos Wastewater Project. The document can be found at the following web address:
http://slocountywater.org/site/Water%20Resources/LosOsos/pdf/WCIP_Addendum%201_rev.pdf

In June 2017, the County approved a subset of the BMC rebate programs intended for properties connect to the Los Osos Wastewater Project as shown on the attached summary (Exhibit A). Two of the BMC's recommended measures are not included in the staff recommendation. These are the septic tank repurposing program (BMC Outdoor 1) and the Low Impact Development Landscape measure (BMC Outdoor 4). While both measures are reasonable elements of a community water conservation program, they are not recommended for inclusion in the County's efforts because there is no clear nexus between the wastewater project and the reduction of outdoor irrigation using potable water supplies. On June 20, 2017, the County submitted the measures in Exhibit A to the Executive Director of the California Coastal Commission. In November 2017, the County received approval for the rebates and is currently processing them upon request.

At the March 2018 BMC meeting, the committee requested regular updates on conservation fixtures. Staff is awaiting feedback from County Planning staff on Title 19 data. However, the following summary was provided by Public Works regarding wastewater project related retrofits:

| Summary of Conservation Rebates Provided through February 2018 | |
|---|---|
| Fixture | Cumulative Total |
| Toilets | 3,327 |
| Showerheads | 2,385 |
| Faucet Aerators | 3,226 |
| Clothes Washers | 110 |
| Hot Water Recirculating System | 0 |
| Gray Water System | 0 |
| Laundry only Gray Water System | 0 |

| Summary of Conservation Rebates Provided through February 2018 | |
|---|---|
| Recycled Water Irrigation Commercial and Institutional | 0 |
| Other | 3 |
| Total Value of Provided Rebates | $929,844.80 |

As of this writing, minimal activity has been reported in 2018 on the use of additional rebates as recommended by the BMC. Several customers have taken advantage of the higher rebate for clothes washers.

During the January 2018 BMC meeting, Golden State Water Company volunteered to work with staff on community outreach, including preparation for a community conservation meeting. A tentative date of Thursday, June 21, 2018 (7 pm to 9 pm) has been suggested, and the South Bay Community Center has been booked while the date is confirmed. The proposed agenda for the meeting was approved at the March 2018 BMC meeting as follows:

1. Overview of water conservation opportunities in Los Osos (20 min)
    a. New rebates in wastewater service area
    b. GSWC rebates available for customers outside wastewater service area
    c. Statewide rebates – turf removal
    d. Water audits
2. Technology and benefits overview for new rebates (20 min)
    a. Hot water recirculation
    b. Grey water systems
    c. Ultra low flow toilets
    d. Laundry to garden
3. Vendor presentations (20 min)
4. Individual discussions at informational booths, including Q&A (45 min)

With the assistance of GSWC, the attached information post card was assembled to provide notice of the meeting. Representatives from each BMC party are encouraged to attend. A tri-fold handout explaining the different rebate programs will also be prepared for the meeting. Additional written outreach will be recommended by staff in the future, including a possible survey to determine how many 1.6 gal/flush toilets remain in the community.

<u>Title 19 Status</u>
As described in the March 2017 BMC meeting, Title 19 retrofits are pursued by private parties in order to facilitate development within the community. In recent years, the County has found that minimal retrofit opportunities are available through pre-approved measures with published values for water savings. This situation primarily impacts new development that is either outside of the prohibition zone, or not subject to Special Condition 6 of the Los Osos Wastewater Project's Coastal Development Permit. The County currently considers retrofits on a case by case basis, including the installation of high-efficiency clothes washers. Since such retrofits are expected to continue irrespective of rebate funding, BMC ased staff will continue to communicate with County Planning regarding the potential inclusion of measures from the Addendum to the Water Conservation Implementation Plan within an updated version of Title 19.

