

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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**Annual report on the control of seawater intrusion
2019 - 2020**

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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) 2019-20 (i.e., July 1, 2019, through June 30, 2020).

SUMMARY

During FY 2019-20, a total of 5,536.9 acre-feet (AF) of water was injected into the ABP (an average rate of 7.7 cubic feet per second (cfs)). Of that total, OCWD purchased 2,099.5 acre-feet (38 percent) and the Water Replenishment District of Southern California (WRD) purchased 3,437.4 acre-feet (62 percent). This total injected amount was 241.7 AF more than FY 2018-19 but was 401 AF lower than the average injection of 5,938 AF for the previous five fiscal years. Regional groundwater levels generally increased when compared to the previous fiscal year, partly due to an average rain season. This is one reason for the decrease in injection when compared to the 5-year average injection amount. The ABP also experienced a full shutdown on May 19th, which lasted about 2 days. This shutdown is detailed in the Injection Operation section of this report and Appendix A-18 details individual well shutdowns that occurred in FY 2019-20.

The total costs associated with the ABP in FY 2019-20 are summarized below:

- Total Cost in FY 2019-20: \$9,164,922
 - Injection Water costs: \$6,632,200 (OCWD: \$2,515,561; WRD: \$4,116,639)
 - Total Operations and Maintenance Costs (not including liability insurance): \$2,466,147
 - Injection-related costs: \$2,464,635 (OCWD: \$911,189; LACFCD: \$1,553,446)
 - Equivalent cost per AF of water injected: \$445
 - Extraction-related costs: \$1,512 (LACFCD only)
 - Liability Insurance cost: \$66,575 (OCWD: \$33,288; LACFCD: \$33,287)

During this reporting period, the ABP generally had groundwater elevations above or near protective elevations throughout all aquifer zones. Compared to the last reporting period, groundwater elevations west of the San Gabriel River generally increased. East of the San Gabriel River, ground elevations showed increases with a few localized decreases due to operational activities related to redevelopment.

West of the San Gabriel River, chloride concentrations had a slight decrease across all Zones. East of the San Gabriel River, chloride concentrations decreased by at least 150 mg/L, with the exception of B-Zone, which had an increase. 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 best 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.

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 and further project details are included in Appendix A-17.

ABP Unit 15 Injection and Observation Wells

LACFCD was awarded grant funding up to \$4,191,693 from the State Water Resources Control Board, Proposition 1 Groundwater Grant to construct five new injection wells and two new observation wells to replace and supplement existing ABP facilities. The total estimated cost of the project is \$8,383,386. Project construction is estimated to begin in November 2021 with a project completion date of February 28, 2023. LACPW is currently working with the LADWP Real Estate office to amend the existing License Agreement between LACPW and LADWP to include the new well locations.

The Unit 15 Project will accomplish the following:

- Destroy injection well 33W 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 nested 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.

INJECTION OPERATIONS

The total amount of water injected into the ABP during FY 2019-20 was 5,536.9 AF. Of this total, approximately 15.5 percent (856.5 AF) was recycled water and 84.5 percent (4,680.4 AF) was imported water. The maximum monthly injection during this reporting period was 574.9 AF (100 percent imported) which occurred in October 2019. The minimum monthly injection of 335.2 AF (100 percent imported) occurred in July 2019. The typical operation of the ABP consists of injecting more water during the spring/summer time frame and injecting less during the fall/winter times. During this reporting period the ABP had a full barrier shutdown during the month of May, which is the reason for the low injection amount for that month. Furthermore, during the months of March and April, the COVID-19 Pandemic limited LACPW's ability to make changes to the ABP during a time when typical increases in flows to the ABP are expected, which contributed to the low injection rates during the months of March and April of 2020.

The percentage of recycled water injection increased from the previous year because the Leo J. Vander Lans Advanced Water Treatment Facility (LVL AWTF) was able to provide recycled water after the last phase of Los Angeles County Sanitation's (LACSAN) maintenance project, which was completed in November 2019. This project restricted Title 22 water to the LVL AWTF. Since completion of the plant expansion in 2014, the LVL AWTF has operated intermittently between 3 and 4 million gallons per day (MGD). Further details regarding LVL operations can be found in the "Recycled Water Operations" section of this report.

The injection volumes and costs for FY 2018-19 and FY 2019-20 are shown in Table 1. The representative unit costs included in Table 1 for imported and reclaimed water were calculated by WRD. Table 1 shows that the volume of water injected into the ABP during FY 2019-20 increased by 4.6 percent from the previous year. The increase in flow is due to operational increases of OCWD's Unit 14 injection wells, which were previously set at lower injection rates due to leaking air relief valves (ARV). These ARV's have since been replaced. Also, in FY18-19, OCPW's Channel Restoration Project inhibited LACPW's ability to adjust wells for nearly four months because the wells were covered by steel

plates. OCPW completed their project in January 2019 and LACPW was then able to adjust wells as needed, which is reflected in the overall increase in flow for FY19-20.

All ABP injection well shutdowns that occurred during FY 2019-20 are summarized in Appendix A-18. There were no major shutdowns during this reporting period; however, there was a minor full barrier shutdown that took place in the month of May. This shutdown was the result of ABP field staff installing and testing new actuators for the PRV pilot valves. The actuators were successfully mounted and put into service and flow resumed to the ABP.

The actuators were installed to remotely control the downstream pressure of the imported water PRV. When the LVL AWTF comes online and supplies the ABP, a pressure surge is sent through the system and could potentially cause damage to injection wells, especially those near their max casing pressure. The actuators can be used to lower the downstream pressure of the PRV and offset the pressure surge caused by the LVL AWTF.

TABLE 1. INJECTION OPERATIONS

	Imported Water Injections			Recycled Water Injections			Total Injections		
	FY18-19	FY19-20	Percent Change From Previous Year	FY18-19	FY19-20	Percent Change From Previous Year	FY18-19	FY19-20	Percent Change From Previous Year
<u>VOLUME OF WATER INJECTED IN ACRE-FEET</u>									
OCWD ¹	1,965.9	1,763.8	-10.3	42.6	335.7	688.0	2,008.5	2,099.5	4.5
WRD ²	3,214.0	2,916.6	-9.3	72.7	520.8	616.4	3,286.7	3,437.4	4.6
TOTAL	5,179.9	4,680.4	-9.6	115.3	856.5	642.8	5,295.2	5,536.9	4.6
<u>UNIT COST OF WATER PER ACRE-FOOT³</u>									
JULY - DEC	\$1,164.49	\$1,184.01	1.7	\$1,164.49	\$1,184.01	1.7			
JAN - JUN	\$1,199.45	\$1,213.15	1.1	\$1,199.45	\$1,213.15	1.1			
<u>COST OF WATER PURCHASED</u>									
OCWD ¹	\$2,321,847	\$2,108,307	-9.2	\$51,097	\$407,255	697.0	\$2,372,944	\$2,515,561	6.0
WRD ²	\$3,791,224	\$3,484,831	-8.1	\$87,200	\$631,809	624.6	\$3,878,424	\$4,116,639	6.1
TOTAL	\$6,113,071	\$5,593,138	-8.5	\$138,296	\$1,039,063	651.3	\$6,251,368	\$6,632,200	6.1
<u>AVERAGE INJECTION RATE IN CFS</u>									
OCWD ¹	2.72	2.44	-10.3	0.06	0.46	688.0	2.77	2.90	4.5
WRD ²	4.44	4.03	-9.3	0.10	0.72	616.4	4.54	4.75	4.6
TOTAL	7.16	6.47	-9.6	0.16	1.18	642.8	7.31	7.65	4.6

¹ Orange County Water District (OCWD)

² Water Replenishment District of Southern California (WRD)

³ 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

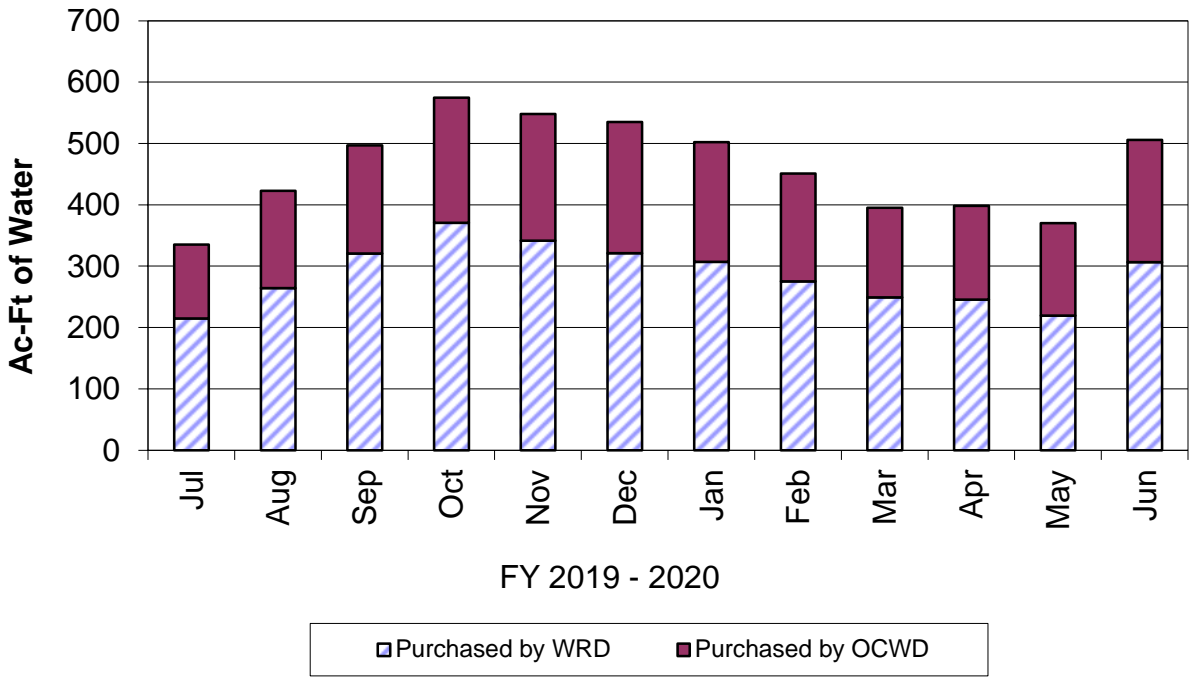
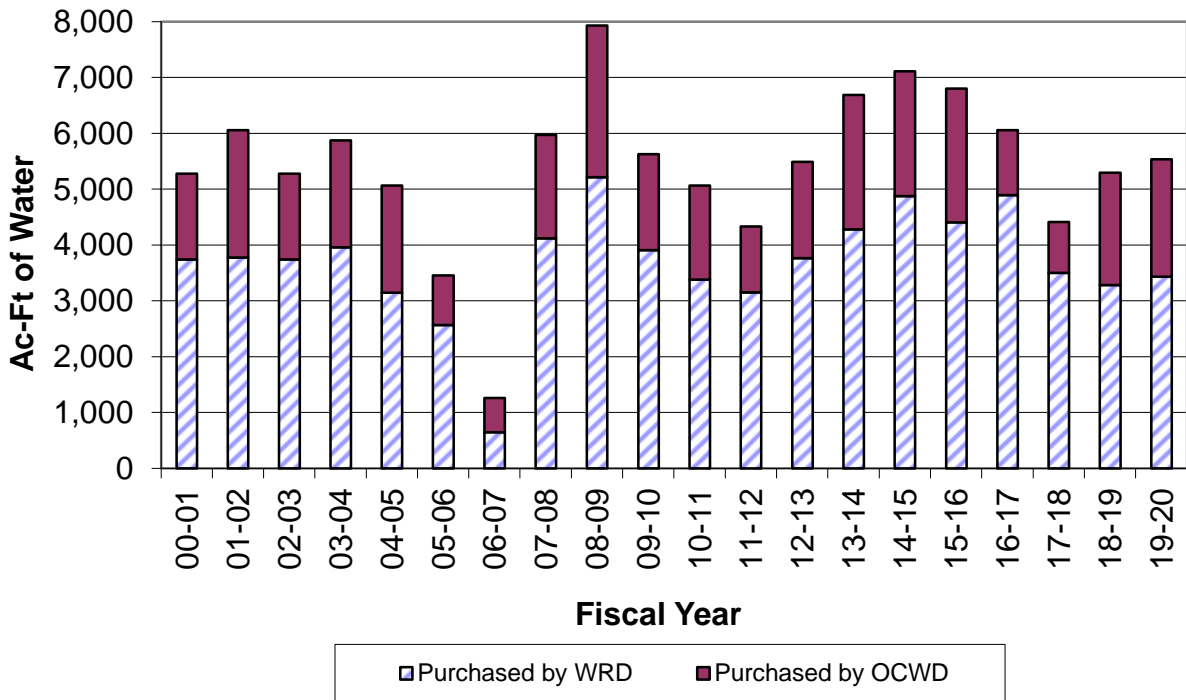


FIGURE 2 - ANNUAL AMOUNT OF WATER INJECTED



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 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 second treatment train and a third stage of RO. This third stage of treatment allows the LVL to treat the brine generated and thereby further reduce waste that would otherwise go to the regional sewage treatment plant. The Long Beach Water Reclamation Plant (LBWRD) 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 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.

LACSAN planned maintenance activities at the LBWRD that limited LBWD's ability to provide recycled water to LVL AWTF over three consecutive summers started in Summer 2017. The first shutdown was delayed considerably, and as a result, LVL AWTF was placed on standby from mid-July 2017 to the beginning of March 2018, and then again starting in the beginning of May 2018. The LVL AWTF was scheduled to go back online in November 2018; however, maintenance issues at the LVL AWTF prevented the plant from supplying the ABP with recycled water. The plant came back online in March 2019 and remained in operation until April 2019, when it went back offline due to a lack of source water as a result of LACSAN's planned project.

For FY19-20, the LVL AWTF supplied the ABP intermittently at a flow rate between 3.2 MGD to 4.0 MGD. During the first part of the fiscal year, the LVL AWTF was shut down due to the last phase of LACSAN's planned project, as mentioned above. During the month of December, the LVL AWTF provided advanced treated recycled water to the ABP at a rate of 3.2 MGD, and continued through the month of June, at which, flows were increased to 4.0 MGD. During this reporting period, the LVL AWTF continued to have operational issues which has caused the plant to shut down twelve (12) times due to various reasons. The shutdowns and startups are of a great concern, as it causes undue stress to the main water supply line, 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 2019-20, Public Works completed redevelopment activities at the following 33 well casings: 33S (A,I), 33S1 (C,B), 33T (A,I), 33U (A,I), 33U3 (C,B), 33V (A,I), 33W (C,B,A,I), 34E (C,B), 34E (I), 34F (A), 34F (I), 34H (I), 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), 34T (C/B) , 34T (A), 34T (I), 34X (C/B), 34X (A), 34X (I), 34Z (A,I), 34Z2 (A), 34Z2 (I), 35E (I), 35F (I), and 35G (A,I).

Observation well cleanouts are performed on an as-needed basis to clean out accumulated sediments and microbiological build-up within the well casings. Public Works crews typically rotate between the ABP, Dominguez Gap Barrier Project, and West Coast Basin Barrier Project. During FY 2019-20, Public Works completed cleanouts activities at the following 3 well casings: 33ST (I), 33N21 (A), and 33N21 (I)

Figure 3 depicts the operating status of each injection and extraction well during FY 2019-20. Routine redevelopment activities were performed on injection wells including the newly constructed Unit 14 wells, which underwent their first routine redevelopment since being constructed. As mentioned earlier in this report, the ABP had a full barrier shutdown in May 2020 during the installation and testing of actuators on the ABP PRV pilot valves. The following is a brief summary of the individual shutdowns, as explained in Appendix A-18.

West of the San Gabriel River, injection well 33W suffered from surface leakage intermittently after being struck by an automobile in 2003 and a subsequent sink hole later developed in 2007. LACFCD 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. Well 33W has operated at a minimal flowrate since that time. This well is slated to be replaced during the upcoming 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 caused by grouting failure. Injection well 33Z2 (A,I) was off due to faulty isolation valves, which was replaced and the well was put back into service. Injection well 33G had a faulty well head gasket and needed a replacement. As indicated on Figure 3, the well remained off for an extended period because time was needed to obtain a street occupancy permit from the City of Long Beach. This well was repaired on September 4, 2019, and put back into operation.

East of the San Gabriel River, 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. 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. Well casings 34H(A) and 34H(I) are slated to be replaced during the upcoming ABP Unit 15 Well Replacement Project. Injection well 34V remained offline to repair the PVC vault piping.

The ABP pressure reducing station pilot valves were outfitted with actuators for each of the three lines that service the ABP, as explained in the *Injection Operations Section* of the report.

ABP maintenance crews replaced the vault lids at injection wells 34S and 34V, which were in need of replacement due to normal wear and tear. ABP field crews also raised and replaced the vault lids located at the Point C flow meter vault and Point C butterfly valve vault, which were buried when the Alamitos channel access roads were regraded as part of the OCPW Channel Restoration Project.

FIGURE 3 - Injection and Extraction Well Operating Status

- Well in Operation
- H - Header Repair
- M - Misc. Repair
- X - Barrier Shutdown
- X - Waiting for Repair
- R - Redevelopment
- W - Water Quality Sampling (wells turned down or off)
- A - Abandoned
- D - Disassembled
- V - Vault Piping Repair
- C - Casing Repair
- L - Surface Leakage (operating at a reduced rate)
- S - Subsidence
- G - Grouted
- P - Packer Repair
- N - Not Needed
- T - Tremie Repair
- U - Under Construction
- O - Other Circumstances

Well No.	2019						2020					
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1 33G (A,I)	X	X	X	X	X	X						X
2 33J (A,I)												X
3 33L (A,I)												X
4 33N (A,I)												X
5 33Q (A,I)												X
6 33Q1 (C,B)												X
7 33S (A,I)												X
8 33S1 (C,B)	L	L	L	L	L	L	L	L	L	L	L	L
9 33T (A,I)												X
10 33U (A,I)												X
11 33U3 (C,B)												X
12 33V (A,I)												X
13 33W (C,B,A,I)	R	R	R	R	D	D	D	L	L	L	L	L
14 33X (C,B,A,I)	D	O	O									X
15 33Y (C,B,A,I)												X
16 33Z (C,B,A,I)												X
17 33Z2 (A)	X	X	X	V								X
18 33Z2 (I)	X	X	X	V								X
19 34D (C,B,A,I)	X	X	X	X	X	X	X	X	X	X	X	X
20 34E (C,B)												X
21 34E (I)												X
22 34F (A)												X
23 34F (I)												X
24 34G (A)	X	P										X
25 34G2 (C,B)												X
26 34G2 (I)												X
27 34H (A)	O	O	O	O	O	O	O	O	O	O	O	O
28 34H (I)												X
29 34J (A)												X
30 34J (I)												X
31 34J2 (C/B)												X
32 34K (C/B)												X
33 34L (C,B,A,I)												X
34 34N (C/B)												X
35 34N (A)												X
36 34N (I)												X
37 34Q (C/B)												X
38 34Q (A)												X
39 34Q (I)												X
40 34S (A)												X
41 34S (I)												X
42 34S (C,B)												X
43 34T (C/B)												X
44 34T (A)												X
45 34T (I)	O	O	O	O	O	O	O	O	O	O	O	X
46 34V (A)												X
47 34V (I)												X
48 34V (C,B)												X
49 34X (B)												X
50 34X (A)												X
51 34X (I)												X
52 34Z2 (A)												X
53 34Z2 (I)	O	O	O	O	O	O	O	O	O	O	O	X
54 34Z (I)												X
55 35E (I)												X
56 35F (I)												X
57 35G (A,I)												X
58 35H1 (A)												X
59 35H1 (I)												X
60 35H2 (A)												X
61 33V*15P*	N	N	N	N	N	N	N	N	N	N	N	N
62 34H*17P*	N	N	N	N	N	N	N	N	N	N	N	N
63 34H*18P*	N	N	N	N	N	N	N	N	N	N	N	N
64 34S*22P*	N	N	N	N	N	N	N	N	N	N	N	N

*Extraction Well

HYDROGEOLOGIC EFFECTS

Figures 4 through 8 (pp. 14-22) show the average monthly groundwater elevation relative to the average groundwater elevation of the 10 preceding years (FY 2009-10 to FY 2018-19) 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 barrier performance, 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 and March 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, and these wells are located further from the ABP and thus have lower groundwater elevations.

