

# **Alamitos Barrier Project**

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## **Member Agencies:**

Orange County Water District  
Water Replenishment District of Southern California  
Long Beach Water Department  
Golden State Water Company  
Los Angeles County Flood Control District

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## Submitted by:

Paul Boice, Secretary  
Joint Management Committee

**Annual report on the control of seawater intrusion  
2021 - 2022**

## **INTRODUCTION**

The Alamitos Barrier Project (ABP) was designed and constructed to protect the groundwater supplies of the Central/Orange County Basin of the Coastal Plain from the intrusion of seawater through the Alamitos Gap area. The project facilities are located near the Los Angeles-Orange County border about two miles inland from the terminus of the San Gabriel River. The original facilities included injection wells to form a freshwater pressure ridge and extraction wells to form a saltwater trough. The freshwater pressure ridge has proven to be historically effective, whereas the saltwater trough has not. As a result, the extraction wells are currently not in operation. A map showing the supply pipeline, injection wells, extraction wells, and observation wells is shown on page A-12.1.

Los Angeles County Public Works (Public Works) operates and maintains the ABP and its associated facilities under the direction and approval of the Joint Management Committee (JMC), acting on behalf of the Los Angeles County Flood Control District (LACFCD) and the Orange County Water District (OCWD).

This report summarizes design and construction issues, operation and maintenance activities, hydrogeologic effects, chloride concentrations, and project costs for Fiscal Year (FY) 2021-22 (i.e., July 1, 2021, through June 30, 2022).

## **SUMMARY**

During FY 2021-22, a total of 7,187.8 acre-feet (AF) of water was injected into the ABP (an average rate of 9.9 cubic feet per second (cfs)). Of that total, OCWD purchased 2,703.9 AF (37.6 percent) and the Water Replenishment District of Southern California (WRD) purchased 4,483.9 AF (62.4 percent). This total injected amount was 686.9 AF more than FY 2020-21 and was 1,400.0 AF higher than the average injection of 5,787 AF for the previous five fiscal years. The ABP experienced two partial shutdowns, which occurred from September 15 to October 5, 2021, and January 4 to March 23, 2022. These shutdowns are detailed in the Injection Operation section of this report and Table 2, which also includes details of individual well shutdowns that occurred in FY 2021-22.

The total costs associated with the ABP in FY 2021-22 are summarized below:

- Total Cost in FY 2021-22: \$12,311,591.
  - Injection Water costs: \$9,230,507 (OCWD: \$3,465,298; WRD: \$5,765,209)
  - Total Operations and Maintenance Costs (not including liability insurance): \$3,004,850.
    - Injection-related costs: \$2,403,462 (OCWD: \$904,182; LACFCD: \$1,499,280)
      - Equivalent cost per AF of water injected: \$334.38
    - Extraction-related costs: \$2,847 (LACFCD only)
  - Liability Insurance cost: \$76,234 (OCWD: \$38,117; LACFCD \$38,117)

During this reporting period, the ABP generally had groundwater elevations near or above protective elevations throughout all aquifer zones, except some portions of the A and I Zones, due to ineffective injection wells that are in need of replacement or injection wells that are screened across 4 zones. Compared to the last reporting period, groundwater elevations west and east of the San Gabriel River generally increased slightly.

West of the San Gabriel River, chloride concentrations had a slight increase across all Zones, except for the R Zone. East of the San Gabriel River, chloride concentrations increased slightly, most likely due to the partial shutdown needed for well maintenance at injection well 34V, with the exception of the R and B Zones, which had a minimal decrease. Detailed analyses of the reporting period's groundwater elevations and chloride concentrations are provided in the "Hydrogeologic Effects" and "Chlorides" sections of the report.

It is imperative that the ABP operate consistently and continuously to prevent seawater intrusion. The JMC will continue to ensure that the ABP is operated and maintained efficiently, economically, and continuously protects the region's groundwater supplies. The replacement of existing injection wells that are beyond their useful operational life as part of Public Works Alamosa Barrier Project Unit 15 Replacement Wells Project will significantly aid in the protection of the region's groundwater resources.

## **PROJECTS AND STUDIES**

Capital improvement projects and studies over this reporting period are briefly summarized below. The general location of each project is identified on the map in Appendix A-12.2.

**Table 1. Capital Improvement Projects and Contracts**

<b>Project Title</b>	<b>Description</b>	<b>Board Award Date</b>	<b>Contractor</b>	<b>Final Contract Amount</b>	<b>Field Acceptance</b>
ABP Unit 15 Replacement Wells	Construction of 5 new injection wells and 2 nested observation wells	11/16/2021	Environmental Construction, Inc.	\$7,170,765.00 [Estimated]	March 2023 [Estimated]
Seawater Barrier Condition Assessment	Assessment of portions of the ABP supply line, appurtenances, and wells	N/A	CH2M Hill (now Jacobs)	TBD	Field work completion: December 2021. Final Report: October 2022

Note: For a full history of improvement projects and contracts on record, please contact LACPW.

### **ABP Unit 15 Injection and Observation Wells**

Construct five new injection wells and two new observation wells to replace and supplement existing ABP facilities located within the Cities of Long Beach and Seal Beach. The five injection wells will be constructed to replace four existing injection wells, which are beyond their useful life and require immediate replacement. In October 2019, LACFCD was awarded grant funding up to \$4,191,693 from the State Water Resources Control Board, Proposition 1 Groundwater Grant to construct these wells and the total estimated cost of the project is \$8,383,386. Project construction began in May 2022 with an anticipated project completion date of March 2023. LACPW and LADWP entered into a 5-year License Agreement for the new wells that are purposed to be constructed on the Haynes Generating Station owned by LADWP. LACPW and LADWP will continue working towards a 30-year license agreement to encompass all ABP facilities located within the Haynes Generating Station.

The ABP Unit 15 Project includes the following:

- Destroy injection well 33W (C,B,A,I) and construct two replacement injection wells, 33W2(C,B) and 33W2(A,I) to provide additional operational flexibility.
- Destroy injection well 34F(A) and construct replacement injection well 34F2(A).
- Destroy injection wells 34H(A) and 34H(I) and construct two replacement wells 34H2(A) and 34H2(I).
- Construct new internodal observation wells 34FG and 34G2H2

#### Seawater Barriers Condition Assessment

This project involves the assessment of all three of LACFCD's Seawater Barriers (Alamitos Barrier Project, Dominguez Gap Project, and West Coast Basin Barrier Project). The project is managed by LACPW and it is funded by LACFCD and OCWD. This project involves the evaluation of 5,764 feet of the ABP supply pipeline, appurtenances, and 11 injection wells. The scope of work was developed during FY 2019-20. CH2M Hill (now Jacobs Engineering Group) was selected from a list of LACPW As-Needed Engineering Consultants in February 2021 and a Notice to Proceed was issued in March 2021. Field work started in May 2021 and was completed in December 2021. The final report is anticipated to be finalized and distributed during the first half of FY 2022-23.

## **INJECTION OPERATIONS**

The total amount of water injected into the ABP during FY 2021-22 was 7,187.8 AF. Of this total, approximately 56 percent (4,023.9 AF) was recycled water and 44 percent (3,163.9 AF) was imported water. The maximum monthly injection during this reporting period was 674.7 AF (44.3 percent imported, and 55.7 percent recycled) which occurred in August 2021. The minimum monthly injection of 509.3 AF (24.8 percent imported, and 75.2 percent recycled) occurred in February 2022, and is directly related to a partial shutdown that occurred in this month. The ABP had two partial shutdowns, which included a 3 week shutdown in September 2021 and a 11-week shutdown beginning in January 2022. The partial shutdown in September 2021 was necessary so that injection wells at 34S and 34V could be assessed during the Seawater Barriers Condition Assessment. The second partial shutdown was related to redevelopment activities at injection well 34V (C/B, A and I Zones) and the retrofit of observation well 34Y0.1. In order to perform redevelopment activities at injection well 34V, a total of 23 injection wells in the vicinity had to be turned off to alleviate artesian conditions. During this period, LACFCD took advantage of the opportunity and retrofitted observation well 34Y0.1 so that chloride sampling can be performed in the future even if the well is under pressure. All ABP injection well shutdowns that occurred during FY 2021-22 are summarized in the table below.

**Table 2. Summary of the ABP Shutdowns**

<b>Shutdown</b>	<b>Startup</b>	<b>Duration (days)</b>	<b>Impacted Portion of ABP</b>	<b>Reason</b>
9/15/2021	10/5/2021	20	34J2 (C/B), 34K (C/B), 34L (C,B,A,I), 34N (C/B), 34N (A), 34N (I), 34Q (C/B), 34Q (A), 34Q (I), 34S (C/B), 34S (A), 34S (I), 34T (C/B), 34T (A), 34T (I), 34V (C/B), 34V (A), 34V (I), 34X (B), 34X (A), 34X (I), 34Z2 (A), 34Z2 (I), 35E (I), and 35F (I)	Seawater Barriers Condition Assessment
01/04/2022	3/22/2022	77	34G (I), 34H (I), 34L (C,B,A,I), 34N (C/B), 34N (A), 34N (I), 34Q (C/B), 34Q (A), 34Q (I), 34S (C/B), 34S (A), 34S (I), 34T (C/B), 34T (A), 34T (I), 34V (C/B), 34V (A), 34V (I), 34X (B), 34X (A), 34X (I), 34Z2 (A), 34Z2 (I), 35E (I), and 35F (I)	Redevelopment of injection well 34V

**Notes:**

\* Routine and/or minor shutdowns of individual wells are not listed here but are included in Figure 3 of the Annual JMC Report and Table 2 for the Semi-Annual Meeting.

Since completion of the Leo J. Vander Lans Advanced Water Treatment Facility (LVL AWTF) expansion in 2014, the LVL AWTF has operated intermittently between 2.5 and 6 million gallons per day (MGD). During FY 2021-22 , the percentage of recycled water delivered to the ABP increased by 6.6 percent. Further details regarding LVL AWTF operations can be found in the *Recycled Water Operations* section of this report.

The injection volumes and costs for FY 2020-21 and FY 2021-22 are shown in Table 3. The representative unit costs included in Table 3 for imported and reclaimed water were calculated by WRD. Table 3 shows that the volume of water injected into the ABP during FY 2021-22 increased by 10.6 percent (686.9 AF) from the previous year. The increase in injection was most likely a result of lower groundwater and increased pumping due to the region receiving below average rainfall and an ongoing drought.

**TABLE 3. INJECTION OPERATIONS**

Imported Water Injections			Recycled Water Injections			Total Injections		
FY20-21	FY21-22	Percent Change From Previous Year	FY20-21	FY21-22	Percent Change From Previous Year	FY20-21	FY21-22	Percent Change From Previous Year

VOLUME OF WATER INJECTED IN ACRE-FEET

OCWD <sup>1</sup>	1,093.3	1,228.1	12.3%	1,498.5	1,475.8	-1.5%	2,591.8	2,703.9	4.3%
WRD <sup>2</sup>	1,634.4	1,935.8	18.4%	2,274.7	2,548.1	12.0%	3,909.1	4,483.9	14.7%
TOTAL	2,727.7	3,163.9	16.0%	3,773.2	4,023.9	6.6%	6,500.9	7,187.8	10.6%

UNIT COST OF WATER PER ACRE-FOOT<sup>3</sup>

JULY - DEC	\$1,203.79	\$1,258.83	4.6%	\$1,203.79	\$1,258.83	4.6%			
JAN - JUN	\$1,237.25	\$1,312.51	6.1%	\$1,237.25	\$1,312.51	6.1%			

COST OF WATER PURCHASED

OCWD <sup>1</sup>	\$1,331,609	\$1,566,785	17.7%	\$1,825,326	\$1,898,513	4.0%	\$3,156,935	\$3,465,298	9.8%
WRD <sup>2</sup>	\$1,993,548	\$2,475,603	24.2%	\$2,775,675	\$3,289,605	18.5%	\$4,769,223	\$5,765,209	20.9%
TOTAL	\$3,325,157	\$4,042,388	21.6%	\$4,601,001	\$5,188,119	12.8%	\$7,926,158	\$9,230,507	16.5%

AVERAGE INJECTION RATE IN CFS

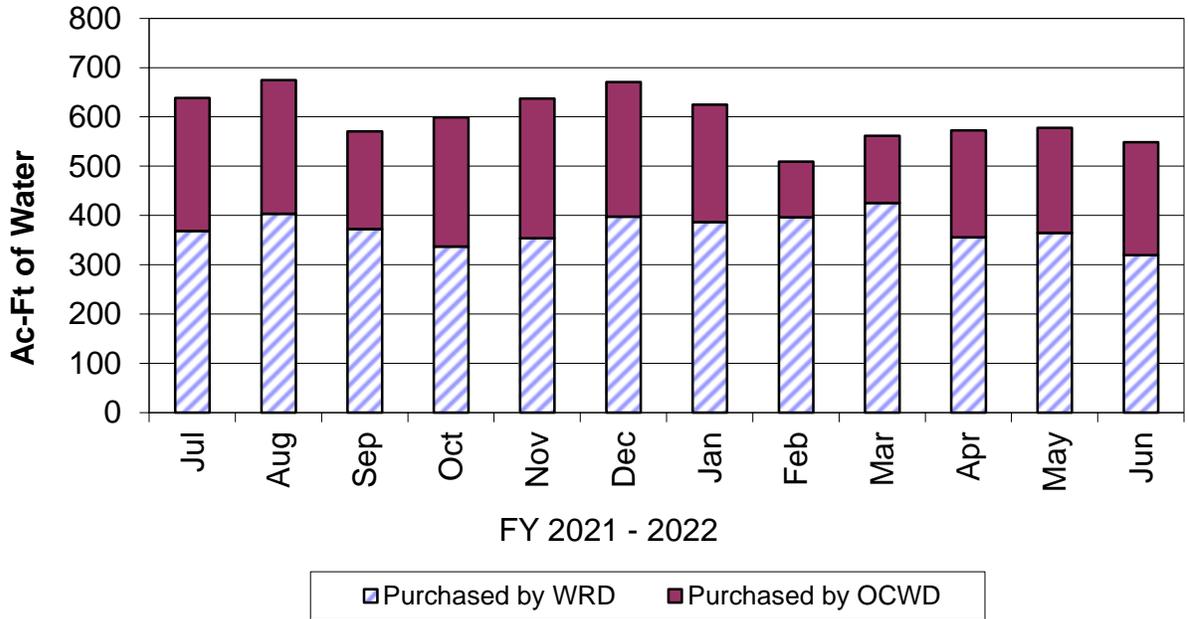
OCWD <sup>1</sup>	1.51	1.70	12.3%	2.07	2.04	-1.5%	3.58	3.74	4.3%
WRD <sup>2</sup>	2.26	2.67	18.4%	3.14	3.52	12.0%	5.40	6.19	14.7%
TOTAL	3.77	4.37	16.0%	5.21	5.56	6.6%	8.98	9.93	10.6%

<sup>1</sup> Orange County Water District (OCWD)

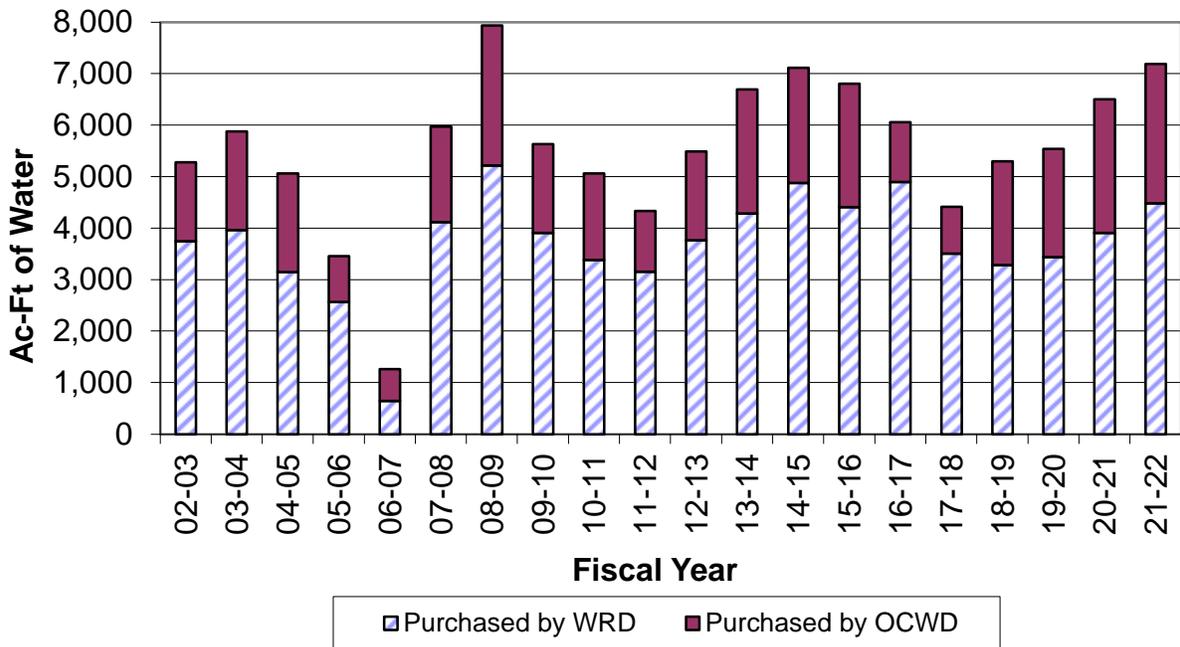
<sup>2</sup> Water Replenishment District of Southern California (WRD)

<sup>3</sup> The Unit Cost of **Imported Water** Per Acre-Foot is the sum of the Metropolitan Water District's wholesale rate at LB-07A (managed by Long Beach Water Department), the \$5 Administrative Surcharge, Readiness-To-Serve (RTS) costs, and Capacity costs (using total volume plus penalties). This amount is greater than what is shown on monthly invoices because Capacity costs are not typically known or accounted for at the time of those invoices. Based on the agreement between the OCWD and the WRD, the representative Unit Cost of **Recycled Water** Per Acre-Foot is equal to that of the imported water and is shown in the calculations by the WRD.

**FIGURE 1 - MONTHLY AMOUNT OF WATER INJECTED**



**FIGURE 2 - ANNUAL AMOUNT OF WATER INJECTED**



## **RECYCLED WATER OPERATIONS**

The LVL AWTF was constructed in 2005 to provide up to 3 million gallons per day (MGD) of advanced treated recycled water to inject at the ABP. The LVL AWTF treatment train consists of Micro-Filtration (MF), Reverse Osmosis (RO), and Ultra-Violet light (UV) disinfection. An expansion project completed in 2014 increased the plant capacity to 8 MGD by adding a recovery MF system and a third stage RO system. The Long Beach Water Reclamation Plant (LBWRP) owned by the Los Angeles County Sanitation Districts (LACSAN) provides recycled water to Long Beach Water Department (LBWD), who in turn provides recycled water to the LVL for advanced treatment.

The LVL AWTF was authorized to deliver up to 3 MGD for injection at the ABP under Regional Water Quality Control Board (RWQCB) Order No. R4-2005-0061 with the condition that the 10-year running average of recycled water contribution does not exceed 50 percent. In conjunction with completion of the plant expansion project, the LVL AWTF was authorized under RWQCB Order No. R4-2014-0111 to inject up to 8 MGD of advanced treated recycled water with no limitation on the percent recycled water contribution running average.

During the reporting period, the LVL AWTF provided a total of 4,023.9 AF of advanced treated recycled water to the ABP at rates between 2.5 MGD to 5.3 MGD. On average the LVL AWTF produced an amount of advanced treated recycled water equivalent to 90 percent of the total water injected into Los Angeles County's portion of the barrier. In addition, the volume of advanced treated recycled water delivered during FY 2021-22 was 6.6% higher than FY 2020-21.

WRD has made significant improvements over the past few years at the LVL AWTF. However, sixty-one (61) plant shutdowns occurred during the reporting period where most of the shutdowns were of short duration. LACPW, WRD, and LVL ATWF Operational Staff continue to have weekly discussions regarding facility operations and how to maximize recycled water delivery while preventing undue stress on the ABP infrastructure, which has been in operation since the mid-1960's.

**MAINTENANCE**

Typical well maintenance at the ABP includes injection well redevelopments and observation well cleanouts. The purpose of injection well redevelopments is to remove accumulated sediments and microbiological build-up within the well casings to restore each well’s ability to operate at its maximum injection capacity. Each of the 60 injection well casings are routinely redeveloped once every two years. During FY 2021-22, LACPW completed redevelopment activities at 22 well casings

**Table 4. Injection Well Redevelopment Program**

33G (A,I)	33J (A,I)	33L (A,I)	33N (A,I)	33Q (A,I)	33Q1 (C,B)
33S (A,I)	33S1 (C,B)	33T (A,I)	33U (A,I)	33U3 (C,B)	34E (C,B)
34E (I)	34F (I)	34G (A)	34J (A)	34J (I)	34J2 (C/B)
34L (C,B,A,I)	34V (C,B)	34V (A)	34V (I)		

Observation well cleanouts are performed on an as-needed basis to clean out accumulated sediments and microbiological build-up within the well casings. LACPW staff performing observation well cleanouts typically rotate between the ABP, Dominguez Gap Barrier Project, and West Coast Basin Barrier Project. During FY 2021-22, LACPW completed cleanout activities at 15 well casings

**Table 5. Observation Well Clean-out Program**

33S 18 (C)	33ST (I)	33T 29 (A)	33W 11 (C)	33W 11 (B)	33W 11 (A)
33W 11 (I)	33X 20 (R)	33X 20 (B)	34LS (I)	33N 21 (A)	34N 21 (I)
34N '7 (A)	34T0.1 (B)	34T0.1 (I)			

Figure 3 depicts the operating status of each injection and extraction well during FY 2021-22. The ABP was in operation throughout the entire reporting period, except when the ABP was partially shutdown in the months of September 2021 and partial shutdown that began in January 2022 and ended in March 2022.

### Wells West of the San Gabriel River

Injection well 33W has suffered from surface leakage intermittently after being struck by an automobile in 2003 and a subsequent sink hole developed in 2007. LACPW staff installed a packer in June 2016, just above the perforations to isolate the injection zone, and the well operated at normal injection rates and pressures until November 2017, when the well started to exhibit surface leakage again. Injection well 33W has operated at a minimal flowrate, between 0.10 cfs and 0.15 cfs since that time. This well is slated to be replaced during the upcoming ABP Unit 15 Well Replacement Project. Injection well 33S1, also located west of the San Gabriel River, continues to operate at a limited flow due to potential surface leakage.

### Wells East of the San Gabriel River

Injection well 34G(A) has historically experienced surface leakage issues. The area around the well was grouted in 2000 and 2004 to prevent surface leakage, which seemed to resolve the issue until 2016. In July 2016, a packer was installed due to reoccurring surface leakage. The goal of the packer was to direct the water below the poor casing welds, which were suspected of being the cause of the surface leakage. The well was turned off in 2019 due to reoccurring surface leakage. However, injection was resumed in December 2021 at a reduced rate and no signs of surface leakage have since been reported.

Excessive fill was observed during redevelopment of injection well 34H (I) in May 2014. Video inspection revealed a hole near the top of the perforations at 403 feet bgs. Since this well has a 6-inch casing, a sleeve cannot be installed to cover the hole. The well was put back into service at a lower injection rate due to the hole. It should be noted that injection well 34H (A) has been offline since Spring 2015 because it also has a hole that is not repairable, and the casing is filled with sediment and cannot take water. Injection wells 34H (A) and 34H (I) are slated to be replaced during the ongoing ABP Unit 15 Well Replacement Project.

In order to redevelop injection well 34V, LACPW staff turned off 23 nearby injection wells (partial shutdown) in an effort to reduce ground water levels. To prevent partial shutdowns of this sort in the future, LACPW is investigating a wellhead modification project that aims to modify these wells into a “self-juttering” well to allow these wells to undergo airlift redevelopment without the need to disassemble the wellhead. Project benefits include cost and time savings related to maintaining an effective seawater barrier by eliminating the need for partial shutdowns.

Injection well 35G (A) was constructed in 1991 and injected into the A and I Zone until 2013, when a redevelopment swab became lodged at a depth of 100-feet, in the blank section between the A and I Zone perforations. As a result, the well was still operational, but could only inject into the A Zone and on February 25, 2020, this well was turned off due to the vault filling up with water. Well 35G (A) was one of the 11 ABP injection well casings that were included in the Seawater Barriers Condition Assessment.

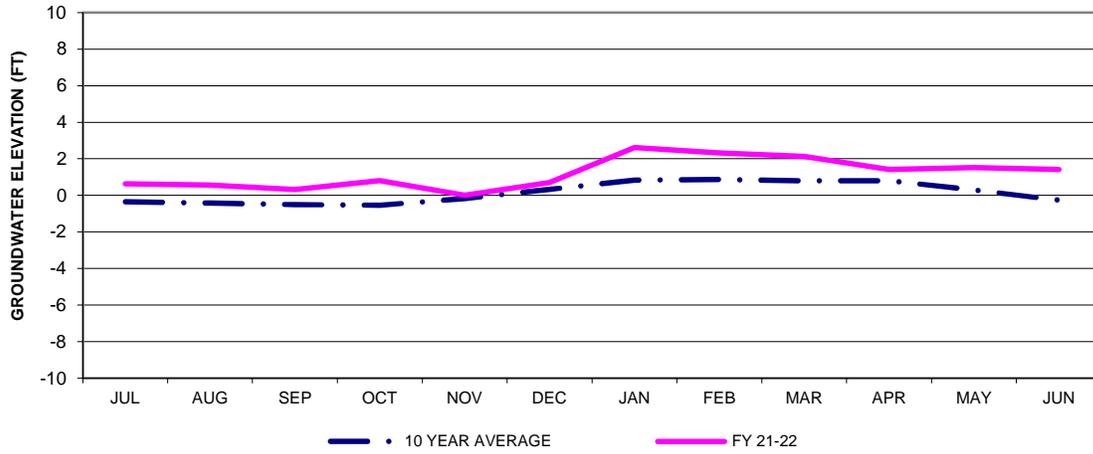


## **HYDROGEOLOGIC EFFECTS**

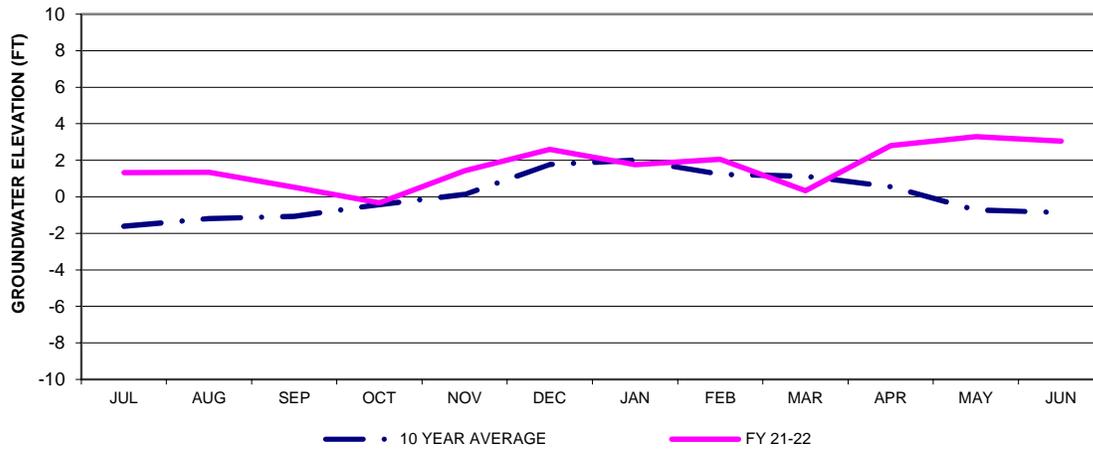
Figures 4 through 8 (pp. 16-20) show the average monthly groundwater elevation relative to the average groundwater elevation of the 10 preceding years (FY 2011-12 to FY 2021-22) in the vicinity of the ABP alignment in the R, C, B, A, and I Zones, respectively. Two graphs were created for each aquifer to account for changes in groundwater elevation trends along two portions of the ABP alignment: wells west of the San Gabriel River and wells east of the San Gabriel River. It is important to note that the 10-year average does not represent a groundwater elevation goal, nor does it specifically reflect the performance of the ABP, but is simply included for comparison purposes. The graph includes all available semi-monthly, monthly, semi-annual, and annual data for wells within the ABP alignment and landward for approximately 2,000 feet from the ABP. As a result, semi-monthly values are “weighted” more heavily than the annuals in the calculation of the monthly average. Also, the months of September 2021 and March 2022 consistently have lower values than preceding and succeeding months due to the fact that semi-annual and annual water levels are measured during these months.

As shown in the graphs, groundwater elevations along the entire ABP were generally above historical averages. Lower groundwater levels during the months September to October 2021 and January to March 2022 were the direct result of the two partial shutdowns to support the Seawater Barriers Condition Assessment and redevelopment of injection well 34V, as mentioned above. Groundwater elevations west of the San Gabriel River were generally below the 10-year historical average for the first half of the fiscal year, (i.e., July – December). For the latter half of FY2021-22, groundwater levels were generally above the 10-year historical average. Groundwater elevations east of the San Gabriel River were generally above the 10-year historical average for the fiscal year. The two significant drops in groundwater levels for all zones are related to the partial shutdowns that occurred east of the San Gabriel River.