## EXHIBIT A

| **Water Conservation Implementation Plan, Los Osos Wastewater Project**<br>**Proposed Rebate Program**<br>*changes in italics* | | | |
|---|---|---|---|
| Measures Required for Connection to the Wastewater System | | | |
| *Fixture or Appliance* | *Existing Fixture Flow Rate* | *New Fixture Flow Rate Eligible for Rebate* | *Rebates* |
| Toilets<br>Residential & Commercial | Greater than 1.6 gpf | 1.28 gpf or less | $250 |
| Showerheads<br>Residential & Commercial | Greater than 2.0 gpm | 1.5 gpm or less | $40 |
| Faucet Aerators<br>Residential | Greater than 1.5 gpm | 1.5 gpm or less | $5 |
| Faucet Aerators<br>Commercial | Greater than 0.5 gpm | 0.5 gpm | $5 |
| Urinals<br>Commercial | Greater than 1.0 gpf | 0.5 gpf or less | $500 |
| Pre-rinse Spray Valves<br>Commercial | Greater than 1.15 gpm | 1.15 gpm or less | N/A |
| Optional Measures Eligible for Rebates<br>(Requires Connection to the Wastewater System and Compliance with Above Measures) | | | |
| Toilets<br>Residential & Commercial | Equal to 1.6 gpf | ~~1.0~~ *1.28* gpf or less | $250 |
| Washers<br>Residential & Commercial | Less than Tier 3, Water Factor 4 | Tier 3, Water Factor 4 or Less | ~~$150~~ *$450 (1)* |
| *Hot Water Recirc System<br>Residential & Commercial* | *N/A* | *N/A* | *$350* |
| *Showerheads<br>Residential & Commercial* | *1.5 gpm or more* | *Less than 1.5 gpm* | *$40* |
| *Complete Gray Water System* | *N/A* | *N/A* | *$500* |
| *Laundry only Gray Water System* | *N/A* | *N/A* | *$50* |
| *Recycled Water Irrigation<br>Commercial & Institutional* | *N/A* | *N/A* | *negotiated* |
| ~~Alternative Measures~~ | ~~1.28 gpf toilet~~<br>~~1.5 gpm showerhead~~<br>~~1.5 gpm faucet aerators~~ | ~~Needs prior approval~~ | ~~$300~~ |

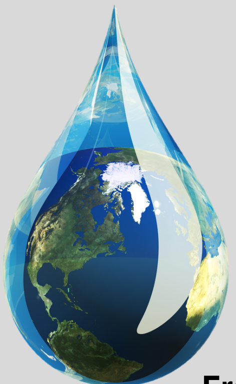
gpf = gallons per flush
gpm = gallons per minute

*NOTES: (1) Rebate not retroactive to prior*

# Los Osos Conservation Expo

**June 20, 2018 I 7-9 p.m.** Draft - Date to be confirmed (6/21)

South Bay Community Center I 2180 Palisades Ave., Los Osos CA



- Learn about the conservation programs, resources and rebates available in your neighborhood
- Meet with conservation experts offering products that can improve your water-use efficiency
- Hear important updates from the Los Osos Groundwater Basin Management Committee and local water agencies

**Free admission, hosted by the Los Osos Groundwater Basin Management Committee, in cooperation with local water agencies**

LOS OSOS COMMUNITY SERVICES DISTRICT

Golden State Water Company
A Subsidiary of American States Water Company

COUNTY of SAN LUIS OBISPO

S & T MUTUAL WATER CO

For more information, please email xxxxx | ¿Preguntas? Por favor llama XXX-XXX-XXXX

<Insert Return Address Here>

<Insert Mailing Address Here>

**TO:** Los Osos Basin Management Committee

**FROM:** Rob Miller, Interim Executive Director

**DATE:** May 16, 2018

**SUBJECT:** Item 7c. Review Initial Water Quality Data from Spring, 2018 Deep Aquifer Monitoring

## Recommendations

Receive report and provide input to staff for future action.

## Discussion

The BMC monitors basin conditions within the lower aquifer in October and April of each year. Data regarding water quality was collected in April 2018, and the results are attached. The positive data obtained in this sampling event followed a winter with low to moderate rainfall. Staff would like to remind the Committee and public that conclusions on the status of seawater intrusion should not be drawn from a single monitoring event.