As shown in the graphs, groundwater elevations along the entire ABP were generally above historical averages, except in July 2019 due to an ABP shutdown that occurred in June 2019, resulting in a short period of recovery from July to August. Groundwater elevations west of the San Gabriel River were generally above the 10-year historical average, despite routine well maintenance and the limited availability to adjust wells during March and April 2020 due to the COVID-19 pandemic. Groundwater elevations were significantly higher than historical averages east of the San Gabriel River. These elevations are most likely the result of OCWD’s Unit 14 Project, which added 17 injection wells to the north-south alignment of the ABP. In general, the figures east of the San Gabriel River show the expected seasonal trends of higher groundwater elevations in the winter months (decreased pumping) and much lower groundwater elevations in the summer months (increased pumping).

FIGURE 4a RECENT ZONE WEST OF THE SAN GABRIEL RIVER

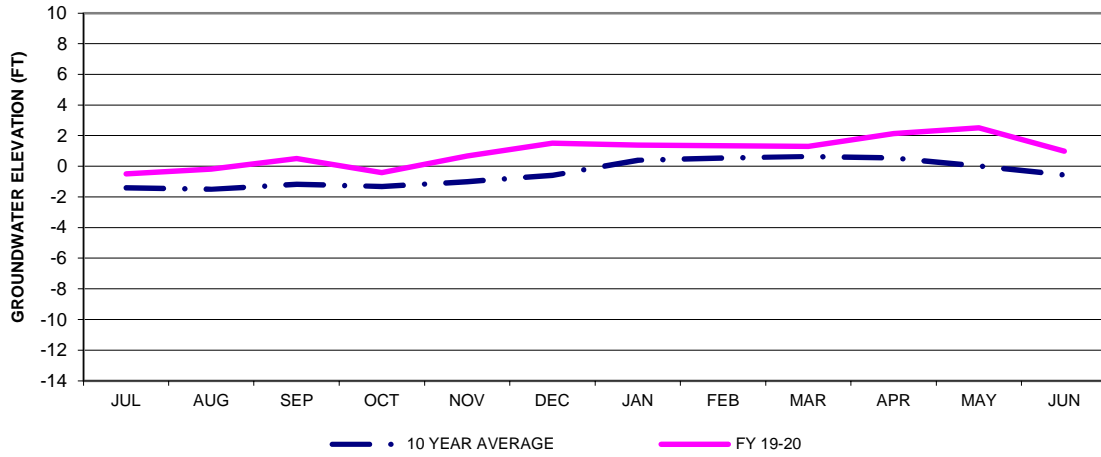


FIGURE 4b RECENT ZONE EAST OF THE SAN GABRIEL RIVER

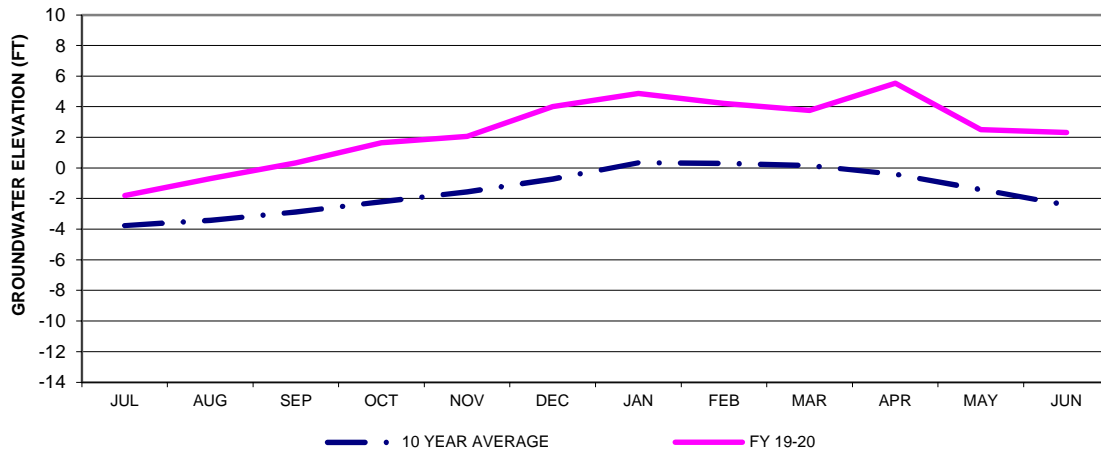


FIGURE 5a C-ZONE WEST OF THE SAN GABRIEL RIVER

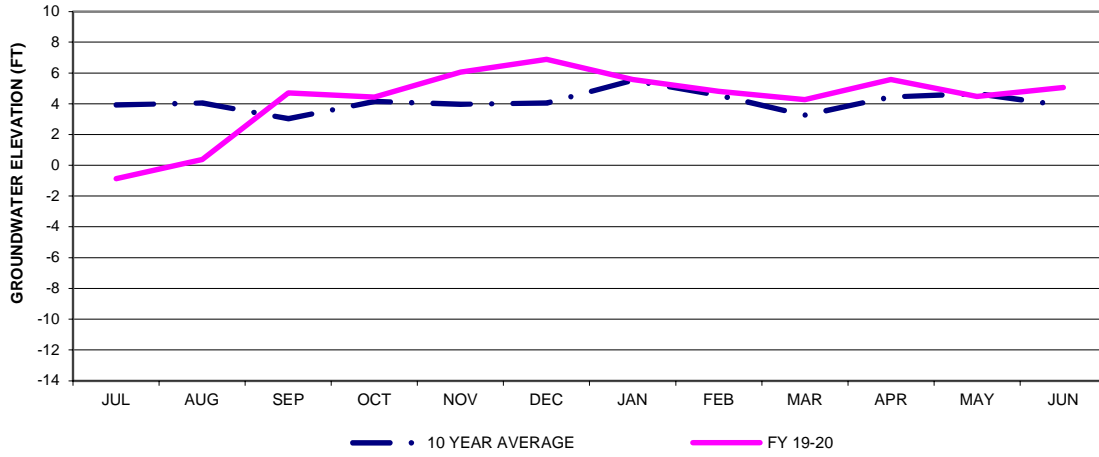


FIGURE 5b C-ZONE EAST OF THE SAN GABRIEL RIVER

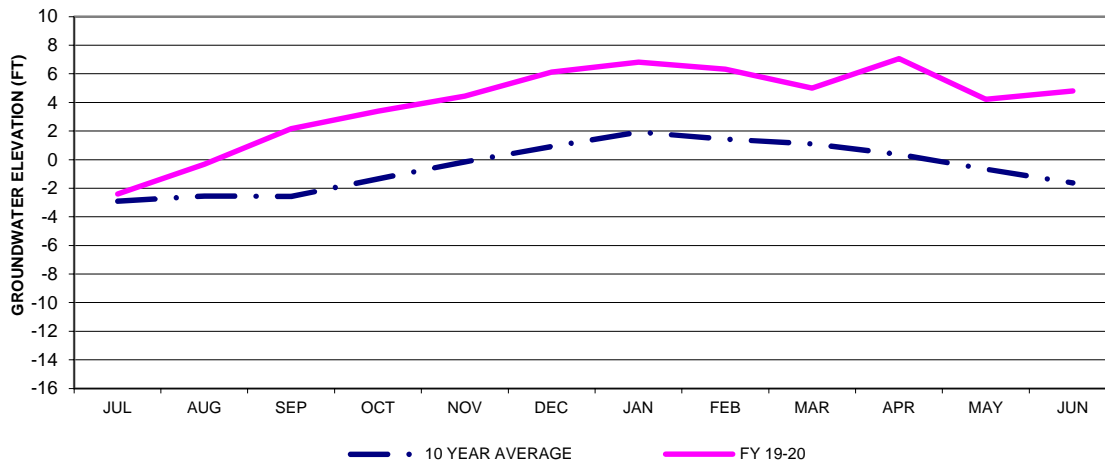


FIGURE 6a B-ZONE WEST OF THE SAN GABRIEL RIVER

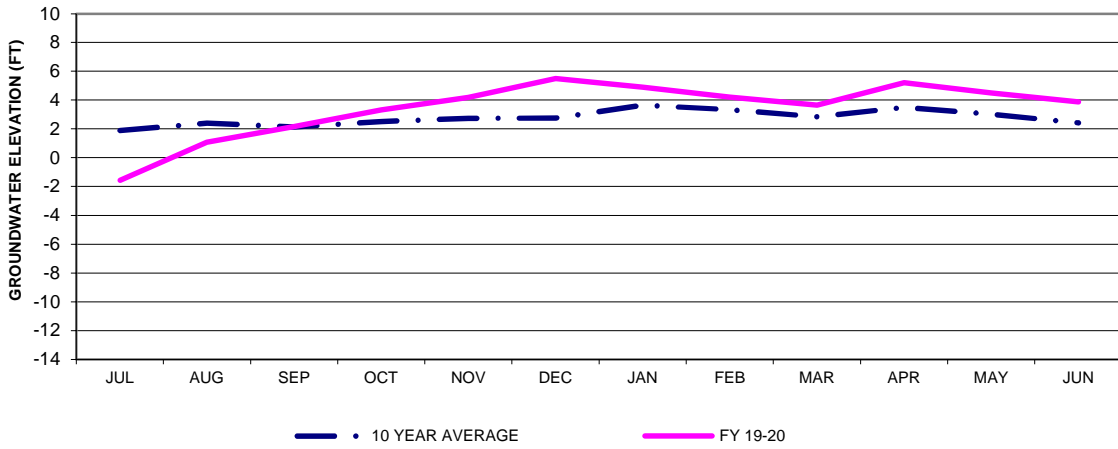


FIGURE 6b B-ZONE EAST OF THE SAN GABRIEL RIVER

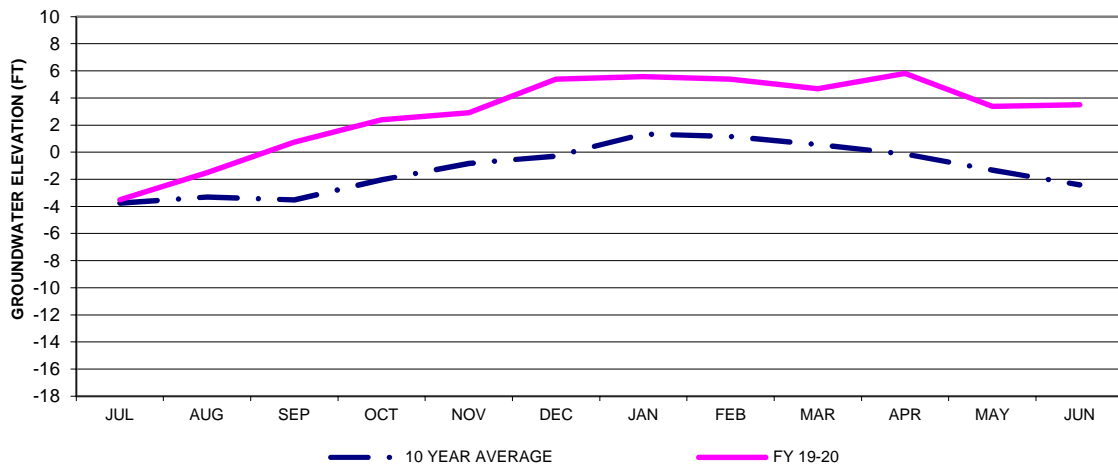


FIGURE 7a A-ZONE WEST OF THE SAN GABRIEL RIVER

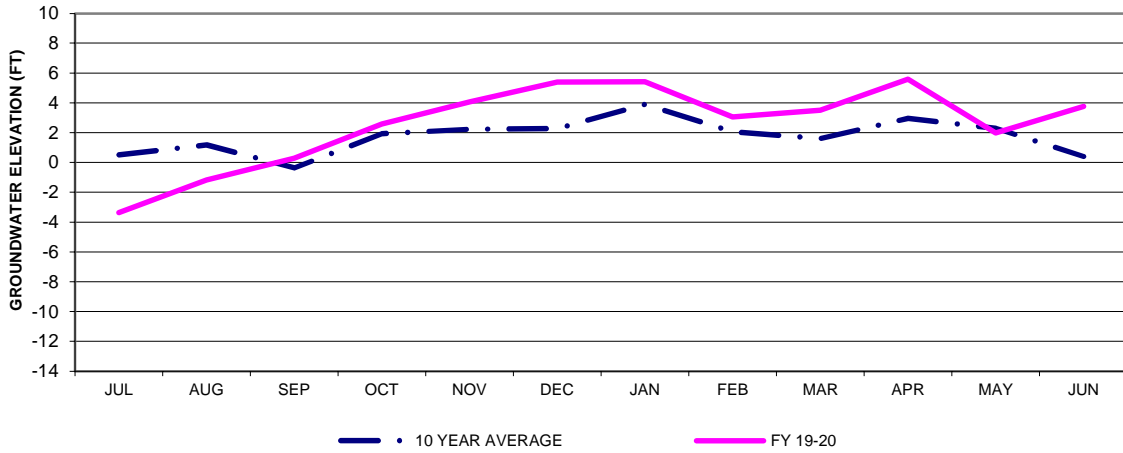


FIGURE 7b A-ZONE EAST OF THE SAN GABRIEL RIVER

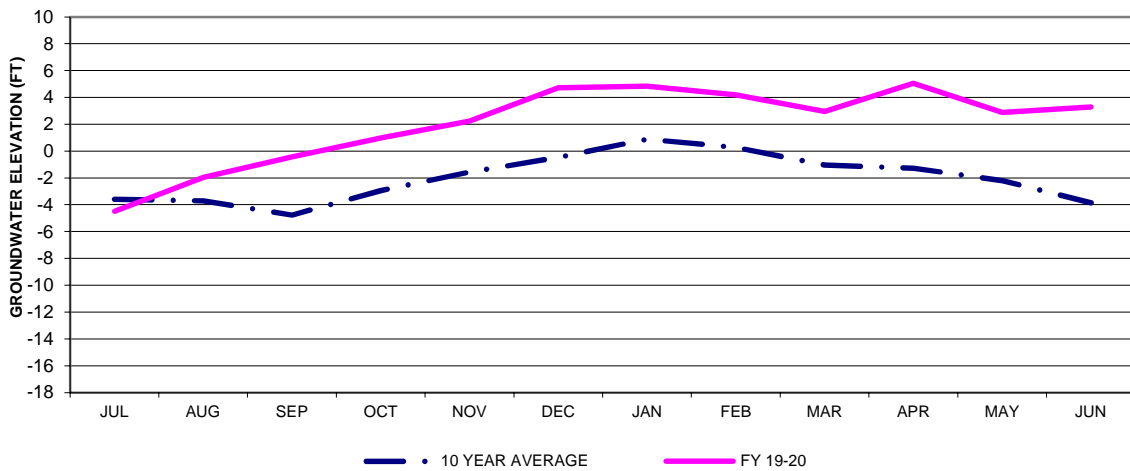


FIGURE 8a I-ZONE WEST OF THE SAN GABRIEL RIVER

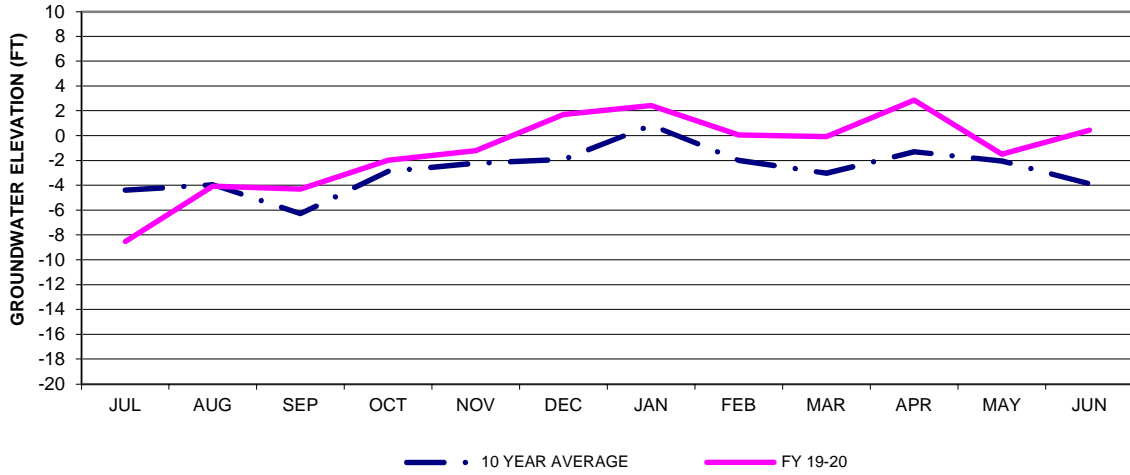
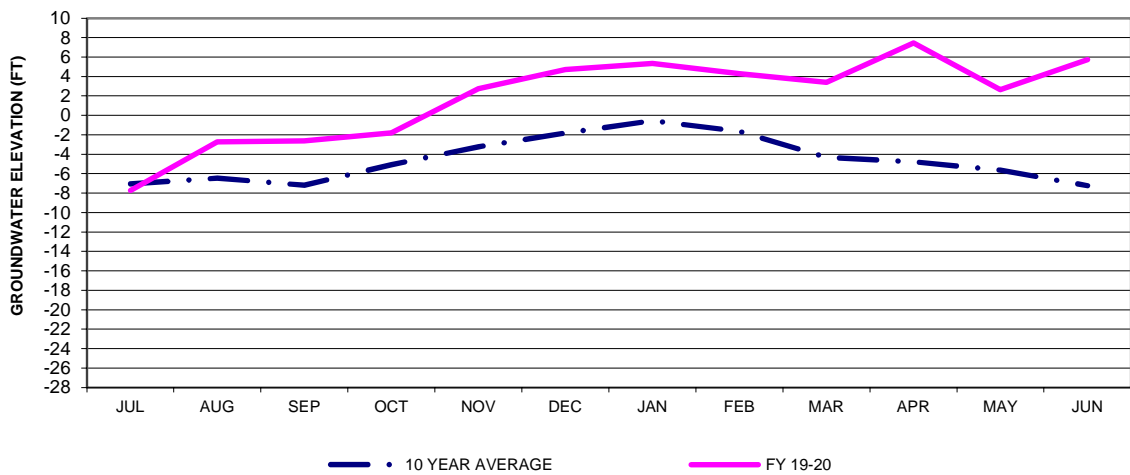


FIGURE 8b I-ZONE EAST OF THE SAN GABRIEL RIVER



Groundwater elevation contours for the R, C, B, A, and I Zones have been prepared from data collected in Spring 2020 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 at the San Gabriel River, continue to have higher groundwater elevations than their surroundings. The groundwater levels along the north-south alignment of the ABP showed large increases due to OCWD's ABP Unit 14 Project. Other areas of historically elevated groundwater levels (e.g., near 33XY and 33YZ) remained relatively constant when compared to the same time last year because the nearby injection wells are screened across four aquifers. These injection wells over inject into aquifers C and B, and under inject into aquifers A and I. The wells in this section of the ABP, between Los Cerritos Channel and the San Gabriel River, have injection wells that are screened across four aquifers.

Contours of changes in groundwater elevations for the R, C, B, A, and I Zones between Spring 2019 and Spring 2020 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 2019, which was then subtracted from the corresponding and available data from Spring 2020 (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 increases along the north-south alignment related to OCWD's Unit 14 Project. Below is a brief summary and discussion of each aquifer zone:

- R Zone:
 - Groundwater elevations along the ABP alignment generally remained between 2 and 4 feet above sea level.
 - Compared to last year, groundwater elevations remained relatively unchanged.
- C Zone:
 - Groundwater elevations along the western alignment were between 2 and 8 feet above sea level, with the greatest elevations at observation wells 33YZ and 34DG near the San Gabriel River. East of the San Gabriel River groundwater elevations along the ABP alignment were observed to be between 6 and 8 feet.
 - Compared to last year, groundwater elevations west of the San Gabriel River generally increased about 1 foot, with an exception at 33XY, which decreased slightly. East of the San Gabriel River, ground water levels increased between 1 and 3 feet.
- B Zone:
 - Groundwater elevations generally were between 2 and 5 feet along the entire ABP alignment. Elevations greater than or near 5 feet occurred near the San Gabriel River and along the north-south alignment of the ABP.
 - Compared to last year, groundwater levels west of the San Gabriel River were observed to have increased up to 2 feet. East of the San Gabriel River, decreases were observed to be generally between 1 and 2 feet.
- A Zone:
 - Groundwater elevations along the ABP alignment were generally between 5 and 7 feet, and near or at protective elevations. Groundwater elevations along the ABP alignment east of the San Gabriel River were measured to be between 2 and 8 feet, with elevations greater than 8 feet occurring at wells 34HJ, 34JL, and 34LS.