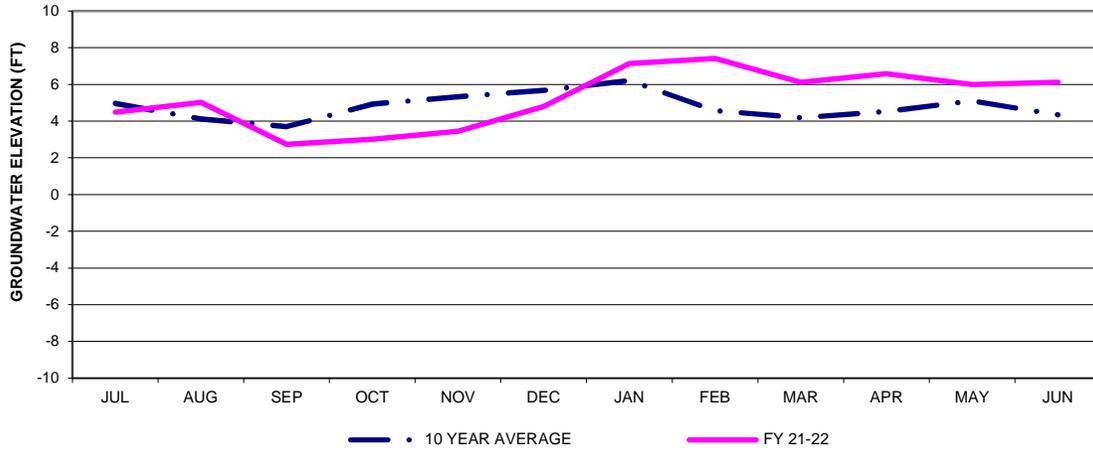
**FIGURE 4a RECENT ZONE WEST OF THE SAN GABRIEL RIVER**



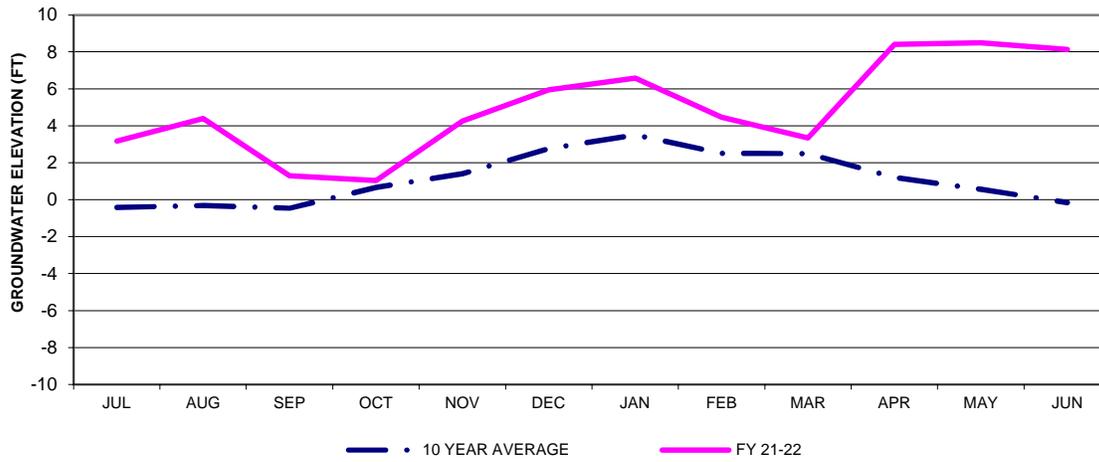
**FIGURE 4b RECENT ZONE EAST OF THE SAN GABRIEL RIVER**



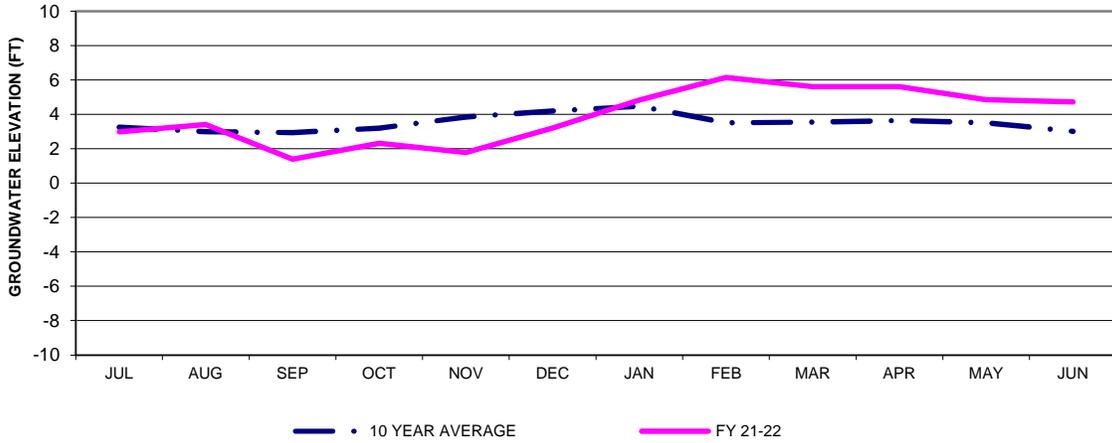
**FIGURE 5a C-ZONE WEST OF THE SAN GABRIEL RIVER**



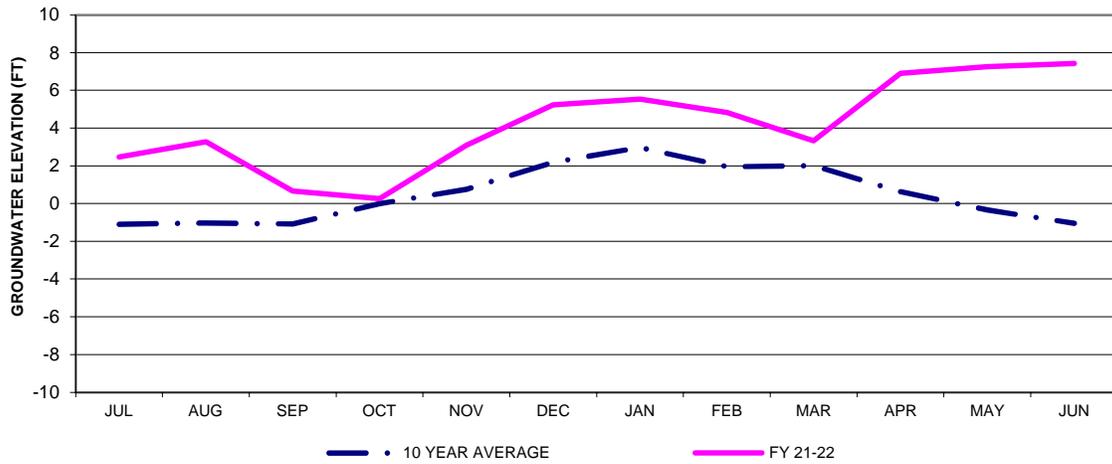
**FIGURE 5b C-ZONE EAST OF THE SAN GABRIEL RIVER**



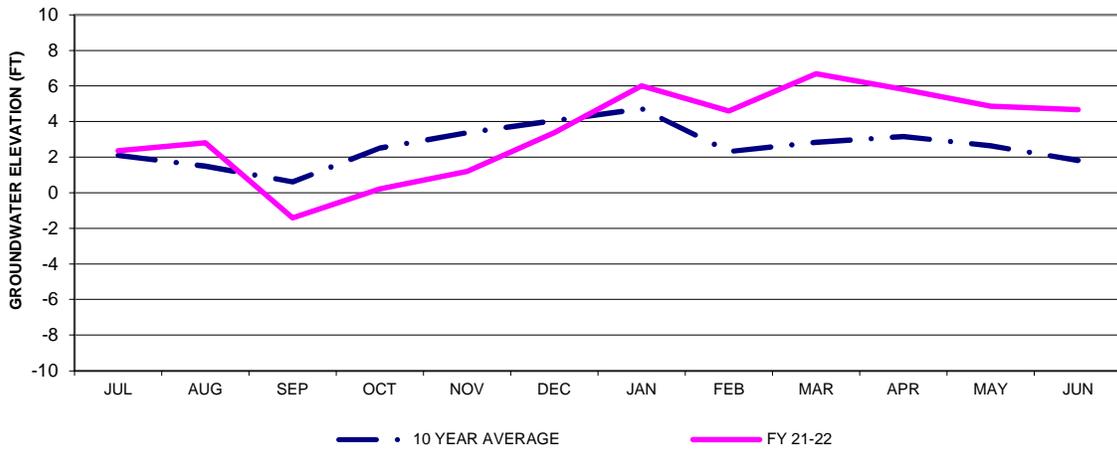
**FIGURE 6a B-ZONE WEST OF THE SAN GABRIEL RIVER**



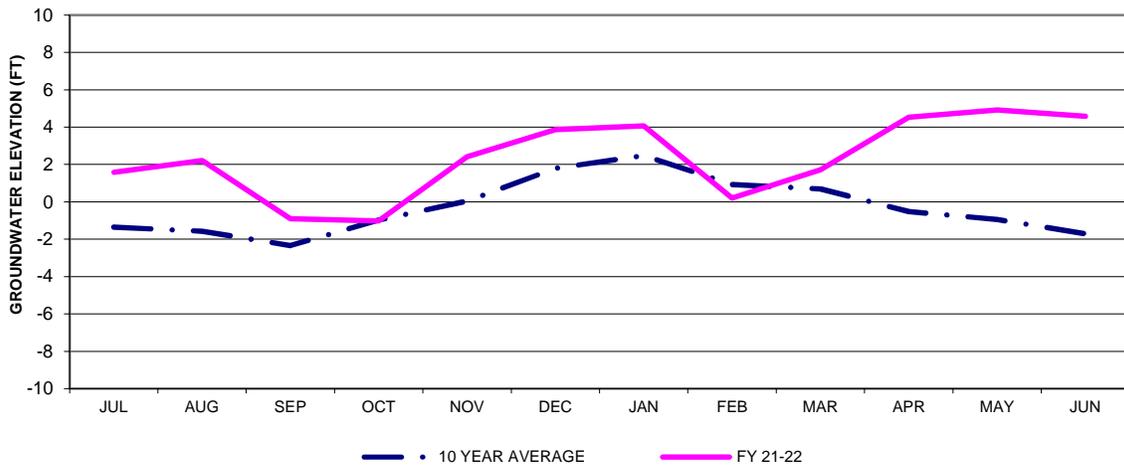
**FIGURE 6b B-ZONE EAST OF THE SAN GABRIEL RIVER**



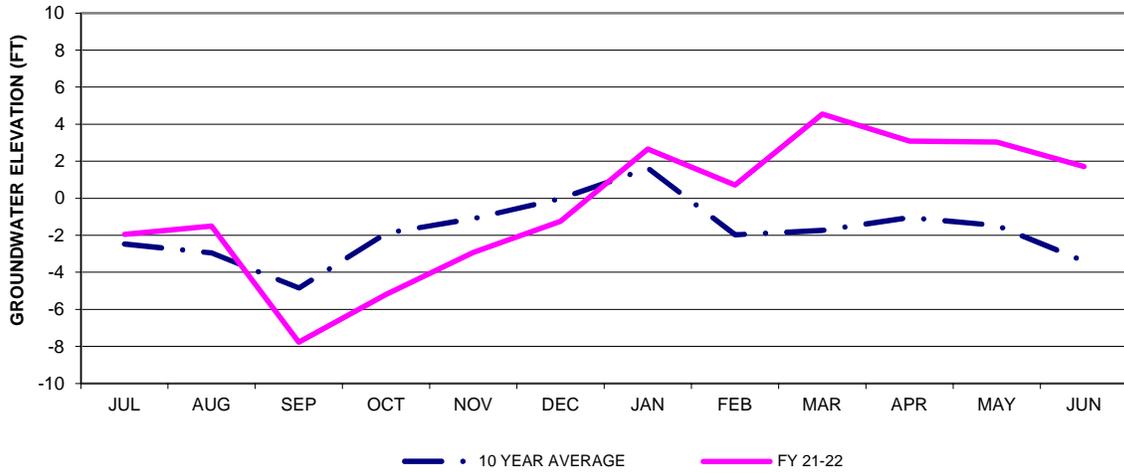
**FIGURE 7a A-ZONE WEST OF THE SAN GABRIEL RIVER**



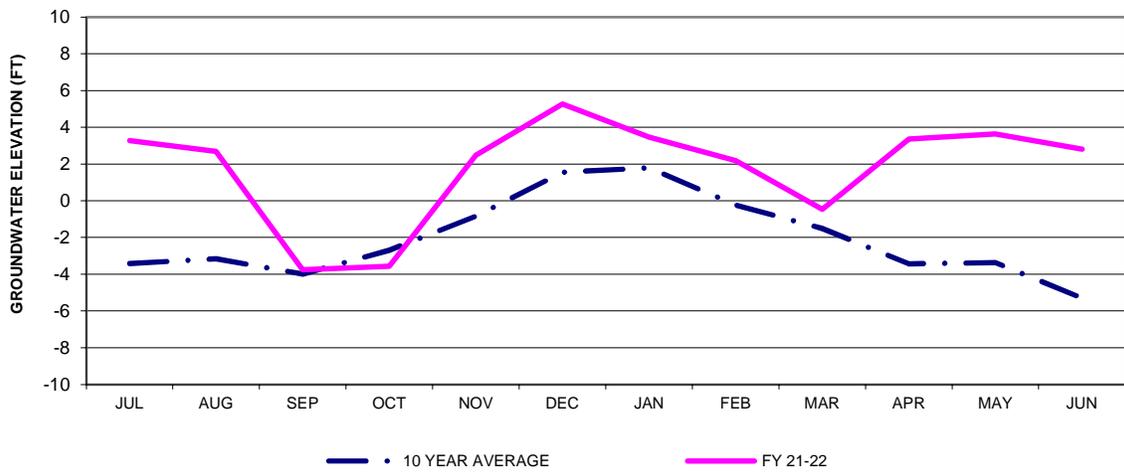
**FIGURE 7b A-ZONE EAST OF THE SAN GABRIEL RIVER**



**FIGURE 8a I-ZONE WEST OF THE SAN GABRIEL RIVER**



**FIGURE 8b I-ZONE EAST OF THE SAN GABRIEL RIVER**



Groundwater elevation contours for the R, C, B, A, and I Zones have been prepared from data collected in Spring 2022 and are included in Appendix A-1.1, 2.1, 3.1, 4.1, and 5.1. In general, the contours show that the groundwater levels were the highest near the ABP alignment, and typically decrease moving landward. The general shapes of each contour are similar to the previous year and some similar groundwater mounds are seen around certain injection wells. Areas historically having higher groundwater elevations in the C and B Zones, especially near the bend in the ABP alignment near the San Gabriel River, continue to have higher groundwater elevations than their surroundings. Other areas of historically elevated groundwater levels in the C and B Zones (e.g., near well 33XY and 33YZ) remained relatively constant when compared to the same time last year. This can be attributed to the fact the nearby injection wells are screened across all four aquifers and they over inject into C and B Zones, and under inject into A and I Zones.

Contours of changes in groundwater elevations for the R, C, B, A, and I Zones between Spring 2021 and Spring 2022 are shown in A-1.2, 2.2, 3.2, 4.2, and 5.2. The data set is based on available data from Spring 2021, which was then subtracted from the corresponding and available data from Spring 2022 (shown in A-1.3, 2.3, 3.3, 4.3, and 5.3). These contours clearly identify increases and decreases in groundwater elevations from one reporting period to the next. In general, groundwater elevations remained relatively unchanged from the previous reporting period with the exception of localized decreases in all zones near injection well 34V, which was due to the partial shutdown for redevelopment. Below is a brief summary and discussion of each aquifer zone:

- R Zone:
  - Groundwater elevations west of the San Gabriel River remained under 2.0 feet above sea level. Along the north-south alignment groundwater elevations ranged from -1.0 to 4.0 feet.
  - Compared to last year, groundwater elevations along the eastern and western alignment remained relatively unchanged, with an exception at observation wells 34F5 and 34N'7, which increased by 3.9 and 2.9 feet, respectively.

- C Zone:
  - Groundwater elevations along the western alignment were between 2.0 and 14.2 feet above sea level, with the highest elevations at observation wells 33XY and 33YZ. East of the San Gabriel River groundwater elevations along the ABP alignment were observed to be consistently above 4.0 feet, with the highest at observation well 34DG at 10.8 feet. Groundwater levels across the ABP alignment for this zone were between 8.8 feet and -3.0 feet below the protective elevation.
  - Compared to last year, groundwater elevations west of the San Gabriel River generally increased by 1.0 foot, with a 1.0 foot decrease at observation well 33U'0.5. East of the San Gabriel River, from observation wells 34DG to 34L'1, groundwater levels generally remained unchanged, with an exception at observation well 34F5, which increased by 7.8 feet. Groundwater levels south of observation well 34L'1 generally decreased, with some locations decreasing over 5.0 feet.
  
- B Zone:
  - Groundwater elevations along the ABP alignment were generally between 3.0 and 11.0 feet above sea level feet with the highest groundwater elevation of 13.3 feet at well 34DG. Groundwater levels at internodal observation wells ranged from 6.7 feet above to -2.9 feet below the protective elevation.
  - Compared to last year, groundwater levels west of the San Gabriel River generally remained the same with increases and decreases by no more than 1.0 foot. East of the San Gabriel River, groundwater levels in observation wells 34DG and 34JL decreased 2.0 feet and 3.0 feet, respectively. At observation wells 34LS and 34T0.1, decreases in groundwater levels were about 5.0 feet.

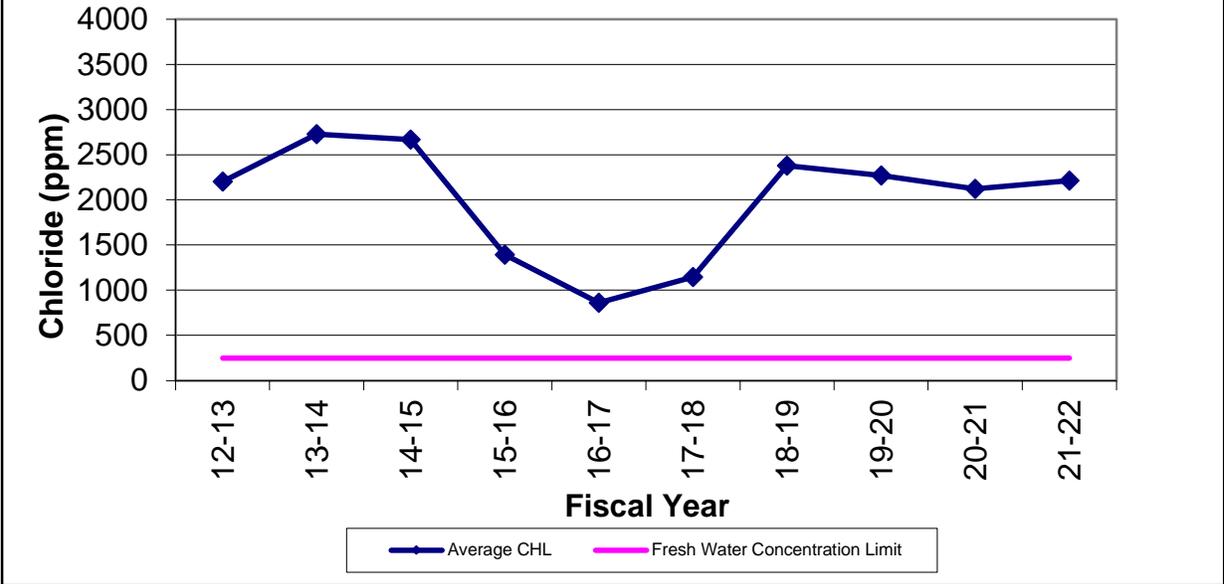
- A Zone:
  - Groundwater elevations along the ABP alignment between 33GJ and 34S0.1 were generally 4.0 to 12.0 feet above sea level. Groundwater elevations west of the San Gabriel River were observed to be at least 3 feet above the protective elevation at internodal observation wells. Groundwater levels east of the San Gabriel River were between 1.5 and 3.2 feet below the protective elevation, except observation well 35H11.
  - Compared to last year, groundwater elevations generally increased 1.0 to 3.5 feet west of the San Gabriel River. East of the San Gabriel River, groundwater elevations decreased 0.5 to 6.0 feet.
  
- I Zone:
  - West of the San Gabriel River, groundwater elevations were observed to be 1.0 to 12.0 feet above sea level. Groundwater elevations east of the San Gabriel River were 4.0 to 11.0 feet above sea level. Groundwater levels were above protective elevations at wells from observation wells 33GJ to 33UV, 34LS, 34S0.1, and 35E0.1.
  - Compared to last year, groundwater elevations generally remained unchanged from observation wells 33GJ to 33UV. Ground water elevations at observation wells 33WX, 33XY, and 33YZ had increase of over 5.0 feet. East of the San Gabriel River, groundwater elevations increased 2.0 to 7.0 feet at observation wells 34DG to 34LS and decreased 4.0 to 11.0 feet between observation wells 34S0.1 to 34Y0.1.

Graphs showing the average, maximum and minimum groundwater elevations at each internodal observation well throughout FY 2021-22 are included in Appendix A-13 through A-16. As shown in the graphs for the C and B Zones, the average groundwater elevations were above protective elevation at many wells along the ABP. For the A and I Zones, the average groundwater elevations were below the protective elevation for many wells along the ABP for this reporting period. A comparison of FY 2021-22 graphs with FY 2020-21 graphs indicate that average elevations generally increased slightly in the C and B Zone, while the average elevations in the A and I Zones remained relatively unchanged between the two reporting periods. LACPW will look to ensure that groundwater water levels are at or above protective elevations when possible to prevent saltwater intrusion.

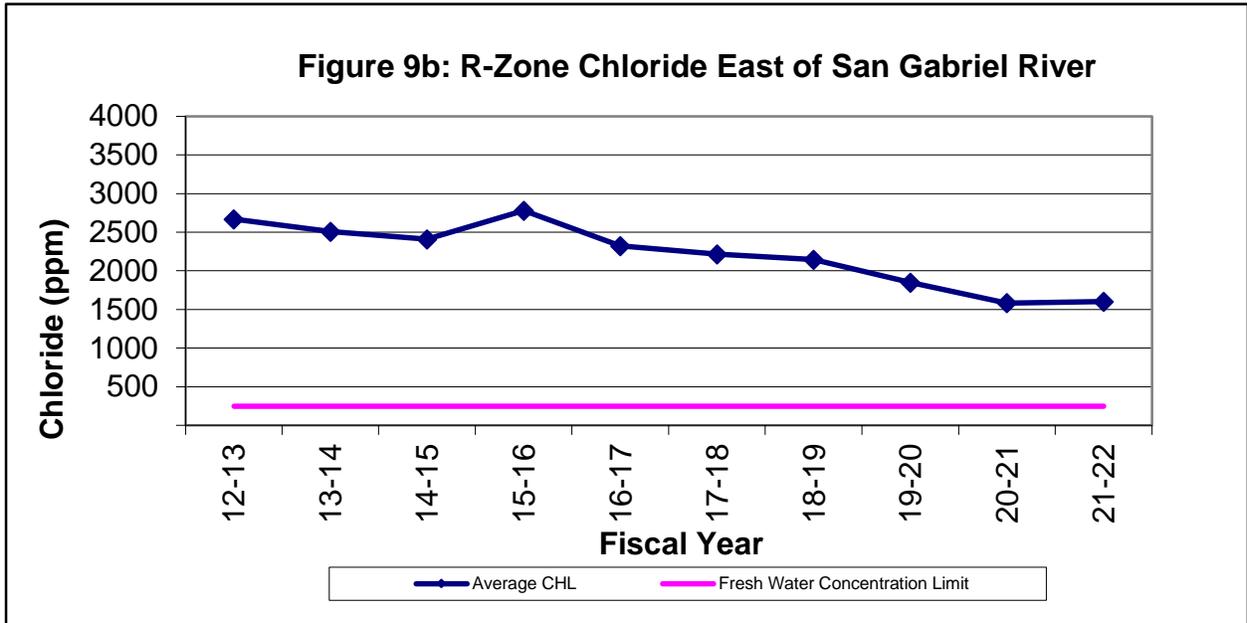
## **CHLORIDES**

Figures 9a through 13b (pp. 26-30) show the historical chloride concentrations in each individual aquifer zone. The graphs plot the average of every maximum value measured at each observation well during each sampling event within the target area throughout FY 2021-22. The data includes all available information from the annual and semi-annual chloride sampling events for wells within the ABP alignment and landward for approximately 2,000 feet from the ABP. As a result, the semi-annual values are “weighted” more heavily than the annuals in the calculation of the annual average. Two sets of graphs were created for each aquifer to account for changes in chloride concentration trends in the areas to the west and east of the San Gabriel River, respectively. In each figure, the average of the maximum chloride concentrations per well per event over the last 10 fiscal years (including FY 2021-22) is shown with respect to the freshwater condition (250 mg/L).

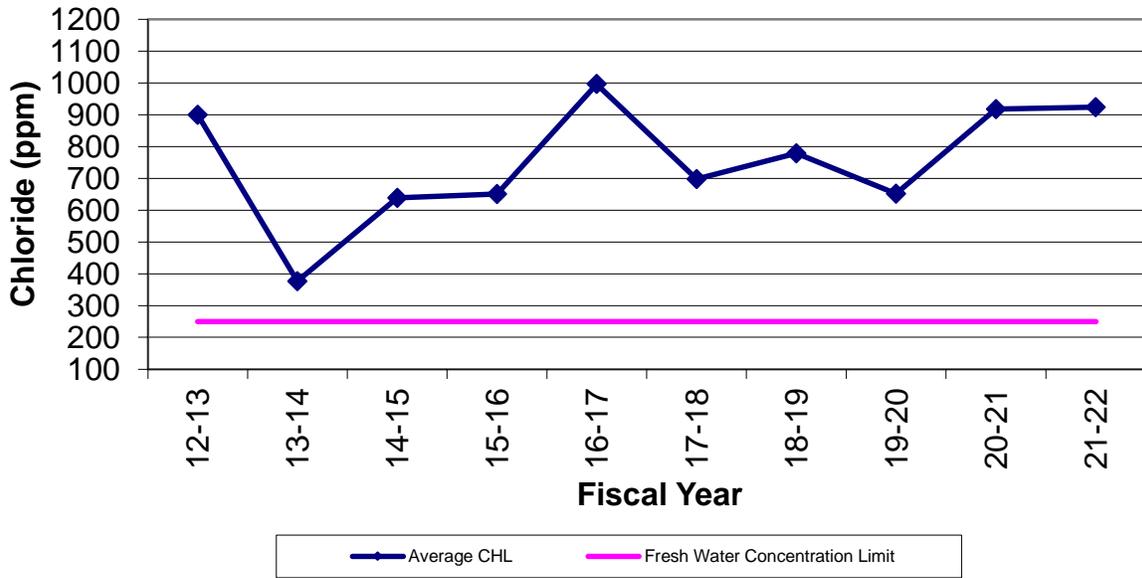
**Figure 9a: R-Zone Chloride West of San Gabriel River**



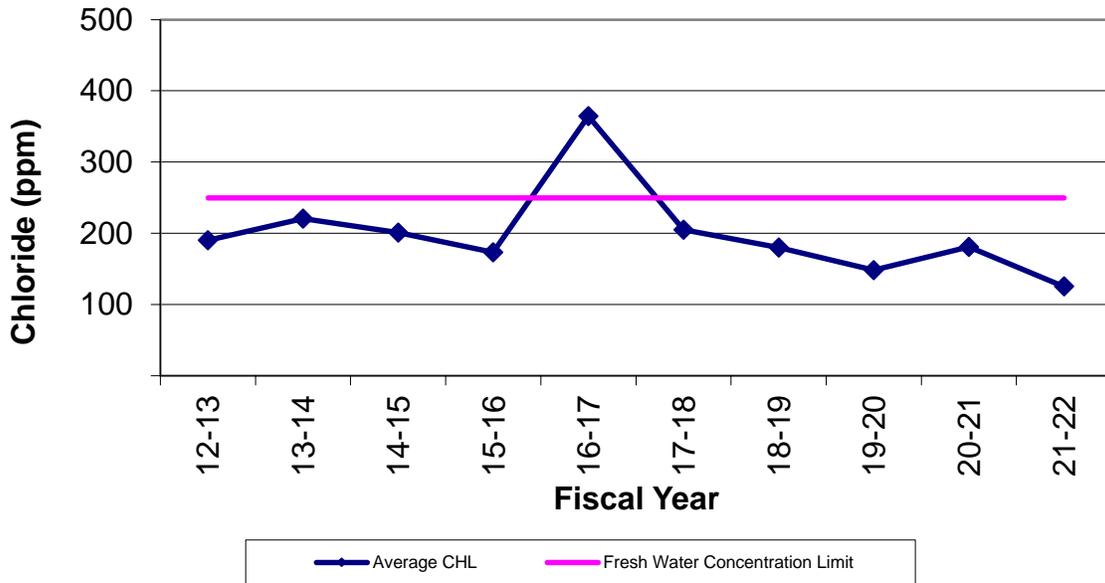
**Figure 9b: R-Zone Chloride East of San Gabriel River**



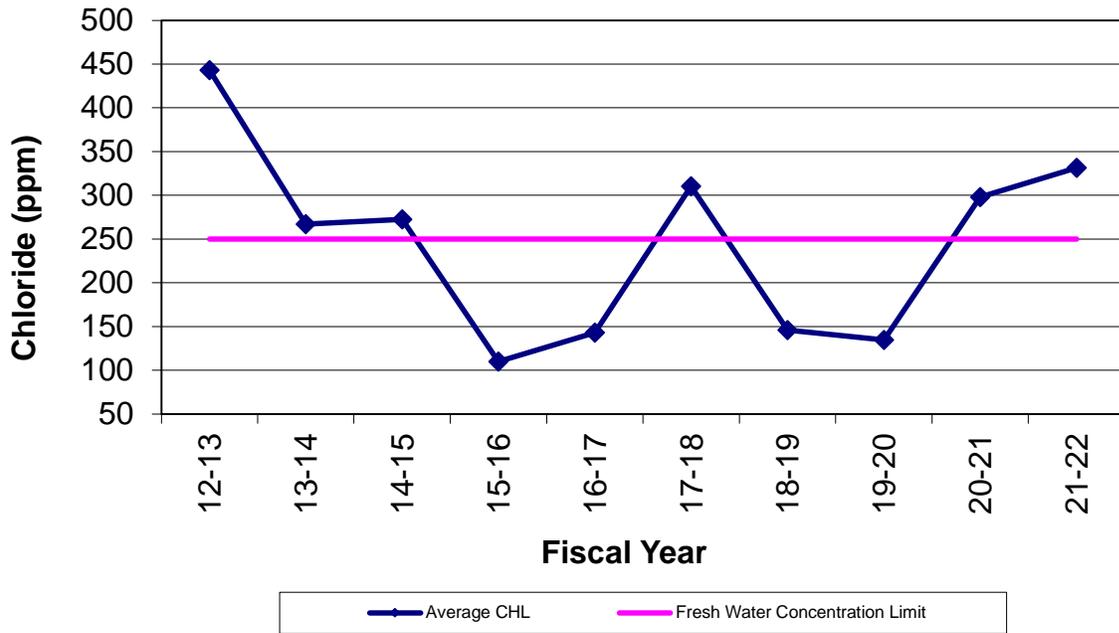
**Figure 10a: C-Zone Chloride West of San Gabriel River**