# Table 2
# Water Quality Results - Lower Aquifer Monitoring

| Station ID | Well Name | Basin Plan Well ID | Aquifer Zone | Date | HCO3 | Total Hardness | Cond | pH | TDS | Cl | NO3 | SO4 | Ca | Mg | K | Na |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mg/l | mg/l | umhos/cm | | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l |
| 30S/10E-11A2 | Sand Spit #1 East | LA2 | D | 3/14/2005 | 180 | 4600 | 16000 | 7.3 | 8900 | 5400 | ND | 430 | 770 | 640 | 20 | 1300 |
| | | | | 10/21/2015 | 150 | 6640 | 17700 | 7.4 | 13100 | 6300 | ND | 740 | 1030 | 990 | 31 | 1560 |
| 30S/10E-12J1 | MBO5 DWR Obs. | LA11 | E | 2/14/2005 | 350 | 370 | 1300 | 8.1 | 840 | 77 | ND | 190 | 51 | 58 | 6.1 | 110 |
| | | | | 11/20/2009 | 300 | 360 | 1150 | 7.5 | 732 | 83 | ND | 190 | 51 | 58 | 4.4 | 95 |
| | | | | 7/24/2014 | 360 | 489 | 1290 | 7.7 | 780 | 105 | ND | 212 | 69 | 77 | 5 | 88 |
| | | | | 4/22/2015 | 360 | 475 | 1290 | 7.8 | 810 | 112 | ND | 189 | 65 | 76 | 5 | 88 |
| | | | | 10/1/2015 | 250 | 486 | 1280 | 7.3 | 840 | 117 | ND | 188 | 68 | 77 | 4 | 85 |
| | | | | 4/20/2016 | 330 | 524 | 1370 | n/a | 840 | 151 | ND | 193 | 73 | 40 | 5 | 83 |
| | | | | 10/10/2016 | 350 | 497 | 1370 | 7.1 | 930 | 173 | ND | 189 | 69 | 79 | 4 | 81 |
| | | | | 4/11/2017 | 350 | 541 | 1380 | 7.5 | 880 | 167 | ND | 186 | 75 | 86 | 4 | 81 |
| | | | | 10/4/2017 | 300 | 543 | 1370 | 7 | 850 | 162 | ND | 191 | 76 | 86 | 5 | 90 |
| | | | | 4/10/2018 | 350 | 595 | 1390 | 7.6 | 820 | **173** | ND | 192 | 85 | 93 | 5 | 97 |
| 30S/10E-13J1* | GSWC Rosina | LA10 | D | 12/20/2004 | 72 | 230 | 720 | 7.1 | 410 | 150 | 7 | 14 | 38 | 33 | 1.4 | 29 |
| | | | | 1/14/2010 | 35 | 260 | 778 | 6 | 435 | 200 | 7.1 | 13 | 41 | 38 | 1.5 | 33 |