- Compared to last year, groundwater elevations generally increased 1 to 4 feet along the western portion of the ABP. East of the San Gabriel River, groundwater elevations were observed to have increased 1 to 4 feet, with the exception of 34DG and 34F5, which decreased 2 feet.
- I Zone:
 - Groundwater elevations were observed to be between 1 and 6 feet above sea level for the portion of the ABP west of observation well 33UV, with elevations greater than 6 feet at 33JL, 33NQ, and 33UV. Wells between 33UV and the San Gabriel River had groundwater elevations below 2 feet. East of the San Gabriel River, elevations were measured to be between 4 and 12 feet, with an elevation greater than 12 feet observed at 34T0.1.
 - Compared to last year, groundwater elevations west of the Los Cerritos Channel generally increased 1 to 3 feet. Slight decreases between 0.5 and 3 feet were observed between the Los Cerritos Channel and San Gabriel River. Groundwater levels significantly increased on the eastern portion of the ABP and were observed to be between 1 to 8 feet.

Graphs showing the average, maximum and minimum groundwater elevations at each internodal observation well throughout FY 2019-20 are included in Appendix A-13 through A-16. As shown in the graphs, the average groundwater elevations were above or just below the protective elevation at many wells along the ABP during FY 2019-20 for wells associated with Zones C and B. For Zones A and I, the average groundwater elevations were found to be below the protective elevation for many wells along the ABP for this reporting period. A comparison of FY 2019-20 graphs with FY 2018-19 graphs indicate that average elevations generally increased slightly in Zones C and B. The comparison for the A and I Zones reveal that these elevations remain relatively unchanged between the two reporting periods.

CHLORIDES

Figures 9a through 13b (pp. 23-32) 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 2019-20. 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 portions of the ABP alignment 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 19-20) is shown with respect to the freshwater condition (250 mg/L).