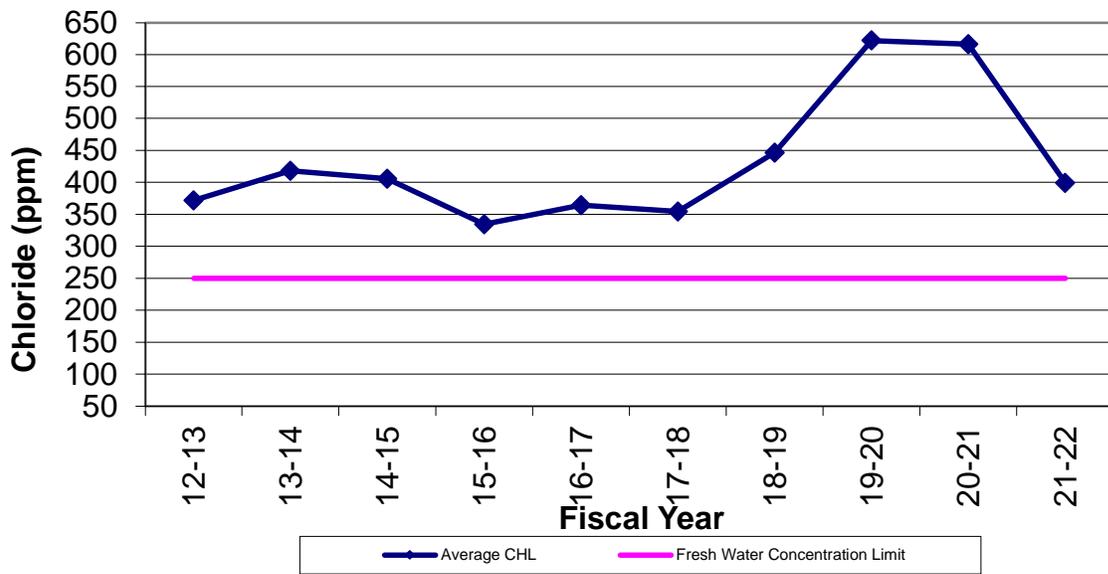
**Figure 10b: C-Zone Chloride East of San Gabriel River**



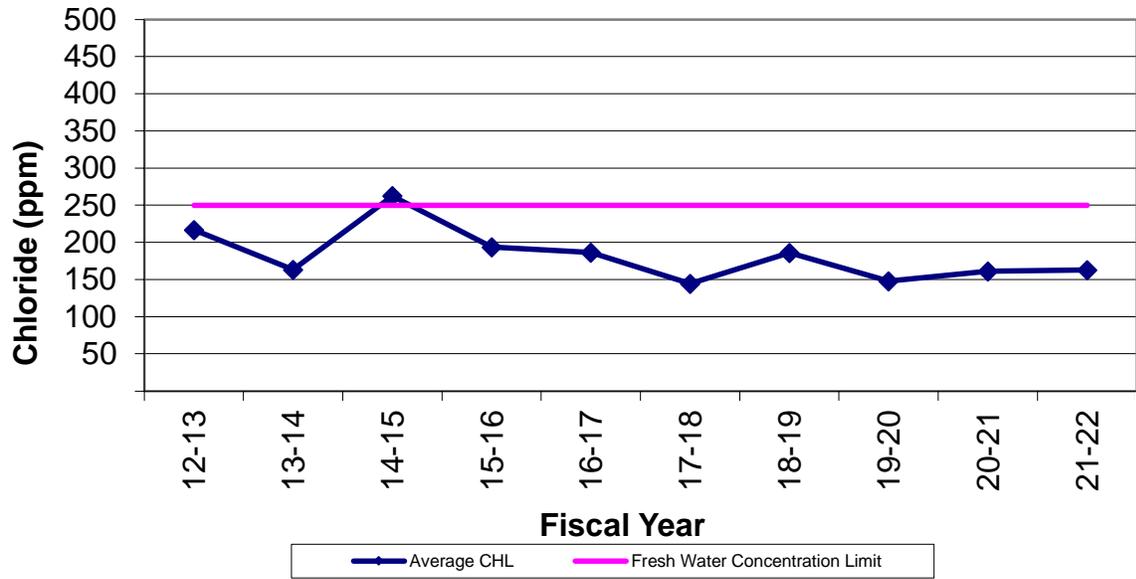
**Figure 11a: B-Zone Chloride West of San Gabriel River**



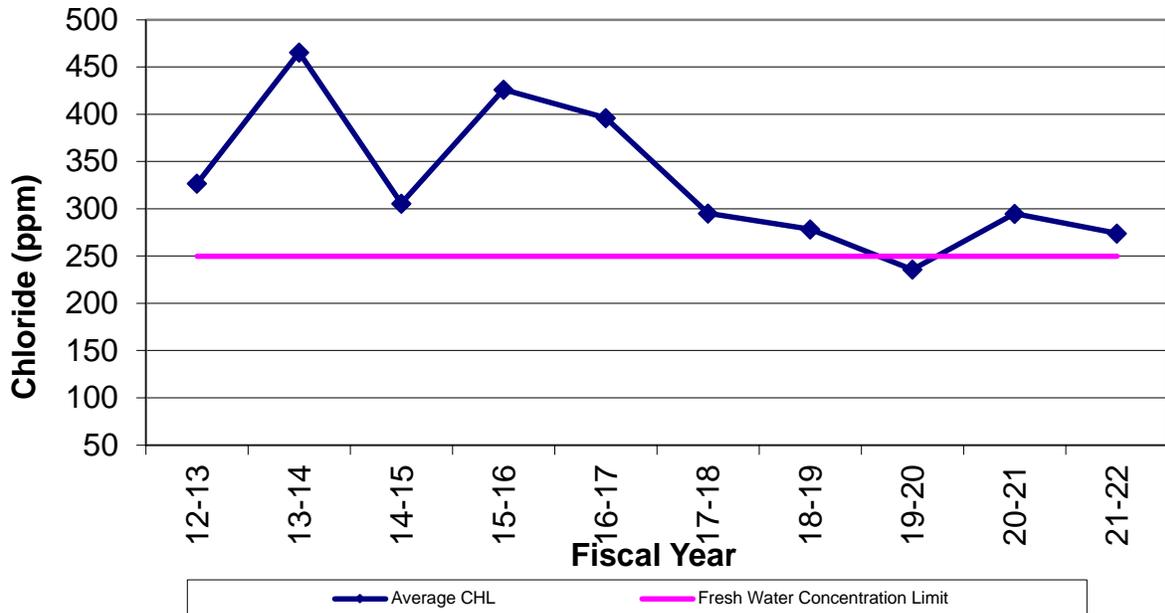
**Figure 11b: B-Zone Chloride East of San Gabriel River**



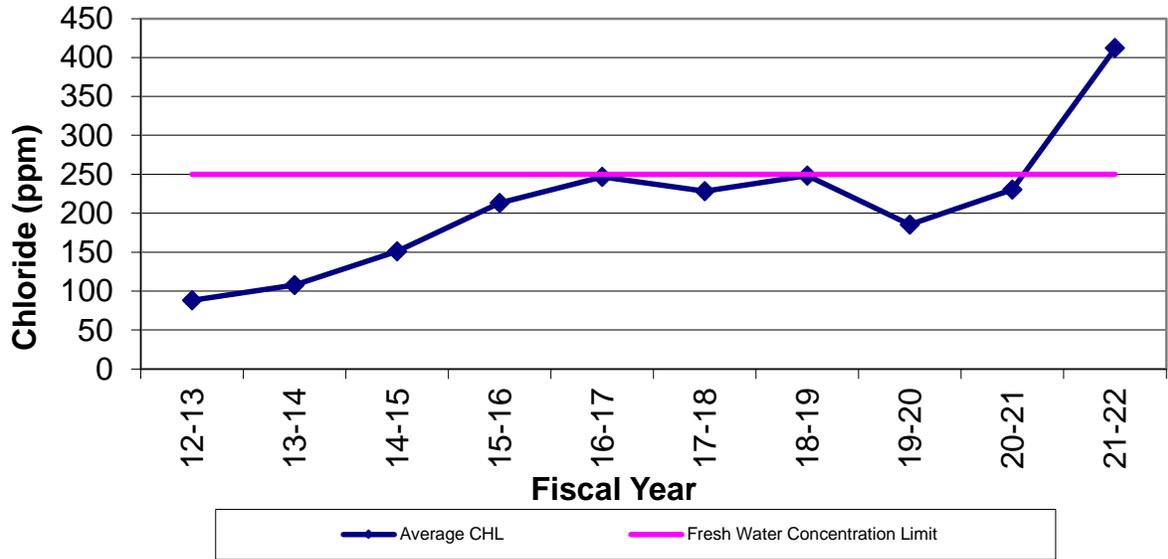
**Figure 12a: A-Zone Chloride West of San Gabriel River**



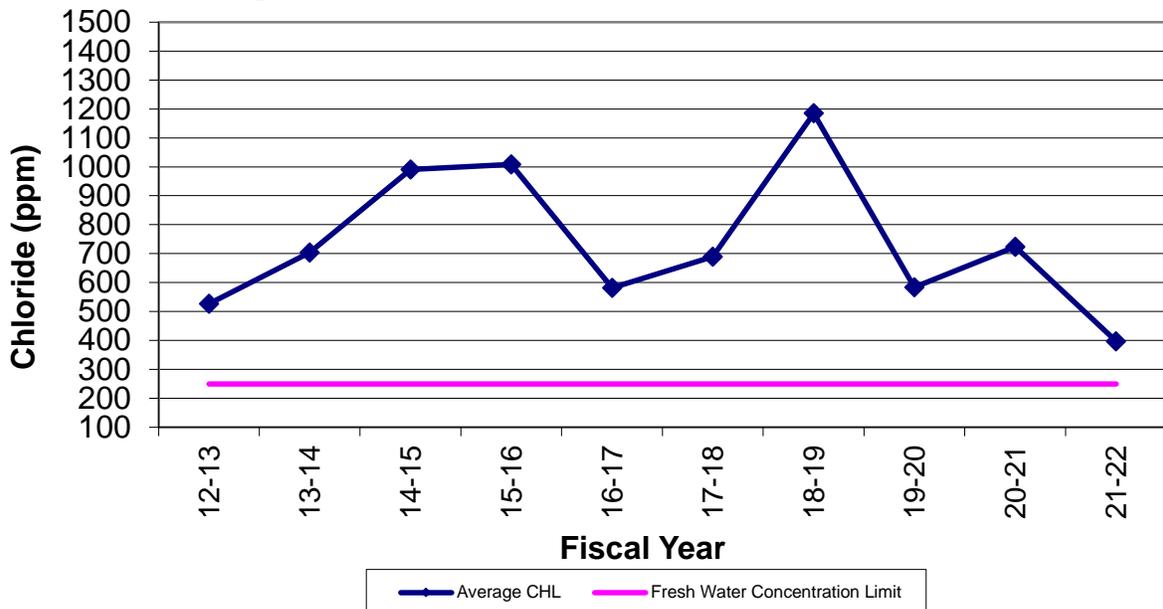
**Figure 12b: A-Zone Chloride East of San Gabriel River**



**Figure 13a: I-Zone Chloride West of San Gabriel River**



**Figure 13b: I-Zone Chloride East of San Gabriel River**



West of the San Gabriel River, average maximum chloride concentrations increased in all Zones. The increases in chlorides were minimal, with the R Zone and I Zone having the largest increases of 92 and 182 mg/L, respectively. An increase of chlorides at observation wells 33XY and 33X20 contributed to the overall increase in chlorides for the I Zone.

East of the San Gabriel River, average maximum chloride concentrations decreased significantly in all zones, except for the R Zone, which had a slight increase of 18 mg/L.

Chloride concentration contour maps for the R, C, B, A, and I Zones have been prepared from data collected in the Spring of 2022 and are included in Appendix A-6.1, A-7.1, A-8.1, A-9.1, and A-10.1, respectively. The I Zone chloride concentration map (A-10.1) was further analyzed and interpreted by OCWD Hydrogeologists as it pertains to chlorides east of the San Gabriel River. The chloride contour maps are based on the maximum chloride concentration (mg/L) measured at each observation well. Chloride data was gathered from observation wells located within the immediate vicinity of the ABP and does not represent basin-wide conditions for the groundwater basin protected by the ABP. Wells with chloride concentrations of 250 mg/L or less were considered fresh. The chloride measurements used in this report were taken during the semi-annual sampling event between March and April 2022, and the annual event in February and March 2022.

Contours of **changes** in chloride concentration for the R, C, B, A, and I Zones between Spring 2021 and Spring 2022 are shown in Appendices A-6.2, A-7.2, A-8.2, A-9.2, and A-10.2. The data set is based on available data for Spring 2021, which was then subtracted from the corresponding data for Spring 2022. These contours very clearly identify areas where chloride concentrations increased and decreased between these two reporting periods.

The chloride concentration contours for FY 2021-22 are similar in shape and pattern to those of the previous year. The current contours and the corresponding chloride concentration cross-section (A-11) for this reporting period indicate that intrusion of

seawater across the ABP continued to be controlled west of the San Gabriel River. East of the San Gabriel River, several areas recorded elevated chloride concentrations indicating potential seawater intrusion.

- R Zone:
  - Chloride concentrations remained elevated landward and seaward of the ABP.
  - Along the ABP alignment from observation well 33Z'1 to 34S0.1, chloride concentrations decreased by 300 mg/L. The rest of the alignment generally had little to no change in chloride concentrations.
  
- C Zone:
  - Chloride concentration along the ABP alignment remained at or just below 250 mg/L. Persistent chlorides remained north of the western alignment near observation wells 33S18 and 33T13. East of the San Gabriel River, chloride concentrations remained below 250 mg/L.
  - Compared to the last reporting period, chloride concentrations in this zone remained relatively unchanged. A decrease of 80 mg/L was observed at observation well 34T0.1. An increase of over 600 mg/L was measured at observation well 33S18.
  
- B Zone:
  - Much of the chloride concentrations along the ABP alignment remained below 250 mg/L. Elevated chlorides remain at observation wells 33Q15 and 34U8 which had chloride concentrations of 6,200 mg/L and 2,900 mg/L, respectively.
  - Compared to the last reporting period, chloride concentrations along much of the ABP alignment were observed to have mostly decreased. The largest increases of over 500 mg/L were observed at observation wells 33Q15 and 34U8, located landward of the ABP.

- A Zone:
  - Along the ABP alignment, chloride concentrations generally were below 250 mg/L, with the exception of observation wells 34DG, 35E0.1, and 35H12, which had concentrations of 1,700 mg/L, 2,000 mg/L, and 700 mg/L, respectively.
  - Chlorides remain generally unchanged from the last reporting period for most of the ABP alignment with the exception of observation wells 34HJ which had a decrease of 880 mg/L. An increase of 1,922 mg/L was observed at observation well 35E0.1 and decrease of over 2,000 mg/L was observed at observation well 34U8.
  
- I Zone:
  - Chloride concentrations remained below 250 mg/L along the ABP alignment with the exception of observation wells 34T0.1 and 35E0.1, which had chloride concentrations of 1,900 mg/L and 2,000 mg/L, respectively.
  - West of the San Gabriel River, chloride concentrations generally remained unchanged, except for 33XY, which had an increase of 700 mg/L. East of the San Gabriel River, significant decreases occurred at 34JL and 34S0.1 which had chloride concentrations reductions of 3,911 mg/L and 1,270 mg/L, respectively. Increases occurred at observations wells 34T0.1 and 35E0.1 by 1,805 mg/L and 1,410 mg/L, respectively

Persistent elevated chloride concentrations remain north of the western alignment near observation wells 33S 18 and 33T13 in the C and B Zones and near observation well 33X20 for the I Zone. East of the San Gabriel River, high chlorides at observation well 34X40 in the I Zone are on a decline. A possible reason for the high chloride concentrations near observation well 34X40 could be remaining seawater from previous intrusions. The increase in chlorides at observation well 34U8 in the B Zone may be related to the reduction in injection at adjacent wells in order to perform redevelopment activities at injection well 34V mentioned above in this report. LACPW will look to ensure

that groundwater levels are at or above protective elevations when possible to prevent saltwater intrusion.

### **BARRIER PROJECT COSTS**

This section of the report is divided into four parts: Water Costs, Services and Supplies Costs (operation and maintenance), Fixed Assets Costs (capital outlay), and Budget. Under the terms of the 1964 Cooperative Agreement between LACFCD and OCWD, fixed assets are typically divided into facilities paid for by the LACFCD, facilities paid for by the OCWD, and joint facilities paid for by both agencies, depending on their location. Under the same agreement, water costs are divided between the LACFCD (whose portion is paid by the WRD per a separate agreement) and the OCWD. The total cost of the ABP in FY 2021-22 was \$12,311,591 which can be broken down as follows: water costs of \$9,230,507, Operation and Maintenance costs of \$3,005,487 and joint liability insurance cost of \$76,234.

## WATER COSTS

During FY 2021-22, 7,187.8 AF of water was injected at an estimated total cost of \$9,230,507, as shown in Table 6. The monthly unit water cost (dollars per AF) from July 2021 to June 2022 varied periodically as shown above in Table 3. The monthly quantity of water injected and total water costs paid by each agency are shown below in Table 6.

**TABLE 6. QUANTITY OF WATER INJECTED AND COSTS**

<b>MONTH</b>	<b>VOLUME BY WRD (AF)</b>	<b>VOLUME BY OCWD (AF)</b>	<b>TOTAL VOLUME (AF)</b>
Jul-21	369.0	269.4	638.4
Aug-21	403.5	271.2	674.7
Sep-21	372.6	198.5	571.1
Oct-21	337.4	261.9	599.3
Nov-21	354.0	283.3	637.3
Dec-21	398.1	273.0	671.1
Jan-22	386.9	238.5	625.4
Feb-22	396.3	113.0	509.3
Mar-22	425.9	135.7	561.6
Apr-22	355.6	217.2	572.8
May-22	365.1	213.1	578.2
Jun-22	319.5	229.1	548.6
<b>TOTAL INJECTED</b>	<b>4,483.9</b>	<b>2,703.9</b>	<b>7,187.8</b>
<b>TOTAL COST (\$)</b> [From Tbl. 3]	<b>\$5,765,209</b>	<b>\$3,465,298</b>	<b>\$9,230,507</b>

## OPERATIONS AND MAINTENANCE COSTS

A total of \$3,081,721 was spent on Operations and Maintenance during FY 2021-22. Pursuant to the 1964 Cooperative Agreement, the OCWD pays a percentage of the applicable services and supplies costs for injection operations proportional to the percentage of the total amount of injection water paid for by the OCWD. The distribution of FY 2021-22 services and supplies costs is summarized in Table 7.

**TABLE 7. DISTRIBUTION OF SERVICES AND SUPPLIES COSTS FOR  
INJECTION AND EXTRACTION ACTIVITIES**

ITEM	LACFCD	OCWD	TOTAL
Service & Supplies of Injection Facilities (including Observation Wells)	\$1,499,280	\$904,182	\$2,403,462 <sup>1</sup>
Service & Supplies of Extraction Facilities	\$2,847	\$0	\$2,847 <sup>2</sup>
Special Projects	\$563,636	\$35,542	\$599,178 <sup>3</sup>
<b>SUBTOTAL</b>	<b>\$2,065,763</b>	<b>\$939,724</b>	<b>\$3,005,487</b>
Liability Insurance	\$38,117	\$38,117	\$76,234
<b>TOTAL</b>	<b>\$2,103,880</b>	<b>\$977,841</b>	<b>\$3,081,721</b>

The values in Table 3 come from the ABP FY 2021-22 Costs (see A-17) as follows:

<sup>1</sup> The sum of Items 1, 2, 3, 7, 8, 9, 10, 11, 12, and 13. OCWD is responsible for 37.6% of all costs for these items per the agreement. OCWD is only responsible for 37.6% of costs associated with Item 14, Seawater Barrier Condition Assessment.

<sup>2</sup> The sum of Items 4, 5, and 6; OCWD is not responsible for any portion of the cost for these items.

<sup>3</sup> The sum of Item 14. OCWD is responsible for 37.6% of costs associated with Seawater Barrier Condition Assessment. LACFCD responsible for 100% of costs associated with Alamitos Barrier Project Unit 15 Well Replacement Project.

The yearly cost of the services and supplies (including special programs but excluding water and extraction costs) for the last 10 years of ABP operations are shown in Table 8.

**TABLE 8. COSTS OF SERVICES AND SUPPLIES FOR INJECTION**

<b>Fiscal Year</b>	<b>Volume of Water Injected (AF)</b>	<b>Total Cost</b>	<b>Cost Per AF Injected</b>
2012-13	5,490.4	\$2,477,565	\$451.25
2013-14 <sup>1</sup>	6,692.3	\$3,605,859	\$538.81
2014-15	7,113.1	\$1,678,123	\$235.92
2015-16	6,807.7	\$2,237,637	\$328.69
2016-17	6,060.0	\$1,650,686	\$272.39
2017-18	4,414.1	\$2,138,420	\$484.45
2018-19	5,295.2	\$2,293,529	\$433.13
2019-20	5,536.9	\$2,465,320	\$445.25
2020-21	6,500.9	\$2,649,077	\$407.49
2021-22	7,187.8	\$2,403,462	\$334.38

<sup>1</sup> The costs reported in Table 8 prior to the FY 2014-15 period are higher because these years included costs for multiple repairs and/or capital improvement projects.

The costs of the services and supplies for extraction operations for the last 10 years, including electrical costs, are shown in Table 9.

**TABLE 9. COSTS OF SERVICES AND SUPPLIES FOR EXTRACTION**

<b>Fiscal Year</b>	<b>Volume of Water Extracted (AF)</b>	<b>Total Cost</b>	<b>Cost Per AF Extracted</b>
2012-13	0.0	\$70,408	N/A
2013-14	0.0	\$6,768	N/A
2014-15	0.0	\$13,714	N/A
2015-16	0.0	\$6,961	N/A
2016-17	0.0	\$1,510	N/A
2017-18	0.0	\$1,538	N/A
2018-19	0.0	\$1,556	N/A
2019-20	0.0	\$1,512	N/A
2020-21	0.0	\$1,132	N/A
2021-22	0.0	\$2,847	N/A

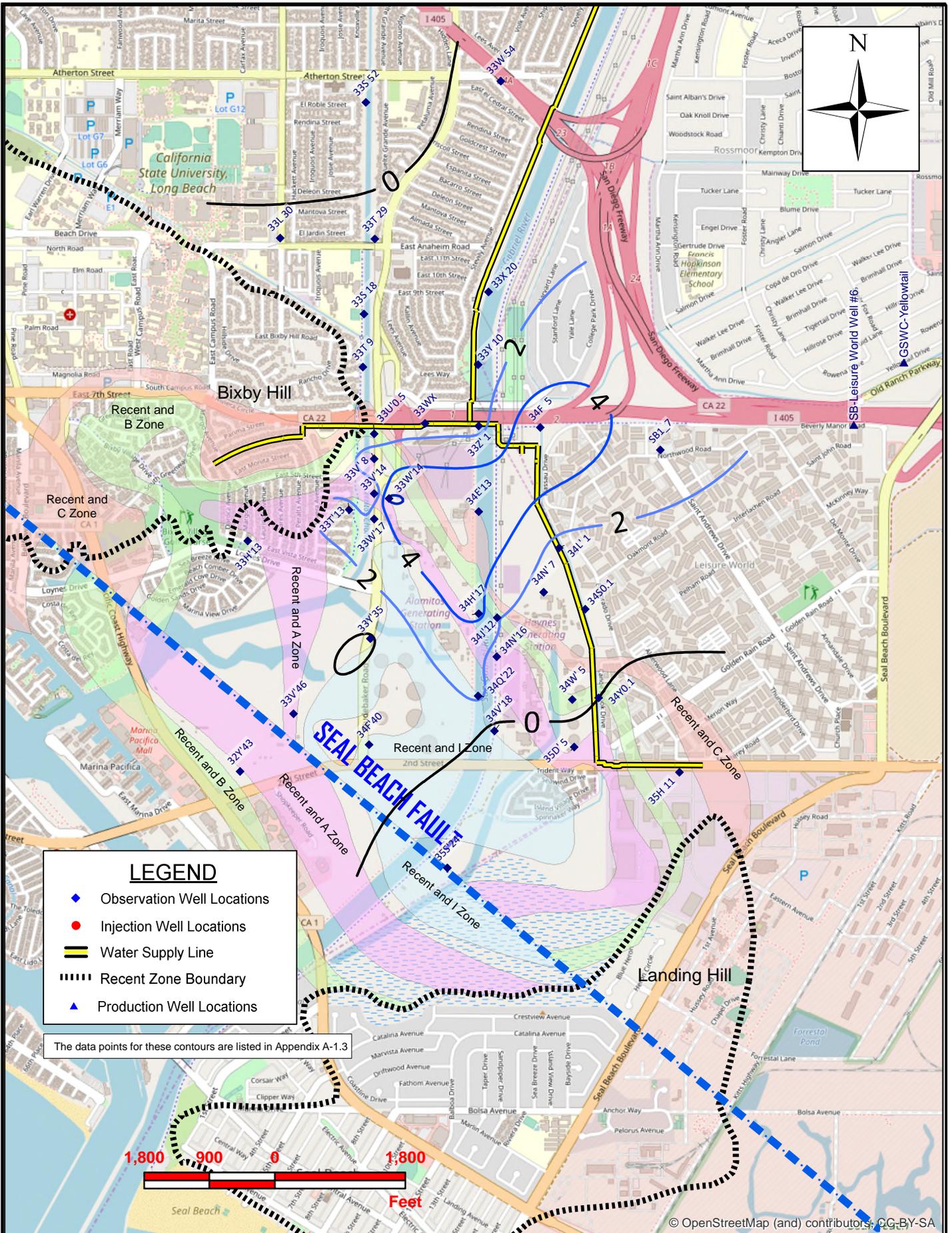
**FIXED ASSETS**

During Fiscal Year 2021-22, there were no new LACFCD facilities, OCWD facilities, or joint facilities added to the ABP.