| | | | | 7/24/2014 | 80 | 418 | 1200 | 7.3 | 910 | 303 | 7.6 | 16 | 67 | 61 | 2 | 39 |
| | | | | 4/22/2015 | 80 | 431 | 1230 | 7.1 | 750 | 331 | 8.3 | 20 | 69 | 63 | 2 | 39 |
| | | | | 10/5/2015 | 70 | 460 | 1280 | 7 | 950 | 329 | 7.3 | 19 | 74 | 67 | 2 | 41 |
| | | | | 4/26/2016 | 80 | 412 | 1170 | 7.1 | 840 | 299 | 8 | 18 | 66 | 60 | 2 | 37 |
| | | | | 10/12/2016 | 60 | 509 | 1430 | 6.8 | 1100 | 389 | 8 | 26.7 | 82 | 74 | 2 | 44 |
| | | | | 4/10/2017 | 80 | 327 | 957 | 6.9 | 720 | 231 | 11.7 | 14.7 | 52 | 48 | 2 | 35 |
| | | | | 10/12/2017 | 80 | 245 | 702 | 6.9 | 510 | 164 | 15 | 12.5 | 39 | 36 | 2 | 33 |
| | | | | 4/24/2018 | 70 | 188 | 620 | 7.4 | 400 | **136** | 19 | 12.3 | 29 | 28 | 1 | 29 |
| 30S/10E-13M2 | Howard East | LA31 | C,D | 11/22/2004 | 51 | 810 | 2900 | 7.3 | 1500 | 810 | 2.4 | 140 | 60 | 120 | 4.7 | 210 |
| | | | | 12/9/2009 | 55 | 1100 | 3740 | 7.1 | 2170 | 1100 | 2.2 | 220 | 160 | 160 | 4.8 | 370 |
| | | | | 8/4/2014 | 60 | 757 | 3340 | 7.1 | 2450 | 990 | 2.5 | 178 | 117 | 113 | 5 | 382 |
| | | | | 4/21/2015 | 60 | 739 | 3430 | 7.3 | 1930 | 950 | 2.5 | 178 | 117 | 113 | 5 | 382 |
| | | | | 10/6/2015 | 30 | 756 | 3370 | 7.1 | 2140 | 960 | 2.4 | 185 | 115 | 114 | 5 | 342 |
| | | | | 4/20/2016 | 50 | 726 | 3520 | 7.2 | 2190 | 941 | 3.1 | 179 | 113 | 108 | 5 | 400 |
| | | | | 10/19/2016 | 70 | 722 | 3420 | 7.4 | 2190 | 943 | 2.8 | 182 | 113 | 107 | 4 | 398 |
| | | | | 4/17/2017 | 60 | 733 | 3380 | 6.8 | 2060 | 907 | 2.6 | 178 | 114 | 109 | 4 | 413 |
| | | | | 10/5/2017 | 60 | 738 | 3350 | 7.5 | 2190 | 960 | 3.1 | 160 | 116 | 109 | 5 | 411 |
| | | | | 4/24/2018 | 70 | 664 | 3370 | 7.2 | 2020 | **946** | 2.8 | 186 | 103 | 99 | 4 | 367 |