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

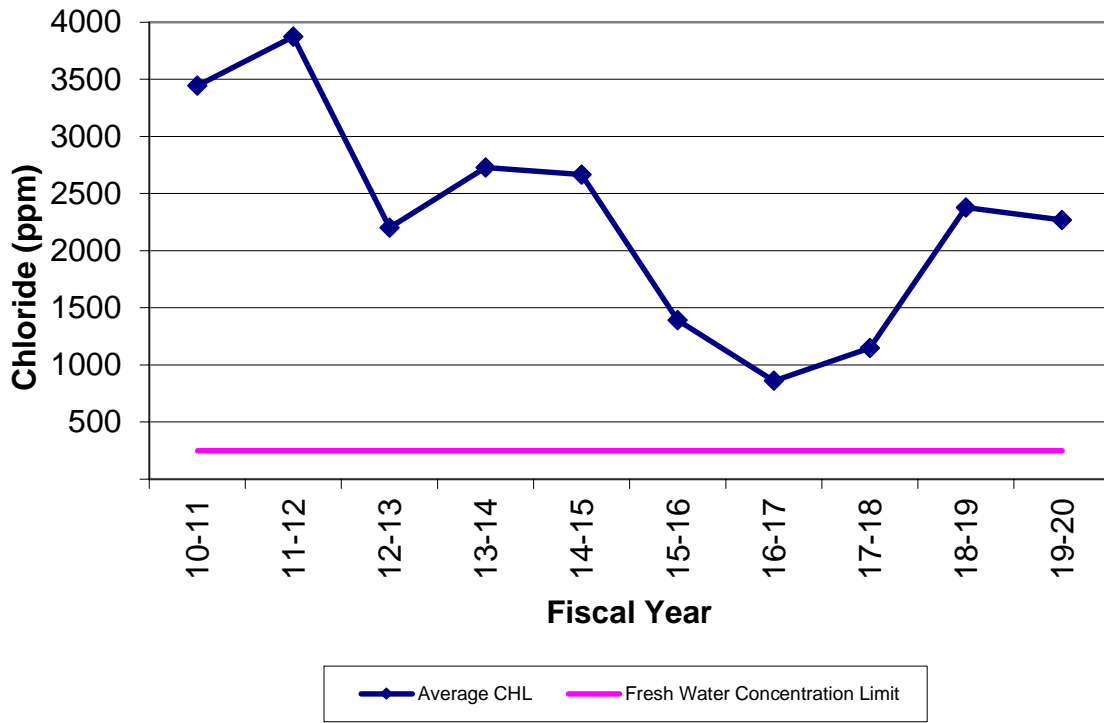


Figure 9b: R-Zone Chloride East of San Gabriel River

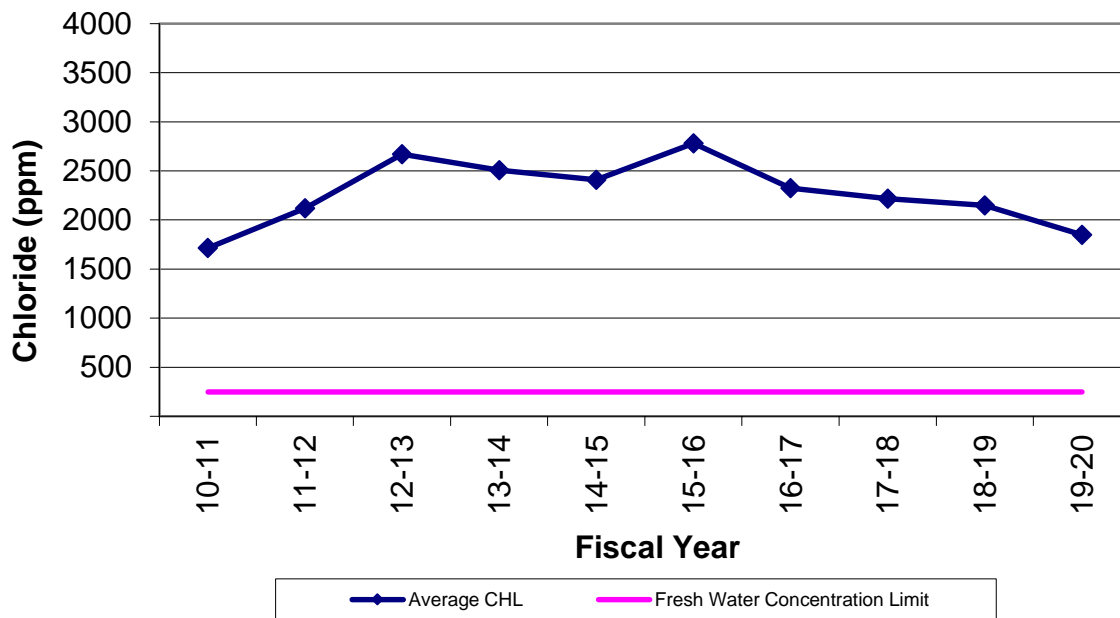


Figure 10a: C-Zone Chloride West of San Gabriel River

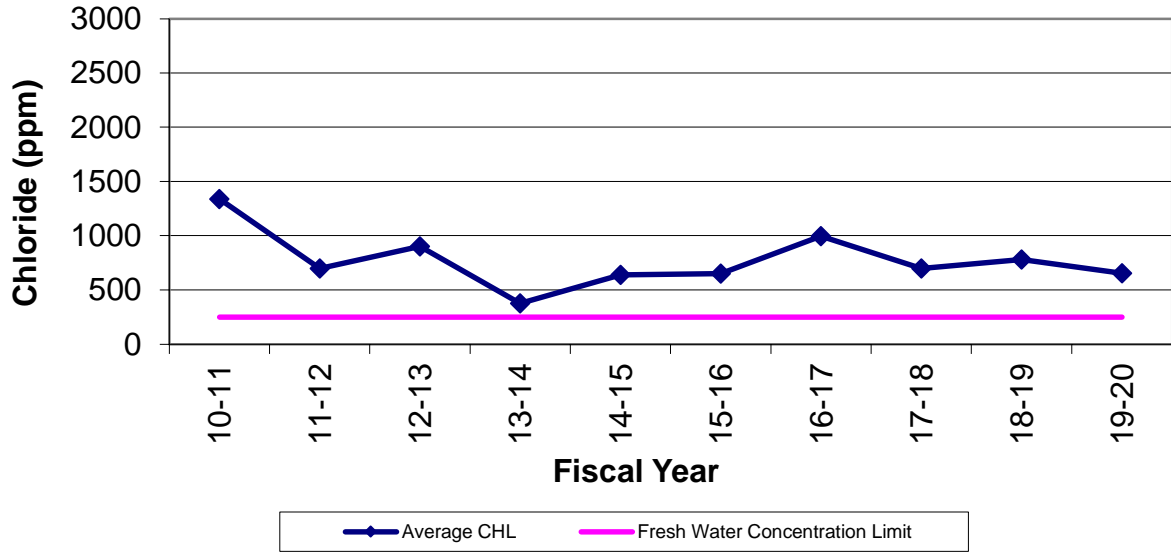


Figure 10b: C-Zone Chloride East of San Gabriel River

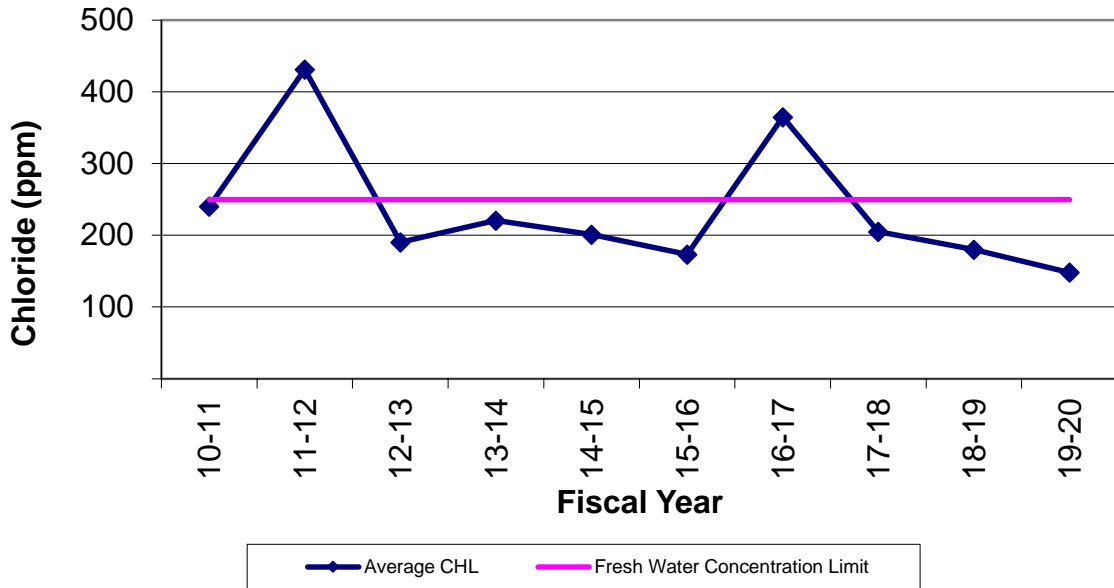


Figure 11a: B-Zone Chloride West of San Gabriel River

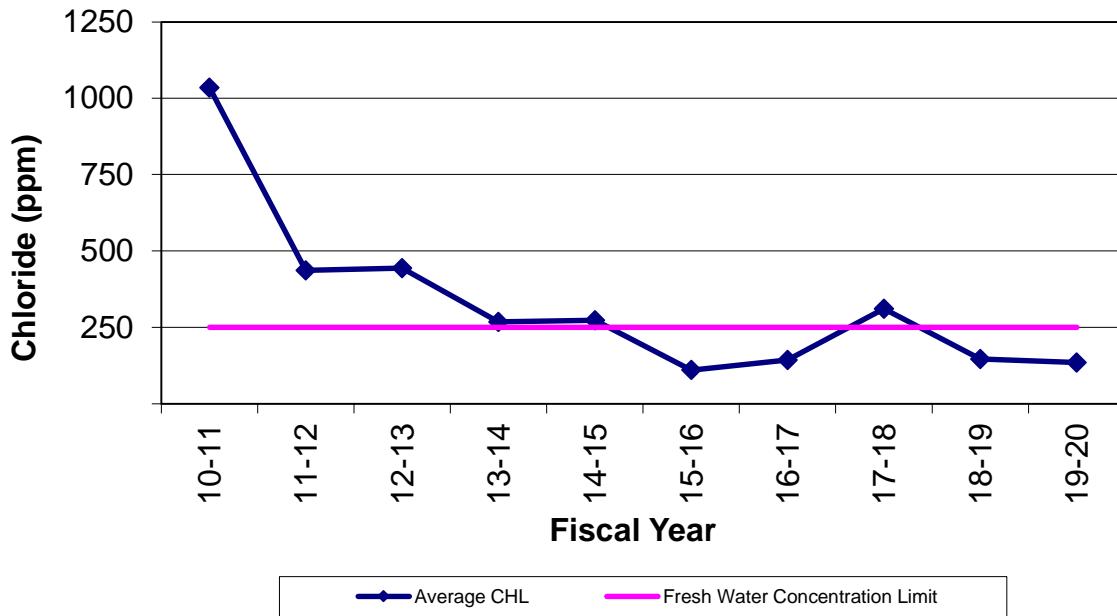


Figure 11b: B-Zone Chloride East of San Gabriel River

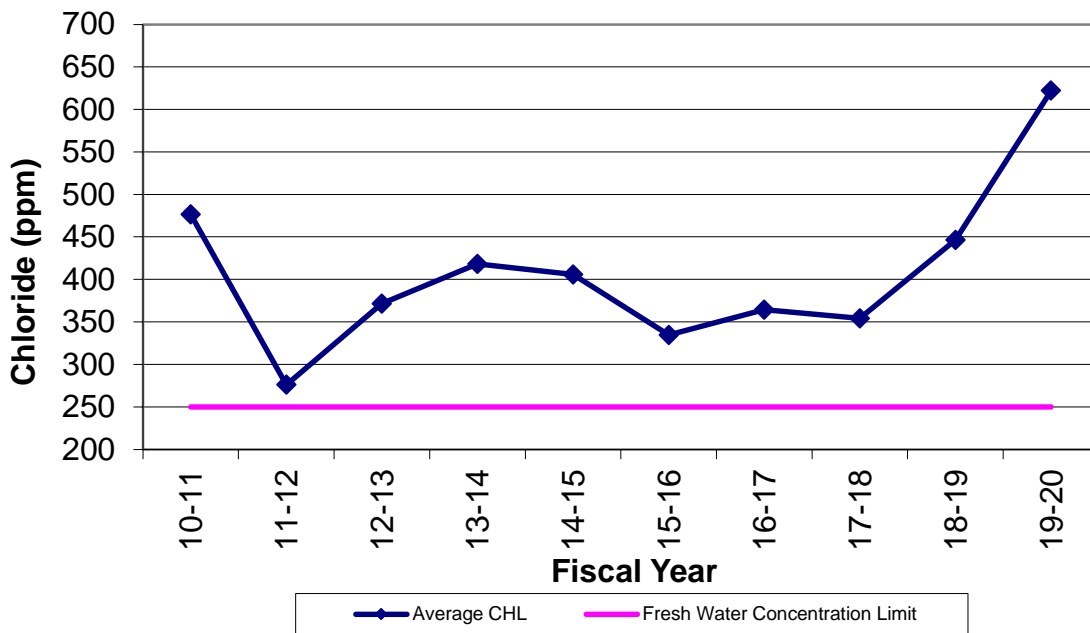


Figure 12a: A-Zone Chloride West of San Gabriel River

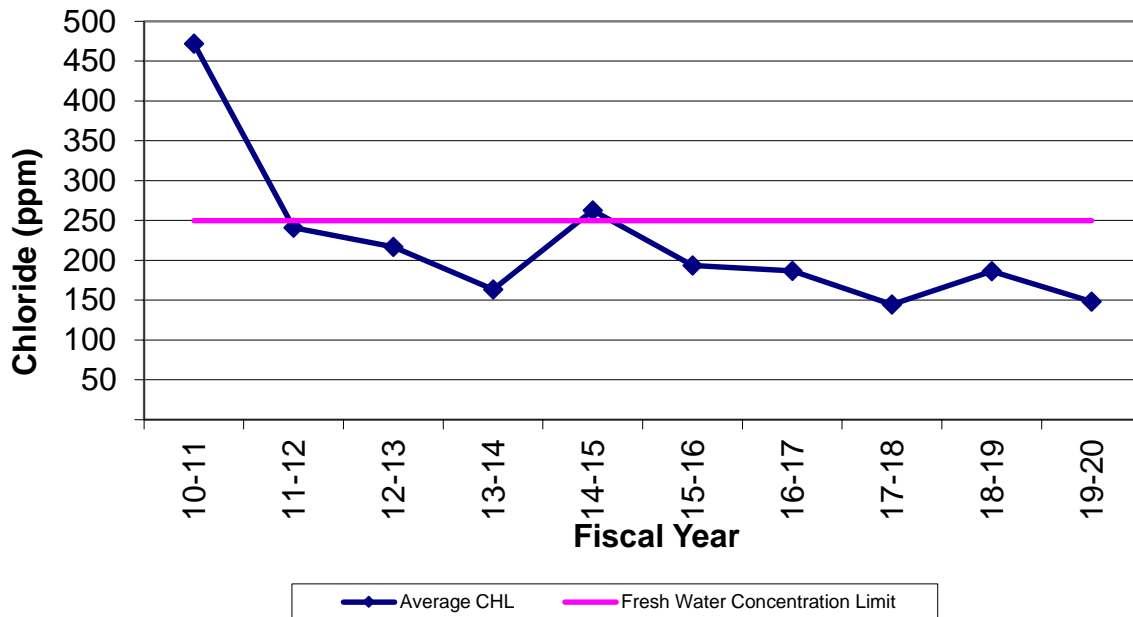


Figure 12b: A-Zone Chloride East of San Gabriel River

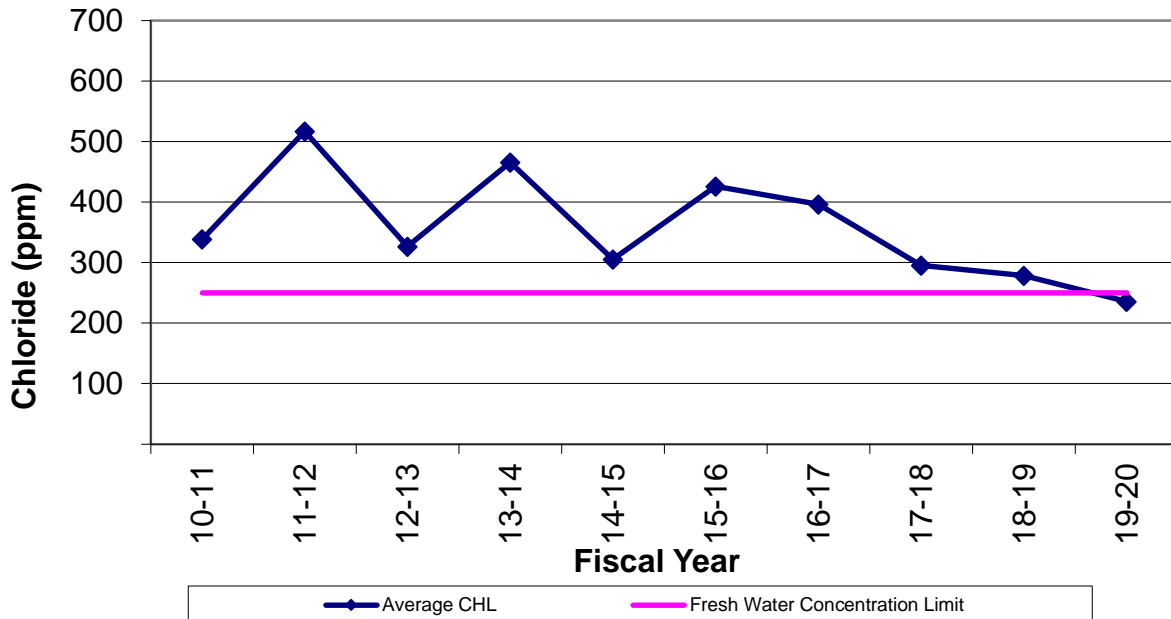


Figure 13a: I-Zone Chloride West of San Gabriel River

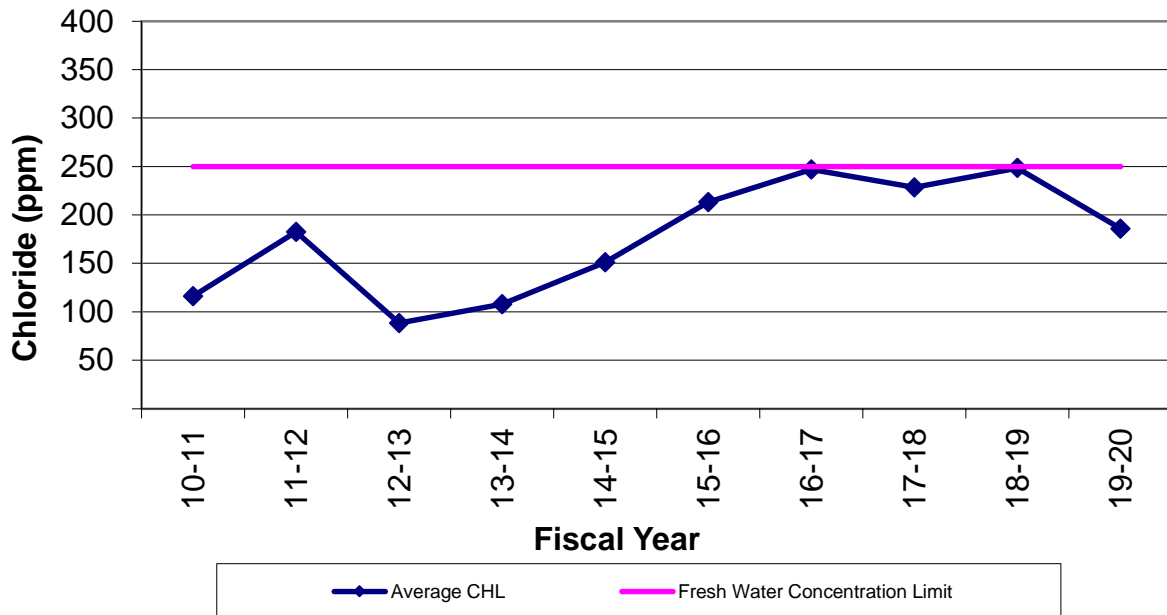
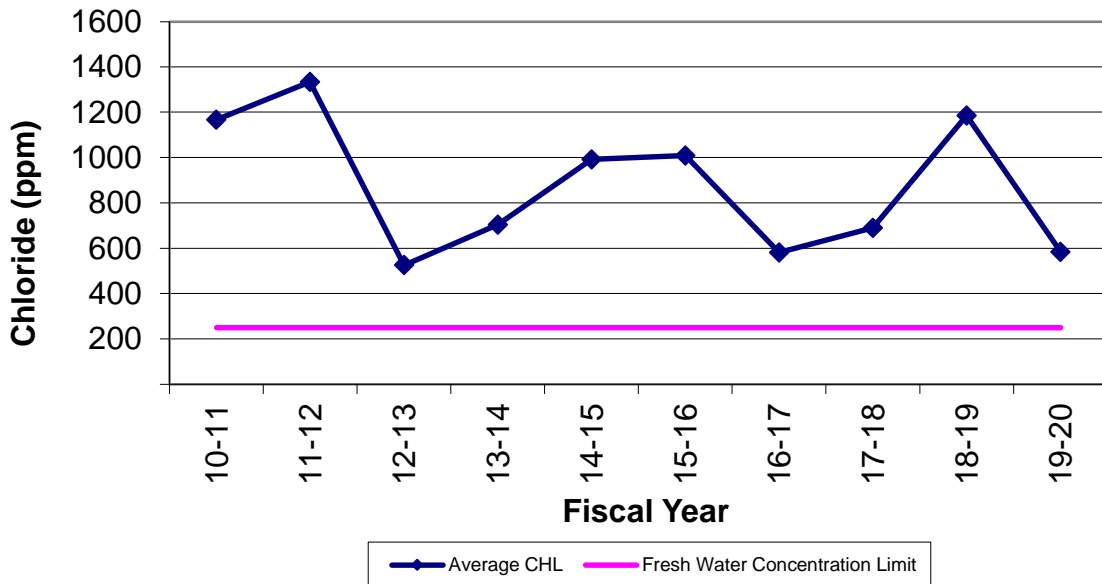


Figure 13b: I-Zone Chloride East of San Gabriel River



West of the San Gabriel River, FY 2019-20 average maximum chloride concentrations decreased in the R, C, B, A, and I Zones. The C Zone had a decrease of 125 mg/L, while the remaining zones had decreases of not more than 65 mg/L.

East of the San Gabriel River, FY 2019-20 average maximum chloride concentrations decreased slightly in the R, C, and A Zones. The I Zone had a significant reduction in chloride concentrations of 600 mg/L. The only Zone that showed an uptick in chloride concentrations was the B Zone. Persistent chlorides remain around well 34JL and there were high chlorides at wells 34U 8 and 34V3 that contributed to the overall increase in the B Zone.

Chloride concentration contour maps for the R, C, B, A, and I Zones have been prepared from data collected in the Spring of 2020 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 from March through April 2020, and the annual event from February through March 2020.

Contours of changes in chloride concentration for the R, C, B, A, and I Zones between Spring 2019 and Spring 2020 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 2020 which is compared to data collected for Spring 2019. The Spring 2019 data is then subtracted from data collected in Spring 2020. These contours very clearly identify areas where chloride concentrations increased and decreased between these two reporting periods. The

chloride concentration contours for FY 2019-20 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 seawater intrusion. Additional areas of high chloride concentrations and/or notable changes in concentration (since the FY 2018-19 report) are as follows:

- R Zone:
 - Chloride concentrations remained elevated landward and seaward of the ABP alignment.
 - In the vicinity of wells 33V'8 and 33Y 10, chloride concentrations decreased over 1000 mg/L. Chloride levels west of the San Gabriel River along the ABP alignment decreased significantly. The north-south alignment had little change, with the exception of 34S0.1, which decreased over 500 mg/L.

- C Zone:
 - Chloride concentrations along the ABP alignment remained at or just below 250 mg/L, except for 34T0.1, which had a concentration greater than 600 mg/L.
 - Compared to the last reporting period, this zone had slight increases and decreases along the ABP of no more than 110 mg/L. Well 33T 13 had a decrease in chloride concentrations of 1050 mg/L in an area where chlorides have been persistent.

- B Zone:
 - Chloride concentrations within this zone generally remained below 250 mg/L with the exception of wells 34JL, 34U 8, and 34V3, which had chloride concentrations greater than 2,000 mg/L.
 - Compared to last reporting period, the west alignment was observed to have slight decreases in chloride concentrations. The eastern portion had a significant decrease at well 34JL of 1,000 mg/L. Landward, there were increases at wells 34U 8 and 34V3 of over 1,000 mg/L.

- A Zone:
 - West of the San Gabriel River, chloride concentrations were below 250 mg/L, east of the San Gabriel River chlorides remained below 250 mg/L, with the exception of 34DG, which had concentrations greater than 1,000 mg/L.
 - Chlorides remain generally unchanged along the ABP alignment when compared to FY18-19, with the exception of increased chlorides at observation well 34DG and decreased chlorides at observation well 34Y0.1, both located east of the San Gabriel River.

- I Zone:
 - Chloride concentrations remained consistent along much of the ABP alignment since the last reporting period. Wells between 34S0.1 and 35E0.1 were observed to have chloride concentrations between 400 and 6,000 mg/L.
 - Significant decreases in chloride concentrations were observed at wells 34LS and 34T0.1. Chloride concentrations at 35E0.1 increased by over 2,000 mg/L.

There continues to be high chloride concentrations in all zones north of and northwest of the ABP, with the exception of the A Zone. Three possible causes include the remaining seawater from previous intrusions, migration of seawater inland by the Los Cerritos

Channel, and suspected intrusion around the west end of the ABP. Elevated chloride concentrations in the area immediately north of the western alignment and west of the ABP will continue to be monitored using the observation wells constructed by LACPW in the 2012-13 reporting period. Elevated chlorides remain landward of the north-south alignment in the B and I Zones. The high chlorides in the B Zone are due from a persistent plume at 34JL. The high chlorides at 34U 8 and 34V3 may be the result of LACPW lowering injection at wells to accommodate the LVL AWTF and to sample wells along the Alamitos Channel that are normally artesian. The chloride concentrations in the vicinity of the ABP Unit 14 project has shown a steady decline in chloride concentrations, especially in the I Zone aquifer, due to the newly constructed wells, with significant decreases near observation well 34LS.

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 2019-20 (not including liability insurance) was \$9,098,347 which can be broken down as follows: water costs of \$6,632,200, Operation and Maintenance costs of \$2,466,148.

WATER COSTS

During FY 2019-20, 5,536.9 AF of water was injected at an estimated total cost of \$6,632,200, as shown in Table 2. The monthly unit water cost (dollars per AF) from July 2019 to June 2020 varied periodically as shown earlier in Table 1. The monthly quantity of water injected and total water costs paid by each agency are shown below in Table 2.

TABLE 2. QUANTITY OF WATER INJECTED AND COSTS

MONTH	AMT BY WRD (AF)	AMT BY OCWD (AF)	TOTAL AMT (AF)
Jul-19	215.1	120.1	335.2
Aug-19	264.6	158.4	423.0
Sep-19	320.7	176.6	497.3
Oct-19	370.8	204.1	574.9
Nov-19	341.8	206.2	548.0
Dec-19	321.2	213.9	535.1
Jan-20	307.0	195.4	502.4
Feb-20	275.5	175.4	450.9
Mar-20	249.1	146.4	395.5
Apr-20	245.4	152.9	398.3
May-20	219.3	151.1	370.4
Jun-20	306.9	199.0	505.9
TOTAL INJECTED	3,437.4	2,099.5	5,536.9
TOTAL COST (\$) [From Tbl. 1]	\$4,116,639	\$2,515,561	\$6,632,200

OPERATIONS AND MAINTENANCE COSTS

A total of \$2,466,148 was spent on Operations and Maintenance during FY 2019-20. 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 2019-20 services and supplies costs is summarized in Table 3.

TABLE 3. DISTRIBUTION OF SERVICES AND SUPPLIES COSTS FOR INJECTION AND EXTRACTION ACTIVITIES

ITEM	LOS ANGELES COUNTY	ORANGE COUNTY	TOTAL
Service & Supplies of Injection Facilities (including Observation Wells)	1,553,446	911,189	2,464,635
Service & Supplies of Extraction Facilities	1,512	0	1,512
Right of Way Acquisition	0	0	0
SUBTOTAL	1,554,959	911,189	2,466,148
Liability Insurance	33,288	33,288	66,575
TOTAL	1,588,246	944,477	2,532,723

The values in Table 3 come from the ABP FY 2019-20 Costs (see A-19) as follows:

¹ The sum of Items 1, 2, 3, 7, 8, 9, 10, 11, 12, and 13. OCWD is responsible for 37.9% of all costs for these items per the agreement.

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

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 4.

TABLE 4. COSTS OF SERVICES AND SUPPLIES FOR INJECTION

Fiscal Year	Volume of Water Injected (Ac-Ft)	Total Cost	Cost Per Ac-Ft Injected
2010-11	5,066.1	\$2,830,801	\$558.77
2011-12	4,334.7	\$2,368,788	\$546.47
2012-13	5,490.4	\$2,477,565	\$451.25
2013-14 ¹	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

¹The costs reported in Table 4 prior to the FY14-15 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 5.

TABLE 5. COSTS OF SERVICES AND SUPPLIES FOR EXTRACTION

Fiscal Year	Volume of Water Extracted (Ac-Ft)	Total Cost	Cost Per Ac-Ft Extracted
2010-11	0.0	\$4,552	N/A
2011-12	0.0	\$6,219	N/A
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

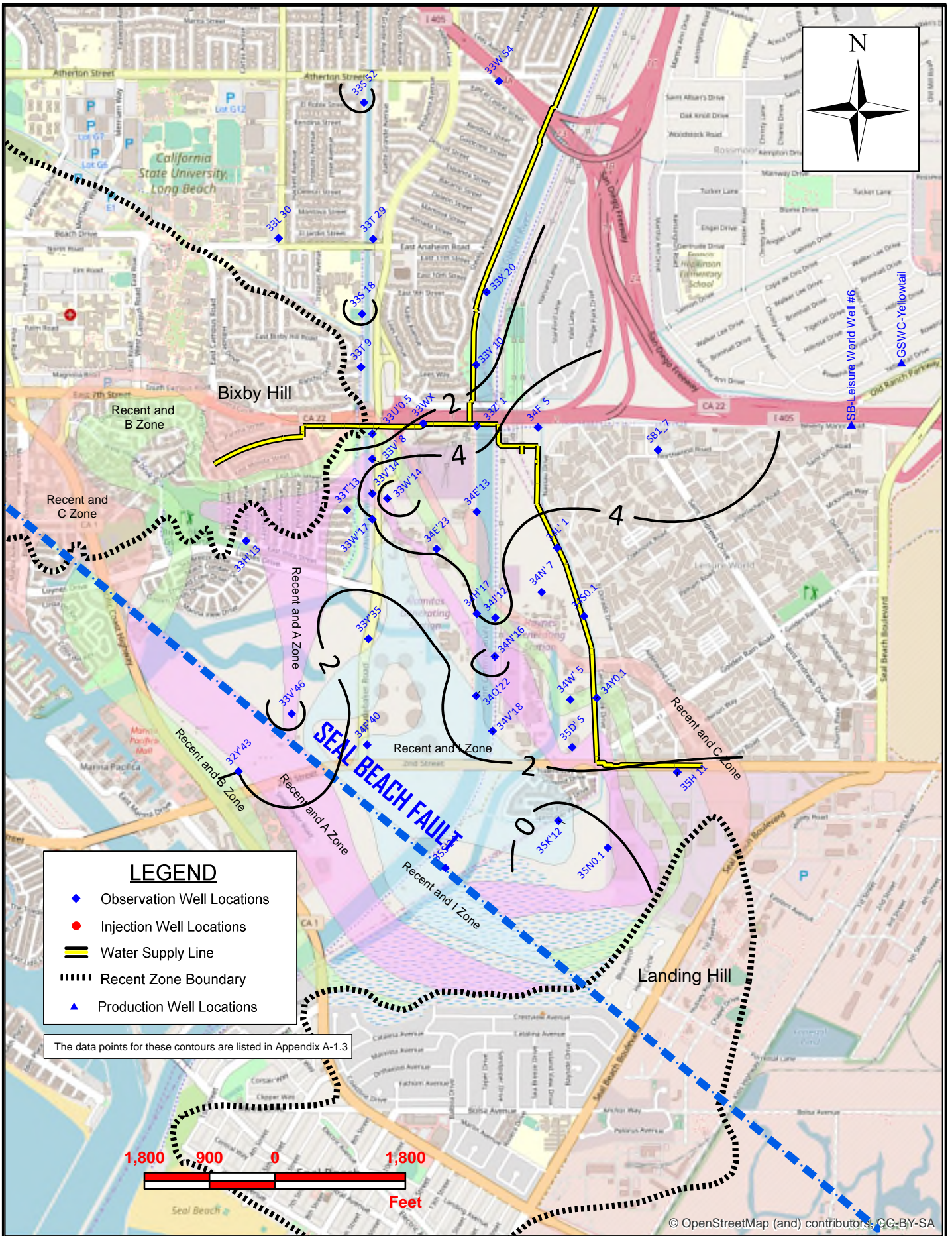
FIXED ASSETS

During Fiscal Year 2019-20, there were no new LACFCD facilities, OCWD facilities, or joint facilities added to the ABP.

BUDGET

The FY 2021-22 budget for the cost of ABP Supplies and Services is \$2,798,000. A breakdown of this amount, along with past expenditures per category, is shown in Appendix A-20.

APPENDIX



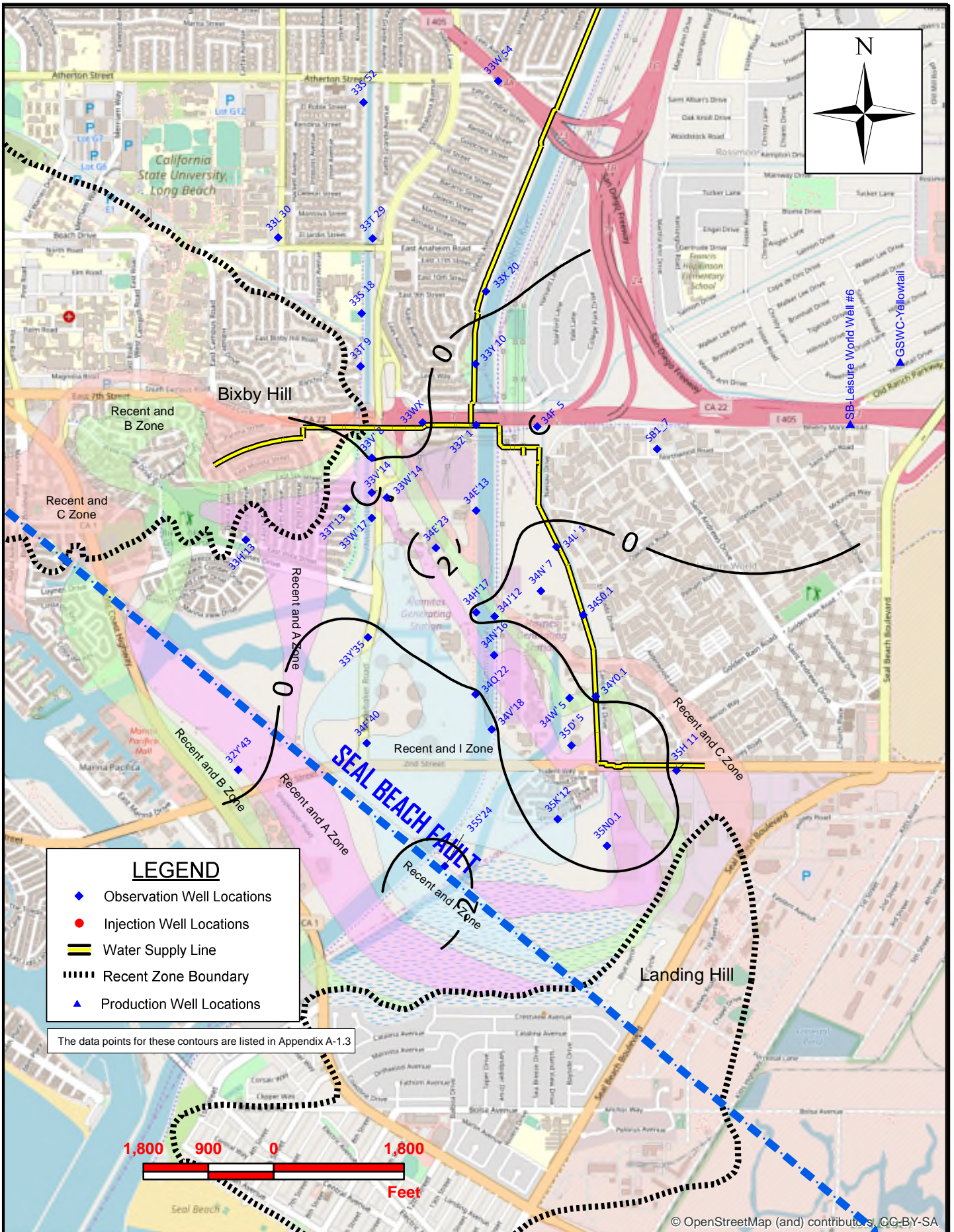
LEGEND

- ◆ 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



Alamitos Barrier Project
R Zone Groundwater Elevation (ft) Contours, Spring 2020



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



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

POINT	PROJ	FCD	AQUIFER	DATE	FY 19-20 ELEV	P.E. ¹	Δ^2	FY 18-19 ELEV	CHANGE IN ELEV
1	32Y'43	493WW	RECENT	20200226	2.0			1.7	0.3
2	33H'13	493YY	R,A	20200213	2.8			2.3	0.5
3	33L 30	491G	RECENT	20200219	1.3			1.5	-0.2
4	33S 18	492AH	RECENT	20200219	2.3			3.6	-1.3
5	33S 52	491J	RECENT	20200219	-0.1			0.5	-0.6
6	33T 9	492CV	RECENT	20200303	0.9			1.5	-0.6
7	33T'13	492AU	RECENT	20200218	3.6			2.9	0.7
8	33T 29	491D	RECENT	20200226	1.2			2.2	-1.0
9	33U'0.5	492CB	RECENT	20200303	0.4				n/a
10	33V' 8	492BY	R,A	20200225	3.5			3.7	-0.2
11	33V'14	492JJ	RECENT	20200225	4.8			0.6	4.2
12	33V'46	493UU	RECENT	20200226	4.7				n/a
13	33W 54	501C	RECENT	20200219	1.3			2.3	-1.0
14	33W'14	492AT	RECENT	20200225	7.9			8.0	-0.1
15	33W'17	493PP	RECENT	20200225	3.8			3.3	0.5
16	33WX	502AZ	RECENT	20200324	2.3			2.4	-0.1
17	33X 20	502L	RECENT	20200303	1.5			2.0	-0.5
18	33Y 10	502BA	RECENT	20200219	1.2			0.3	0.9
19	33Y'35	493AB	RECENT	20200219	0.2			0.5	-0.3
20	33Z' 1	502AU	RECENT	20200311	3.0			2.3	0.7
21	34E'13	503AU	RECENT	20200303	4.7			4.6	0.1
22	34E'23	503X	RECENT	20200227	4.1			0.5	3.6
23	34F 5	502BT	RECENT	20200303	5.9			3.7	2.2
24	34F'40	483J	RECENT	20200225	1.2			1.8	-0.6
25	34H'17	503Y	RECENT	20200303	4.0			4.2	-0.2
26	34J'12	503U	RECENT	20200227	4.5			4.6	-0.1
27	34L' 1	503P	RECENT	20200325	2.8			3.3	-0.5
28	34N' 7	503AE	RECENT	20200220	3.2			3.8	-0.6
29	34N'16	503W	RECENT	20190916	1.3			0.3	1.0
30	34Q'22	503T	RECENT	20200226	2.7			2.8	-0.1
31	34S0.1	503BT	RECENT	20200319	2.9			3.2	-0.3
32	34V'18	503V	RECENT	20200227	2.7			2.8	-0.1
33	34W' 5	503AH	RECENT	20200220	3.8			3.6	0.2
34	34Y0.1	503CK	RECENT	20200319	3.5			3.6	-0.1
35	35D' 5	503AL	RECENT	20200219	3.4			2.0	1.4
36	35H 11	514F	RECENT	20200309	1.8			1.9	-0.1
37	35K'12	504R	RECENT	20200226	-1.1			-1.8	0.7
38	35N0.1	504M	RECENT	20200226	-0.3			-0.6	0.3
39	35S'24	504K	RECENT	20200303	1.4			4.0	-2.6
40	SB1_7		RECENT	20200317	4.9			4.1	0.8