**BUDGET**

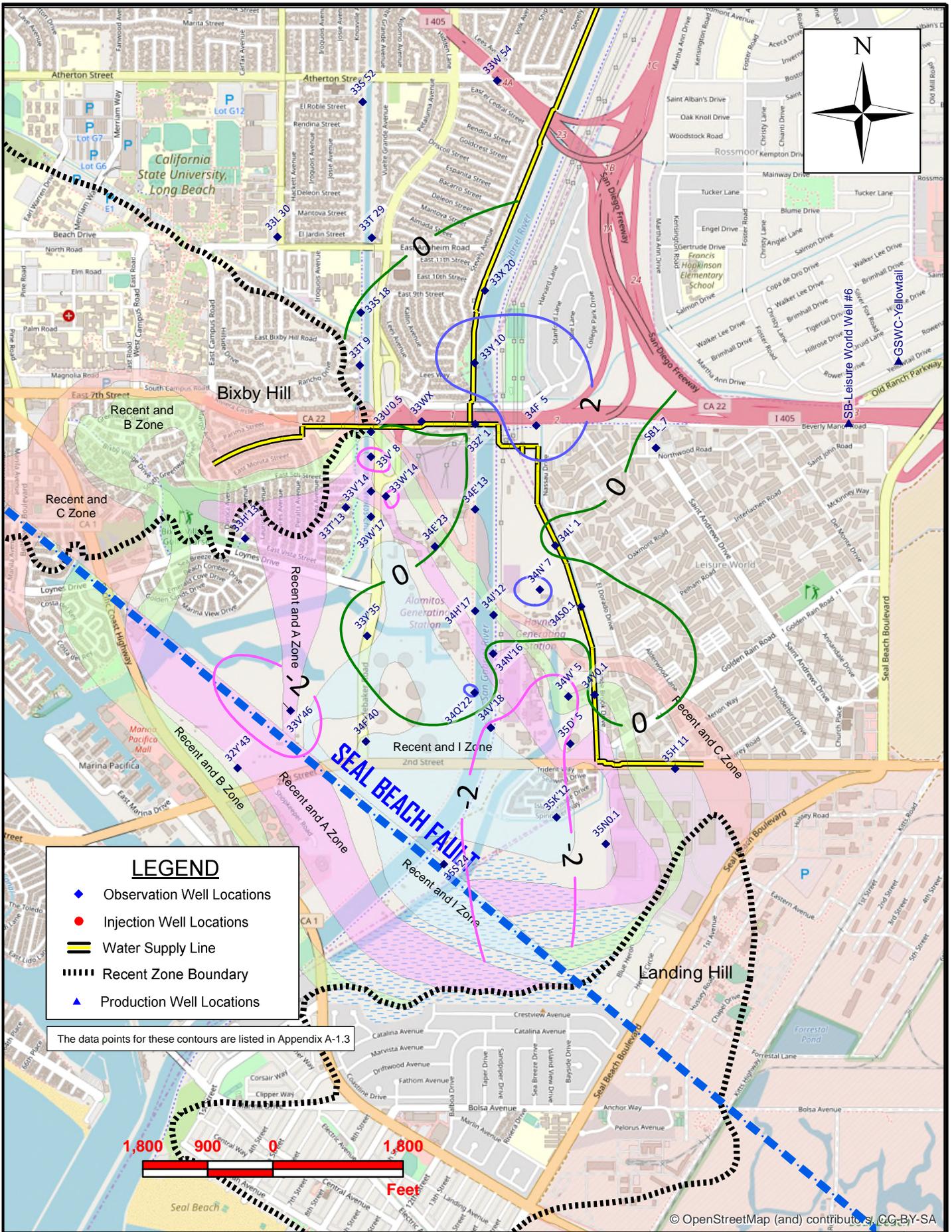
The FY 2023-24 budget for the cost of ABP Supplies and Services is \$2,980,000. A breakdown of this amount, along with past expenditures per category, is shown in Appendix A-18

# APPENDIX



Alamitos Barrier Project  
R Zone Groundwater Elevation (ft) Contours, Spring 2022





**LEGEND**

- ◆ Observation Well Locations
- Injection Well Locations
- Water Supply Line
- - - - Recent Zone Boundary
- ▲ Production Well Locations

The data points for these contours are listed in Appendix A-1.3



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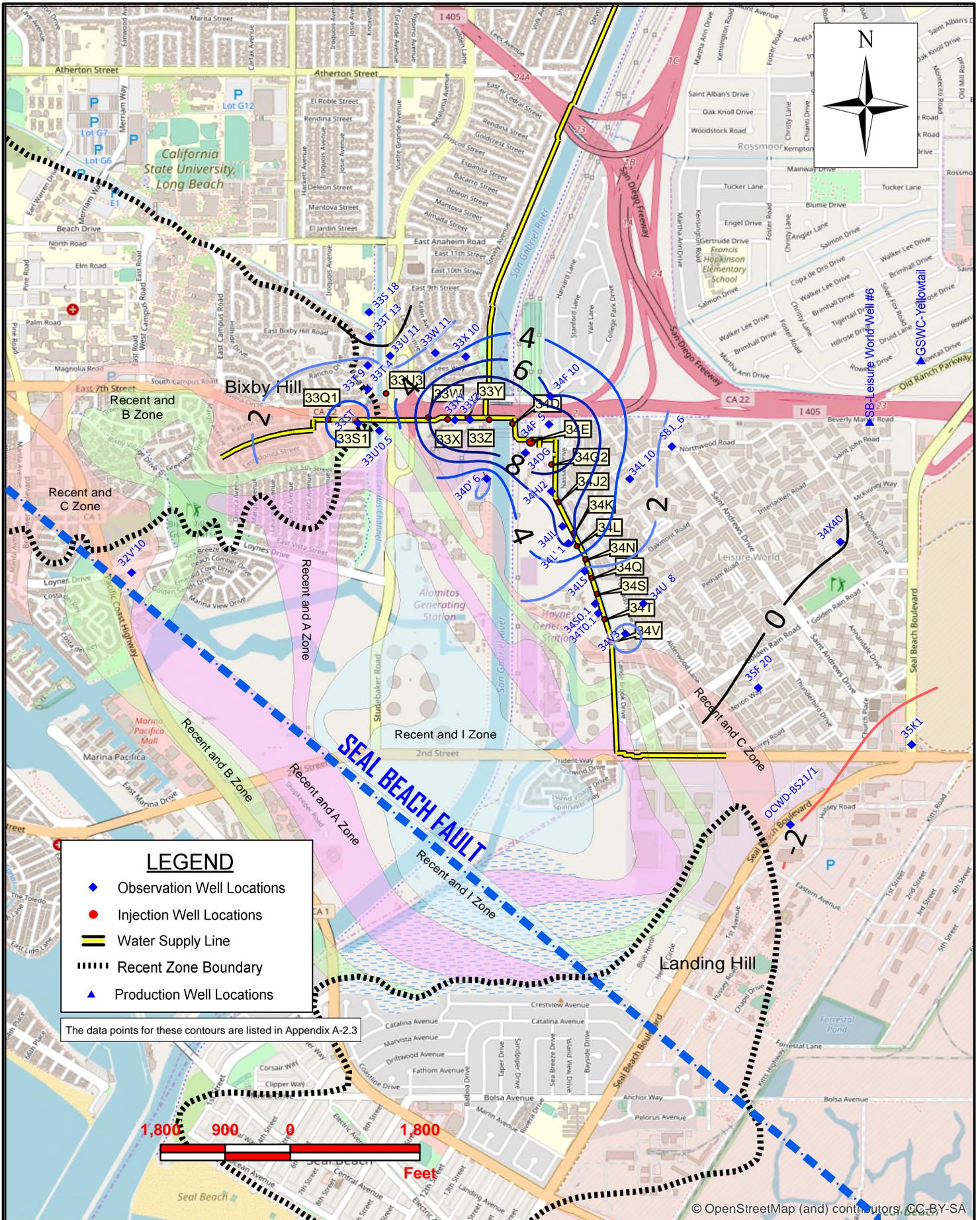
**ALAMITOS BARRIER PROJECT**  
**R-Zone**  
**Groundwater Elevation Data for Contours and Tables**

POINT	PROJ	FCD	AQUIFER	DATE	FY 21-22 ELEV	P.E. <sup>1</sup>	$\Delta^2$	FY 20-21 ELEV2	CHANGE IN ELEV
1	32Y'43	493WW	R	20220308	1.3			2.4	-1.1
2	33H'13	493YY	R,A	20220210	1.7			3.3	-1.6
3	33L 30	491G	R	20220214	0.3				n/a
4	33S 18	492AH	R	20220214	1.8				n/a
5	33S 52	491J	R	20220215	-1.0			-0.3	-0.7
6	33T 9	492CV	R	20220314	1.3			1.1	0.2
7	33T'13	492AU	R	20220222	2.6			2.9	-0.3
8	33T 29	491D	R	20220215	0.5			1.1	-0.6
9	33U'0.5	492CB	R	20220309	0.6			0.5	0.1
10	33V' 8	492BY	R,A	20220216	3.4			6.6	-3.2
11	33V'14	492HH	R	20220307	0.2			0.1	0.1
12	33V'46	493UU	R	20220308	0.1			3.2	-3.1
13	33W 54	501C	R	20220222	0.6			1.8	-1.2
14	33W'14	492AT	R	20220222	6.4			8.6	-2.2
15	33W'17	493PP	R	20220222	2.2			4.2	-2.0
16	33WX	502AZ	R	20220309	1.1			0.6	0.5
17	33X 20	502L	R	20220315	1.2			0.2	1.0
18	33Y 10	502BA	R	20220222	1.0			-2.6	3.6
19	33Y'35	493AB	R	20220222	-0.2			-1.2	1.0
20	33Z' 1	502AU	R	20220316	1.4			1.4	0.0
21	34E'13	503AU	R	20220316	5.8			5.4	0.4
22	34F 5	502BT	R	20220323	5.9			2.0	3.9
23	34F'40	483J	R	20220222	0.4			1.4	-1.0
24	34H'17	503Y	R	20220405	4.6			3.0	1.6
25	34J'12	503U	R	20220303	2.1				n/a
26	34L' 1	503P	R	20220301	1.3			2.0	-0.7
27	34N' 7	503AE	R	20220223	1.2			-1.7	2.9
28	34N'16	503W	R	20220307	1.5			2.1	-0.6
29	34Q'22	503T	R	20220405	2.3			-0.1	2.4
30	34S0.1	503BT	R	20220302	0.4			0.0	0.4
31	34V'18	503V	R	20220308	-0.5			2.1	-2.6
32	34W' 5	503AH	R	20220223	0.2			4.0	-3.8
33	34Y0.1	503CK	R	20220317	0.0			-1.3	1.3
34	35D' 5	503AL	R	20220303	-0.2			1.6	-1.8
35	35H 11	514F	R	20220301	-1.0			0.1	-1.1
36	35S'24	504K	R	20220405	-0.6			1.3	-1.9
37	SB1_7		R	20220318	3.0			3.7	-0.7
AVG=					1.4			AVG=	1.7

<sup>1</sup> P.E. represents the protective elevations calculated for internodal wells.

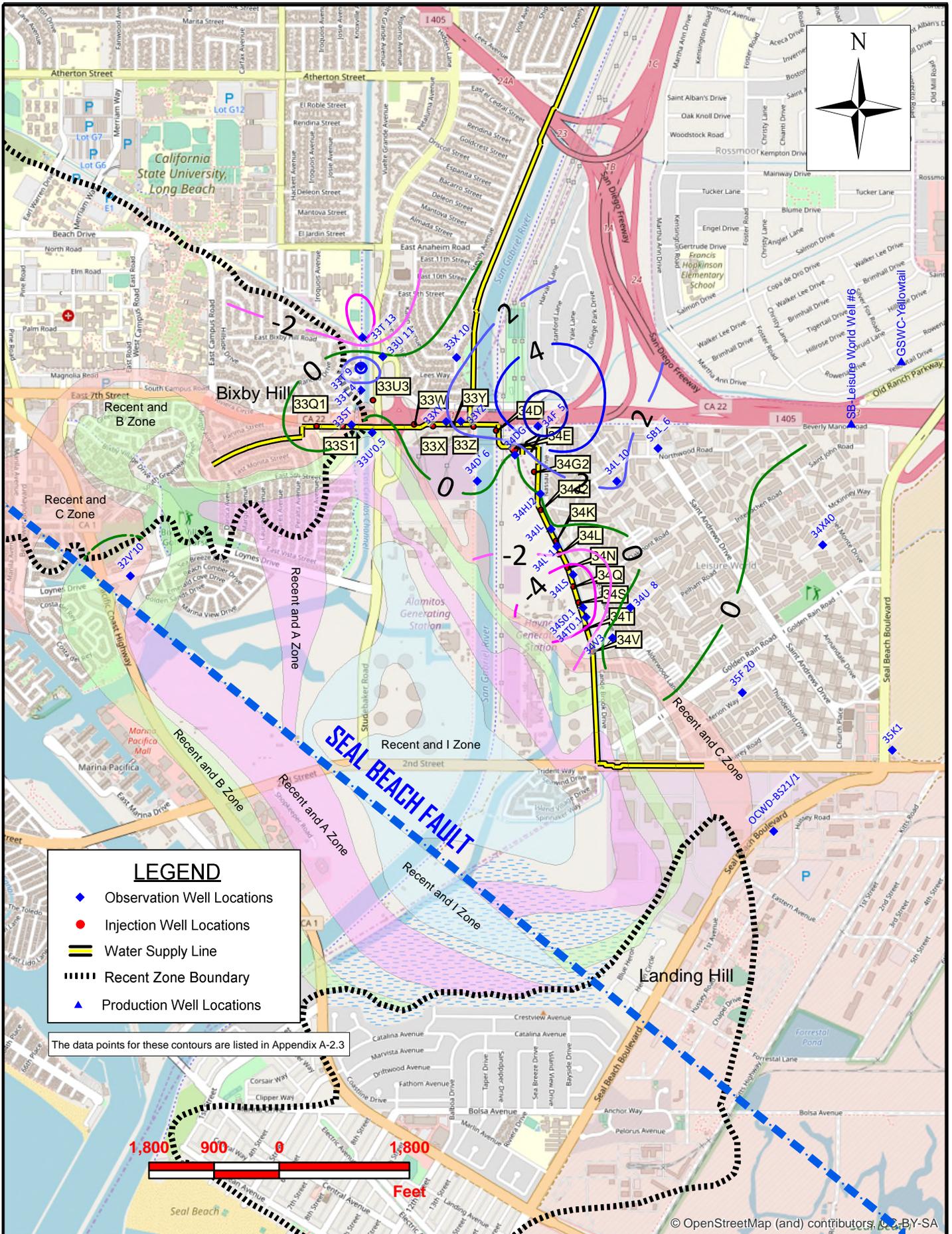
<sup>2</sup>  $\Delta$  (+/-) represents how much groundwater level is above/below respective P.E.

= A max. or min. elevation during that period.



Alamitos Barrier Project  
C Zone Groundwater Elevation (ft) Contours, Spring 2022





**LEGEND**

- ◆ Observation Well Locations
- Injection Well Locations
- Water Supply Line
- - - - Recent Zone Boundary
- ▲ Production Well Locations

The data points for these contours are listed in Appendix A-2.3



Alamitos Barrier Project  
C Zone Change in Elevation (ft), Spring 2021 to Spring 2022







**ALAMITOS BARRIER PROJECT**  
**B-Zone**  
**Groundwater Elevation Data for Contours and Tables**

POINT	PROJ	FCD	AQUIFER	DATE	FY 21-22 ELEV	P.E. <sup>1</sup>	Δ <sup>2</sup>	FY 20-21 ELEV2	CHANGE IN ELEV
1	32V'10	483G	B	20220209	-11.6			-1.3	-10.3
2	32Z'5	482W	AB	20220210	-0.5			-0.7	0.2
3	33H 57	481	B	20220303	-17.9			-18.9	1.0
4	33JL	492BQ	B	20220310	3.3	0.8	2.5	3.9	-0.6
5	33NQ	492BN	B	20220309	4.4	0.7	3.7	4.1	0.3
6	33Q 9	492CM	B	20220308	2.9			-0.8	3.7
7	33Q 15	492AN	B	20220216	-0.5				n/a
8	33ST	492BK	CB	20220309	3.5	0.9	2.6	4.9	-1.4
9	33T 3	492CL	B	20220406	2.2			4.2	-2.0
10	33T 4	492CS	B	20220406	4.2			4.8	-0.6
11	33T 9	492YY	B	20220314	7.3			6.1	1.2
12	33T 13	492AB	B	20220314	-0.2			-1.8	1.6
13	33U 11	492AK	B	20220315	6.7			4.2	2.5
14	33U'0.5	492BZ	B	20220406	3.9			4.9	-1.0
15	33X 10	502BC	B	20220406	7.2			6.2	1.0
16	33X 20	502K	B	20220502	-3.2			-5.6	2.4
17	33XY	502BM	B	20220523	9.8	6.3	3.5	10.1	-0.4
18	33YZ	502AC	B	20220418	10.9	7.1	3.8	10.1	0.8
19	34D' 6	502BG	B	20220316	10.6			7.9	2.7
20	34DG	502Y	B	20220324	13.3	6.6	6.7	11.5	1.8
21	34F 5	502BS	B	20220405	11.6			8.1	3.5
22	34F 10	502AQ	B	20220324	5.2				n/a
23	34HJ2	502CJ	B	20220523	8.2	5.9	2.3	8.0	0.2
24	34JL	503AQ	B	20220502	9.9	5.3	4.6	6.6	3.3
25	34L 10	502AL	B	20220307	3.7			0.4	3.3
26	34LS	503BE	B	20220324	2.5	5.4	-2.9	7.3	-4.8
27	34T0.1	503AC	B	20220317	5.2	6.1	-0.9	10.7	-5.5
28	34U 8	513E	B	20220323	-0.3			-1.3	1.0
29	34V3	503CC	B	20220406	5.7			1.2	4.5
30	34X40	513Q	B	20220329	-0.7			-1.6	0.9
31	35F 20	513K	B	20220324	-1.0			-1.2	0.2
32	35J1	514M	B	20220301	-2.4	5.8	-8.2	-2.0	-0.4
33	35K1	523A	B	20220301	-3.2	5.8	-9.0	-2.6	-0.6
34	OCWD-BS14/1		B	20220308	-3.1			-2.5	-0.6
35	OCWD-BS21/2		B	20220308	-2.7			-3.1	0.5

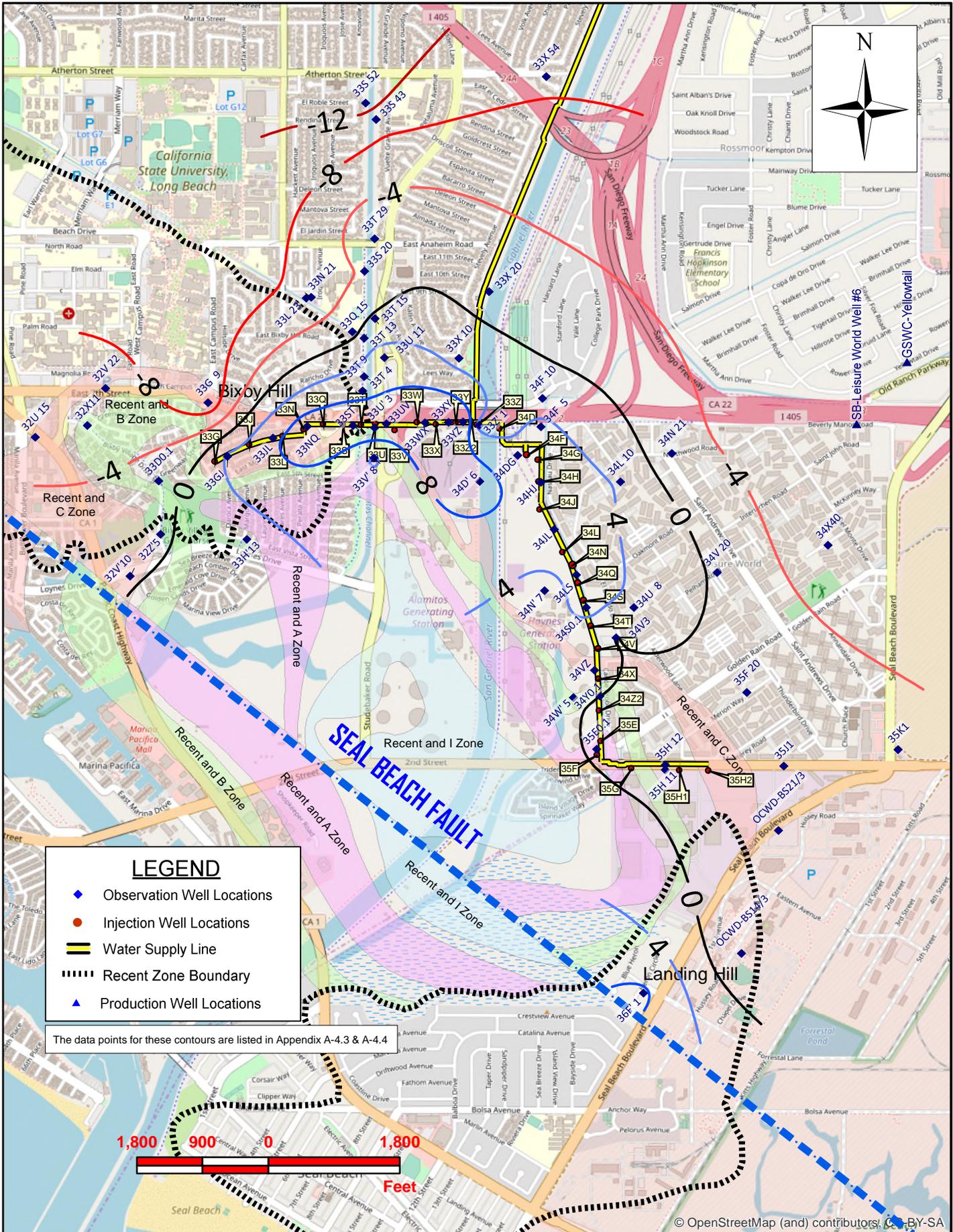
AVG= 2.7

AVG= 2.5

<sup>1</sup> P.E. represents the protective elevations calculated for internodal wells.

<sup>2</sup> Δ (+/-) represents how much groundwater level is above/below respective P.E.

= A max. or min. elevation during that period.



**LEGEND**

- ◆ Observation Well Locations
- Injection Well Locations
- Water Supply Line
- Recent Zone Boundary
- ▲ Production Well Locations

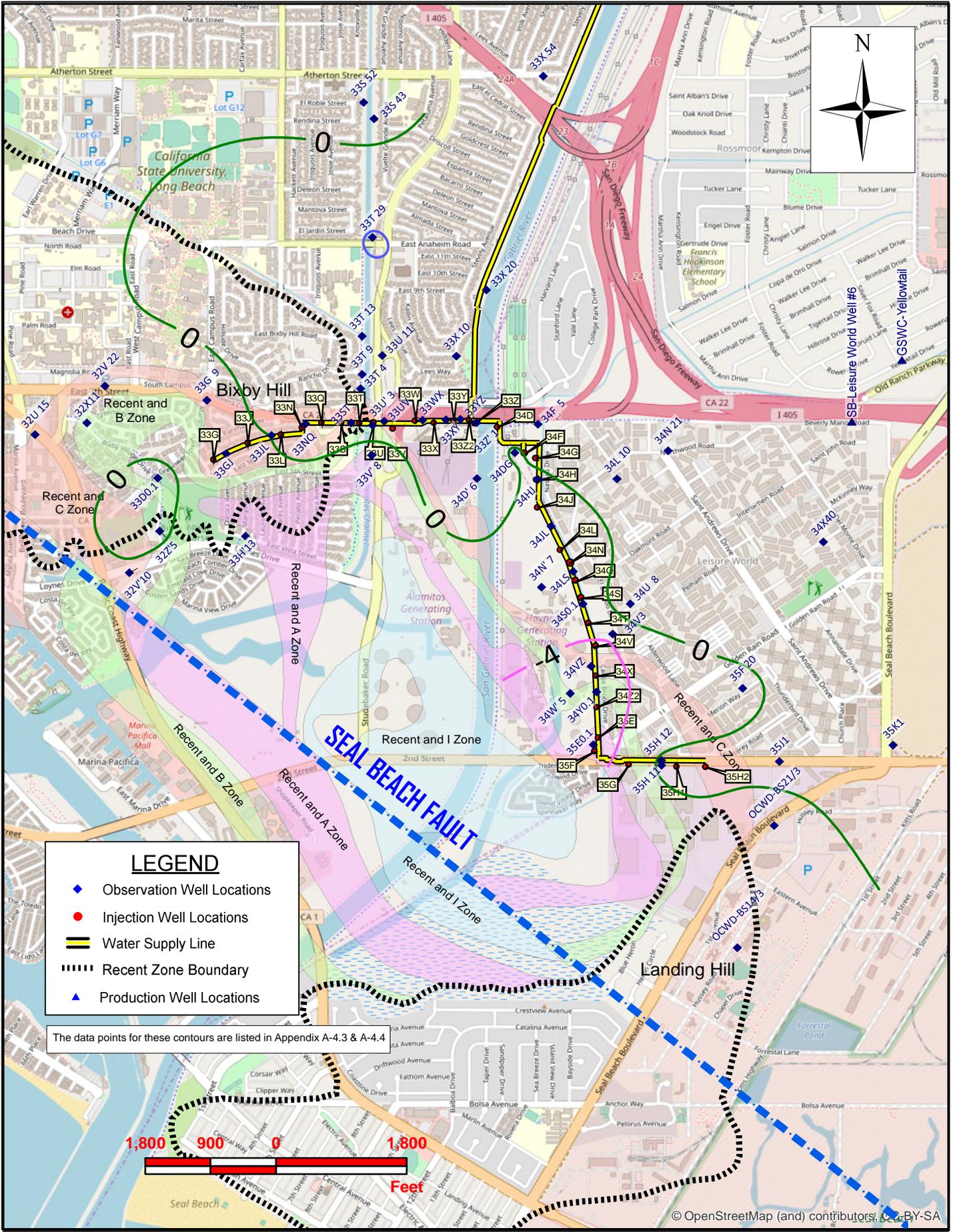
The data points for these contours are listed in Appendix A-4.3 & A-4.4



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**Alamitos Barrier Project**  
**A Zone Groundwater Elevation (ft) Contours, Spring 2022**



**ALAMITOS BARRIER PROJECT**  
**A-Zone**  
Groundwater Elevation Data for Contours and Tables (Page 1 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 21-22 ELEV	P.E. <sup>1</sup>	Δ <sup>2</sup>	FY 20-21 ELEV	CHANGE IN ELEV
1	32U 15	482M	A	20220210	-5.0			-4.6	-0.4
2	32V 22	482P	A	20220214	-5.5			-5.5	0.0
3	32V'10	483F	A	20220209	-0.2			-0.1	-0.1
4	32X11	482S	A	20220310	-7.0			-6.4	-0.6
5	32Z'5	482W	AB	20220210	-0.5			-0.7	0.2
6	33D0.1	482U	AI	20220310	-1.6			-1.9	0.3
7	33G 9	482F	A	20220210	-10.7			-9.5	-1.2
8	33GJ	482X	A	20220301	4.5	1.4	3.1	5.0	-0.5
9	33H'13	493YY	R,A	20220210	1.7			3.3	-1.6
10	33JL	492BW	AI	20220324	7.4	3.1	4.3	7.4	0.0
11	33L 23	492RR	A	20220308	-7.0				n/a
12	33N 21	492BU	A	20220208	-6.0				n/a
13	33NQ	492BP	AI	20220309	9.8	3.6	6.2	7.2	2.6
14	33Q 15	492AM	A	20220216	-1.6				n/a
15	33S 20	492BR	A	20220214	-3.7				n/a
16	33S 43	491E	A	20220215	-9.4			-8.2	-1.2
17	33S 52	491H	A	20220215	-14.0			-12.8	-1.2
18	33ST	492BL	A	20220309	10.8	2.8	8.0	7.9	2.9
19	33T 4	492CR	A	20220314	6.6			4.6	2.0
20	33T 9	492TT	A	20220314	5.3			2.3	3.0
21	33T 13	492ZZ	A	20220314	2.6			-0.2	2.8
22	33T 15	492SS	A	20220215	0.8				n/a
23	33T 29	491C	A	20220215	-0.1			-4.4	4.3
24	33U' 3	492WW	A	20220216	10.4	7.6	2.8	7.2	3.2
25	33U 11	492AJ	A	20220315	5.3			1.6	3.7
26	33UV	492BH	A	20220324	10.0	4.0	6.0	7.3	2.7
27	33V' 8	492BY	RA	20220216	3.4			6.6	-3.2
28	33WX	502AF	A	20220324	10.7	7.6	3.1	7.7	3.1
29	33X 10	502BD	A	20220223	2.6			0.5	2.1
30	33X 20	502J	A	20220315	-1.5			-4.3	2.8
31	33X 54	501	AI	20220303	-8.6			-10.0	1.4
32	33XY	502BN	A	20220324	11.5	8.0	3.5	8.4	3.2
33	33YZ	502AD	A	20220324	11.9	8.7	3.2	8.4	3.5
34	33Z' 1	502G	A	20220316	2.7			2.5	0.2
35	34D' 6	502BH	A	20220316	9.9			6.6	3.3
36	34DG	502Z	A	20220323	4.7	8.5	-3.8	5.1	-0.4
37	34F 5	502BR	A	20220323	5.0			2.0	3.0
38	34F 10	502AR	A	20220329	1.8				n/a
39	34HJ	502BX	A	20220324	6.4	8.6	-2.2	6.8	-0.4
40	34JL	503AP	A	20220324	5.7	7.8	-2.1	7.9	-2.1
41	34L 10	502AM	A	20220307	3.6			1.5	2.1

<sup>1</sup> P.E. represents the protective elevations calculated for internodal wells.

<sup>2</sup> Δ (+/-) represents how much groundwater level is above/below respective P.E.

= A max. or min. elevation during that period.