# Water Quality Results - Lower Aquifer Monitoring

| Station ID | Well Name | Basin Plan Well ID | Aquifer Zone | Date | HCO3 | Total Hardness | Cond | pH | TDS | Cl | NO3 | SO4 | Ca | Mg | K | Na |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mg/l | mg/l | umhos/cm | | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l |
| **30S/10E-13N** | S&T #5 | LA8 | D | 11/23/2004 | 42 | 80 | 390 | 6.9 | 200 | 67 | 26 | 9.2 | 13 | 12 | 1.7 | 38 |
| | | | | 11/19/2009 | 41 | 89 | 386 | 6.8 | 267 | 73 | 27 | 11 | 15 | 13 | 1.4 | 38 |
| | | | | 7/24/2014 | 50 | 100 | 438 | 7.4 | 270 | 76 | 31 | 10 | 17 | 14 | 2 | 38 |
| | | | | 4/21/2015 | 50 | 98 | 445 | 6.9 | 280 | 77 | 33.9 | 11 | 16 | 14 | 2 | 38 |
| | | | | 10/6/2015 | 40 | 98 | 422 | 7.2 | 310 | 75 | 30 | 10 | 16 | 14 | 1 | 38 |
| | | | | 4/20/2016 | 20 | 97.5 | 446 | 7 | 320 | 76 | 32 | 12 | 16 | 14 | 1 | 38 |
| | | | | 10/13/2016 | 50 | 104 | 470 | 8 | 320 | 79 | 31.9 | 12 | 17 | 15 | 1 | 40 |
| | | | | 4/11/2017 | 50 | 100 | 434 | 7.4 | 270 | 77 | 32.4 | 12.4 | 17 | 14 | 1 | 38 |
| | | | | 10/2/2017 | 30 | 95 | 438 | 7.2 | 290 | 78 | 33.5 | 13.2 | 15 | 14 | 1 | 36 |
| | | | | 4/11/2018 | 60 | 104 | 440 | 7 | 260 | **79** | 34.8 | 13.5 | 17 | 15 | 1 | 39 |
| 30S/10E-14B2 | Sand Spit #3 Deep | LA3 | D | 3/15/2005 | 100 | 3600 | 30000 | 8 | 17000 | 8500 | ND | 960 | 1200 | 130 | 34 | 4300 |
| | | | | 10/21/2015 | ND | 7140 | 29500 | 11 | 24700 | 10000 | ND | 530 | 2830 | 20 | 80 | 4040 |
| 30S/10E-24C1 | GSWC Cabrillo | LA9 | D | 12/20/2004 | 64 | 130 | 610 | 7 | 310 | 110 | 20 | 19 | 22 | 19 | 1.6 | 50 |
| | | | | 11/20/2009 | 60 | 150 | 611 | 7.1 | 347 | 130 | 18 | 22 | 23 | 22 | 1.6 | 52 |
| | | | | 7/24/2014 | 40 | 69 | 339 | 7.6 | 240 | 46 | 37 | 6 | 11 | 10 | 1 | 32 |
| | | | | 4/22/2015 | 70 | 117 | 530 | 7.3 | 320 | 95 | 24.2 | 16 | 19 | 17 | 2 | 45 |
| | | | | 10/5/2015 | 50 | 75 | 349 | 7.6 | 270 | 50 | 33.4 | 7 | 12 | 11 | 1 | 34 |
| | | | | 4/26/2016 | 70 | 115 | 499 | 7 | 300 | 90 | 24.6 | 16 | 18 | 17 | 2 | 44 |
| | | | | 10/12/2016 | 70 | 111 | 506 | 7.1 | 320 | 93 | 24.4 | 15.1 | 18 | 16 | 1 | 44 |
| | | | | 4/10/2017 | 70 | 111 | 490 | 7 | 310 | 89 | 25.1 | 15.9 | 18 | 16 | 1 | 43 |
| | | | | 10/12/2017 | 70 | 117 | 484 | 7 | 270 | 89 | 26.7 | 16.3 | 19 | 17 | 2 | 46 |
| | | | | 4/24/2018 | 70 | 115 | 486 | 7.8 | 300 | **90** | 27.2 | 16.7 | 18 | 17 | 1 | 43 |
| **30S/11E-7Q3** | LOCSD 8th St. | LA12 | D | 11/18/2004 | 250 | 270 | 790 | 7.5 | 410 | 73 | ND | 39 | 44 | 40 | 2.3 | 48 |
| | | | | 11/19/2009 | 220 | 290 | 782 | 7.4 | 465 | 92 | ND | 46 | 46 | 42 | 1.9 | 53 |
| | | | | 7/23/2014 | 290 | 303 | 876 | 7.6 | 460 | 91 | ND | 43 | 49 | 44 | 2 | 54 |
| | | | | 4/21/2015 | 290 | 305 | 897 | 7.7 | 500 | 101 | ND | 55 | 48 | 45 | 2 | 59 |
| | | | | 10/6/2015 | 280 | 298 | 828 | 7.4 | 490 | 91 | ND | 46 | 47 | 44 | 2 | 55 |
| | | | | 4/20/2016 | 190 | 307 | 907 | 7.7 | 520 | 91 | ND | 49 | 49 | 45 | 2 | 54 |
| | | | | 10/11/2016 | 280 | 278 | 827 | 4.9 | 490 | 93 | ND | 46.2 | 44 | 41 | 2 | 52 |
| | | | | 4/10/2017 | 300 | 294 | 839 | 7.3 | 480 | 91 | ND | 49.5 | 47 | 43 | 2 | 54 |
| | | | | 10/4/2017 | 220 | 305 | 826 | 6.5 | 470 | 92 | ND | 45 | 48 | 45 | 2 | 56 |
| | | | | 4/10/2018 | 300 | 319 | 814 | 7.7 | 440 | **93** | ND | 46.2 | 52 | 46 | 2 | 56 |