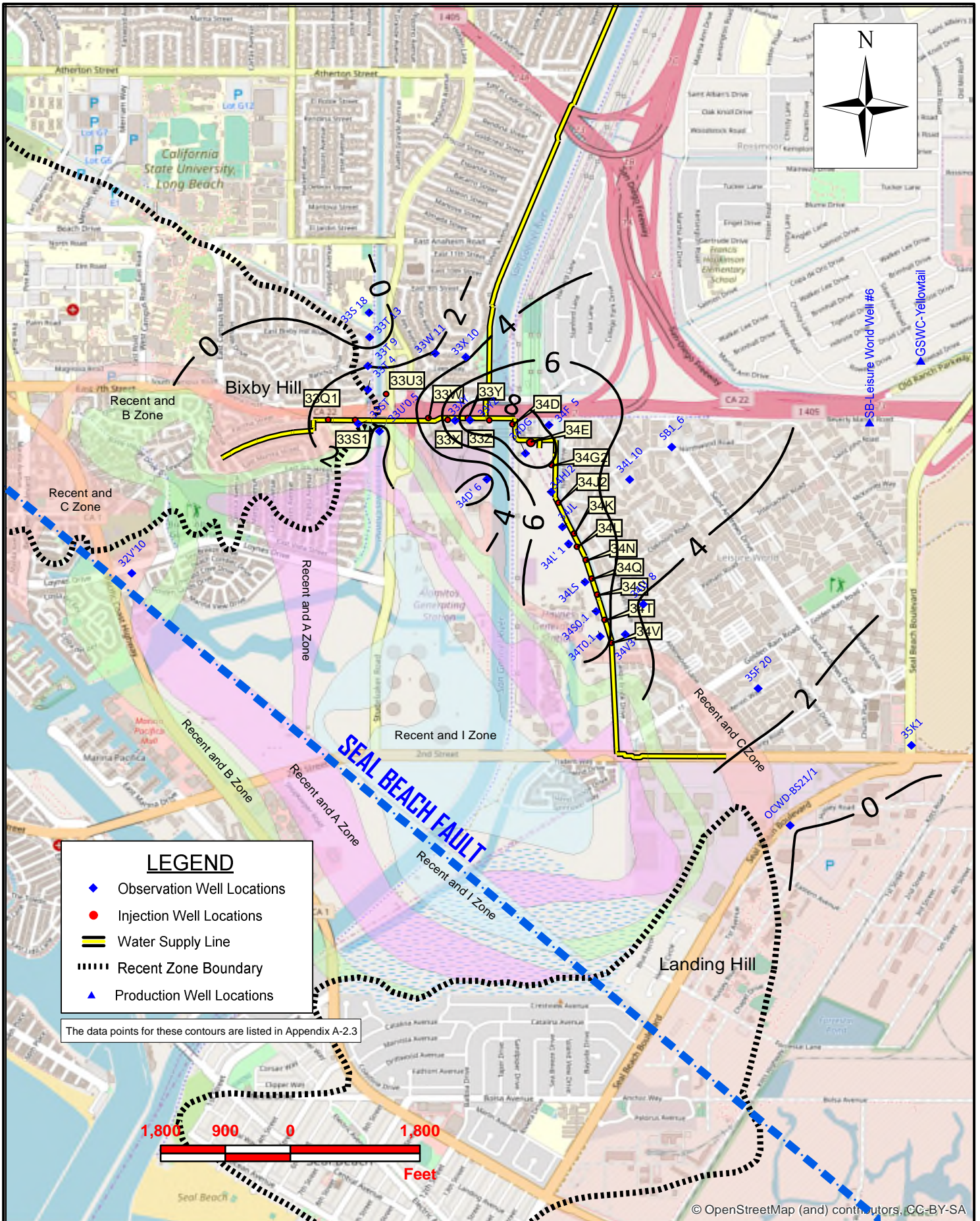
AVG= 2.6

AVG= 2.5

¹ P.E. represents the protective elevations calculated for internodal wells.

² 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-2.3

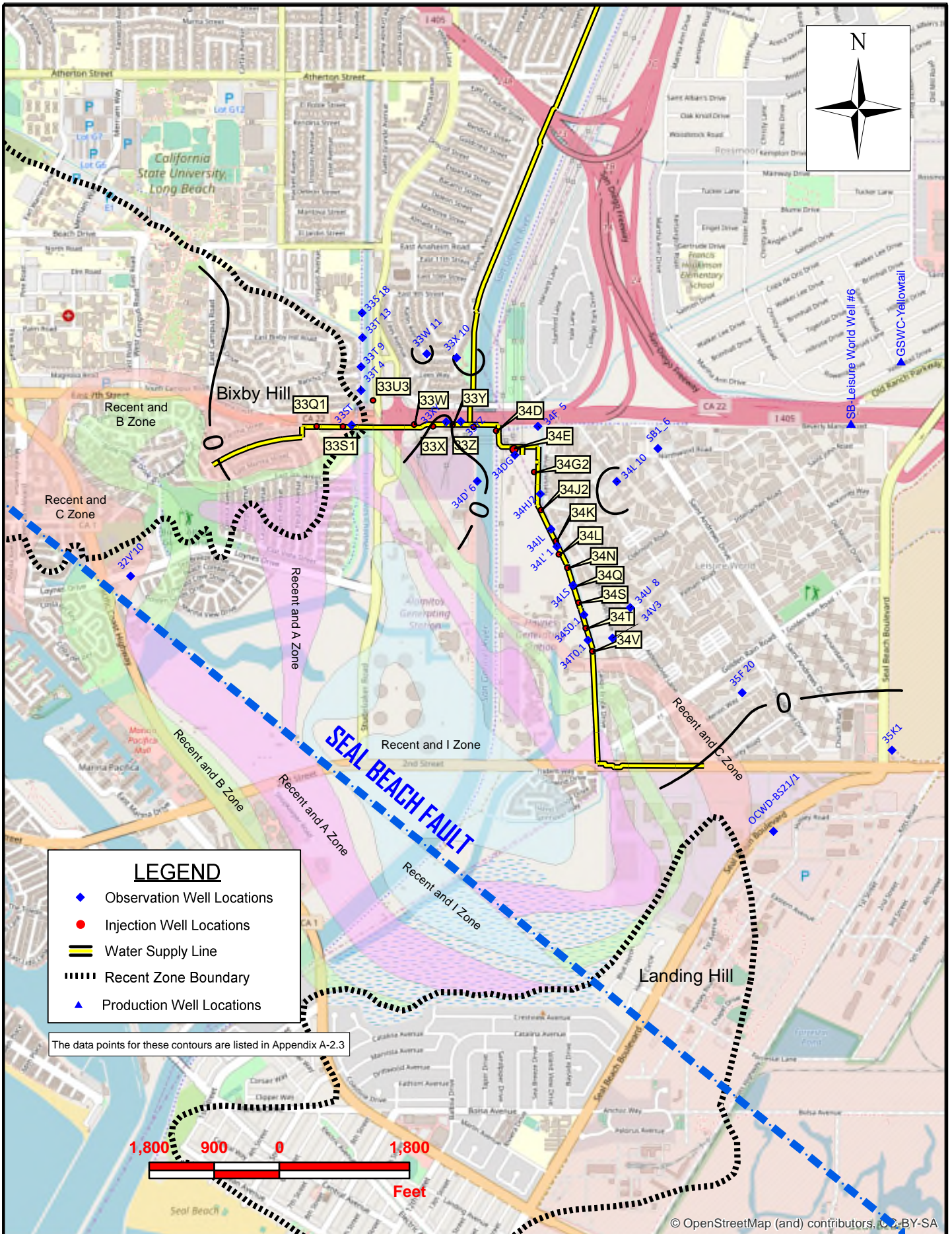


Alamitos Barrier Project
C Zone Groundwater Elevation (ft) Contours, Spring 2020



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C Zone GW.srf



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 2019 to Spring 2020



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

POINT	PROJ	FCD	AQUIFER	DATE	FY 19-20 ELEV	P.E. ¹	Δ ²	FY 18-19 ELEV	CHANGE IN ELEV
1	32V'10	483H	C ZONE	20200213	-0.3			-0.2	-0.1
2	33S 18	492AG	C ZONE	20200219	-0.2			-0.5	0.3
3	33ST	492BK	C,B	20200324	3.2	0.9	2.3	2.5	0.7
4	33T 4	492CT	C ZONE	20200318	3.5			2.3	1.2
5	33T 9	492CU	C ZONE	20200316	2.0			1.6	0.4
6	33T 13	492AC	C ZONE	20200304	-1.2			-2.7	1.5
7	33U'0.5	492CA	C ZONE	20200303	1.5				n/a
8	33W 11	502R	C ZONE	20200311	2.1			-3.0	5.1
9	33X 10	502BB	C ZONE	20200303	3.7			4.3	-0.6
10	33XY	502BL	C ZONE	20200309	7.4	5.4	2.0	7.8	-0.4
11	33YZ	502AB	C ZONE	20200331	9.6	5.4	4.2	8.9	0.8
12	34D' 6	502BF	C ZONE	20200303	1.1			1.5	-0.4
13	34DG	502X	C ZONE	20200304	9.5	5.4	4.1	8.6	0.9
14	34F 5	502BU	C ZONE	20200303	7.7			5.7	2.0
15	34HJ2	502CH	C ZONE	20200304	7.0			4.5	2.5
16	34JL	503AR	C ZONE	20200309	6.8	4.2	2.6	6.9	-0.1
17	34L' 1	503N	C ZONE	20200309	8.1	4.8	3.3	7.2	0.9
18	34L 10	502AK	C ZONE	20200303	4.5			5.3	-0.8
19	34LS	503BF	C ZONE	20200309	7.2	4.5	2.7	6.6	0.6
20	34S0.1	503BU	C ZONE	20200309	6.9	3.7	3.2	3.9	3.0
21	34T0.1	503AB	C ZONE	20200309	6.8	3.6	3.2	6.1	0.7
22	34U 8	513D	C ZONE	20200303	3.6			2.0	1.6
23	34V3	503CB	C ZONE	20200303	4.8			2.5	2.3
24	35F 20	513L	C ZONE	20200316	2.9			2.8	0.1
25	35K1	523D	C ZONE	20200324	0.2	4.3	-4.1	0.5	-0.3
26	SB1_6		C ZONE	20200317	5.5			3.5	2.1
27	OCWD-BS21/1		C ZONE	20200305	0.0			0.6	-0.6

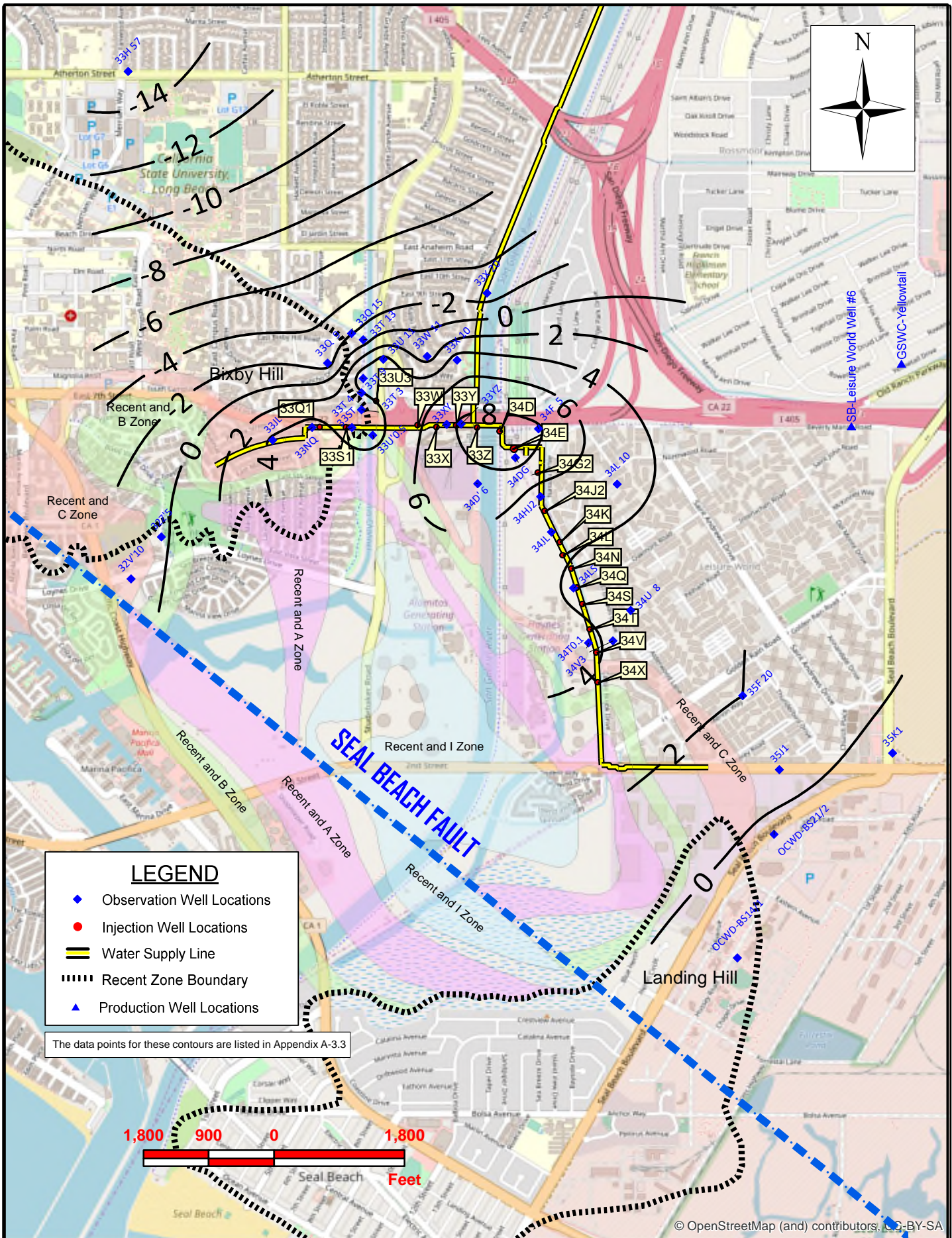
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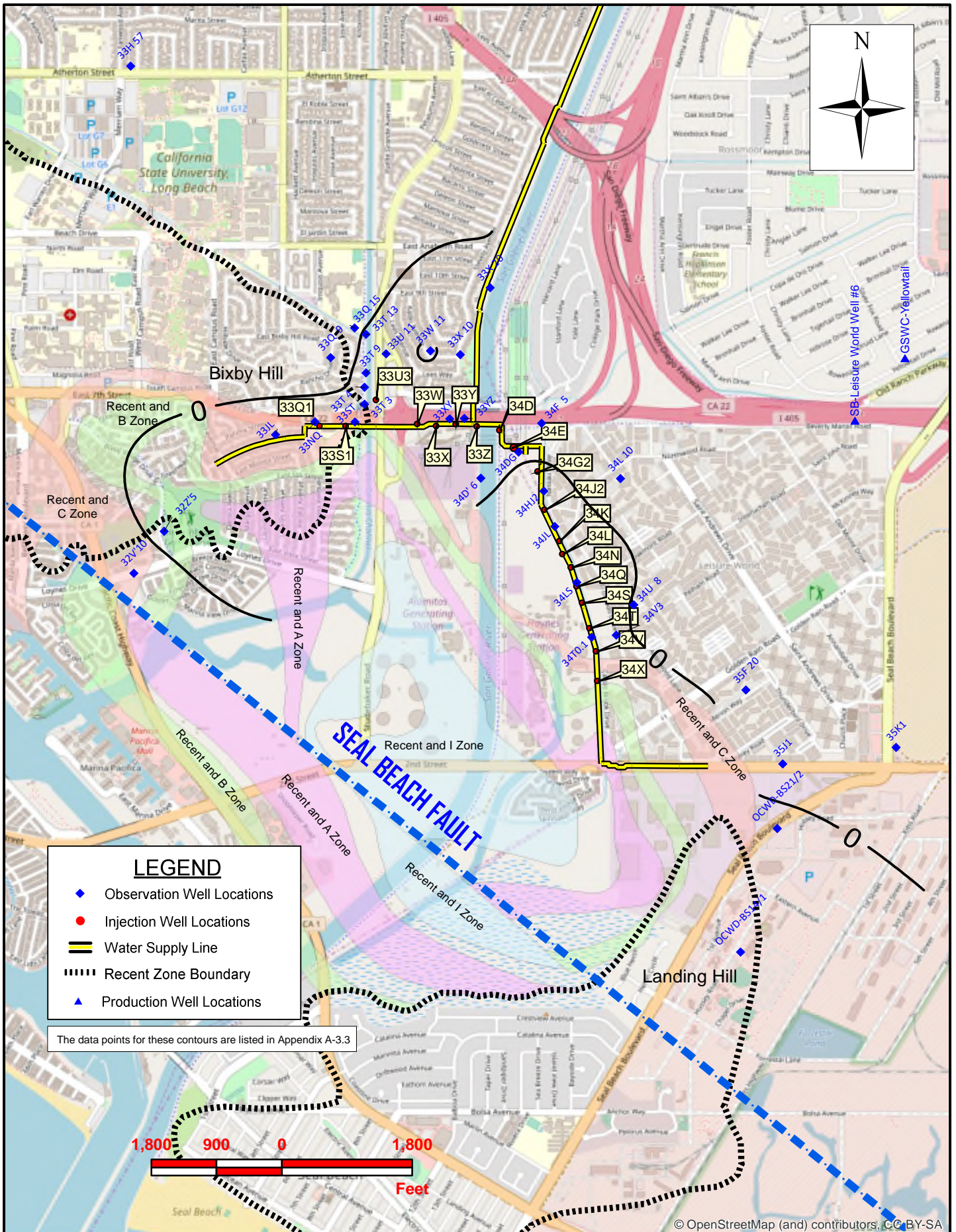
AVG= 3.4

¹ P.E. represents the protective elevations calculated for internodal wells.