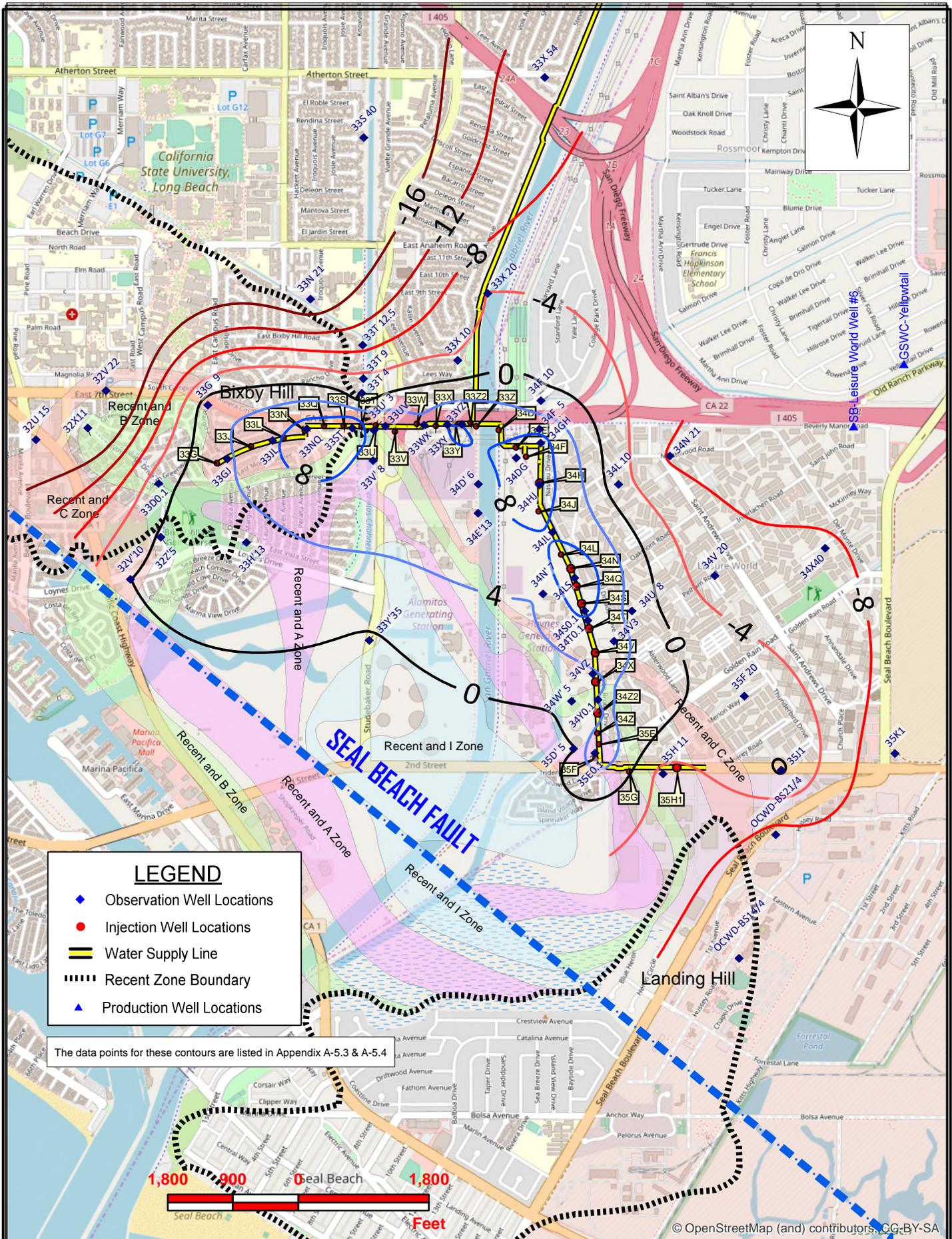
**ALAMITOS BARRIER PROJECT**  
**A-Zone**  
Groundwater Elevation Data for Contours and Tables (Page 2 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 21-22 ELEV	P.E. <sup>1</sup>	$\Delta^2$	FY 20-21 ELEV	CHANGE IN ELEV
41	34LS	503BD	A	20220317	4.9	7.8	-2.9	8.3	-3.4
42	34N 21	512B	A	20220307	-2.6			-4.9	2.3
43	34N' 7	503AF	A	20220223	2.5			2.4	0.1
44	34S0.1	503BV	A	20220302	5.1	6.7	-1.6	6.6	-1.6
45	34U 8	513F	A	20220323	3.3			0.6	2.7
46	34V 20	513B	A	20220330	-0.5				n/a
47	34V3	503CD	A	20220323	-0.1			3.5	-3.6
48	34VZ	503BH	A	20220323	1.2	4.4	-3.2	6.9	-5.7
49	34W' 5	503AJ	A	20220223	0.3			5.9	-5.6
50	34X40	513P	A	20220329	-6.7			-8.0	1.3
51	34Y0.1	503CL	A	20220317	0.0	2.8	-2.8	6.1	-6.1
52	35E0.1	503BK	A	20220323	-0.4	2.4	-2.8	5.6	-6.0
53	35F 20	513J	A	20220324	-1.1			-0.7	-0.4
54	35H 11	514G	A	20220315	-0.8	3.8	-4.6	-1.3	0.5
55	35H 12	514D	A	20220324	-1.9	3.8	-5.7	-2.3	0.4
56	35J1	514L	A	20220324	-1.7	6.2	-7.9	-2.1	0.4
57	35K1	523B	A	20220324	-2.6	6.2	-8.8	-3.6	1.0
58	36F' 1	505D	A	20220303	8.6				n/a
59	OCWD-BS14/3		A	20220308	-3.6			-2.7	-0.9
60	OCWD-BS21/3		A	20220308	-2.6			-1.9	-0.7
AVG=					1.2		AVG=	1.2	

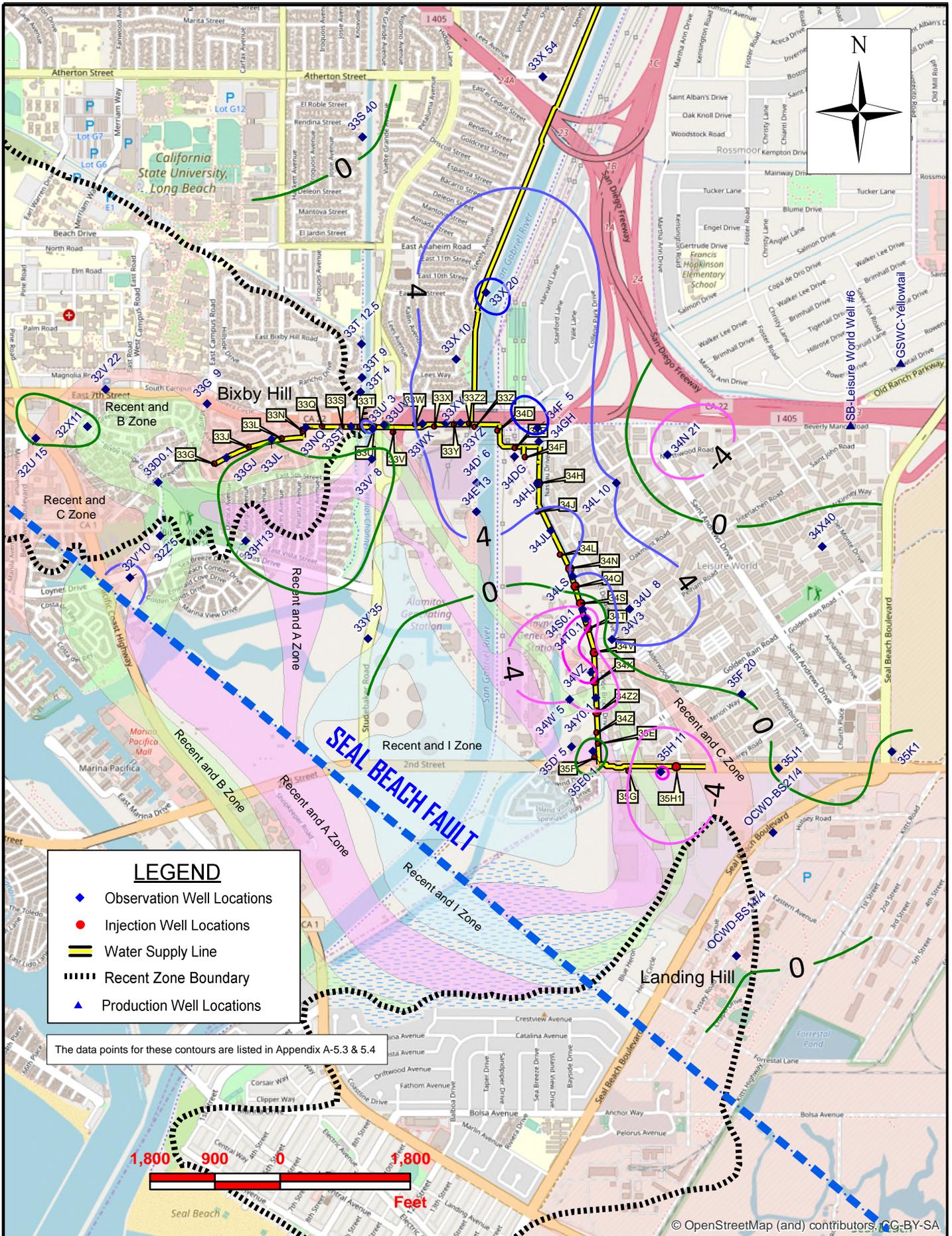
<sup>1</sup> P.E. represents the protective elevations calculated for internodal wells.

<sup>2</sup>  $\Delta$  (+/-) represents how much groundwater level is above/below respective P.E.

= A max. or min. elevation during that period.



Alamitos Barrier Project  
I Zone Groundwater Elevation (ft) Contours, Spring 2022



Alamitos Barrier Project  
I Zone Change in Elevation (ft), Spring 2021 to Spring 2022

ALAMITOS BARRIER PROJECT  
I-Zone  
Groundwater Elevation Data for Contours and Tables (Page 1 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 21-22 ELEV	P.E. <sup>1</sup>	Δ <sup>2</sup>	FY 20-21 ELEV	CHANGE IN ELEV
1	32U 15	482L	I	20220210	-20.7			-20.6	-0.1
2	32V 22	482N	I	20220214	-24.4			-25.3	0.9
3	32V'10	483E	I	20220209	0.0			-4.6	4.6
4	32X11	482R	I	20220310	-22.8			-22.5	-0.3
5	32Z'5	482V	I	20220210	0.4			-2.1	2.5
6	33D0.1	482U	AI	20220310	-1.6			-1.9	0.3
7	33G 9	482G	I	20220210	2.2			-0.1	2.3
8	33GJ	482Y	I	20220324	3.3	2.6	0.7	3.2	0.1
9	33H'13	493XX	I	20220210	1.4			2.1	-0.7
10	33JL	492BW	AI	20220324	7.4	3.1	4.3	7.4	0.0
11	33N 21	492BV	I	20220208	-19.3				n/a
12	33NQ	492BP	AI	20220309	9.8	3.6	6.2	8.8	1.0
13	33S 40	491F	I	20220215	-22.4			-21.9	-0.5
14	33ST	492BM	I	20220309	12.2	4.2	8.0	9.0	3.2
15	33T 4	492CQ	I	20220314	-3.4			-6.9	3.5
16	33T 9	492XX	I	20220314	-2.9			-6.9	4.0
17	33T 12.5	492BT	I	20220216	-9.1			-9.3	0.2
18	33U' 3	492QQ	I	20220216	5.6			0.4	5.2
19	33UV	492BJ	I	20220324	8.4	6.1	2.3	9.0	-0.6
20	33V' 8	492BX	I	20220216	5.0			7.4	-2.4
21	33WX	502AG	I	20220309	4.6	10.4	-5.8	-0.7	5.3
22	33X 10	502BE	I	20220406	-3.5			-8.7	5.2
23	33X 20	502H	I	20220406	-3.9			-12.7	8.8
24	33X 54	501	AI	20220303	-8.6			-10.0	1.4
25	33XY	502BP	I	20220324	8.0	11.0	-3.0	0.3	7.7
26	33Y'35	493ZZ	I	20220222	-0.5			-0.9	0.4
27	33YZ	502AE	I	20220324	7.9	11.1	-3.2	0.9	7.0
28	34D' 6	502BI	I	20220316	6.5			-0.4	6.9
29	34DG	502AA	I	20220301	8.8	11.1	-2.3	3.1	5.7
30	34E'13	503AT	I	20220316	7.2			0.6	6.6
31	34F 5	502BQ	I	20220323	7.1			-1.9	9.0
32	34F 10	502AS	I	20220329	1.3				n/a
33	34GH	502BV	I	20220324	9.5	11.3	-1.8	2.7	6.8
34	34HJ	502BW	I	20220324	9.6	11.0	-1.4	3.9	5.7
35	34JL	503AN	I	20220324	7.9	10.5	-2.6	5.9	1.9
36	34L 10	502AN	I	20220307	-2.5			-6.7	4.2
37	34LS	503BC	I	20220405	11.3	9.5	1.8	7.0	4.3

<sup>1</sup> P.E. represents the protective elevations calculated for internodal wells.

<sup>2</sup> Δ (+/-) represents how much groundwater level is above/below respective P.E.

= A max. or min. elevation during that period.

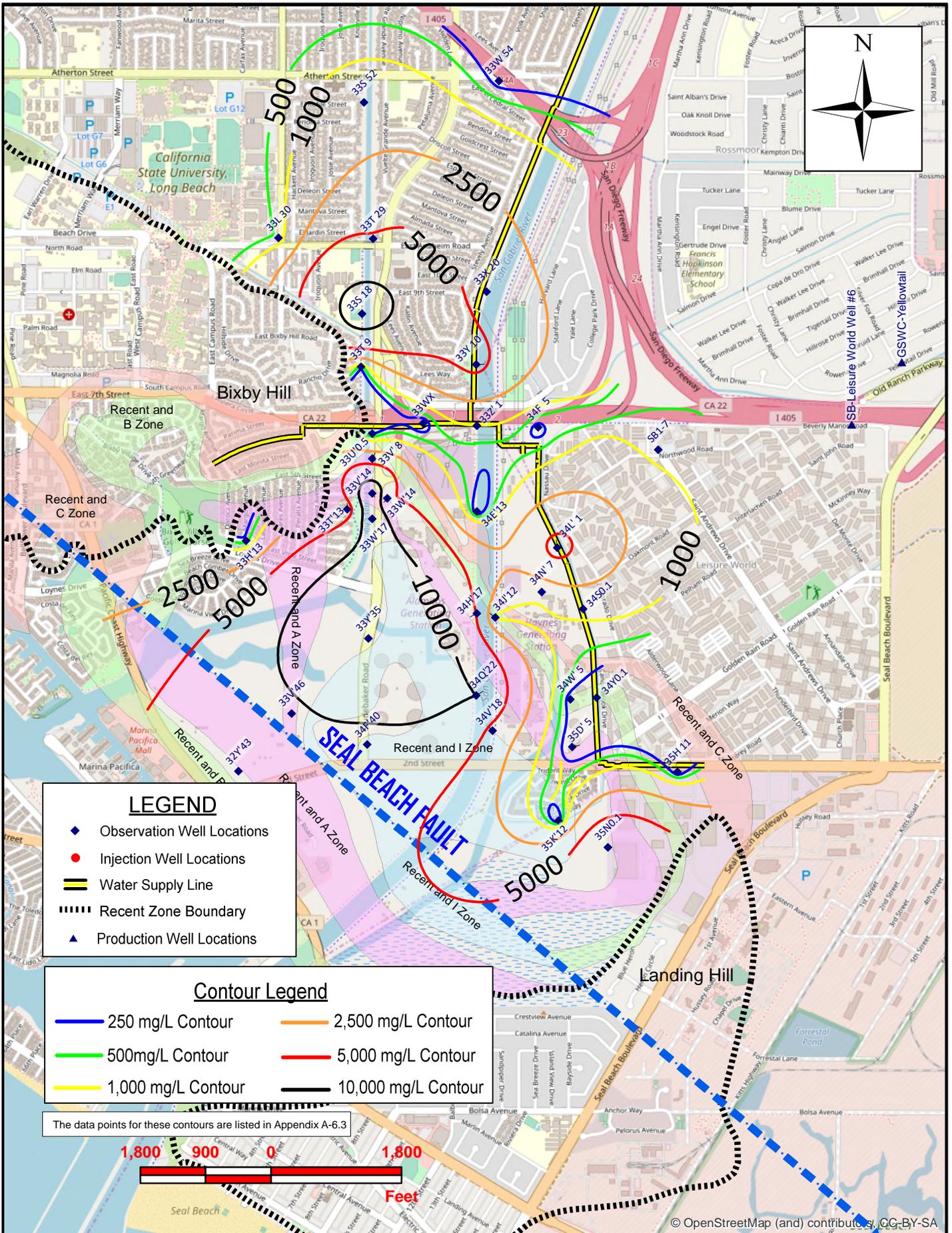
ALAMITOS BARRIER PROJECT  
I-Zone  
Groundwater Elevation Data for Contours and Tables (Page 2 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 21-22 ELEV	P.E. <sup>1</sup>	$\Delta^2$	FY 20-21 ELEV	CHANGE IN ELEV
38	34N 21	512C	I	20220307	-8.4			-1.2	-7.2
39	34N' 7	503AG	I	20220223	4.2				n/a
40	34S0.1	503BW	I	20220405	9.0	8.1	0.9	13.3	-4.4
41	34T0.1	503AD	I	20220405	7.3	8.4	-1.1	17.9	-10.7
42	34U 8	513G	I	20220406	2.3			-5.3	7.6
43	34V 20	513C	I	20220330	-6.4				n/a
44	34V3	503CE	I	20220201	5.8			1.7	4.1
45	34VZ	503BG	I	20220405	3.7	5.9	-2.2	13.4	-9.7
46	34W' 5	503AK	I	20220223	0.6			4.7	-4.1
47	34X40	513N	I	20220329	-7.5			-8.8	1.3
48	34Y0.1	503CM	I	20220405	4.1	4.8	-0.7	10.2	-6.1
49	35D' 5	503AM	I	20220303	-0.3			1.0	-1.3
50	35E0.1	503BJ	I	20220405	7.5	3.0	4.5	5.1	2.4
51	35F 20	513H	I	20220324	-1.5			-1.6	0.1
52	35H 11	514H	I	20220315	-5.5	5.5	-11.0	3.2	-8.7
53	35J1	513M	I	20220404	0.6	4.8	-4.2	0.1	0.5
54	35K1	523C	I	20220324	-11.5	4.8	-16.3	-11.3	-0.2
55	OCWD-BS14/4		I	20220308	-10.0			-9.9	-0.1
56	OCWD-BS21/4		I	20220308	-9.4			-8.1	-1.2
AVG=					-0.3	AVG=		-1.3	

<sup>1</sup> P.E. represents the protective elevations calculated for internodal wells.

<sup>2</sup>  $\Delta$  (+/-) represents how much groundwater level is above/below respective P.E.

= A max. or min. elevation during that period.



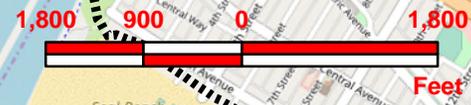
**LEGEND**

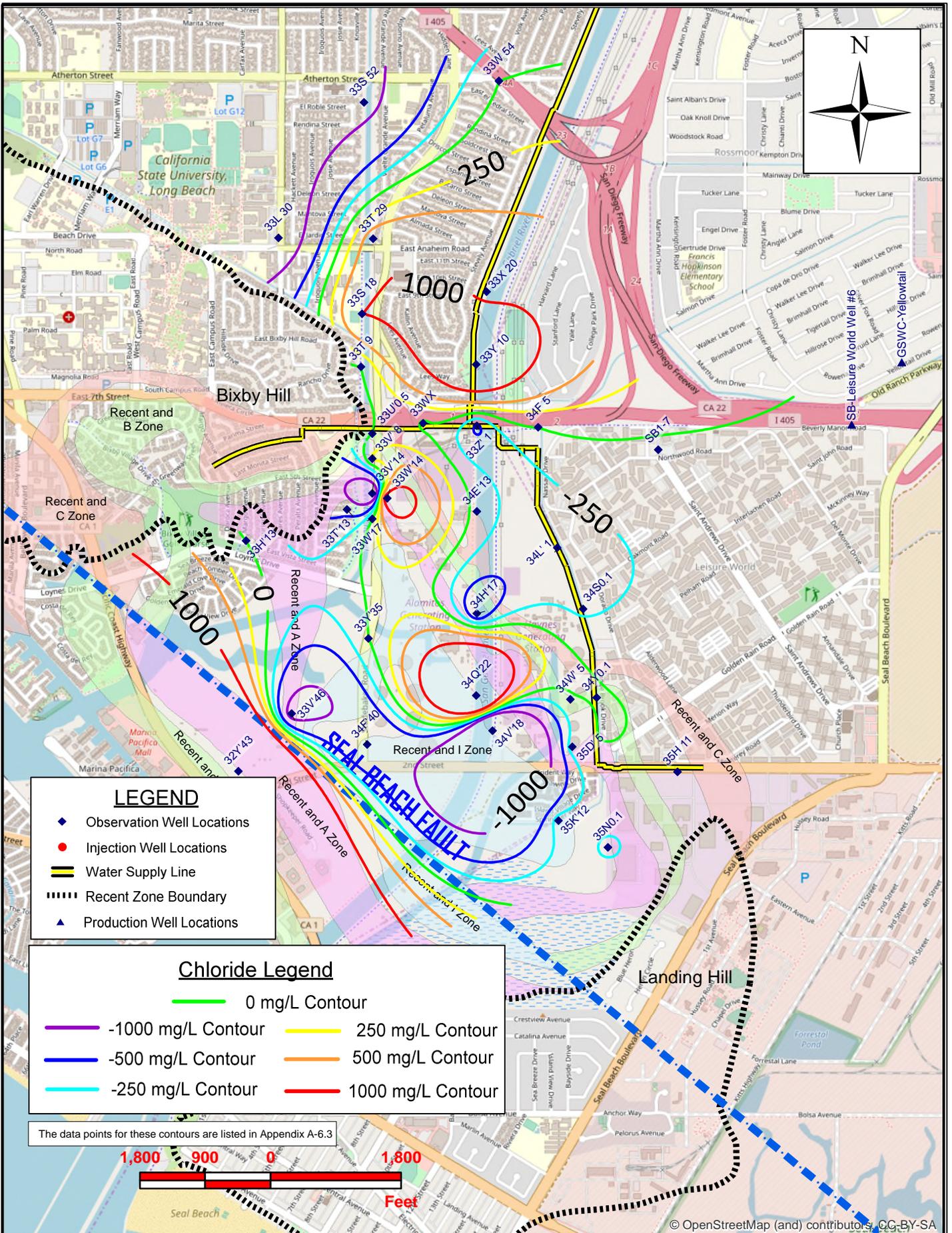
- ◆ Observation Well Locations
- Injection Well Locations
- Water Supply Line
- - - - Recent Zone Boundary
- ▲ Production Well Locations

**Contour Legend**

— 250 mg/L Contour	— 2,500 mg/L Contour
— 500mg/L Contour	— 5,000 mg/L Contour
— 1,000 mg/L Contour	— 10,000 mg/L Contour

The data points for these contours are listed in Appendix A-6.3

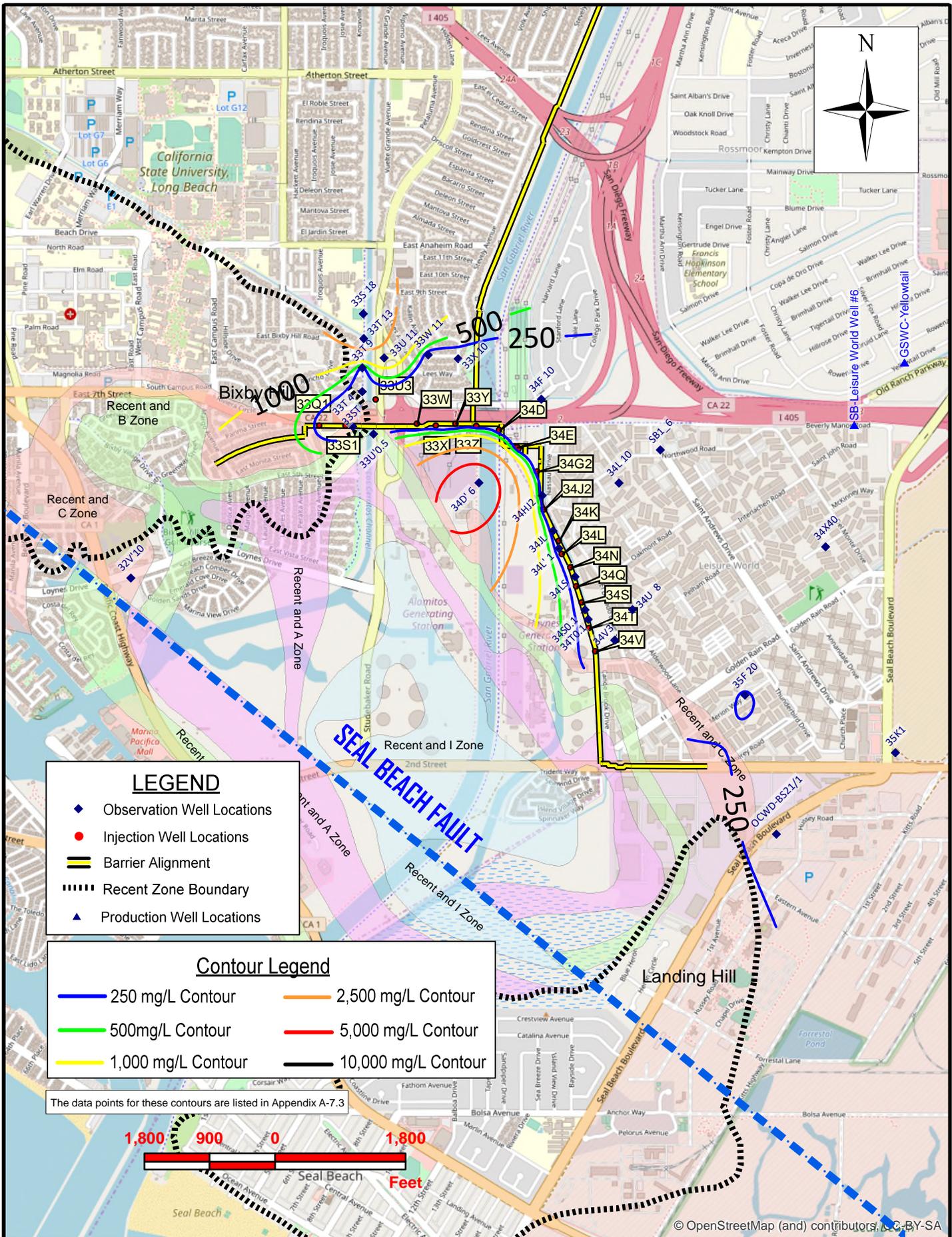




**ALAMITOS BARRIER PROJECT**  
**R-ZONE CHLORIDE CONCENTRATIONS**  
Chloride Data Used for Contours and Cross-Section

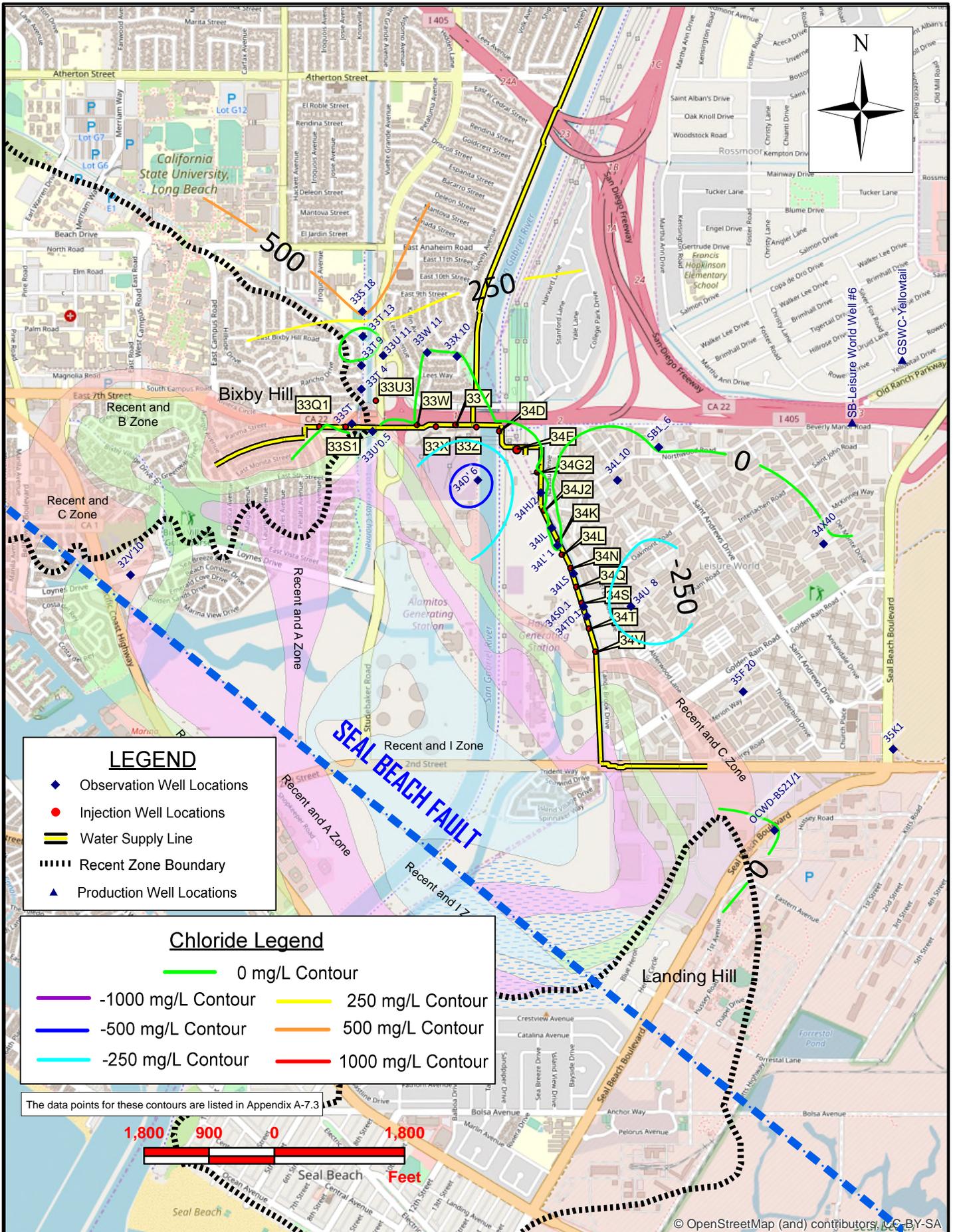
No.	PROJ	FCD	AQUIFER	DATE	Sampling Depths and Chloride Data						For Contours MAX CHL. 21-22	MAX CHLORIDE FY20-21	Change in Chloride (FY21-22 - FY20-21)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)			
1	32Y43	493WW	R	20220308	-43	7,300					7,300	2,000	5,300
2	33H13	493YY	R,A	20220210	-18	310	-38	310	-58	330	330	330	0
3	33L 30	491G	R	20220214	-50	600					600	2,200	-1,600
4	33S 18	492AH	R	20220214	-67	14,000					14,000	13,000	1,000
5	33S 52	491J	R	20220215	-54	1,800					1,800	3,000	-1,200
6	33T 9	492CV	R	20220314	-21	290					290	290	0
7	33T13	492AU	R	20220222	-41	2,300	-51	2,500			2,500	3,100	-600
8	33T 29	491D	R	20220215	-56	5,300					5,300	4,600	700
9	<b>33U0.5</b>	<b>492CB</b>	<b>R</b>	<b>20220309</b>	<b>-15</b>	<b>170</b>					<b>170</b>	<b>170</b>	<b>0</b>
10	33V 8	492BY	RA	20220216	-24	3,600	-48	3,700			3,700	3,400	300
11	33V14	492JJ	R	20220222	-67	16,000					16,000	18,000	-2,000
12	33V46	493UU	R	20220308	-61	8,700					8,700	10,000	-1,300
13	33W14	492AT	R	20220222	-46	3,900	-66	5,400			5,400	3,800	1,600
14	33W17	493PP	R	20220222	-41	4,300	-51	13,000			13,000	13,000	0
15	33W 54	501C	R	20220222	-33	120	-53	110			120	120	0
16	<b>33WX</b>	<b>502AZ</b>	<b>R</b>	<b>20220309</b>	<b>-45</b>	<b>14</b>					<b>14</b>	<b>53</b>	<b>-39</b>
17	33X 20	502L	R	20220315	-68	3,600					3,600	2,800	800
18	33Y 10	502BA	R	20220222	-58	700	-83	5,800			5,800	3,500	2,300
19	33Y35	493AB	R	20220222	-36	22,000					22,000	22,000	0
20	<b>33Z' 1</b>	<b>502AU</b>	<b>R</b>	<b>20220316</b>	<b>-46</b>	<b>940</b>	<b>-56</b>	<b>940</b>			<b>940</b>	<b>1,500</b>	<b>-560</b>
21	34E13	503AU	R	20220316	-19	5	-52	4			5	100	-95
22	34F 5	502BT	R	20220323	-136	83	-146	82	-156	82	83	79	4
23	34F40	483J	R	20220222	-40	7,400					7,400	8,400	-1,000
24	34H17	503Y	R	20220321	-46	4,900					4,900	5,700	-800
25	34J12	503U	R	20220303	-28	240	-36	910			910	910	n/a
26	<b>34L' 1</b>	<b>503P</b>	<b>R</b>	<b>20220323</b>	<b>-57</b>	<b>6,100</b>					<b>6,100</b>	<b>6,400</b>	<b>-300</b>
27	34N 7	503AE	R	20220223	-51	1,300	-61	160	-70	460	1,300	1,300	n/a
28	34Q22	503T	R	20220322	-42	10,000	-57	9,200			10,000	5,800	4,200
29	<b>34S0.1</b>	<b>503BT</b>	<b>R</b>	<b>20220321</b>	<b>-59</b>	<b>890</b>	<b>-69</b>	<b>1,300</b>			<b>1,300</b>	<b>1,600</b>	<b>-300</b>
30	34V18	503V	R	20220308	-48	4,100					4,100	8,300	-4,200
31	34W' 5	503AH	R	20220223	-51	68					68	100	-32
32	<b>34Y0.1</b>	<b>503CK</b>	<b>R</b>	<b>20220317</b>	<b>-60</b>	<b>150</b>	<b>-70</b>	<b>140</b>			<b>150</b>	<b>140</b>	<b>10</b>
33	35D 5	503AL	R	20220303	-57	8					8	120	-112
34	<b>35H 11</b>	<b>514F</b>	<b>R</b>	<b>20220315</b>	<b>-42</b>	<b>22</b>	<b>-65</b>	<b>29</b>			<b>29</b>	<b>150</b>	<b>-121</b>
35	35K12	504R	R	20220303	-44	5	-54	5			5	150	-145
36	35N0.1	504M	R	20220303	-38	9,400	-62	9,700			9,700	10,000	-300
37	SB1-7		R	20220413		770					770	820	-50