# Water Quality Results - Lower Aquifer Monitoring

| Station ID | Well Name | Basin Plan Well ID | Aquifer Zone | Date | HCO3 | Total Hardness | Cond | pH | TDS | Cl | NO3 | SO4 | Ca | Mg | K | Na |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mg/l | mg/l | umhos/cm | | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l |
| 30S/11E-17E8 | So. Bay Obs. Middle | LA22 | D | 1/14/2005 | 150 | 150 | 440 | 7.5 | 290 | 34 | 9.7 | 11 | 24 | 22 | 1.4 | 28 |
| | | | | 11/20/2009 | 120 | 160 | 455 | 7.3 | 255 | 42 | 19 | 12 | 25 | 23 | 1.3 | 29 |
| | | | | 7/23/2014 | 150 | 166 | 500 | 7.6 | 270 | 43 | 28 | 10 | 27 | 24 | 2 | 28 |
| | | | | 4/21/2015 | 150 | 157 | 481 | 7.6 | 270 | 49 | 31.4 | 13 | 25 | 23 | 1 | 28 |
| | | | | 10/1/2015 | 120 | 164 | 475 | 7.4 | 290 | 44 | 29.2 | 10 | 26 | 24 | 1 | 28 |
| | | | | 4/19/2016 | 150 | 164 | 476 | 6.9 | 290 | 45 | 30.5 | 12 | 26 | 24 | 1 | 29 |
| | | | | 10/13/2016 | 140 | 161 | 521 | 7.3 | 290 | 46 | 30.6 | 11.9 | 25 | 24 | 1 | 29 |
| | | | | 4/13/2017 | 150 | 164 | 466 | 7.3 | 300 | 46 | 29.7 | 13.2 | 26 | 24 | 1 | 29 |
| | | | | 10/11/2017 | 150 | 168 | 476 | 7.7 | 260 | 47 | 32 | 14 | 26 | 25 | 1 | 29 |
| | | | | 4/16/2018 | 150 | 165 | 473 | 6.4 | 310 | **47** | 29.7 | 14.2 | 25 | 25 | 1 | 29 |
| 30S/11E-17N10 | GSWC So. Bay #1 | LA20 | C,D,E | Jan 2003 | 250 | -- | 510 | 7.1 | 290 | 37 | ND | 21 | 41 | 25 | 1.3 | 35 |
| | | | | 11/20/2009 | 230 | 220 | 638 | 7.3 | 357 | 41 | 2.4 | 30 | 35 | 33 | 1.7 | 37 |
| | | | | 7/24/2014 | 280 | 232 | 646 | 7.7 | 370 | 37 | 2.3 | 24 | 37 | 34 | 2 | 41 |
| | | | | 4/22/2015 | 290 | 234 | 653 | 7.4 | 360 | 43 | 2.5 | 27 | 36 | 35 | 2 | 42 |
| | | | | 10/5/2015 | 280 | 227 | 614 | 7.2 | 370 | 38 | 2.4 | 23 | 35 | 34 | 2 | 41 |
| | | | | 4/26/2016 | 230 | 227 | 629 | 7.1 | 360 | 39 | 2.6 | 27 | 35 | 34 | 2 | 40 |
| | | | | 10/12/2016 | 290 | 221 | 631 | 7 | 370 | 40 | 2.5 | 25.2 | 34 | 33 | 2 | 40 |
| | | | | 4/10/2017 | 280 | 227 | 624 | 7.2 | 380 | 39 | 2.7 | 26.7 | 35 | 34 | 2 | 40 |
| | | | | 10/12/2017 | 260 | 240 | 583 | 6.6 | 320 | 41 | 2.9 | 27.9 | 37 | 36 | 2 | 43 |
| | | | | 4/24/2018 | 200 | 166 | 515 | 7.4 | 330 | **43** | 14.1 | 23.2 | 27 | 24 | 2 | 31 |
| 30S/11E-18K8 | 10th St. Obs. East (Deep) | LA18 | E | 1/19/2005 | 260 | 290 | 650 | 7.5 | 370 | 33 | ND | 38 | 62 | 33 | 2.5 | 28 |
| | | | | 11/20/2009 | 230 | 220 | 620 | 7.5 | 378 | 32 | ND | 40 | 51 | 24 | 1.8 | 23 |
| | | | | 7/24/2014 | 290 | 271 | 647 | 7.5 | 380 | 28 | ND | 34 | 56 | 32 | 2 | 27 |
| | | | | 4/21/2015 | 290 | 265 | 634 | 7.7 | 400 | 33 | ND | 39 | 55 | 31 | 2 | 27 |
| | | | | 10/19/2015 | 230 | 256 | 621 | 7.3 | 370 | 29 | ND | 33 | 53 | 30 | 2 | 26 |
| | | | | 4/20/2016 | 190 | 265 | 700 | 7.5 | 390 | 31 | ND | 38 | 55 | 31 | 2 | 26 |
| | | | | 10/18/2016 | 290 | 256 | 615 | 6.8 | 370 | 31 | ND | 35.9 | 53 | 30 | 2 | 26 |
| | | | | 4/12/2017 | 290 | 274 | 616 | 7.5 | 450 | 31 | ND | 38 | 57 | 32 | 2 | 27 |
| | | | | 10/9/2017 | 220 | 271 | 619 | 7.8 | 350 | 30 | ND | 35.5 | 56 | 32 | 2 | 27 |
| | | | | 4/17/2018 | 290 | 260 | 625 | 7.3 | 390 | **33** | ND | 39.9 | 53 | 31 | 2 | 27 |