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

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





Alamitos Barrier Project
 B Zone Change in Elevation (ft), Spring 2019 to Spring 2020



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

POINT	PROJ	FCD	AQUIFER	DATE	FY 19-20 ELEV	P.E. ¹	Δ ²	FY 18-19 ELEV2	CHANGE IN ELEV
1	32V'10	483G	B ZONE	20200213	-1.0			-0.1	-0.9
2	32Z'5	482W	B,A	20200213	-0.3			-0.7	0.4
3	33H 57	481	B ZONE	20200316	-15.3			-17.1	1.8
4	33JL	492BQ	B ZONE	20200324	4.3	0.8	3.5	2.5	1.8
5	33NQ	492BN	B ZONE	20200304	4.9	0.7	4.2	2.7	2.2
6	33Q 9	492CM	B ZONE	20200303	-2.8			0.8	-3.6
7	33Q 15	492AN	B ZONE	20200220	-2.0			2.0	-4.0
8	33ST	492BK	C,B	20200324	3.2	0.9	2.3	0.8	2.4
9	33T 3	492CL	B ZONE	20200303	2.5			1.8	0.7
10	33T 4	492CS	B ZONE	20200303	3.8			3.6	0.2
11	33T 9	492YY	B ZONE	20200318	5.6			-3.0	8.6
12	33T 13	492AB	B ZONE	20200304	-1.0			3.2	-4.2
13	33U 11	492AK	B ZONE	20200311	4.6			2.3	2.3
14	33U'0.5	492BZ	B ZONE	20200303	3.3				n/a
15	33W 11	502S	B ZONE	20200311	1.1			-3.6	4.7
16	33X 10	502BC	B ZONE	20200303	5.0			3.4	1.6
17	33X 20	502K	B ZONE	20200303	-3.0			-3.1	0.1
18	33XY	502BM	B ZONE	20200324	7.3	6.3	1.0	6.2	1.1
19	33YZ	502AC	B ZONE	20200324	8.3	7.1	1.2	7.5	0.9
20	34D' 6	502BG	B ZONE	20200303	7.3			6.8	0.5
21	34DG	502Y	B ZONE	20200324	8.7	6.6	2.1	8.5	0.2
22	34F 5	502BS	B ZONE	20200303	8.2			7.6	0.6
23	34HJ2	502CJ	B ZONE	20200324	4.9	5.9	-1.0	5.7	-0.8
24	34JL	503AQ	B ZONE	20200323	4.5	5.3	-0.8	5.6	-1.1
25	34L 10	502AL	B ZONE	20200303	4.9			3.3	1.6
26	34LS	503BE	B ZONE	20200324	3.7	5.4	-1.7	6.5	-2.8
27	34T0.1	503AC	B ZONE	20200319	4.6	6.1	-1.5	6.8	-2.2
28	34U 8	513E	B ZONE	20200318	2.6			2.4	0.2
29	34V3	503CC	B ZONE	20200318	3.5			3.8	-0.3
30	35F 20	513K	B ZONE	20200316	2.0			1.9	0.1
31	35J1	514M	B ZONE	20200324	0.6	5.8	-5.2	-0.3	0.9
32	35K1	523A	B ZONE	20200309	-0.5	5.8	-6.3	-1.1	0.6
33	OCWD-BS14/1		B ZONE	20200305	-1.0			-0.3	-0.7
34	OCWD-BS21/2		B ZONE	20200305	-0.4			0.2	-0.6

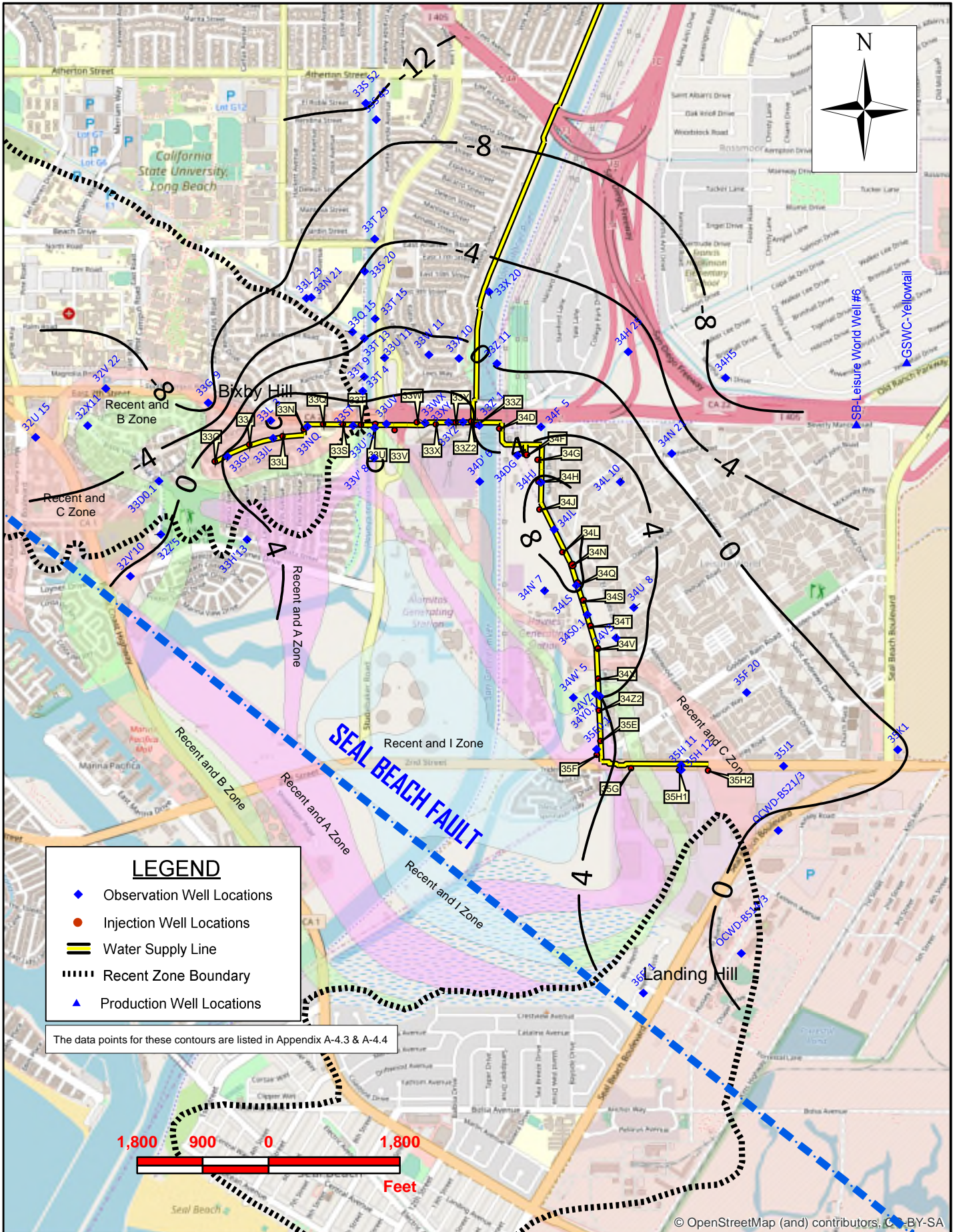
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AVG= 2.0

¹ P.E. represents the protective elevations calculated for internodal wells.

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

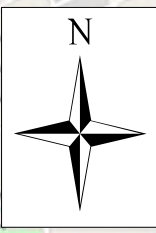
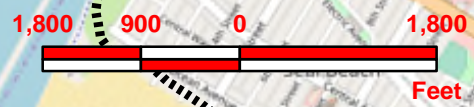
= A max. or min. elevation during that period.



LEGEND

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

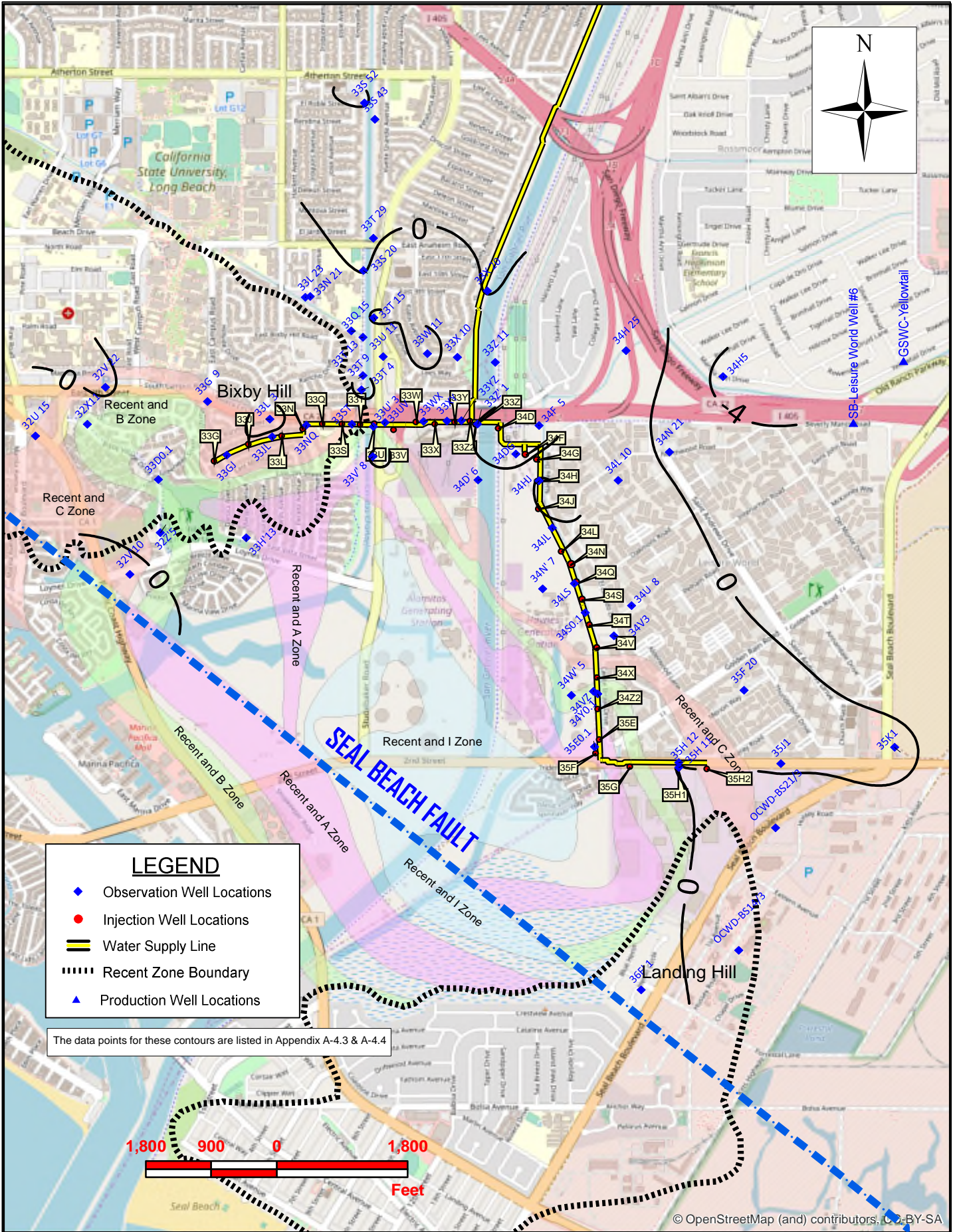
The data points for these contours are listed in Appendix A-4.3 & A-4.4



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Alamitos Barrier Project
A Zone Groundwater Elevation (ft) Contours, Spring 2020



Alamitos Barrier Project
A Zone Change in Elevation (ft), Spring 2019 to Spring 2020



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

POINT	PROJ	FCD	AQUIFER	DATE	FY 19-20 ELEV	P.E. ¹	Δ ²	FY 18-19 ELEV	CHANGE IN ELEV
1	32U 15	482M	A ZONE	20200213	-5.6			-5.9	0.3
2	32V 22	482P	A ZONE	20200213	-5.5			-5.3	-0.2
3	32V'10	483F	A ZONE	20200213	0.4			0.6	-0.2
4	32X11	482S	A ZONE	20200303	-7.2			-7.8	0.6
5	32Z'5	482W	B,A	20200213	-0.3			-0.7	0.4
6	33D0.1	482U	A,I	20200304	-2.0			-2.5	0.5
7	33G 9	482F	A ZONE	20200213	-9.7			-11.7	2.0
8	33GJ	482X	A ZONE	20200311	4.9	1.4	3.5	0.9	4.0
9	33H'13	493YY	R,A	20200213	2.8			2.3	0.5
10	33JL	492BW	A,I	20200311	6.4	3.1	3.3	2.8	3.6
11	33L 3	492	A ZONE	20200219	9.2			4.4	4.8
12	33L 23	492RR	A ZONE	20200218	-7.3			-8.7	1.4
13	33N 21	492BU	A ZONE	20200218	-6.0			-7.2	1.2
14	33NQ	492BP	A ZONE	20200304	6.4	3.6	2.8	3.2	3.2
15	33Q 15	492AM	A ZONE	20200220	-2.1			-3.2	1.1
16	33S 20	492BR	A ZONE	20200219	-3.8			-3.6	-0.2
17	33S 43	491E	A ZONE	20200220	-9.0			-8.4	-0.6
18	33S 52	491H	A ZONE	20200219	-12.9			-13.0	0.1
19	33ST	492BL	A ZONE	20200324	5.8	2.8	3.0	3.3	2.5
20	33T 4	492CR	A ZONE	20200318	2.8			3.4	-0.6
21	33T 9	492TT	A ZONE	20200318	2.5			2.6	-0.1
22	33T 13	492ZZ	A ZONE	20200304	0.0			-1.0	1.0
23	33T 15	492SS	A ZONE	20200220	-0.9			-5.6	4.7
24	33T 29	491C	A ZONE	20200226	-4.3			-4.2	-0.1
25	33U 11	492AJ	A ZONE	20200311	2.5			1.2	1.3
26	33U' 3	492WW	A ZONE	20200225	7.2			7.1	0.1
27	33UV	492BH	A ZONE	20200309	5.0	4.0	1.0	4.8	0.2
28	33V' 8	492BY	R,A	20200225	3.5			3.7	-0.2
29	33W 11	502T	A ZONE	20200311	0.7			-5.1	5.8
30	33WX	502AF	A ZONE	20200324	5.7	7.6	-1.9	4.3	1.4
31	33X 10	502BD	A ZONE	20200303	1.5			-0.3	1.8
32	33X 20	502J	A ZONE	20200303	-2.8			-2.6	-0.2
33	33XY	502BN	A ZONE	20200324	6.2	8.0	-1.9	5.5	0.7
34	33YZ	502AD	A ZONE	20200324	7.2	8.7	-1.5	5.4	1.8
35	33Z' 1	502G	A ZONE	20200311	2.2			2.4	-0.2
36	33Z 11	502V	A ZONE	20200227	-0.3			-3.2	2.9
37	34D' 6	502BH	A ZONE	20200303	5.3			4.1	1.2
38	34DG	502Z	A ZONE	20200324	4.4	8.5	-4.1	6.6	-2.2
39	34F 5	502BR	A ZONE	20200303	3.0			5.1	-2.1

¹ P.E. represents the protective elevations calculated for internodal wells.

² 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 19-20 ELEV	P.E. ¹	Δ^2	FY 18-19 ELEV	CHANGE IN ELEV
40	34H 25	502AH	A ZONE	20200326	-1.7			-5.2	3.5
41	34H5	512E	A ZONE	20200326	-9.5			-4.4	-5.1
42	34HJ	502BX	A ZONE	20200304	8.8	8.6	0.2	4.3	4.5
43	34JL	503AP	A ZONE	20200309	8.3	7.8	0.5	4.5	3.8
44	34L 10	502AM	A ZONE	20200303	6.5			2.9	3.6
45	34LS	503BD	A ZONE	20200309	8.3	7.7	0.6	5.0	3.3
46	34N 21	512B	A ZONE	20200226	-2.0			-0.9	-1.1
47	34N' 7	503AF	A ZONE	20200303	7.3			5.0	2.3
48	34S0.1	503BV	A ZONE	20200309	6.9	6.7	0.2	6.2	0.7
49	34U 8	513F	A ZONE	20200318	4.5			3.2	1.3
50	34V3	503CD	A ZONE	20200318	5.4			4.8	0.6
51	34VZ	503BH	A ZONE	20200309	6.9	4.4	2.5	4.1	2.8
52	34W' 5	503AJ	A ZONE	20200220	5.8			5.1	0.7
53	34Y0.1	503CL	A ZONE	20200319	4.0	2.8	1.2	3.7	0.3
54	35E0.1	503BK	A ZONE	20200309	5.1	2.4	2.7	2.1	3.0
55	35F 20	513J	A ZONE	20200316	1.9			1.3	0.6
56	35H 11	514G	A ZONE	20200324	1.1	3.8	-2.7	1.2	-0.1
57	35H 12	514D	A ZONE	20200324	0.2	3.8	-3.6	-0.1	0.3
58	35J1	514L	A ZONE	20200324	0.8	6.2	-5.4	0.7	0.1
59	35K1	523B	A ZONE	20200324	0.2	6.2	-6.0	0.0	0.2
60	36F' 1	505D	A ZONE	20200226	3.7			3.1	0.6
61	OCWD-BS14/3		A ZONE	20200305	-1.5			-0.7	-0.8
62	OCWD-BS21/3		A ZONE	20200305	-0.4			0.2	-0.6