Internodal Wells in **BOLD** and used for A-11 Barrier Cross Section



Alamitos Barrier Project  
C Zone Chloride Concentration (mg/L) Contours, Spring 2022





**LEGEND**

- ◆ Observation Well Locations
- Injection Well Locations
- Water Supply Line
- ▬▬▬ Recent Zone Boundary
- ▲ Production Well Locations

**Chloride Legend**

- 0 mg/L Contour
- -1000 mg/L Contour
- -500 mg/L Contour
- -250 mg/L Contour
- 250 mg/L Contour
- 500 mg/L Contour
- 1000 mg/L Contour

The data points for these contours are listed in Appendix A-7.3

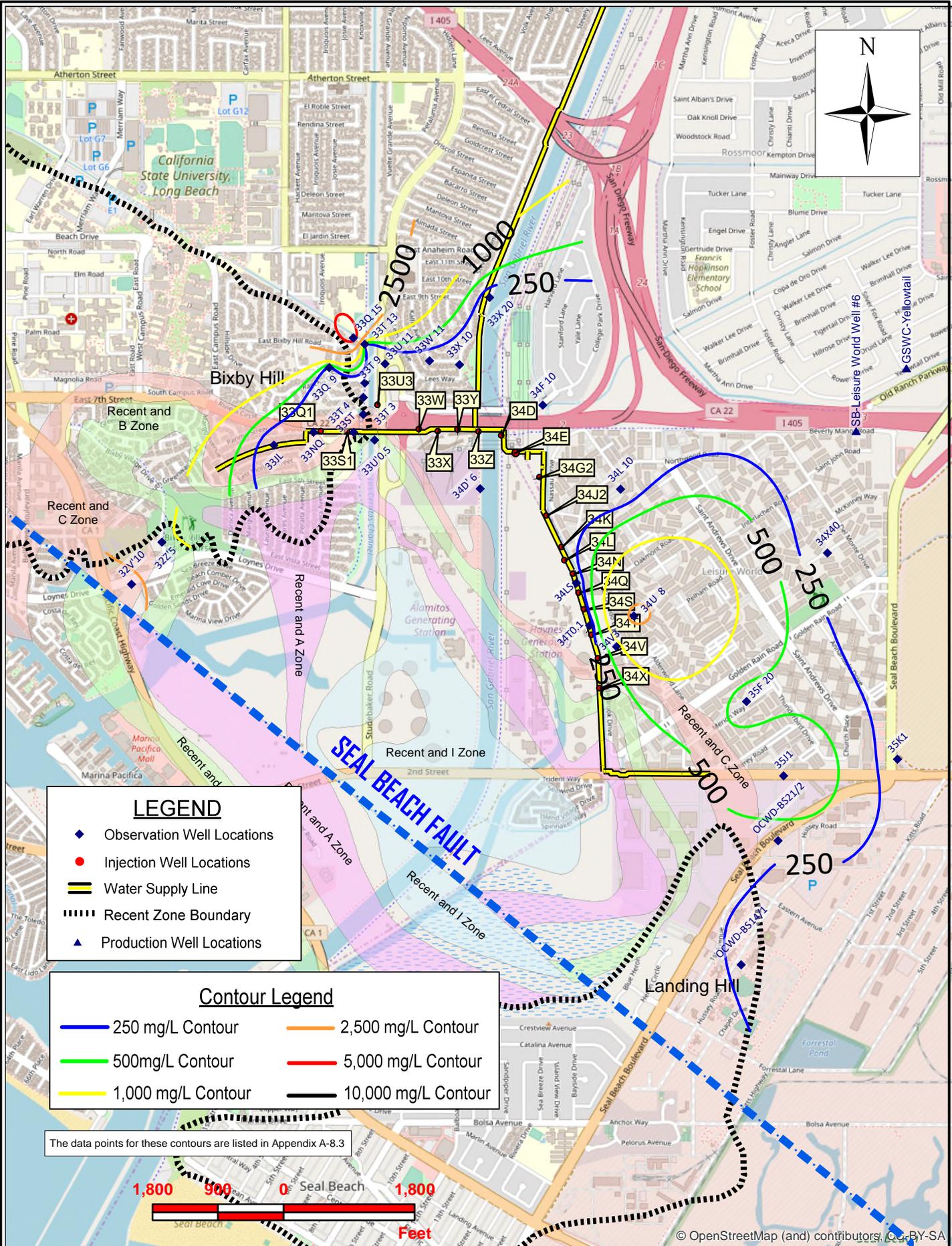


**ALAMITOS BARRIER PROJECT**  
**C-ZONE CHLORIDE CONCENTRATIONS**  
 Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	AQUIFER	DATE	Sampling Depths and Chloride Data						For Contours MAX CHL. 21-22	MAX CHLORIDE FY20-21	Change in Chloride (FY21-22 - FY20-21)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)			
1	32V10	483H	C	20220209	-37	760					760	650	110
2	33S 18	492AG	C	20220214	-225	3,300					3,300	2,700	600
3	<b>33ST</b>	<b>492BK</b>	<b>CB</b>	<b>20220309</b>	<b>-25</b>	<b>86</b>					<b>86</b>	<b>69</b>	<b>17</b>
4	33T 4	492CT	C	20220314	-56	180					180	150	30
5	33T 9	492CU	C	20220314	-129	120	-144	130			130	70	60
6	33T 13	492AC	C	20220314	-199	3,800					3,800	4,100	-300
7	<b>33U0.5</b>	<b>492CA</b>	<b>C</b>	<b>20220309</b>	<b>-39</b>	<b>85</b>					<b>85</b>	<b>83</b>	<b>2</b>
8	33U 11	492AL	C	20220315	-188	1,800					1,800	1,700	100
9	33W 11	502R	C	20220329	-183	74	-216	51			74	85	-11
10	33X 10	502BB	C	20220223	-190	73	-215	71			73	86	-13
11	34D' 6	502BF	C	20220316	-125	8,400					8,400	9,100	-700
12	34F 10	502AP	C	20220324	-211	90					90		n/a
13	<b>34HJ2</b>	<b>502CH</b>	<b>C</b>	<b>20220317</b>	<b>-148</b>	<b>75</b>	<b>-158</b>	<b>75</b>			<b>75</b>	<b>84</b>	<b>-9</b>
14	<b>34JL</b>	<b>503AR</b>	<b>C</b>	<b>20220317</b>	<b>-160</b>	<b>110</b>					<b>110</b>	<b>100</b>	<b>10</b>
15	<b>34L' 1</b>	<b>503N</b>	<b>C</b>	<b>20220323</b>	<b>-162</b>	<b>76</b>					<b>76</b>	<b>71</b>	<b>5</b>
16	34L 10	502AK	C	20220307	-166	10					10	250	-240
17	<b>34LS</b>	<b>503BF</b>	<b>C</b>	<b>20220317</b>	<b>-133</b>	<b>77</b>	<b>-151</b>	<b>80</b>	<b>-163</b>	<b>78</b>	<b>80</b>	<b>99</b>	<b>-19</b>
18	<b>34S0.1</b>	<b>503BU</b>	<b>C</b>	<b>20220321</b>	<b>-129</b>	<b>81</b>	<b>-139</b>	<b>88</b>			<b>88</b>	<b>110</b>	<b>-22</b>
19	<b>34T0.1</b>	<b>503AB</b>	<b>C</b>	<b>20220317</b>	<b>-134</b>	<b>120</b>					<b>120</b>	<b>200</b>	<b>-80</b>
20	34U 8	513D	C	20220323	-150	85	-165	87			87	550	-463
21	34V3	503CB	C	20220323	-168	79					79		n/a
22	34X40	513R	C	20220329	-85	56	-101	55			56	61	-5
23	35F 20	513L	C	20220324	-70	210	-78	260	-85	170	260	300	-40
24	<b>35K1</b>	<b>523D</b>	<b>C</b>	<b>20220329</b>	<b>-88</b>	<b>110</b>	<b>-98</b>	<b>160</b>			<b>160</b>	<b>350</b>	<b>-190</b>
25	OCWD-BS21/1		C	20220308		209					209	204	5
26	SB1_6		C	20220413		90					90	71	19
27	33Q1					DP1					50	50	0
28	33U3					DP2					50	50	0
29	33W					DP3					50	50	0
30	33X					DP4					50	50	0
31	33Y					DP5					50	50	0
32	33Z					DP6					50	50	0
33	34D					DP7					50	50	0
34	34E					DP8					50	50	0
35	34G2					DP9					50	50	0
36	34J2					DP10					50	50	0
37	34V					DP11					50	50	0

DP = Dummy Point with an assumed chloride concentration of 50 mg/L placed at wells that were injecting into this zone during this reporting period.

Internodal Wells in **BOLD** and used for A-11 Barrier Cross Section



**LEGEND**

- ◆ Observation Well Locations
- Injection Well Locations
- Water Supply Line
- ⋯ Recent Zone Boundary
- ▲ Production Well Locations

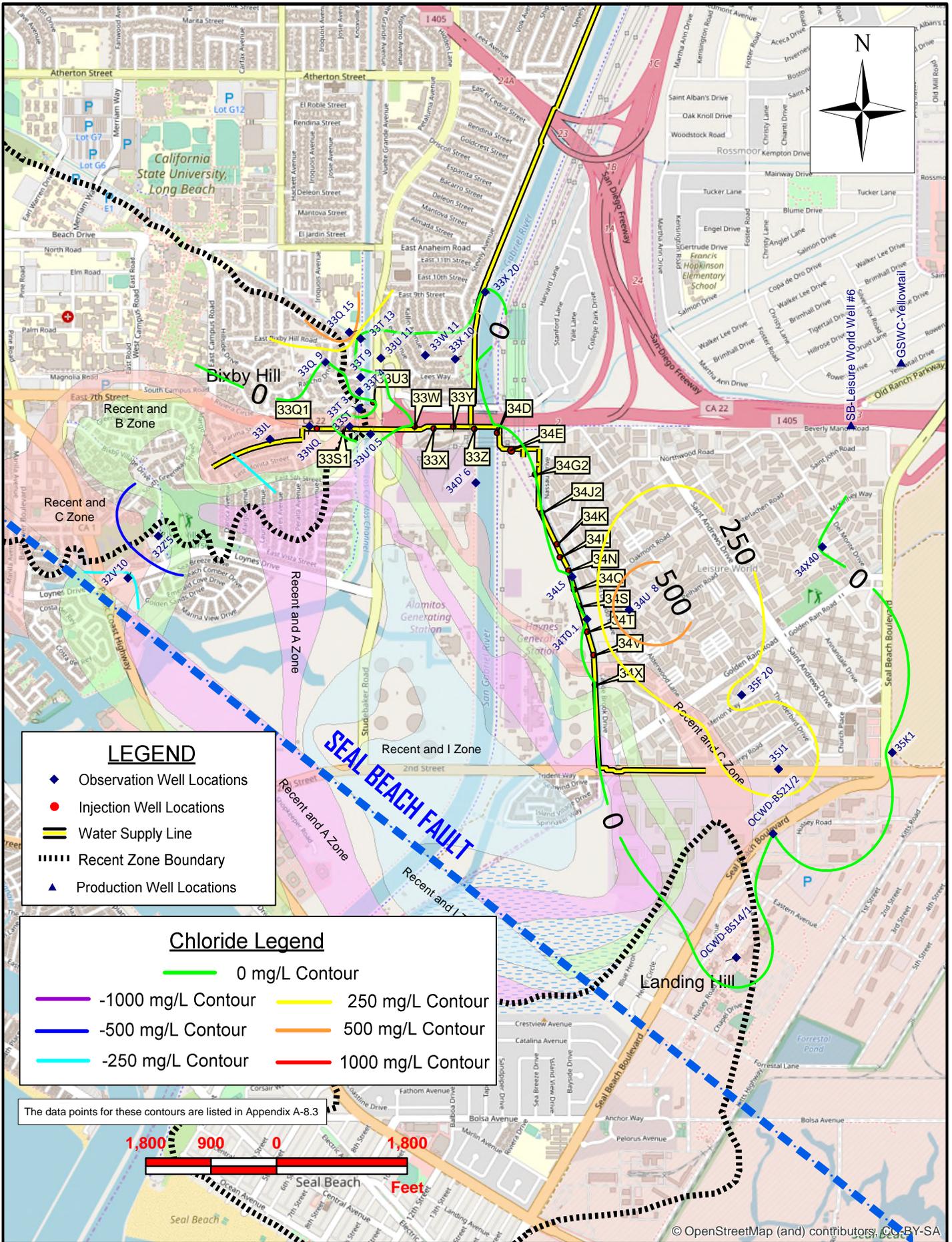
**Contour Legend**

— 250 mg/L Contour	— 2,500 mg/L Contour
— 500mg/L Contour	— 5,000 mg/L Contour
— 1,000 mg/L Contour	— 10,000 mg/L Contour

The data points for these contours are listed in Appendix A-8.3



Alamitos Barrier Project  
B Zone Chloride Concentration (mg/L) Contours, Spring 2022



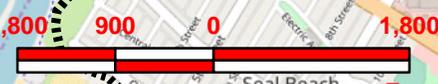
**LEGEND**

- ◆ Observation Well Locations
- Injection Well Locations
- Water Supply Line
- - - - Recent Zone Boundary
- ▲ Production Well Locations

**Chloride Legend**

— 0 mg/L Contour	— 250 mg/L Contour
— -1000 mg/L Contour	— 500 mg/L Contour
— -500 mg/L Contour	— 1000 mg/L Contour
— -250 mg/L Contour	

The data points for these contours are listed in Appendix A-8.3



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**Alamitos Barrier Project**  
**B Zone Change in Chloride Concentration, Spring 2021 to Spring 2022**

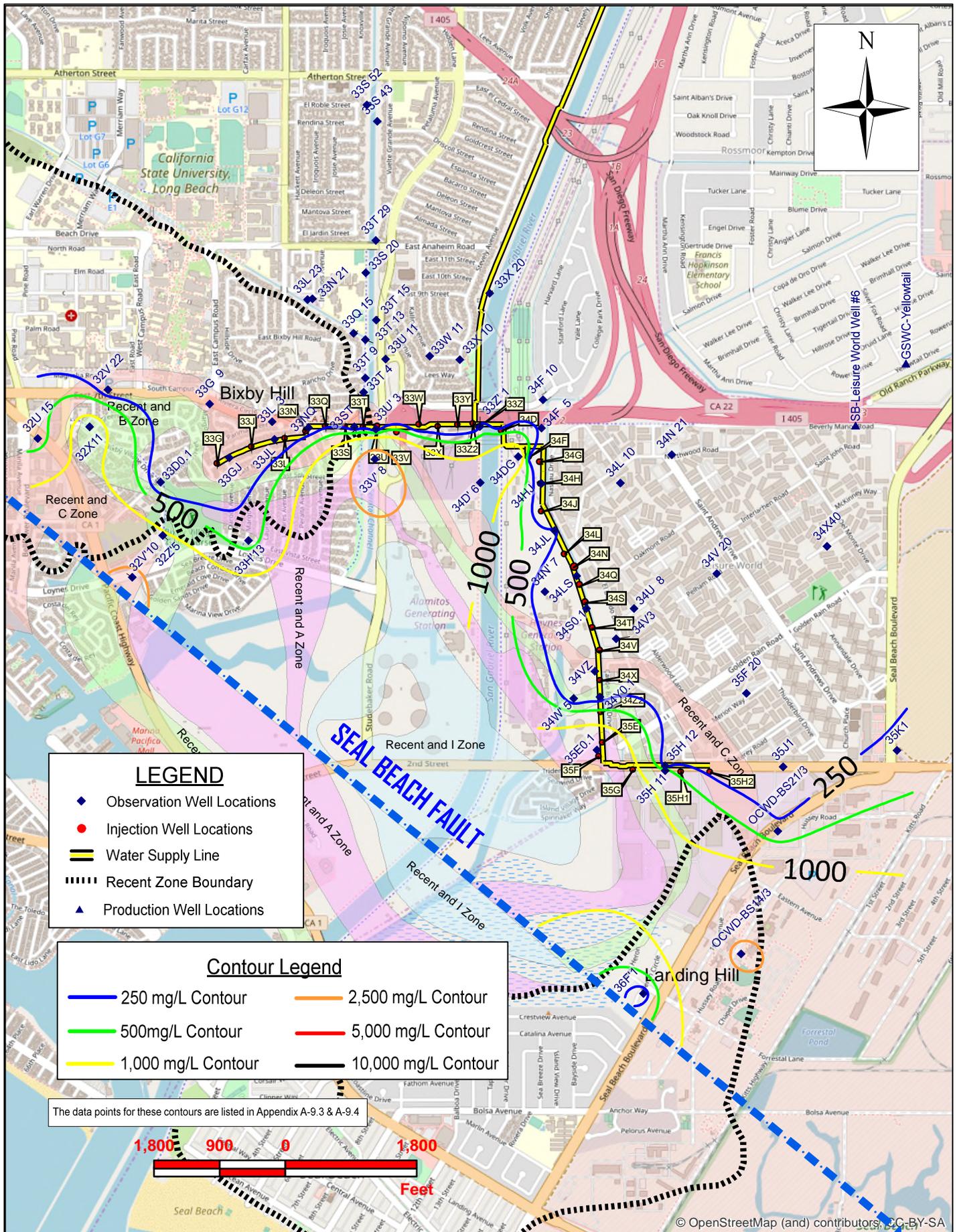
B zone CL.srf

**ALAMITOS BARRIER PROJECT**  
**B-ZONE CHLORIDE CONCENTRATIONS**  
**Chloride Data Used for Contours and Cross-Section**

No.	PROJ	FCD	AQUIFER	DATE	Sampling Depths and Chloride Data						For Contours	MAX CHLORIDE FY20-21	Change in Chloride (FY21-22 - FY20-21)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 21-22		
1	32V '10	483G	B	20220209	-72	2900					2,900	3,100	-200
2	32Z '5	482W	AB	20220210	-20	840	-30	1000	-40	1100	1,100	1,900	-800
<b>3</b>	<b>33JL</b>	<b>492BQ</b>	<b>B</b>	<b>20220310</b>	<b>3</b>	<b>11</b>	<b>-7</b>	<b>13</b>			<b>13</b>	<b>97</b>	<b>-84</b>
4	33NQ	492BN	B	20220309	-3	78	-14	66			78	80	-2
5	33Q 9	492CM	B	20220308	-85	80	-95	85	-105	79	85	110	-25
6	33Q 15	492AN	B	20220216	-263	6200					6,200	5,300	900
7	<b>33ST</b>	<b>492BK</b>	<b>CB</b>	<b>20220309</b>	<b>-25</b>	<b>86</b>					<b>86</b>	<b>69</b>	<b>17</b>
8	33T 3	492CL	B	20220216	-40	79	-57	78	-75	78	79	95	-16
9	33T 4	492CS	B	20220314	-91	73					73	62	11
10	33T 9	492YY	B	20220314	-163	140					140	110	30
11	33T 13	492AB	B	20220314	-254	52					52	320	-268
<b>12</b>	<b>33U '0.5</b>	<b>492BZ</b>	<b>B</b>	<b>20220309</b>	<b>-57</b>	<b>71</b>					<b>71</b>	<b>53</b>	<b>18</b>
13	33U 11	492AK	B	20220315	-260	74					74	78	-4
14	33W 11	502S	B	20220329	-241	90	-269	91			91	130	-39
15	33X 10	502BC	B	20220223	-275	76					76	76	0
16	33X 20	502K	B	20220315	-266	69					69	76	-7
17	34D '6	502BG	B	20220316	-180	9	-194	8			9	140	-131
18	34F 10	502AQ	B	20220324	-269	81					81		n/a
19	34L 10	502AL	B	20220307	-224	7	-249	11			11		n/a
20	34LS	503BE	B	20220317	-188	75					75	76	-1
21	34T0.1	503AC	B	20220317	-174	68	-207	67	-239	70	70	86	-16
22	34U 8	513E	B	20220323	-225	2900					2,900	2,100	800
23	34V 3	503CC	B	20220323	-208	750					750		n/a
24	34X40	513Q	B	20220329	-137	14					14	26	-12
25	35F 20	513K	B	20220324	-115	330					330	110	220
26	35J1	514M	B	20220404	-128	630	-143	690	-148	990	990	550	440
27	35K1	523A	B	20220324	-127	110	-142	120	-157	130	130	150	-20
28	OCWD-BS14/1		B	20220308		239					239	219	20
29	OCWD-BS21/2		B	20220308		276					276	277	-1
30	33U3					DP1					50	50	n/a
31	33W					DP2					50	50	n/a
32	34D					DP3					50	50	n/a
33	34G2					DP4					50	50	n/a
34	34J2					DP5					50	50	n/a
35	34L					DP6					50	50	n/a
36	34S					DP7					50	50	n/a
37	34X					DP8					50	50	n/a

DP = Dummy Point with an assumed chloride concentration of 50 mg/L placed at wells that were injecting into this zone during this reporting period.

Internodal Wells in **BOLD** and used for A-11 Barrier Cross Section



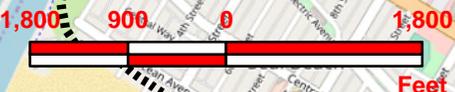
**LEGEND**

- ◆ Observation Well Locations
- Injection Well Locations
- Water Supply Line
- - - - Recent Zone Boundary
- ▲ Production Well Locations

**Contour Legend**

— 250 mg/L Contour	— 2,500 mg/L Contour
— 500mg/L Contour	— 5,000 mg/L Contour
— 1,000 mg/L Contour	— 10,000 mg/L Contour

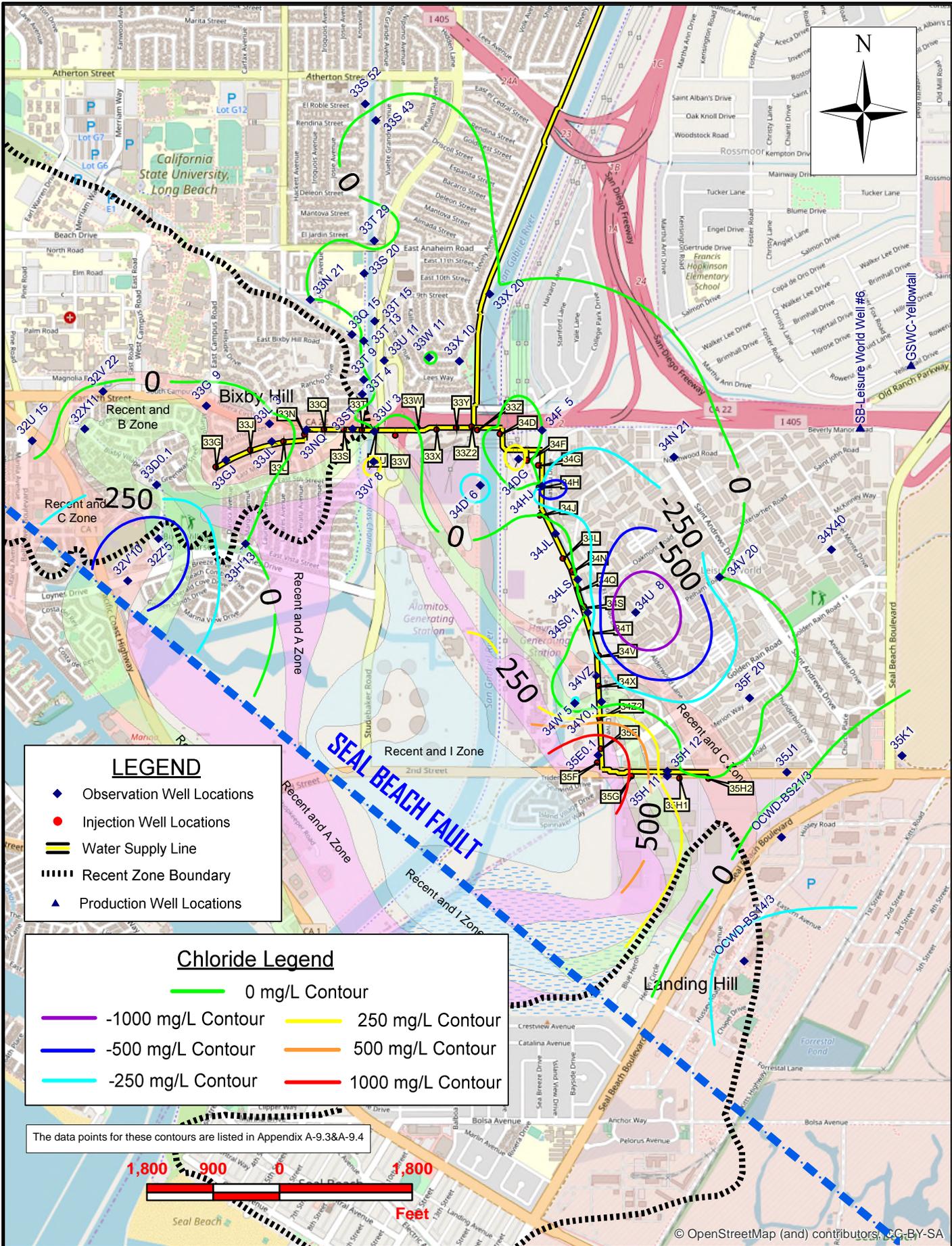
The data points for these contours are listed in Appendix A-9.3 & A-9.4



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**Alamitos Barrier Project**  
**A Zone Chloride Concentration (mg/L) Contours, Spring 2022**



**LEGEND**

- ◆ Observation Well Locations
- Injection Well Locations
- Water Supply Line
- ▬ Recent Zone Boundary
- ▲ Production Well Locations

**Chloride Legend**

— 0 mg/L Contour	— 250 mg/L Contour
— -1000 mg/L Contour	— 500 mg/L Contour
— -500 mg/L Contour	— 1000 mg/L Contour
— -250 mg/L Contour	

The data points for these contours are listed in Appendix A-9.3&A-9.4



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Alamitos Barrier Project  
A Zone Change Chloride Concentration, Spring 2021 to Spring 2022