# Water Quality Results - Lower Aquifer Monitoring

| Station ID | Well Name | Basin Plan Well ID | Aquifer Zone | Date | HCO3 | Total Hardness | Cond | pH | TDS | Cl | NO3 | SO4 | Ca | Mg | K | Na |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | mg/l | mg/l | umhos/cm | | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l |
| 30S/11E-18K9 | LOCSD 10th St. | LA32 | C,D | May 2002 | 250 | -- | 550 | 6.9 | 320 | 37 | 1 | 26 | 31 | 32 | -- | 39 |
| | | | | 11/20/2009 | 180 | 160 | 539 | 7.2 | 307 | 36 | 4.6 | 27 | 27 | 24 | 1.3 | 32 |
| | | | | 7/23/2014 | 220 | 190 | 546 | 7.7 | 300 | 32 | 4.3 | 20 | 30 | 28 | 1 | 35 |
| | | | | 4/21/2015 | 190 | 108 | 504 | 7.6 | 270 | 38 | 7 | 20 | 17 | 16 | 1 | 27 |
| | | | | 10/6/2015 | 50 | 62 | 248 | 7.2 | 190 | 31 | 26.2 | 3 | 10 | 9 | ND | 21 |
| | | | | 4/20/2016 | 130 | 121 | 382 | 7.5 | 220 | 32 | 14.6 | 12 | 19 | 18 | 1 | 27 |
| | | | | 10/11/2016 | 200 | 168 | 511 | 6.6 | 270 | 36 | 5.3 | 21.5 | 26 | 25 | 1 | 34 |
| | | | | 4/10/2017 | 190 | 155 | 461 | 7.3 | 270 | 35 | 8.4 | 19.1 | 24 | 23 | 1 | 31 |
| | | | | 10/9/2017 | 200 | 168 | 493 | 7.6 | 270 | 36 | 6.3 | 23.1 | 26 | 25 | 1 | 33 |
| | | | | 4/10/2018 | 50 | 75.2 | 256 | 7.7 | 150 | **35** | 28.6 | 5 | 12 | 11 | ND | 23 |
| 30S/11E-18L2** | LOCSD Palisades | LA15 | D,E | 11/18/2004 | 220 | 330 | 880 | 7.3 | 420 | 120 | ND | 31 | 54 | 48 | 2.2 | 40 |
| | | | D,E | 11/19/2009 | 200 | 590 | 1460 | 7.2 | 890 | 360 | 1.8 | 39 | 94 | 86 | 2 | 44 |
| | | | D | 7/23/2014 | 250 | 293 | 783 | 7.8 | 390 | 90 | 1.8 | 26 | 48 | 42 | 2 | 40 |
| | | | D | 4/29/2015 | 80 | 78 | 348 | 7.4 | 230 | 43 | 22 | 10 | 13 | 11 | ND | 30 |
| | | | D | 10/28/2015 | 230 | 288 | 782 | 7.4 | 420 | 104 | 2.8 | 29 | 46 | 42 | ND | 36 |
| | | | D | 4/27/2016 | 230 | 264 | 796 | 7.3 | 450 | 93 | 4.1 | 28 | 43 | 38 | 2 | 43 |
| | | | D | 10/11/2016 | 200 | 221 | 694 | 7 | 380 | 91 | 7.3 | 25.5 | 36 | 32 | 1 | 35 |
| | | | D | 10/5/2017 | 180 | 306 | 768 | 7.6 | 400 | 102 | 3.3 | 27 | 50 | 44 | 2 | 40 |
| | | | D | 4/10/2018 | 250 | 311 | 767 | 7.3 | 420 | **100** | 3.4 | 32.4 | 52 | 44 | 2 | 40 |

ND = Not Detected

**Chloride Metric Wells in Green (13J1 weighted x2);** **current chloride concentrations in red**

*Chloride concentrations at 13J1 have varied seasonally by 100+ mg/l, and are affected by well production, so fluctuations are expected.

**Water from 18L2 affected by borehole leakage/upper aquifer influence when inactive

## Table 2 Legend and Detection Limits

| Constituent | Description | Practical Quantitation Limit* |
|---|---|---|
| HCO3 | Bicarbonate Alkalinity in mg/L CaCO3 | 10.0 |
| Total Hardness | Total Hardness in mg/L CaCO3 | -- |
| Cond | Electrical Conductance in μmhos/cm | 1.0 |
| pH | pH in pH units | -- |
| TDS | Total Dissolved Solids in mg/L | 20.0 |
| Cl | Chloride concentration in mg/L | 1.0 |
| NO3 | Nitrate concentration in mg/L | 0.5 |
| SO4 | Sulfate concentration in mg/L | 2.0 |
| Ca | Calcium concentration in mg/L | 1.0 |
| Mg | Magnesium concentration in mg/L | 1.0 |
| K | Potassium concentration in mg/L | 1.0 |
| Na | Sodium concentration in mg/L | 1.0 |

*where dilution not required