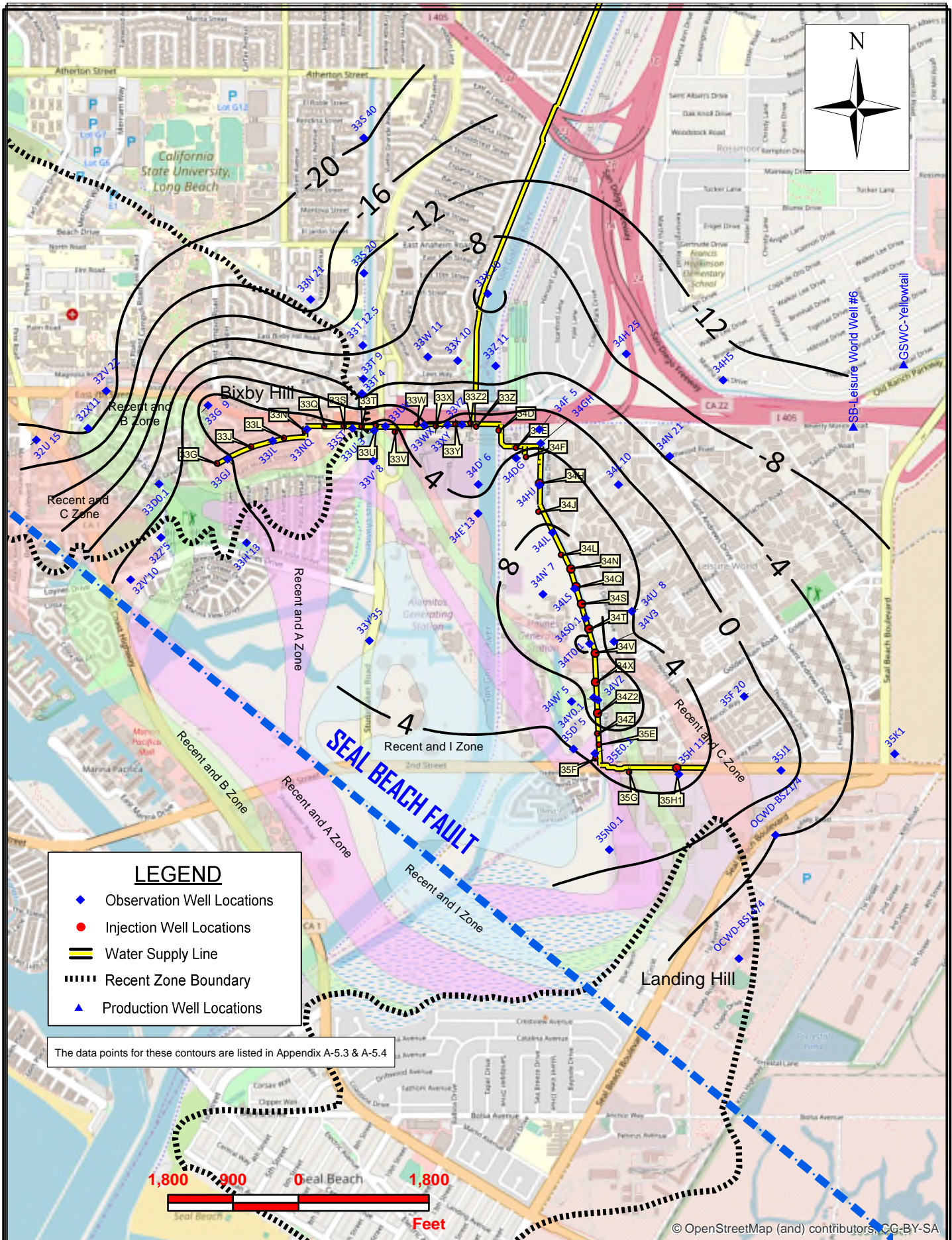
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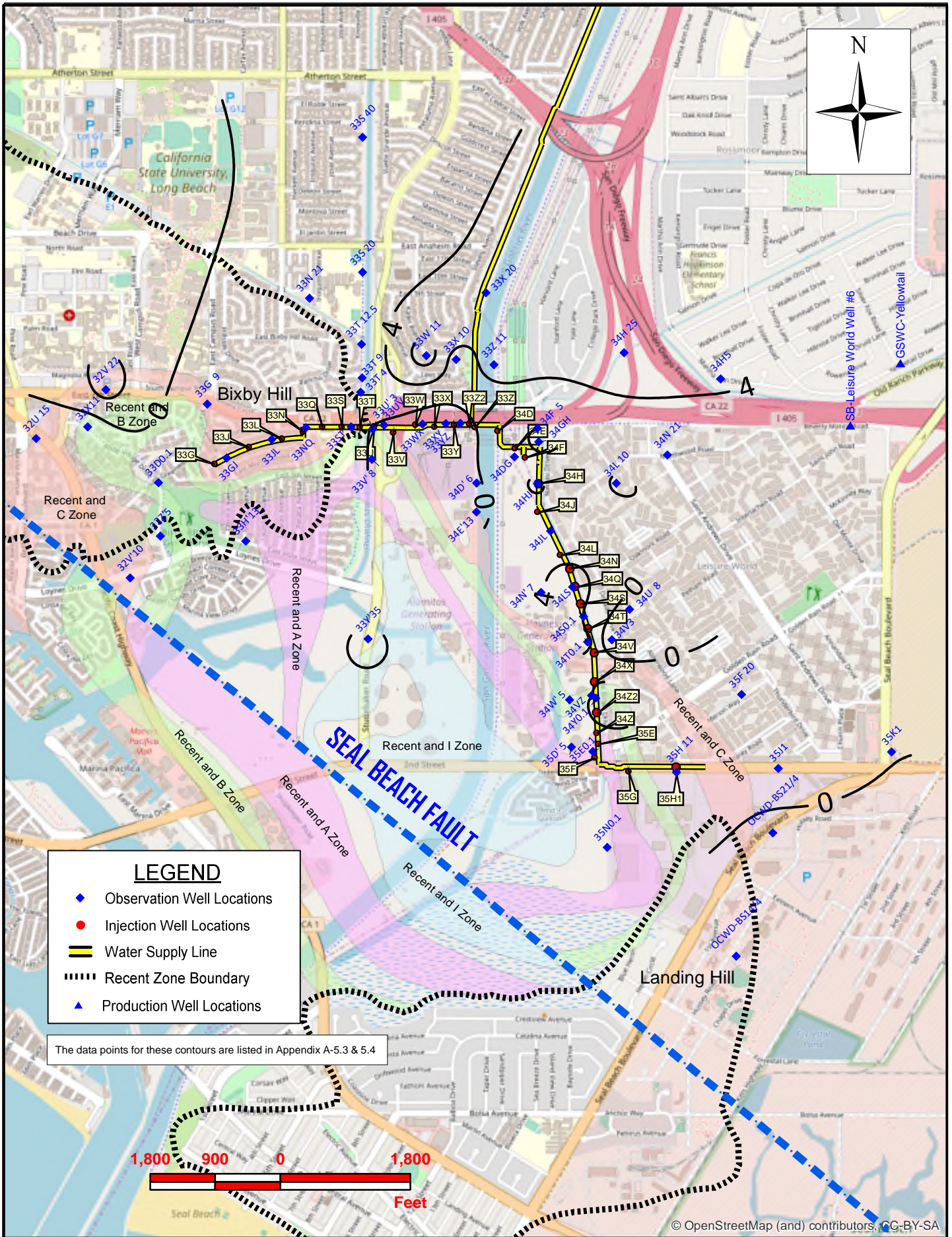
¹ P.E. represents the protective elevations calculated for internodal wells.

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

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



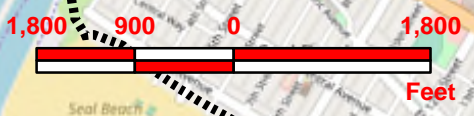
Alamitos Barrier Project
I Zone Groundwater Elevation (ft) Contours, Spring 2020



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-5.3 & 5.4



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Alamitos Barrier Project
I Zone Change in Elevation (ft), Fall 2019 to Fall 2020

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

POINT	PROJ	FCD	AQUIFER	DATE	FY 19-20 ELEV	P.E. ¹	Δ ²	FY 18-19 ELEV	CHANGE IN ELEV
1	32U 15	482L	I ZONE	20200213	-18.4			-20.7	2.3
2	32V 22	482N	I ZONE	20200213	-22.5			-16.8	-5.7
3	32V'10	483E	I ZONE	20200213	1.7			0.6	1.1
4	32X11	482R	I ZONE	20200309	-20.7			-23.3	2.6
5	32Z'5	482V	I ZONE	20200213	1.7			0.2	1.5
6	33D0.1	482U	A,I	20200304	-2.0			-2.5	0.5
7	33G 9	482G	I ZONE	20200213	6.6			2.9	3.7
8	33GJ	482Y	I ZONE	20200324	3.6	2.6	1.0	2.4	1.2
9	33H'13	493XX	I ZONE	20200213	2.7			2.0	0.7
10	33JL	492BW	A,I	20200311	6.4	3.1	3.3	3.2	3.2
11	33N 21	492BV	I ZONE	20200218	-18.4			-20.5	2.1
12	33NQ	492BP	A,I	20200304	6.4	3.6	2.8	3.2	3.2
13	33S 20	492BS	I ZONE	20200219	-10.9			-11.7	0.8
14	33S 40	491F	I ZONE	20200219	-20.3			-21.7	1.4
15	33ST	492BM	I ZONE	20200324	5.3	4.2	1.1	3.5	1.8
16	33T 4	492CQ	I ZONE	20200318	-5.2			-8.2	3.0
17	33T 9	492XX	I ZONE	20200318	-5.0			-7.0	2.0
18	33T 12.5	492BT	I ZONE	20200220	-8.8			-9.6	0.8
19	33U' 3	492QQ	I ZONE	20200225	5.1			5.4	-0.3
20	33UV	492BJ	I ZONE	20200324	6.0	6.1	-0.1	6.4	-0.4
21	33V' 8	492BX	I ZONE	20200225	5.5			5.7	-0.2
22	33W 11	502U	I ZONE	20200311	-7.0			-17.6	10.6
23	33WX	502AG	I ZONE	20200304	0.2	10.4	-10.2	2.0	-1.8
24	33X 10	502BE	I ZONE	20200225	-5.6			-7.5	1.9
25	33X 20	502H	I ZONE	20200303	-2.7			-7.4	4.7
26	33XY	502BP	I ZONE	20200304	0.4	11.0	-10.7	3.2	-2.8
27	33Y'35	493ZZ	I ZONE	20200219	4.7			0.2	4.5
28	33YZ	502AE	I ZONE	20200304	1.6	11.1	-9.5	2.7	-1.1
29	33Z 11	502W	I ZONE	20200227	-6.5			-12.4	5.9
30	34D' 6	502BI	I ZONE	20200303	3.0			3.5	-0.5
31	34DG	502AA	I ZONE	20200324	4.3	11.1	-6.8	0.7	3.6
32	34E'13	503AT	I ZONE	20200303	5.2			6.4	-1.2
33	34F 5	502BQ	I ZONE	20200303	2.7			2.6	0.1
34	34GH	502BV	I ZONE	20200324	3.6	11.3	-7.7	5.5	-1.9
35	34H 25	502AJ	I ZONE	20200326	-9.1			-16.2	7.1
36	34H5	512D	I ZONE	20200326	-11.1			-15.6	4.5
37	34HJ	502BW	I ZONE	20200304	7.2	11.0	-3.8	2.5	4.7

¹ P.E. represents the protective elevations calculated for internodal wells.

² 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 19-20 ELEV	P.E. ¹	Δ ²	FY 18-19 ELEV	CHANGE IN ELEV
38	34JL	503AN	I ZONE	20200309	8.3	10.5	-2.2	6.2	2.1
39	34L 10	502AN	I ZONE	20200303	1.0			1.3	-0.3
40	34LS	503BC	I ZONE	20200309	11.7	9.5	2.2	5.6	6.1
41	34N 21	512C	I ZONE	20200225	-4.4			-5.5	1.1
42	34N' 7	503AG	I ZONE	20200303	9.2			5.5	3.7
43	34S0.1	503BW	I ZONE	20200309	10.1	8.1	2.0	6.2	3.9
44	34T0.1	503AD	I ZONE	20200309	13.2	8.4	4.8	8.0	5.2
45	34U 8	513G	I ZONE	20200303	4.1			5.3	-1.2
46	34V3	503CE	I ZONE	20200326	4.5			7.9	-3.4
47	34VZ	503BG	I ZONE	20200309	10.1	5.9	4.2	6.7	3.5
48	34W' 5	503AK	I ZONE	20200220	4.3			4.4	-0.1
49	34Y0.1	503CM	I ZONE	20200309	13.1	4.8	8.3	5.4	7.7
50	35D' 5	503AM	I ZONE	20200220	4.0			2.2	1.8
51	35E0.1	503BJ	I ZONE	20200324	4.5	3.0	-3.9	3.3	1.2
52	35F 20	513H	I ZONE	20200316	0.9			-0.2	1.1
53	35H 11	514H	I ZONE	20200309	5.2	5.5	-0.3	1.6	3.6
54	35J1	513M	I ZONE	20200309	1.8	3.0	-1.2	-0.7	2.5
55	35K1	523C	I ZONE	20200324	-6.8	4.8	-11.6	-6.9	0.1
56	35N0.1	504N	I ZONE	20200226	0.7			0.3	0.4
57	OCWD-BS14/4		I ZONE	20200305	-6.2			-4.9	-1.3
58	OCWD-BS21/4		I ZONE	20200305	-4.0			-2.4	-1.6

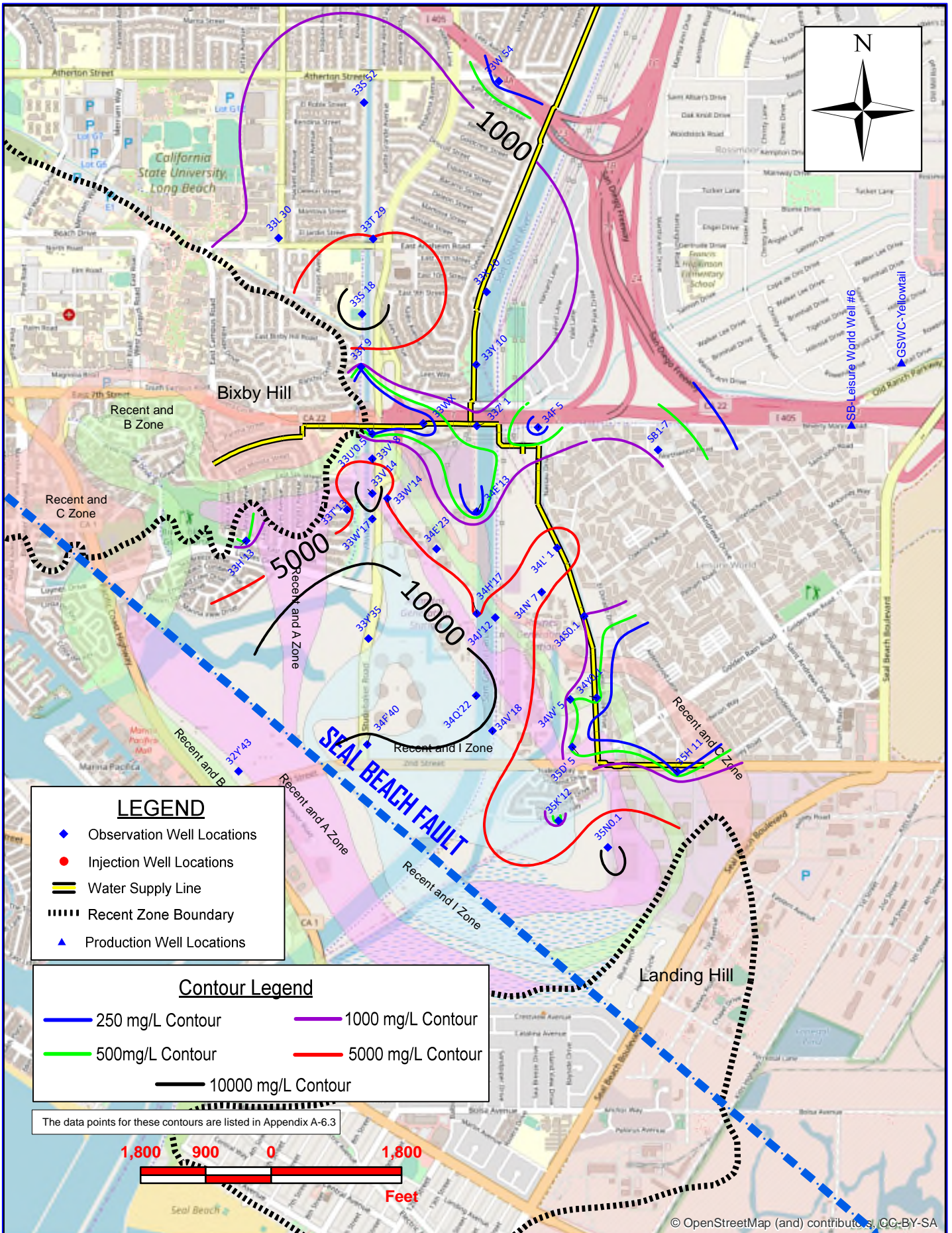
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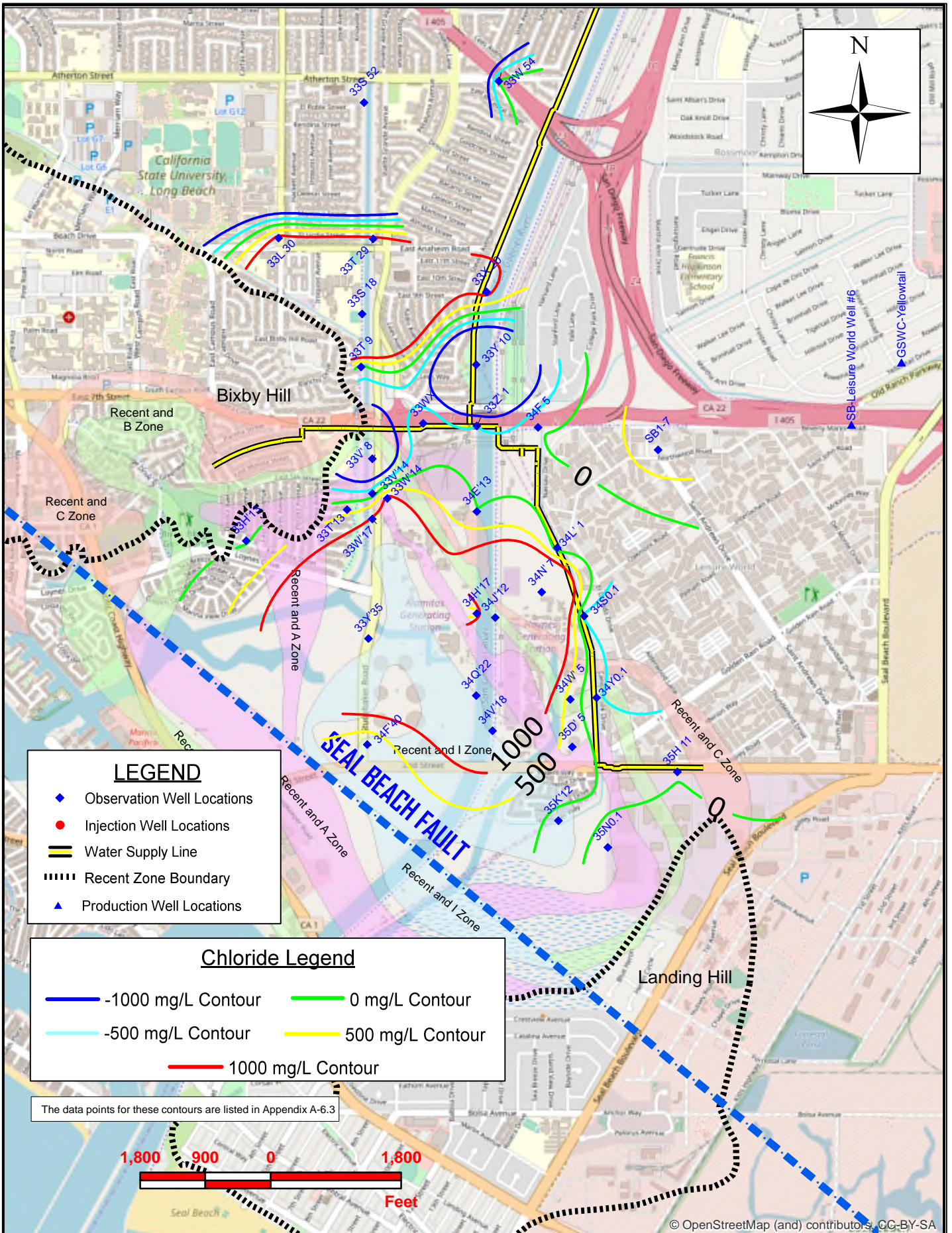
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¹ P.E. represents the protective elevations calculated for internodal wells.