**ALAMITOS BARRIER PROJECT**  
**A-ZONE CHLORIDE CONCENTRATIONS**  
Chloride Data Used for Contours and Cross-Section

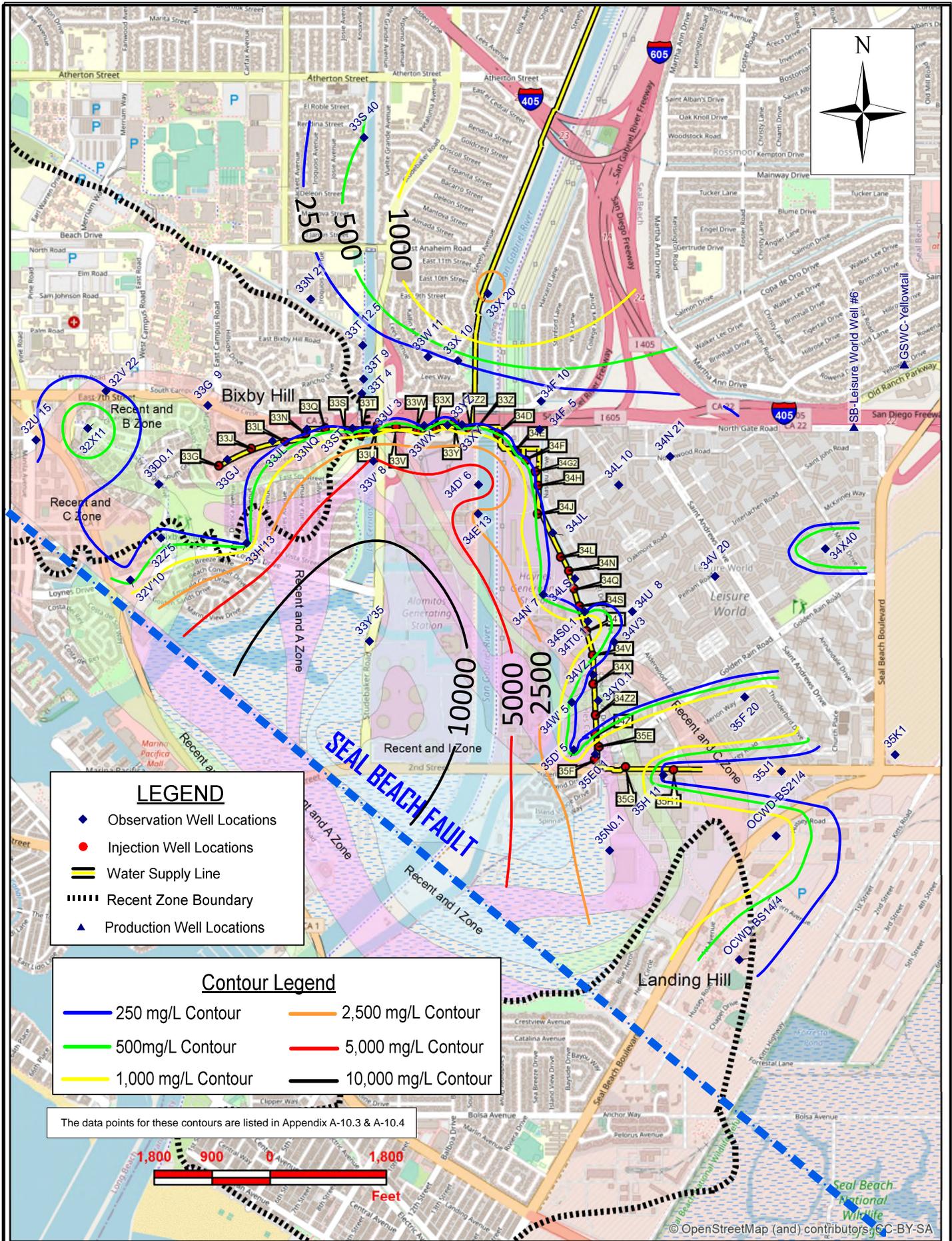
No.	PROJ	FCD	AQUIFER	DATE	Sampling Depths and Chloride Data						For Contours MAX CHL. 21-22	MAX CHLORIDE FY20-21	Change in Chloride (FY21-22 - FY20-21)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)			
1	32U 15	482M	A	20220210	-17	300					300	220	80
2	32V 22	482P	A	20220214	-11	79					79	89	-10
3	32V'10	483F	A	20220209	-90	2,700	-105	2,800			2,800	3,400	-600
4	32X11	482S	A	20220310	-9	36	-24	1,400			1,400	1,500	-100
5	32Z'5	482W	AB	20220210	-20	840	-30	1,000	-40	1,100	1,100	1,900	-800
6	33D0.1	482U	AI	20220310	-24	10	-49	10	-74	10	10	82	-72
7	33G 9	482F	A	20220210	-3		-23	92			92	100	-8
8	33GJ	482X	A	20220310	-35	7					7	78	-71
9	33H'13	493YY	R,A	20220210	-18	310	-38	310	-58	330	330	330	0
10	33JL	492BW	A,I	20220310	-41	7	-79	8	-116	8	8	68	-60
11	33L 3	492	A	20220210	-60	64					64	69	-5
12	33L 23	492RR	A	20220308	-344	120					120		n/a
13	33N 21	492BU	A	20220208	-305	170	-330	140	-346	140	170	170	0
14	33NQ	492BP	A,I	20220309	-48	87	-92	84	-136	86	87	71	16
15	33Q 15	492AM	A	20220216	-337	130					130	91	39
16	33S 20	492BR	A	20220214	-317	110	-336	110	-355	110	110	140	-30
17	33S 43	491E	A	20220215	-333	120	-344	120			120	150	-30
18	33S 52	491H	A	20220215	-284	200	-289	190			200	180	20
19	33ST	492BL	A	20220309	-65	78	-86	77	-100	76	78	68	10
20	33T 13	492ZZ	A	20220314	-128	98					98	110	-12
21	33T 15	492SS	A	20220215	-334	130					130	180	-50
22	33T 29	491C	A	20220215	-350	110					110	100	10
23	33T 4	492CR	A	20220314	-146	75	-166	82	-186	82	82	70	12
24	33T 9	492TT	A	20220314	-262	81					81	77	4
25	33U 11	492AJ	A	20220315	-348	77					77	98	-21
26	33U 3	492WW	A	20220216	-89	96					96	92	4
27	33V 8	492BY	R,A	20220216	-24	3,600	-48	3,700			3,700	3,400	300
28	33W 11	502T	A	20220329	-321	72	-349	77	-376	79	79	75	4
29	33X 10	502BD	A	20220223	-320	79	-340	72	-356	73	79	89	-10
30	33X 20	502J	A	20220315	-353	120					120	120	0
31	33Z' 1	502G	A	20220316	-320	420					420		n/a
32	34D' 6	502BH	A	20220316	-270	51	-303	1,200	-335	1,300	1,300	1,700	-400
33	34DG	502Z	A	20220323	-292	550	-324	1,700			1,700	1,200	500
34	34F 5	502BR	A	20220323	-297	80	-322	200	-347	210	210	210	0
35	34F 10	502AR	A	20220329	-311	79	-326	78			79		n/a
36	34HJ	502BX	A	20220323	-310	70	-321	68	-331	69	70	950	-880
37	34JL	503AP	A	20220317	-262	200	-288	270	-308	250	270	120	150
38	34L 10	502AM	A	20220307	-310	8	-330	9	-354	10	10		n/a
39	34LS	503BD	A	20220317	-238	76	-283	76			76	80	-4
40	34N' 7	503AF	A	20220223	-106	84	-144	66	-176	68	84		n/a
41	34N 21	512B	A	20220307	-328	12	-354	15			15	100	-85
42	34S0.1	503BV	A	20220321	-239	79	-249	77	-256	83	83	86	-3
43	34U 8	513F	A	20220323	-280	88	-310	100			100	2,100	-2,000
44	34V3	503CD	A	20220323	-263	78					78		n/a
45	34V 20	513B	A	20220330	-234	140	-265	150	-292	150	150	150	0
46	34VZ	503BH	A	20220323	-146	85	-156	83			85	73	12
47	34W' 5	503AJ	A	20220223	-81	64	-101	66	-119	96	96	390	-294
48	34X40	513P	A	20220329	-202	29	-232	140			140	66	74

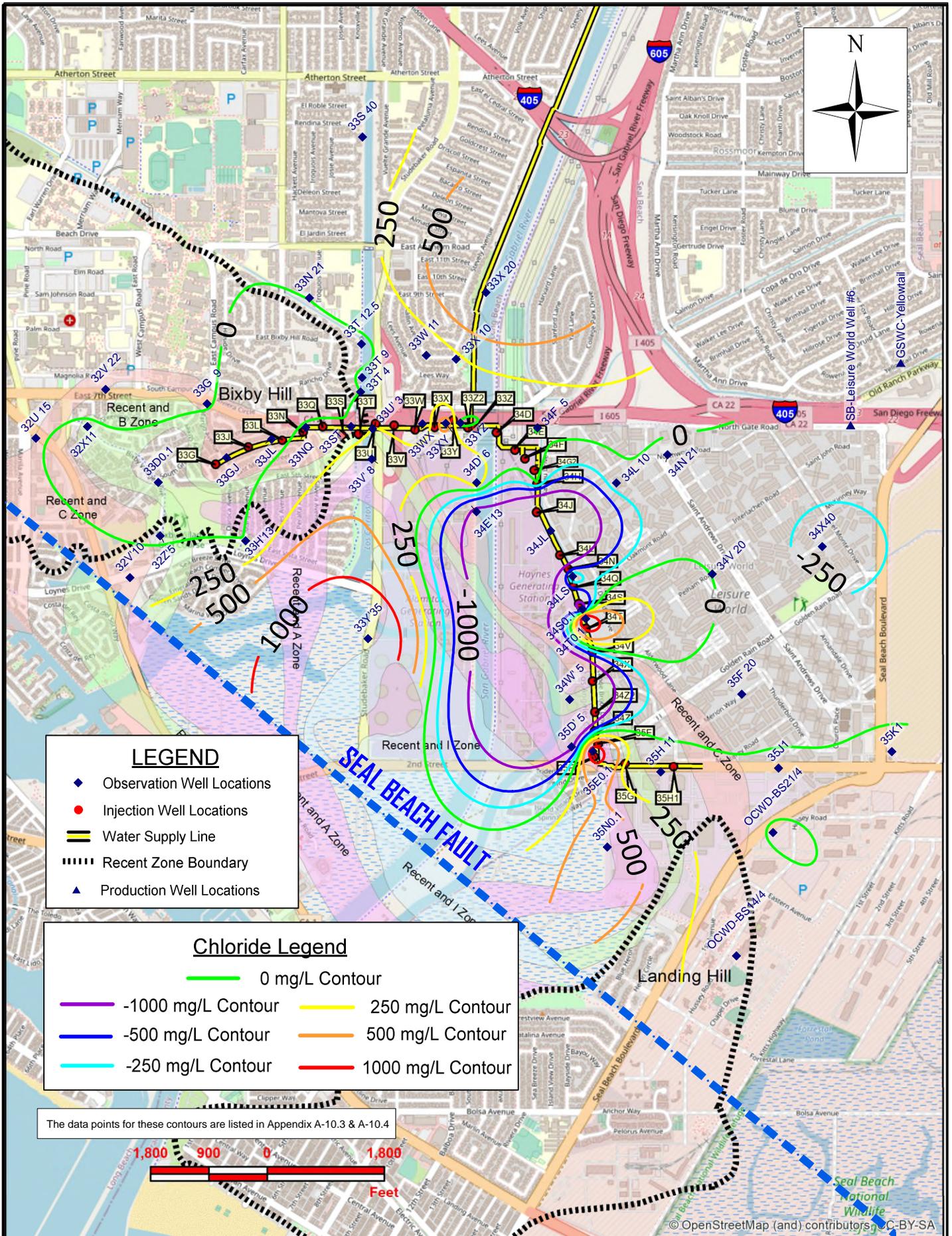
**ALAMITOS BARRIER PROJECT**  
**A-ZONE CHLORIDE CONCENTRATIONS**  
**Chloride Data Used for Contours and Cross-Section**

No.	PROJ	FCD	AQUIFER	DATE	Sampling Depths and Chloride Data						For Contours MAX CHL. 21-22	MAX CHLORIDE FY20-21	Change in Chloride (FY21-22 - FY20-21)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)			
49	34Y0.1	503CL	A	20220317	-107	150					150	290	-140
50	35E0.1	503BK	A	20220323	-74	2,000					2,000	78	1,922
51	35F 20	513J	A	20220324	-129	110	-158	200			200	220	-20
52	35H 11	514G	A	20220315	-123	180	-146	700			700	620	80
53	35H 12	514D	A	20220404	-137	120					120	78	42
54	35J1	514L	A	20220404	-193	100	-208	99	-228	110	110	92	18
55	35K1	523B	A	20220324	-197	14	-212	17	-227	300	300	350	-50
56	36F1	505D	A	20220303	-99	140					140		n/a
57	OCWD-BS14/3		A	20220308		2,780					2,780	3,190	-410
58	OCWD-BS21/3		A	20220308		294					294	331	-37
59	33W						DP1				50	50	n/a
60	33X						DP2				50	50	n/a
61	33Y						DP3				50	50	n/a
62	33Z						DP4				50	50	n/a
63	34D						DP5				50	50	n/a
64	34F						DP6				50	50	n/a
65	34H						DP7				50	50	n/a
66	34J						DP8				50	50	n/a
67	35H2						DP9				50	50	n/a

DP = Dummy Point with an assumed chloride concentration of 50 mg/L placed at wells that were injecting into this zone during this reporting period.

Internodal Wells in **BOLD** and used for A-11 Barrier Cross Section





**ALAMITOS BARRIER PROJECT**  
**I-ZONE CHLORIDE CONCENTRATIONS**  
 Chloride Data Used for Contours and Cross-Section

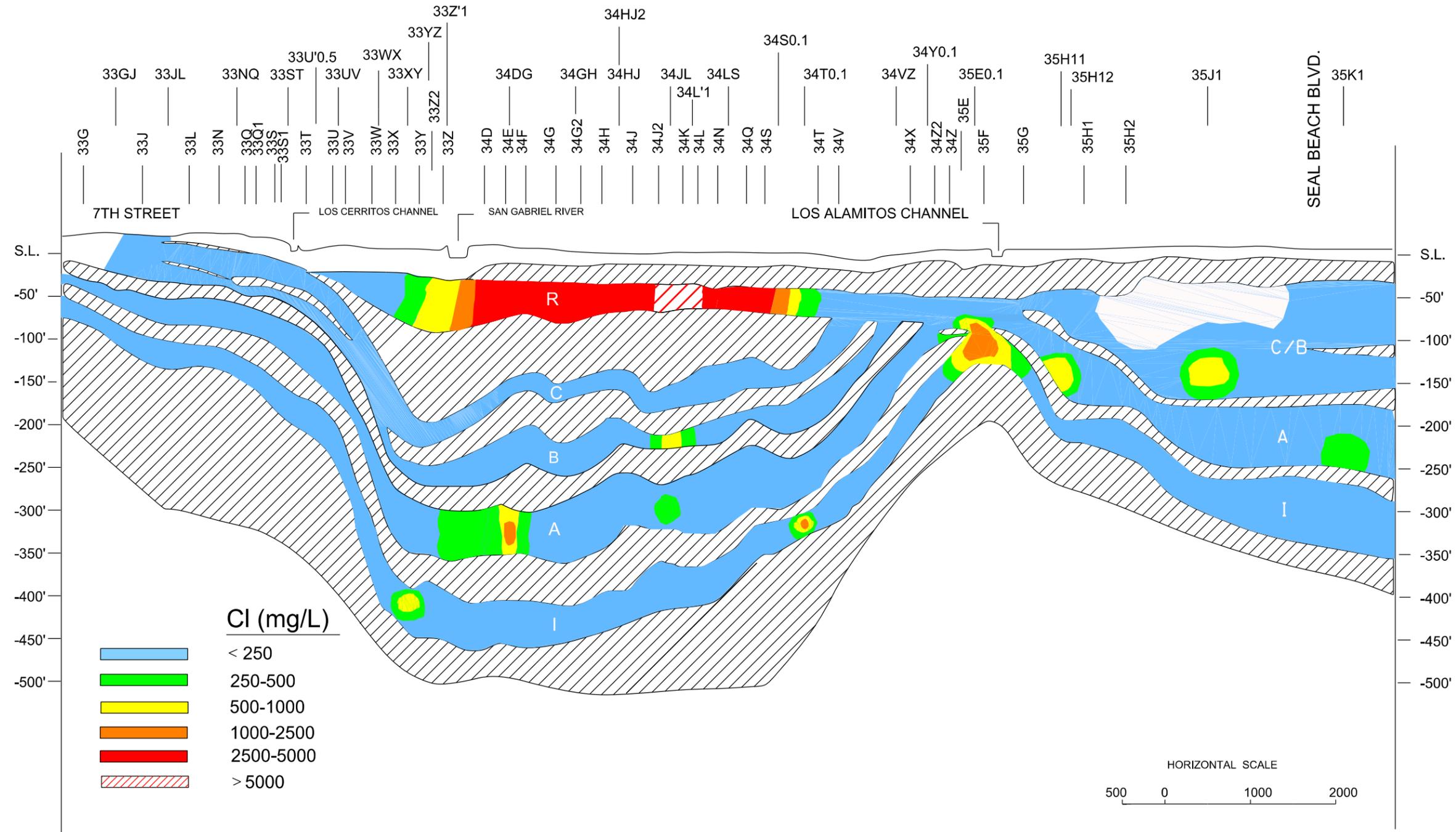
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					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 21-22	FY20-21	(FY21-22 - FY20-21)
1	32U 15	482L	I	20220210	-74	160					160	150	10
2	32V 22	482N	I	20220214	-51	270					270	140	130
3	32V'10	483E	I	20220209	-140	310	-152	320	-165	340	340	250	90
4	32X11	482R	I	20220310	-51	870	-61	870			870	900	-30
5	32Z'5	482V	I	20220210	-68	270	-83	350	-98	400	400	430	-30
6	33D0.1	482U	AI	20220310	-24	10	-49	10	-74	10	10	82	-72
7	33G 9	482G	I	20220210	-34	62	-68	76	-78	81	81	71	10
8	33GJ	482Y	I	20220310	-75	7	-95	7			7	78	-71
9	33H'13	493XX	I	20220210	-89	150					150	140	10
10	33JL	492BW	AI	20220310	-41	7	-79	8	-116	8	8	68	-60
11	33N 21	492BV	I	20220208	-457	66	-468	66			66	64	2
12	33NQ	492BP	AI	20220309	-48	87	-92	84	-136	86	87	71	16
13	33S 40	491F	I	20220215	-470	510					510	450	60
14	33ST	492BM	I	20220309	-130	89	-148	80	-163	84	89	71	18
15	33T 4	492CQ	I	20220314	-277	78	-292	76			78	77	1
16	33T 9	492XX	I	20220314	-364	81					81	62	19
17	33T 12.5	492BT	I	20220216	-423	89	-438	90	-443		90	120	-30
18	33U' 3	492QQ	I	20220216	-147	400					400	140	260
19	33V' 8	492BX	I	20220216	-109	3,600	-130	5,400			5,400	4,900	500
20	33W 11	502U	I	20220329	-423	72	-446	99	-468	140	140	84	56
21	33WX	502AG	I	20220309	-374	14	-391	95	-405	95	95	86	9
22	33X 10	502BE	I	20220223	-420	290	-440	86	-460	77	290	86	204
23	33X 20	502H	I	20220315	-442	2,800					2,800	1,800	1,000
24	33XY	502BP	I	20220330	-403	77	-417	82	-431	810	810	110	700
25	33Y'35	493ZZ	I	20220222	-67	24,000					24,000	22,000	2,000
26	33YZ	502AE	I	20220330	-402	68	-433	72			72	120	-48
27	34D' 6	502BI	I	20220316	-400	1,800	-410	8,000	-418		8,000	7,600	400
28	34E'13	503AT	I	20220316	-289	910	-308	1,600			1,600	2,800	-1,200
29	34F 5	502BQ	I	20220323	-411	66	-426	67	-441	66	67	71	-4
30	34F 10	502AS	I	20220329	-416	75	-442	75			75		n/a
31	34JL	503AN	I	20220317	-382	89	-403	85			89	4,000	-3,911
32	34L 10	502AN	I	20220307	-404	7	-426	7			7	87	-80
33	34LS	503BC	I	20220321	-338	70	-368	69			70	90	-20
34	34N 21	512C	I	20220307	-423	7	-448	7			7	84	-77
35	34N 7	503AG	I	20220223	-221	87	-254	220	-274	250	250		n/a
36	34S0.1	503BW	I	20220321	-306	130	-310	130			130	1,400	-1,270
37	34T0.1	503AD	I	20220317	-289	610	-312	1,800	-334	1,900	1,900	95	1,805
38	34U 8	513G	I	20220323	-360	84	-375	86			86		n/a
39	34V 20	513C	I	20220330	-386	89					89	93	-4
40	34V3	503CE	I	20220323	-328	110					110		n/a

**ALAMITOS BARRIER PROJECT**  
**I-ZONE CHLORIDE CONCENTRATIONS**  
 Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	AQUIFER	DATE	Sampling Depths and Chloride Data						For Contours	MAX CHLORIDE FY20-21	Change in Chloride (FY21-22 - FY20-21)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 21-22		
41	<b>34VZ</b>	<b>503BG</b>	I	<b>20220323</b>	<b>-213.8</b>	<b>80</b>	<b>-223.8</b>	<b>80</b>			<b>80</b>		<b>n/a</b>
42	34W' 5	503AK	I	20220223	-156	330					330	4,700	-4,370
43	34X40	513N	I	20220329	-331	850	-346	100			850	1,200	-350
44	<b>34Y0.1</b>	<b>503CM</b>	I	<b>20220317</b>	<b>-175</b>	<b>120</b>	<b>-185</b>	<b>160</b>			<b>160</b>		<b>n/a</b>
45	35D' 5	503AM	I	20220303	-89	52					52	1,200	-1,148
46	<b>35E0.1</b>	<b>503BJ</b>	I	<b>20220323</b>	<b>-114</b>	<b>2,000</b>					<b>2,000</b>	<b>590</b>	<b>1,410</b>
47	35F 20	513H	I	20220324	-235	2,000	-245	2,900	-255	3,000	3,000	3,200	-200
48	<b>35H 11</b>	<b>514H</b>	I	<b>20220315</b>	<b>-203</b>	<b>210</b>					<b>210</b>	<b>120</b>	<b>90</b>
49	<b>35J1</b>	<b>513M</b>	I	<b>20220404</b>	<b>-261</b>	<b>160</b>	<b>-271</b>	<b>140</b>	<b>-281</b>	<b>150</b>	<b>160</b>	<b>100</b>	<b>60</b>
50	<b>35K1</b>	<b>523C</b>	I	<b>20220330</b>	<b>-363</b>	<b>89</b>	<b>-373</b>	<b>52</b>			<b>89</b>	<b>37</b>	<b>52</b>
51	35N0.1	504N	I	20220303	-71	1,400					1,400	680	720
52	OCWD-BS14/4		I	20220308		417					417	376	41
53	OCWD-BS21/4		I	20220308		1,240					1,240	1,260	-20
54	34D										50	50	n/a
55	34E										50	50	n/a
56	34H										50	50	n/a
57	34Z										50	50	n/a
58	35H1										50	50	n/a

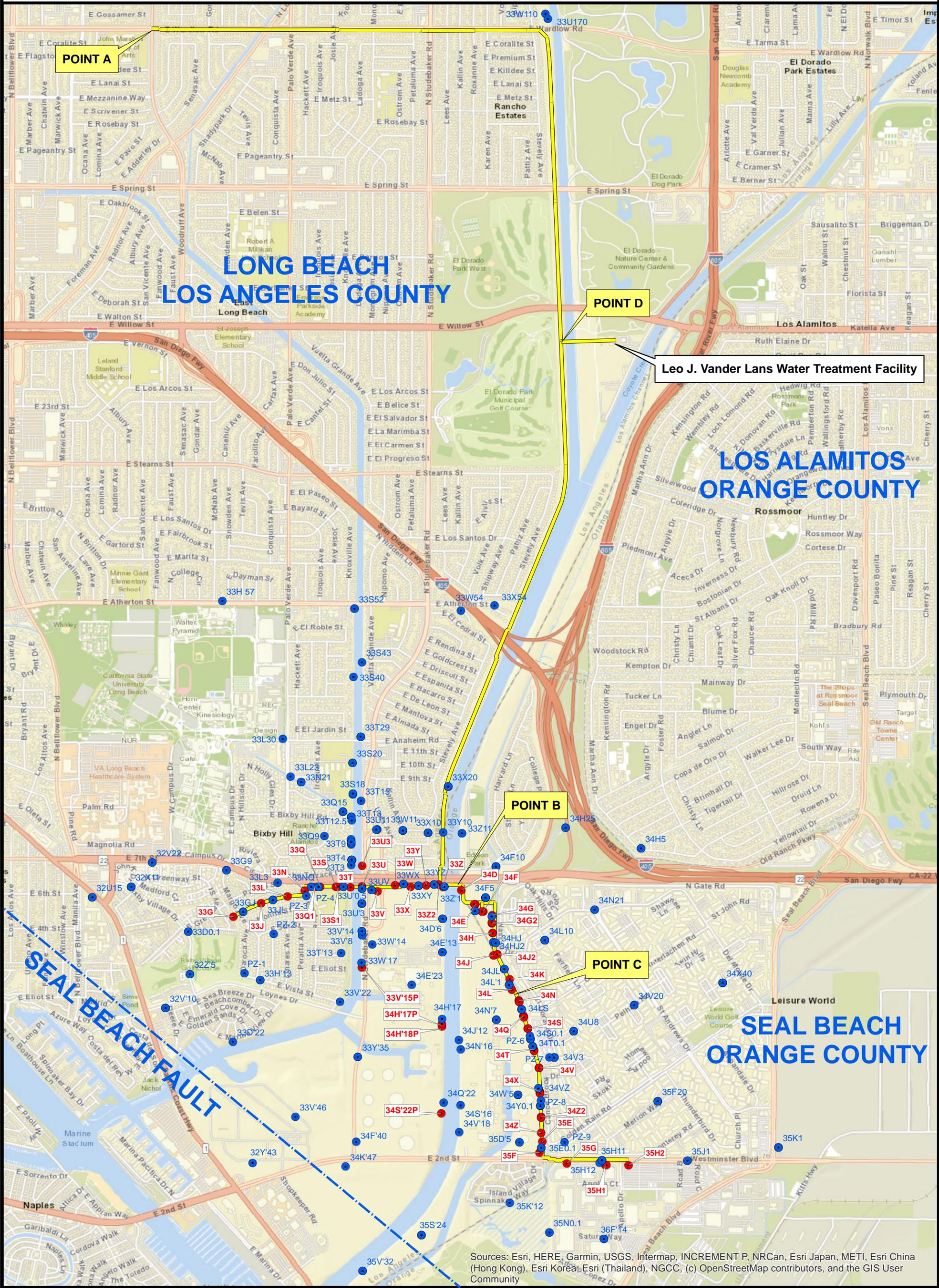
DP = Dummy Point with an assumed chloride concentration of 50 mg/L placed at wells that were injecting into this zone during this reporting period.

Internodal Wells in **BOLD** and used for A-11 Barrier Cross Section

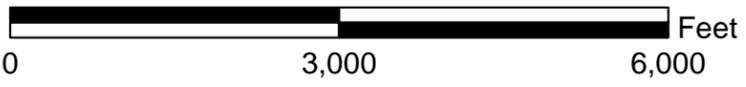


A-11

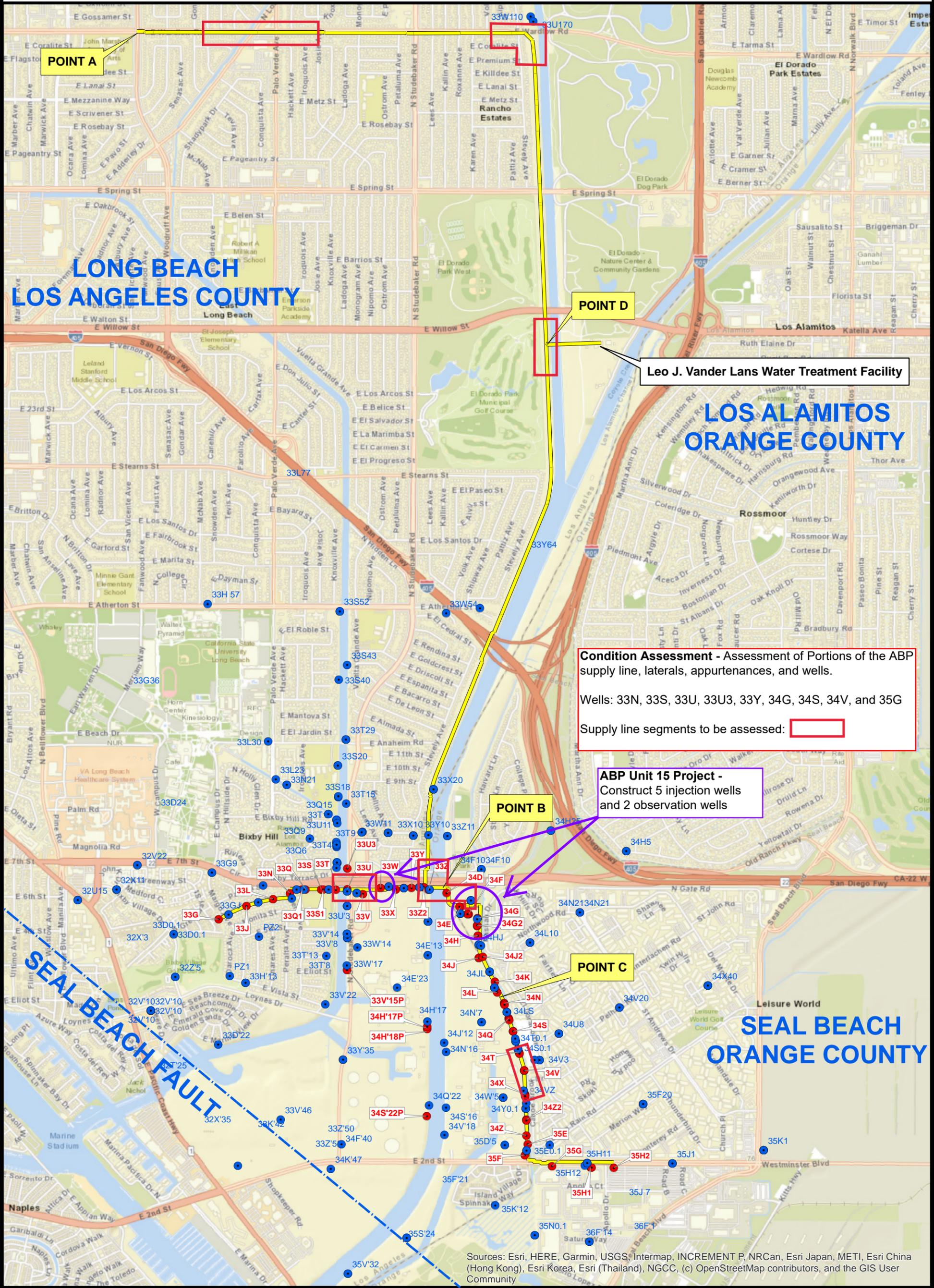
Note: The data points used to create this cross section are listed in the Appendix; A-6.3, 7.3, 8.3, 9.3, 9.4, 10.3, & 10.4



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



Legend	
<span style="color: blue;">●</span>	Alamos Observation Wells
<span style="color: red;">●</span>	Alamos Injection Wells
<span style="color: yellow;">—</span>	Alamos Water Supply Line



**POINT A**

**POINT D**

**Leo J. Vander Lans Water Treatment Facility**

**Condition Assessment - Assessment of Portions of the ABP supply line, laterals, appurtenances, and wells.**  
Wells: 33N, 33S, 33U, 33U3, 33Y, 34G, 34S, 34V, and 35G  
Supply line segments to be assessed:

**ABP Unit 15 Project - Construct 5 injection wells and 2 observation wells**

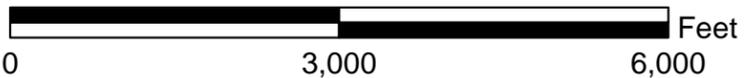
**POINT C**

**LONG BEACH  
LOS ANGELES COUNTY**

**LOS ALAMITOS  
ORANGE COUNTY**

**SEAL BEACH  
ORANGE COUNTY**

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

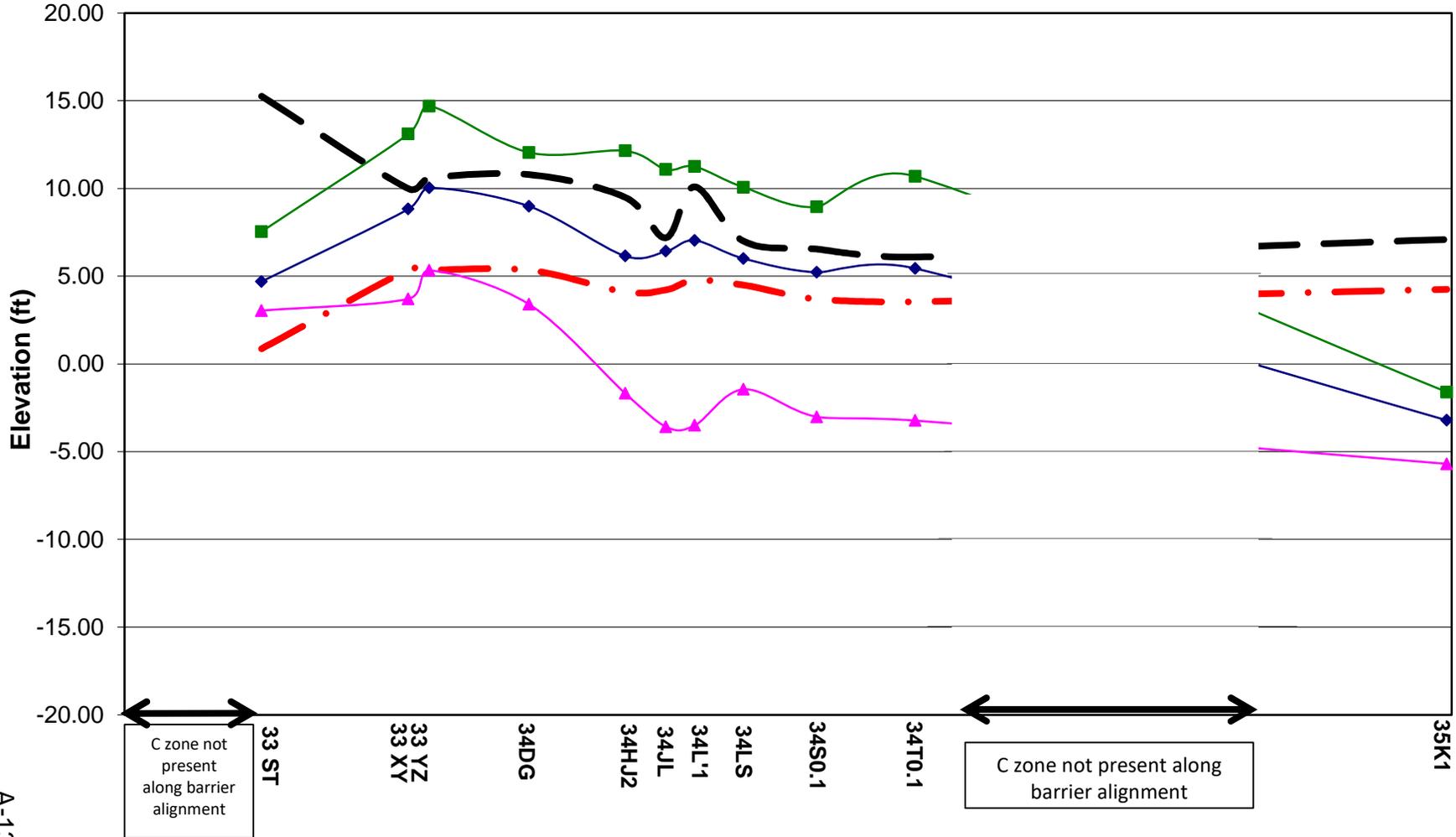


**Legend**

- Alamos\_Observation\_Wells
- Alamos\_Injection\_Wells
- Alamos Water Supply Line

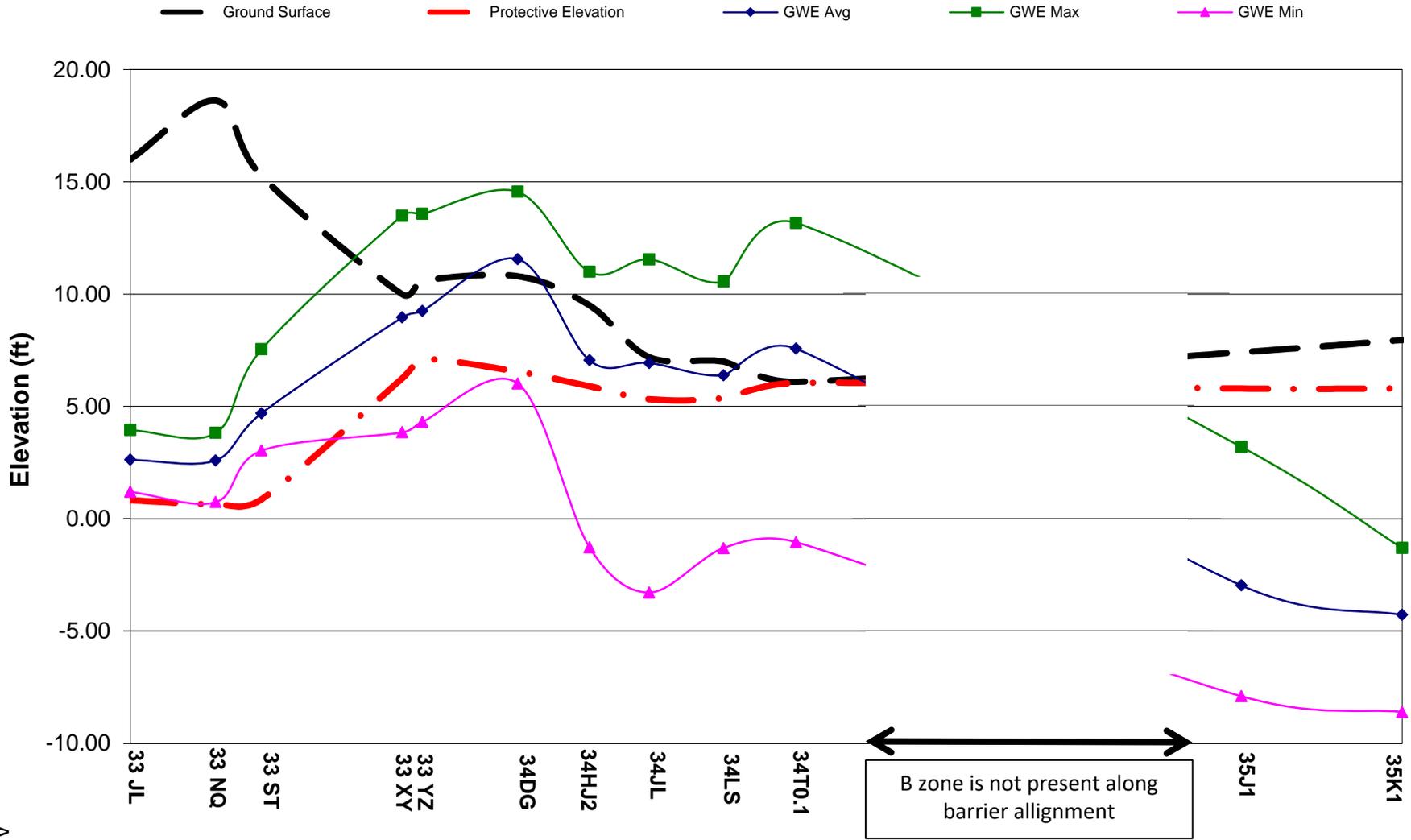
# C Zone - Groundwater Elevation (GWE) Along the ABP FY21-22

— Ground Surface
— Protective Elevation
—◆ GWE Avg
—■ GWE Max
—▲ GWE Min



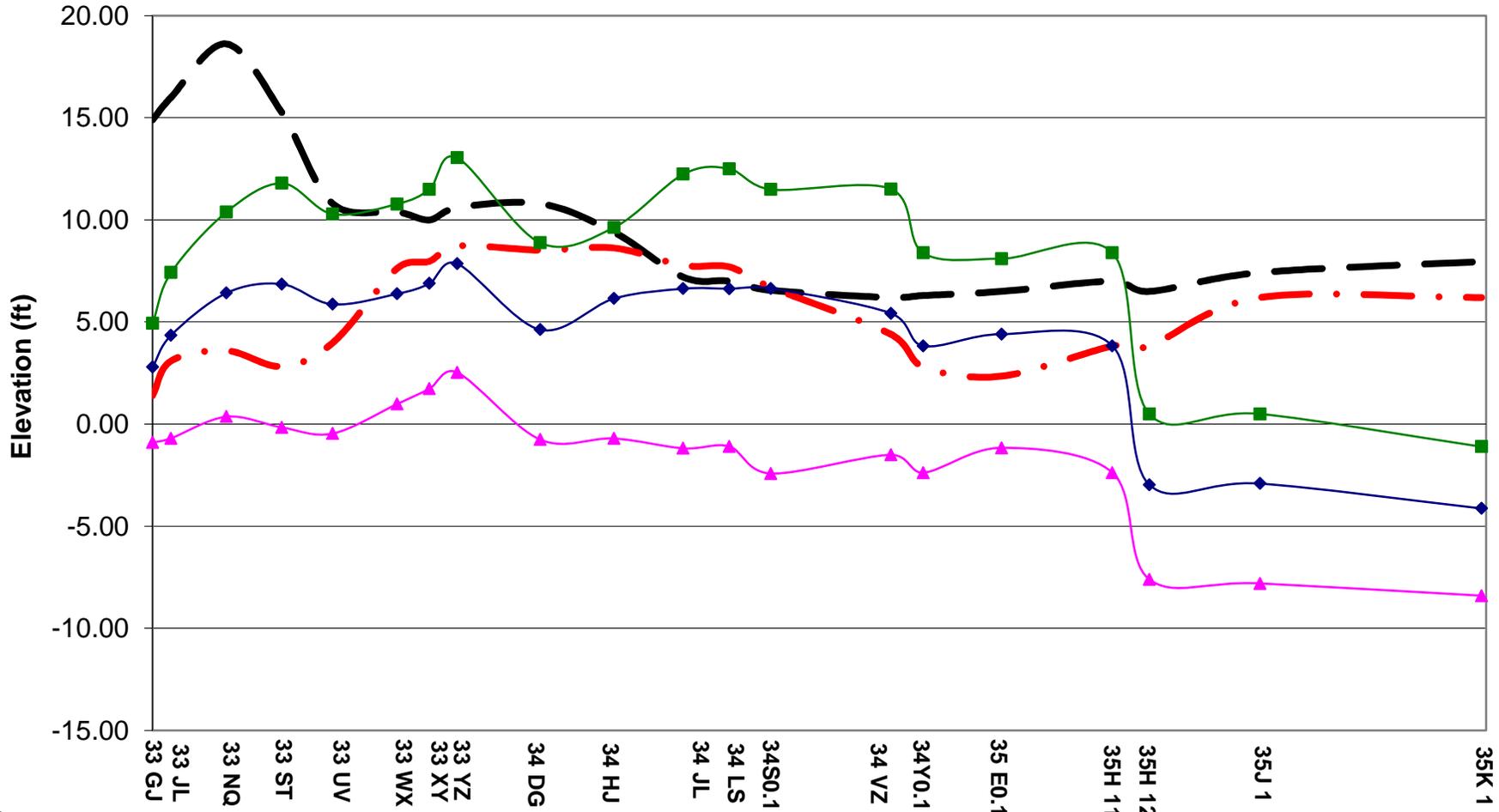
A-13

# B Zone - Groundwater Elevation (GWE) Along the ABP FY21-22



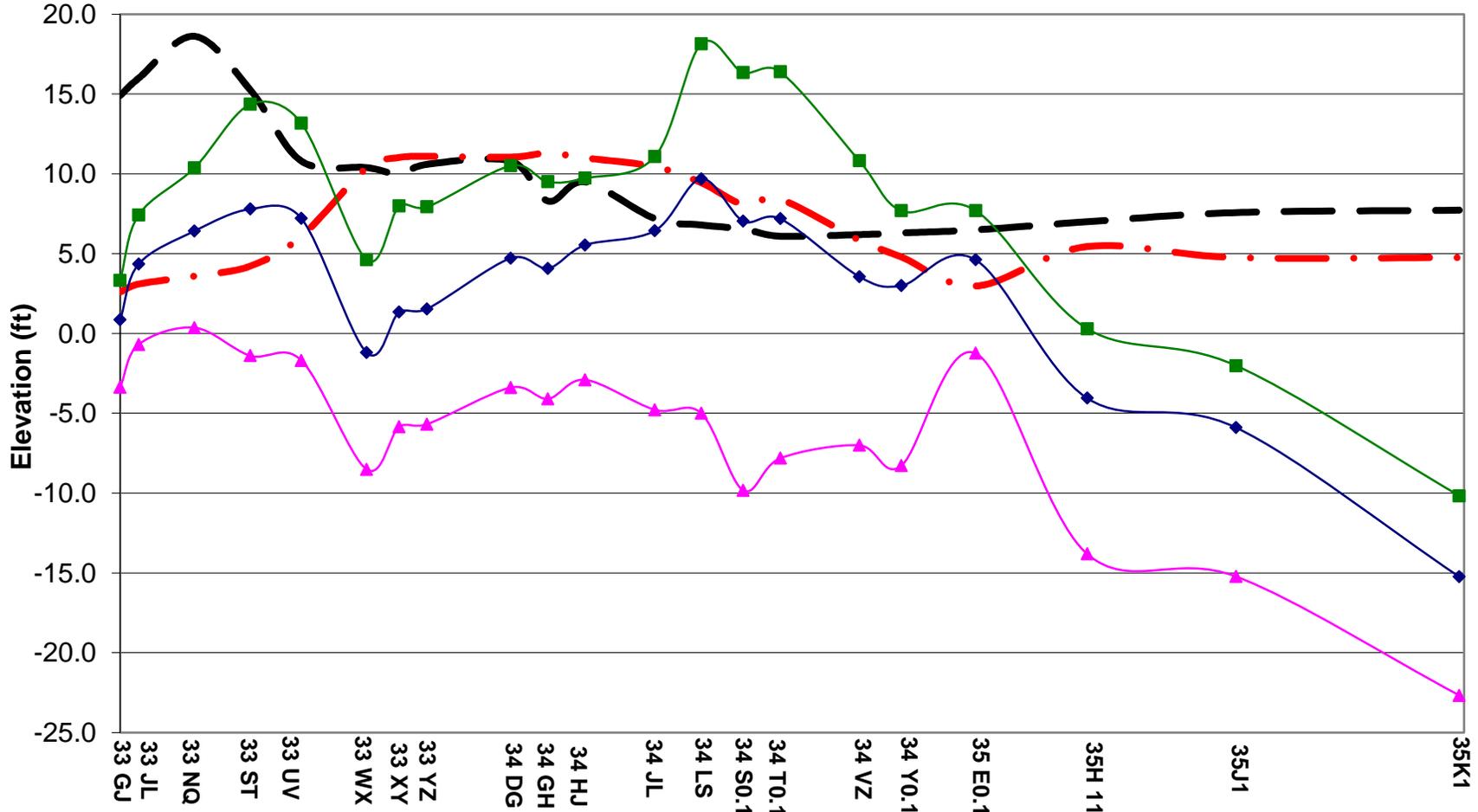
# A Zone - Groundwater Elevation (GWE) Along the ABP FY21-22

— Ground Surface
— Protective Elevation
—◆ GWE Avg
—■ GWE Max
—▲ GWE Min



# I Zone - Groundwater Elevation (GWE) Along the ABP FY21-22

— Ground Surface    
 — Protective Elevation    
 —◆— GWE Avg    
 —■— GWE Max    
 —▲— GWE Min



**ABP EXPENDITURES  
FY 2021-22**

ITEM NO.	DESCRIPTION	JOB NO.	DESCRIPTION	SERVICES AND SUPPLIES	FY 2021-22 BUDGET	% BUDGET FY 21-22	OCWD SHARE	OCWD BUDGET FY 21-22	% OCWD FY 21-22	LADPW SHARE	LACFPW BUDGET FY 21-22	% LACFPW BUDGET FY 21-22	
1.	Analysis and direction of injection operations	H0321550 H0321551	BARRIER PROJECT OPERATION-GEN ABP ANALY&DIR OF INJECTION O	132,489.67 47,477.39	200,000	90.0%	37.6%	77,000.00	80.00	84.6%	112,263.45	93.6%	
			Subtotal #1	179,967.06				143,084.51			330,000		
2.	Maintenance and repair of injection wells	F5064011 F5060009P H0321911 HP01511000 F5009760F	INJECT. WELLS-MAINTAIN/ALAMITO MAINT INJECTION WELLS - ABP MAINT ENGR - BARRIER PROJ Alamitos Barrier Proj-Telemetry Maint. DOBP Automated System (LEED maintenance contract/ABP portion) DRILL EQPT-MAINT/TEST - Eaton Yard OCWP Permit No. FE21-0219	42,087.34 140,843.59 16,538.02 26,428.15 69,758.91 82,508.67 3176.91	550,000	69.2%		220,000	65.0%	337,257.08	71.9%		
			Subtotal #2	380,341.59				21,386.02		76.4%	42,000	84.4%	
3.	Operation of injection	F5064000	RECHARGE OPER U/S - ABP	56,847.48	70,000	81.2%		28,000			42,000		
			Subtotal #3	56,847.48				0.00		0.0%	0.00	0.0%	
4.	Analysis and direction of extraction operations (No cost to OCWD)	H0321555	ABP ANALY&DIR OF EXTRACT OPS	0.00	0.0	0.0%		0.0			0.0		
			Subtotal #4	0.00				0.00		0.0%	0.00	0.0%	
5.	Maintenance, and repair of extraction wells (No cost to OCWD)	F6000900	NON-LABOR EXP BARRIER (ALMT)	2,846.52	10,000	0.0%		0.0			10,000	0.0%	
			Subtotal #5	2,846.52				0.00		0.0%	2,846.52	56.9%	
6.	Operation of extraction wells (No cost to OCWD)	F6000900	NON-LABOR EXP BARRIER (ALMT)	2,846.52	5,000	56.9%		0.0			5,000	56.9%	
			Subtotal #6	2,846.52				0.00		0.0%	2,846.52	56.9%	
7.	Maintenance and repair of distribution system	F6004012 F6004014F F6009118 H0321016 H0321569 F6004010	MAINT PRS - ABP ABP Locate & Mark Barrier Proj. U/grd. Lines Disassemble/Reassemble of Wells ABP Seawater Barriers Administrative Support ALAMITOS BARRIER PROJECT MAINT AIR/VAC-BLOWOFF U/S - ABP	59,185.59 30,639.14 52,526.78 46,228.68 191,201.61 1,402.80	375,000	101.6%		150,000	95.6%	237,782.95	105.7%		
			Subtotal #7	381,184.60				143,401.65			225,000	105.7%	
8.	Maintenance of observation wells	F5064004	OBSERV. WELLS-CLEANOUT/ALAMITO	99,438.37	150,000	66.3%		60,000	62.3%		90,000	68.9%	
			Subtotal #8	99,438.37				37,408.71			62,029.66	68.9%	
9.	Collection of groundwater data	H0321552	ABP COLL OF GW WTR DATA FOR OCWP Permit No. FE21-0141 Seal Beach Permit No. DPW04422 Seal Beach Permit No. DPW04517	125,509.84 534.00 542.07 718.00	200,000	63.7%		80,000	59.9%		120,000	66.2%	
			Subtotal #9	127,303.91				47,891.73			79,412.18	66.2%	
10.	Yard Maintenance	F6001904 F6001920 F6003123 F6003124 FPM34107 F7001907	CONDUCT QUARTERLY INSPECTION CONDUCT QUARTERLY INSPECTION BUILDING MAINTENANCE NONRES BUILDING MAINTENANCE-NONRES Facility Maintenance Alamitos Yd F107 QUARTERLY INSPECTION OF 2	454.54 399.63 17,138.24 16,772.86 18,152.28 799.25	75,000	71.6%		10,000	202.1%		65,000	51.6%	
			Subtotal #10	53,716.82				20,208.27			33,508.55	65,000	
11.	Well redevelopment	F4047105 F4047149 F4047086 F4047087 F4047094 F4047095 F4047099 F4047100 F4047104 F4047107 F4047109 F4047110 F4047113 F4047120 F4047121 F4047122 F4047123 F4047124 F4047150 F4047157 F4047158 F5064022 H0321554 H0321565	Redevelop injection well 33S1 - ABP Redevelop injection well 34F (I) - ABP Redevelop injection well 33N - ABP Redevelop injection well 33J - ABP Redevelop injection well 33O - ABP Redevelop injection well 33L - ABP Redevelop injection well 33Q - ABP Redevelop injection well 33Q1 - ABP Redevelop injection well 33E - ABP Redevelop injection well 34T2 (C/B) - ABP Redevelop injection well 33U - ABP Redevelop injection well 33U3 - ABP Redevelop injection well 33T - ABP Redevelop injection well 34E (C/B) - ABP Redevelop injection well 34E (I) - ABP Redevelop injection well 33U3 - ABP Redevelop injection well 34V (C/B) - ABP Redevelop injection well 34V (A) - ABP Redevelop injection well 34V (I) - ABP Redevelop injection well 34D (A) - ABP Redevelop injection well 34D (A,1) - ABP Redevelop injection well 34I (C,B,A,1) - ABP Redevelop injections wells - ABP ABP WELL REDEVELOPMENT PROGRAM ABP NPDES MONI & REPORT INJ WE OCWP Permit No. FE21-0145	29,463.49 43,850.68 13,015.70 36,456.08 36,172.47 33,884.79 29,984.99 23,879.50 29,743.59 16,093.72 55,814.90 49,745.81 34,126.13 51,142.94 26,063.82 49,169.29 29,776.48 23,297.54 38,698.00 64,038.10 46,552.81 110,624.70 160,223.89 39,490.48 534.00	1,000,000	107.4%		400,000	101.0%	669,845.42	600,000	111.6%	
			Subtotal #11	1,073,814.40				403,968.98			600,000	111.6%	
12.	Processing of data and preparation of reports	H0321553	ABP DATA PRO & PRE OF REPORT	33,642.67	70,000	48.1%		28,000	45.2%		42,000	50.0%	
			Subtotal #12	33,642.67				12,656.37			20,986.30	50.0%	
13.	Reclaim Water Program	H0321556	ABP RECLAIMED WATER SUPPLY	17,205.28	30,000	57.4%		12,000	53.9%		18,000	59.6%	
			Subtotal #13	17,205.28				6,472.63			10,732.65	59.6%	
14.	Projects & Studies (Reimbursable amounts include labor expenses, plus approved contract expenses that are not addressed under a separate agreement).	HP01521000 EP02620001	Seawater Barrier Condition Assessment Alamitos Barrier Project Unit 15 Replacement Injection	94,476.20 504,702.18	63,000	951.1%		8,000	444.3%		55,000	1024.8%	
			Subtotal #14	599,178.38				35,541.95			563,636.44	1024.8%	
15.	ABP Liability Insurance Premiums paid separately by OCWD	N/A	ABP General Liability Coverage	76,234.00	80,000	95.3%		40,000	95.3%		40,000	95.3%	
			Subtotal #15	76,234.00				38,117.00			38,117.00	95.3%	
			TOTAL	3,081,721.07	2,878,000.00	107.1%		977,841.42	1,116,000.00	87.6%	2,103,879.66	1,762,000.00	119.4%

1 OCWD share represents 39.9% of the total costs in all items except for 4, 5, and 6. The percentage is based on amount of overall barrier injection water provided to the Orange County portion of the ABP during this fiscal year.  
2 Per Agreement No. 8458 between the LACFPD and the OCWD, all costs included in Items 4, 5, and 6 are not reimbursable with respect to OCWD.  
3 OCWD will not be responsible for Item 14, Alamitos Barrier Project Unit 15 Replacement Injection project.  
4 Per Agreement No. 8458 between the LACFPD and the OCWD, the cost of liability insurance (item 15) shall be split equally among the Parties.  
5 OCWD FY21-22 Budget totals \$1,076,000. Advanced deposit paid by OCWD was \$10,000 more than half (\$538,000).

TOTAL OPERATION AND MAINTENANCE COST (not including insurance premium)	\$ 3,005,487.07
GRANITE COUNTY'S SHARE OF THE OPERATION AND MAINTENANCE COST (not including insurance premium)	\$ 939,724.42
Less: Los Angeles County's Share of the FY21-22 Liability Insurance	\$ 38,117.00
Less: Permit fees paid by OCWD	\$ 4,504.98
Less: Advance Deposit Paid by OCWD*	\$ 548,000.00
Less: Credit to OCWD for FY20-21 Yard Maintenance Correction	\$ 13,068.11
Less: OCWD Video Survey Services	\$ -
<b>BALANCE DUE FROM GRANITE COUNTY WATER DISTRICT</b>	<b>\$ 336,034.33</b>

## ABP FY 2023-24 Operation and Maintenance Budget

JMC No.	Fiscal Year	LACFCD		OCWD		WRD		TOTAL	
		Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
1.		Analysis and direction of injection operation (\$)							
	2019-20	55,000	132,029	45,000	80,578			100,000	212,607
	2020-21	90,000	141,961	60,000	86,529			150,000	228,490
	2021-22	120,000	112,263	80,000	67,704			200,000	179,967
	2022-23	150,000		100,000				250,000	
	2023-24	150,000		100,000				250,000	
2.		Maintenance and repair of injection wells (\$)							
	2019-20	247,500	327,656	202,500	199,970			450,000	527,626
	2020-21	270,000	220,155	180,000	134,190			450,000	354,345
	2021-22	330,000	237,257	220,000	143,085			550,000	380,342
	2022-23	270,000		180,000				450,000	
	2023-24	300,000		200,000				500,000	
3.		Operations of Injection Well Facilities (\$)							
	2019-20	38,500	40,376	31,500	24,642			70,000	65,018
	2020-21	42,000	44,685	28,000	27,237			70,000	71,922
	2021-22	42,000	35,461	28,000	21,386			70,000	56,847
	2022-23	45,000		30,000				75,000	
	2023-24	45,000		30,000				75,000	
4.		Analysis and direction of extraction operation (\$)							
	2019-20	0	0	0	0			0	0
	2020-21	0	0	0	0			0	0
	2021-22	0	0	0	0			0	0
	2022-23	0	0	0	0			0	0
	2023-24	0	0	0	0			0	0
5.		Redevelopment, maintenance, and repair of extraction wells (\$)							
	2019-20	10,000	0	0	0			10,000	0
	2020-21	10,000	0	0	0			10,000	0
	2021-22	10,000	0	0	0			10,000	0
	2022-23	10,000	0	0	0			10,000	0
	2023-24	5,000	0	0	0			5,000	5,000
6.		Operations of Extraction Wells (\$)							
	2019-20	5,000	1,512	0	0			5,000	1,512
	2020-21	5,000	1,132	0	0			5,000	1,132
	2021-22	5,000	0	0	0			5,000	0
	2022-23	5,000	0	0	0			5,000	0
	2023-24	0	0	0	0			0	0
7.		Maintenance and repair of ABP (\$)							
	2019-20	165,000	231,775	135,000	141,454			300,000	373,229
	2020-21	225,000	256,376	148,000	156,268			370,000	412,644
	2021-22	225,000	237,793	150,000	143,402			375,000	381,185
	2022-23	240,000		160,000				400,000	
	2023-24	270,000		180,000				450,000	
8.		Maintenance of Observation Wells (\$)							
	2019-20	82,500	15,225	67,500	9,292			150,000	24,517
	2020-21	30,000	149,635	20,000	90,598			50,000	239,233
	2021-22	90,000	62,030	60,000	37,409			150,000	99,438
	2022-23	120,000		80,000				200,000	
	2023-24	120,000		80,000				200,000	
9.		Collection of groundwater data (\$)							
	2019-20	96,250	99,931	78,750	60,989			175,000	160,920
	2020-21	120,000	79,846	80,000	48,669			200,000	128,515
	2021-22	120,000	79,412	80,000	47,892			200,000	127,304
	2022-23	120,000		80,000				200,000	
	2023-24	108,000		72,000				180,000	
10.		Yard Maintenance (\$)							
	2019-20	35,750	58,686	29,250	35,816			65,000	94,503
	2020-21	65,000	25,997	10,000	17,238			75,000	43,235
	2021-22	65,000	33,509	10,000	20,208			75,000	53,717
	2022-23	55,000		20,000				75,000	
	2023-24	55,000		20,000				75,000	
11.		Injection Well Redevelopment (\$)							
	2019-20	550,000	548,711	450,000	334,892			1,000,000	883,592
	2020-21	600,000	694,466	400,000	423,297			1,000,000	1,117,763
	2021-22	600,000	669,845	400,000	403,969			1,000,000	1,073,814
	2022-23	600,000		400,000				1,000,000	
	2023-24	600,000		400,000				1,000,000	
12.		Processing of data and preparation of reports (\$)							
	2019-20	44,000	35,606	36,000	21,731			80,000	57,337
	2020-21	48,000	21,630	32,000	13,184			80,000	34,813
	2021-22	42,000	20,986	28,000	12,656			70,000	33,643
	2022-23	42,000		28,000				70,000	
	2023-24	36,000		24,000				60,000	
13.		Oversight of Reclaim Water Program (\$)							
	2019-20	27,500	4,814	22,500	2,938			50,000	7,752
	2020-21	30,000	11,846	20,000	7,221			50,000	19,067
	2021-22	18,000	10,733	12,000	6,473			30,000	17,205
	2022-23	18,000		12,000				30,000	
	2023-24	18,000		12,000				30,000	
14.		Projects and Studies (\$)							
	2019-20	5,500	60,442	4,500	0			10,000	60,442
	2020-21	12,000	749,986	8,000	19,722			20,000	769,708
	2021-22	55,000	563,636	8,000	35,542			63,000	599,178
	2022-23	39,000		26,000				65,000	
	2023-24	39,000		26,000				65,000	
15.		ABP Liability Insurance (\$)							
	2019-20	40,000	33,288	40,000	33,288			80,000	66,575
	2020-21	35,000	33,375	35,000	33,375			70,000	66,750
	2021-22	40,000	38,117	40,000	38,117			80,000	76,234
	2022-23	40,000		40,000				80,000	
	2023-24	42,500		42,500				85,000	
16.		Total ABP Expenditure (\$)							
	2019-20	1,402,500	1,590,052	1,142,500	945,579			2,545,000	2,535,630
	2020-21	1,578,000	2,430,090	1,021,000	1,057,527			2,600,000	3,420,867
	2021-22	1,762,000	2,101,033	1,116,000	977,841			2,878,000	3,078,875
	2022-23	1,754,000		1,156,000				2,910,000	
	2023-24	1,793,500		1,186,500				2,980,000	
TOTALS		Total ABP Operations and Maintenance (\$  Item 16-Item 15)							
	2019-20	1,362,500	1,556,764	1,102,500	912,291			2,465,000	2,469,055
	2020-21	1,544,000	2,396,715	986,000	1,024,152			2,530,000	3,420,867
	2021-22	1,722,000	2,062,916	1,076,000	939,724			2,798,000	3,002,641
	2022-23	1,714,000		1,116,000				2,830,000	
	2023-24	1,751,000		1,144,000				2,895,000	
		Volume of Water (ac-ft)							
	2019-20			2,800	2,100	4,200	3,437	7,000	5,537
	2020-21			3,000	2,592	4,500	3,909	7,500	6,501
	2021-22			2,800	2,704	4,200	4,484	7,000	7,188
	2022-23			3,000		4,500		7,500	
	2023-24			3,200		4,800		8,000	