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

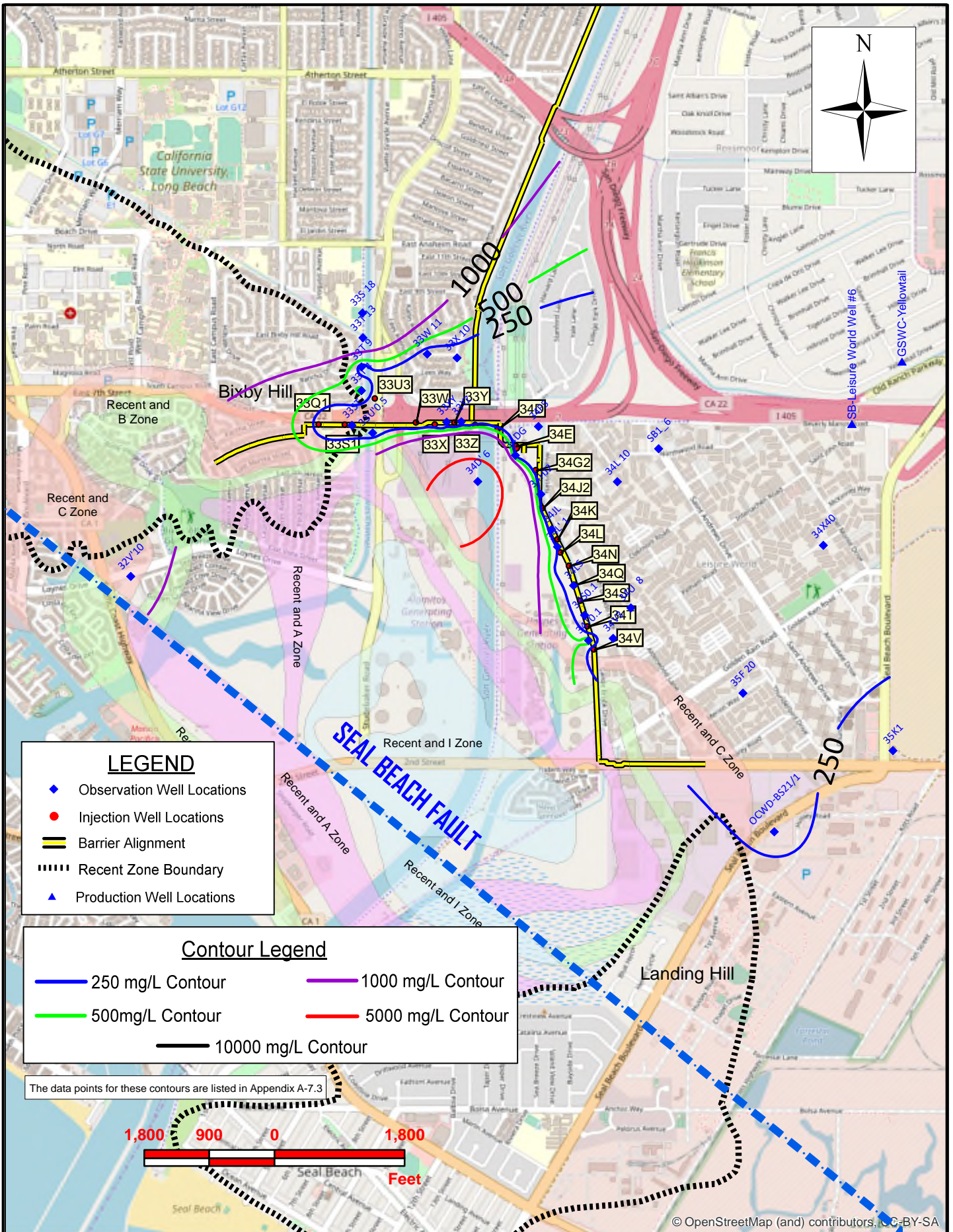
= A max. or min. elevation during that period.





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

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE	Change in Chloride
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 19-20	18-19	(FY19-20 - FY18-19)
1	33H'13	493YY	20200213	R,A	-18	370	-37.8	360	-57.8	350	370	415	-45
2	33L 30	491G	20200219	Recent	-50	1,400					1,400	199	1,201
3	33S 18	492AH	20200219	Recent	-67	14,000					14,000	7,180	6,820
4	33S 52	491J	20200219	Recent	-54	2,400					2,400	16,700	-14,300
5	33T 9	492CV	20200318	Recent	-21	300					300	522	-222
6	33T'13	492AU	20200218	Recent	-41	2,400	-51	2,700			2,700	2,320	380
7	33T 29	491D	20200226	Recent	-56	5,100					5,100	3,940	1,160
8	33U'0.5	492CB	20200305	Recent	-15	200					200		n/a
9	33V 8	492BY	20200225	RA	-24	2,900	-48	3,700			3,700	6,040	-2,340
10	33V'14	492JJ	20200225	Recent	-67	18,000					18,000	18,300	-300
11	33W 54	501C	20200219	Recent	-33	120	-53	140			140	101	39
12	33W'14	492AT	20200225	Recent	-46	3,500	-66				3,500	2,290	1,210
13	33W'17	493PP	20200225	Recent	-41	8,200	-51	9,200			9,200	8,140	1,060
14	33WX	502AZ	20200304	Recent	-45	11					11	0	11
15	33X 20	502L	20200305	Recent	-68	2,800					2,800	1,620	1,180
16	33Y 10	502BA	20200219	Recent	-58	690	-83	2,100			2,100	6,180	-4,080
17	33Y'35	493AB	20200219	Recent	-36	23,000					23,000	19,600	3,400
18	33Z' 1	502AU	20200311	Recent	-46	97	-56	960			960	1,480	-520
19	34E'13	503AU	20200224	Recent	-19	22	-52	37			37	30	7
20	34E'23	503X	20200227	Recent	-43	3,500					3,500		n/a
21	34F 5	502BT	20200325	Recent	-136	75	-146	72	-156	72	75	111	-36
22	34F'40	483J	20200225	Recent	-40	8,500					8,500	8,390	110
23	34H'17	503Y	20200224	Recent	-46	4,600					4,600	4,380	220
24	34J'12	503U	20200227	Recent	-28	1,600	-36	6,800			6,800	1,320	5,480
25	34L' 1	503P	20200331	Recent	-57	6,700					6,700	6,950	-250
26	34N 7	503AE	20200220	Recent	-51	3,400	-61	4,900	-70	5,500	5,500	743	4,757
27	34Q'22	503T	20200226	Recent	-42	9,800	-57	13,000			13,000	11,500	1,500
28	34S0.1	503BT	20200319	Recent	-59	870	-69	880			880	1,510	-630
29	34V'18	503V	20200227	Recent	-48	8,700					8,700	6,790	1,910
30	34W' 5	503AH	20200220	Recent	-51	530					530	208	322
31	34Y0.1	503CK	20200319	Recent	-60	620	-70	620			620	1,070	-450
32	35D' 5	503AL	20200219	Recent	-57	390					390	109	281
33	35H 11	514F	20200325	Recent	-42	20	-65	150			150	160	-10
34	35K'12	504R	20200226	Recent	-44	130	-54	170			170	322	-152
35	35N0.1	504M	20200226	Recent	-38	11,000	-62	11,000			11,000	10,900	100
36	SB1-7		20200413	Recent		870					870	820	50



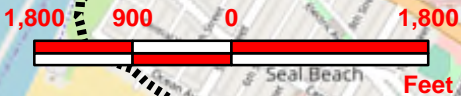
LEGEND

- ◆ Observation Well Locations
- Injection Well Locations
- ▬ Barrier Alignment
- ⋯ Recent Zone Boundary
- ▲ Production Well Locations

Contour Legend

- 250 mg/L Contour
- 500mg/L Contour
- 1000 mg/L Contour
- 5000 mg/L Contour
- 10000 mg/L Contour

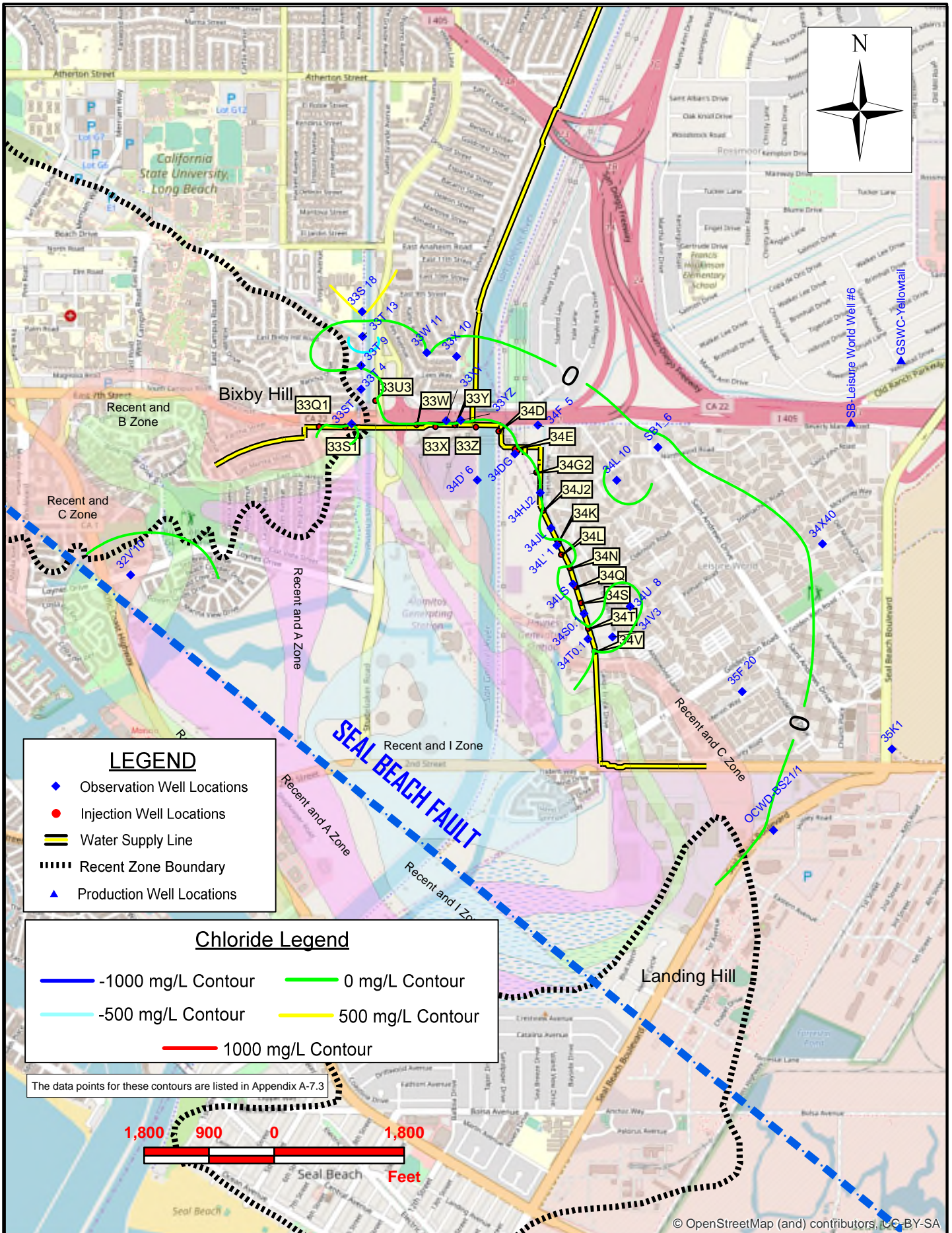
The data points for these contours are listed in Appendix A-7.3



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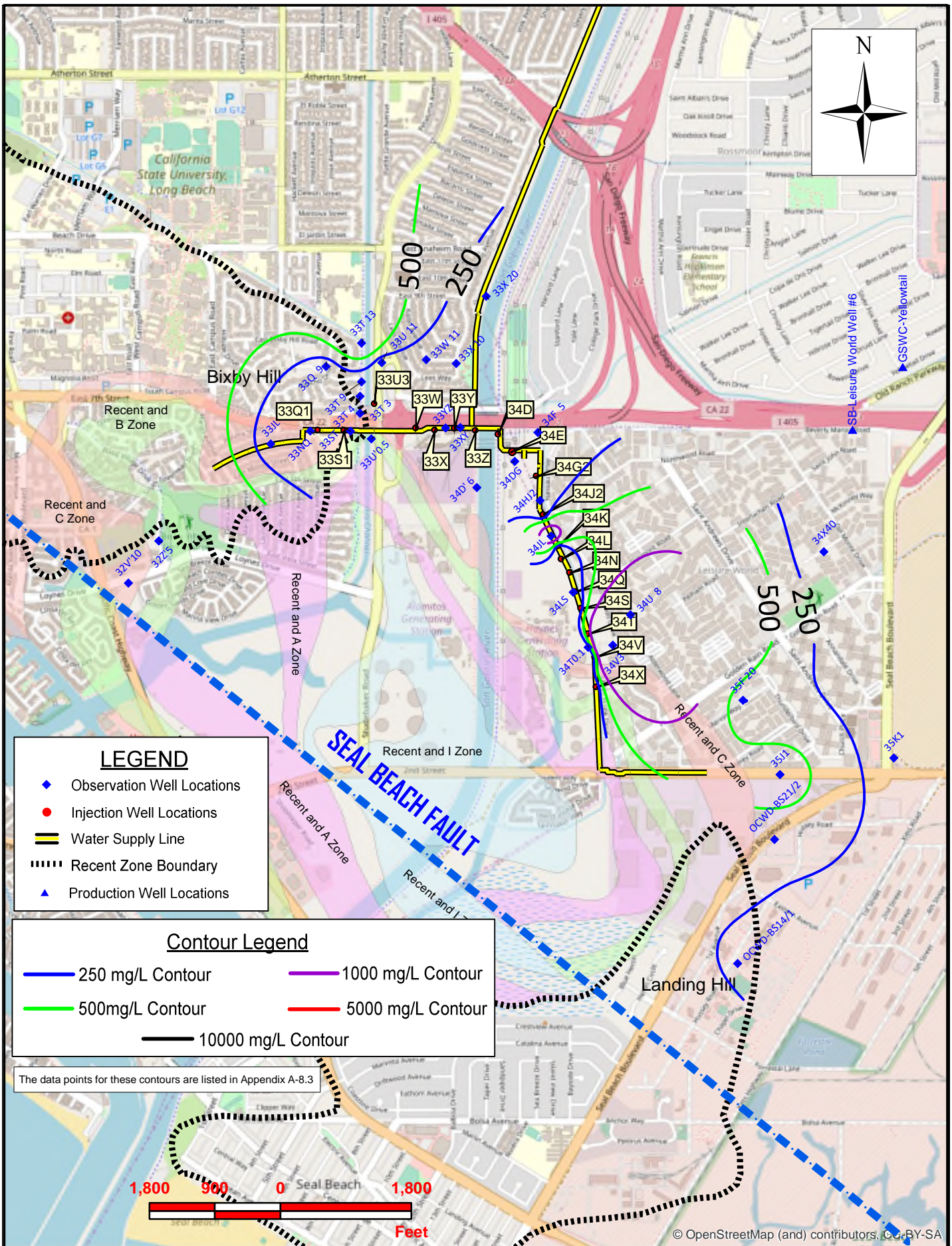
Alamitos Barrier Project
C Zone Chloride Concentration (mg/L) Contours, Spring 2020

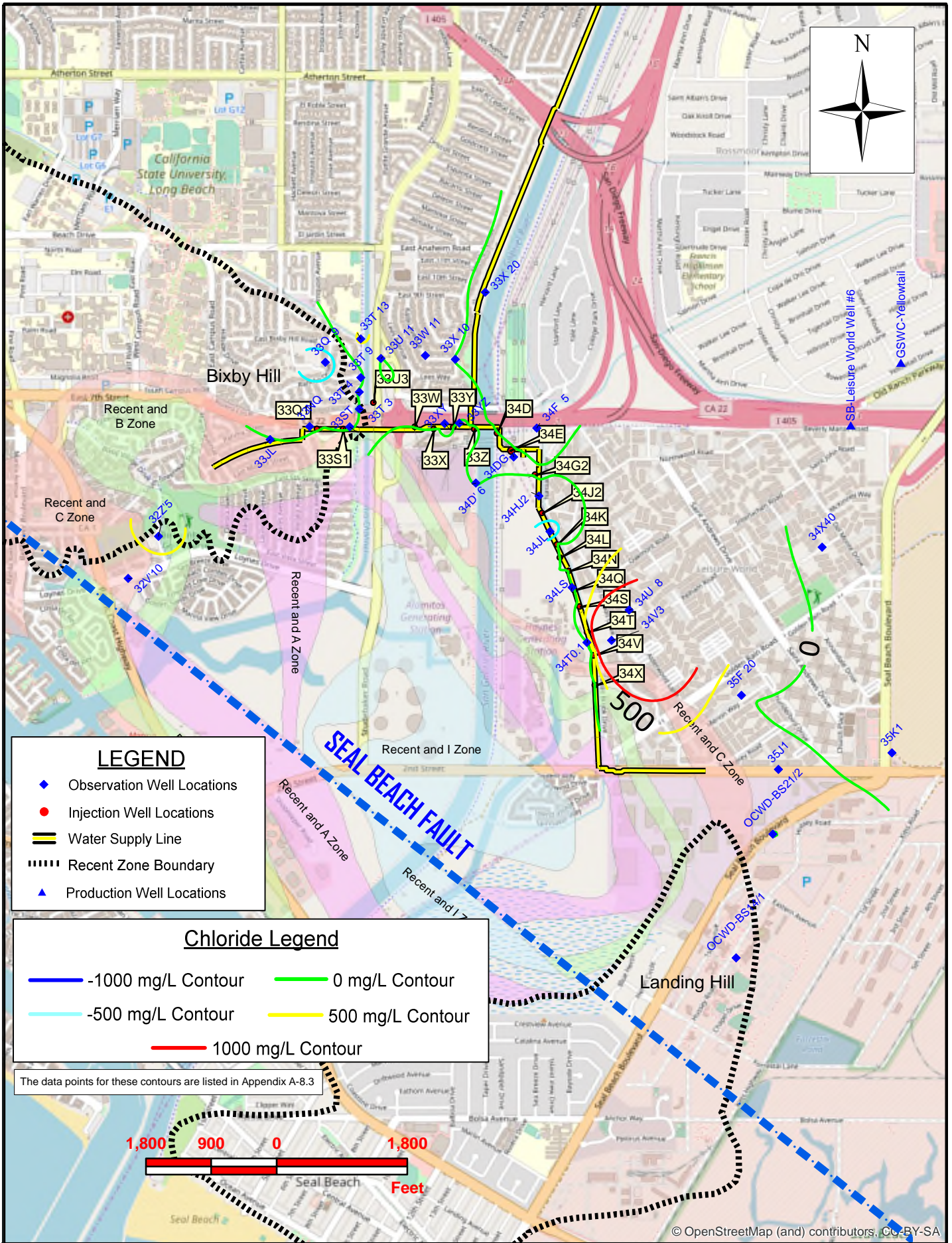


ALAMITOS BARRIER PROJECT
C-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE 18-19	Change in Chloride (FY19-20 - FY18-19)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 19-20		
1	32V10	483H	20200213	C ZONE	-37	830					830	860	-30
2	33S 18	492AG	20200219	C ZONE	-225	2,900					2,900	2,250	650
3	33ST	492BK	20200312	C,B	-25	64					64	68	-4
4	33T 4	492CT	20200318	C ZONE	-56	580					580	194	386
5	33T 9	492CU	20200316	C ZONE	-129	110	-144	110			110	147	-37
6	33T 13	492AC	20200304	C ZONE	-199	1,900					1,900	2,950	-1,050
7	33U0.5	492CA	20200305	C ZONE	-39	76					76		n/a
8	33W 11	502R	20200311	C ZONE	-183	64	-216	75			75	67	8
9	33X 10	502BB	20200225	C ZONE	-190	73	-215	94			94	186	-92
10	33XY	502BL	20200309	C ZONE	-194	65	-210	67			67	77	-10
11	33YZ	502AB	20200331	C ZONE	-195	67	-210	66			67	74	-7
12	34D' 6	502BF	20200224	C ZONE	-125	9,700					9,700	9,190	510
13	34DG	502X	20200325	C ZONE	-190	71	-205	95			95	72	24
14	34F 5	502BU	20200325	C ZONE	-191	70	-201	71	-211	71	71	100	-29
15	34HJ2	502CH	20200323	C ZONE	-148	70	-158	80			80	85	-5
16	34JL	503AR	20200324	C ZONE	-160	80					80	145	-65
17	34L' 1	503N	20200331	C ZONE	-162	230					230	198	32
18	34L 10	502AK	20200226	C ZONE	-166	81					81	63	18
19	34LS	503BF	20200324	C ZONE	-133	92	-151	82	-163	83	92	119	-27
20	34S0.1	503BU	20200319	C ZONE	-129	69	-139	68			69	89	-20
21	34T0.1	503AB	20200319	C ZONE	-134	630					630	523	107
22	34U 8	513D	20200318	C ZONE	-150	97	-165	100			100	85	15
23	34V3	503CB	20200318	C ZONE	-168	120					120	98	22
24	34X40	513R	20200401	C ZONE	-85	51	-101	59			59	46	13
25	35F 20	513L	20200316	C ZONE	-70	75	-78	78	-85	84	84	283	-199
26	35K1	523D	20200401	C ZONE	-88	130	-98	390			390	52	338
27	OCWD-BS21/1		20200427	C ZONE		213					213	202	11
28	SB1_6		20200413	C ZONE		68					68	74	-6
29	33Q1										50	50	n/a
30	33S1										50	50	n/a
31	33U3										50	50	n/a
32	33W										50	50	n/a
33	33X										50	50	n/a
34	33Y										50	50	n/a
35	33Z										50	50	n/a
36	34D										50	50	n/a
37	34E										50	50	n/a
38	34G2										50	50	n/a
39	34J2										50	50	n/a
40	34K										50	50	n/a
41	34L										50	50	n/a
42	34N										50	50	n/a
43	34Q										50	50	n/a
44	34T										50	50	n/a
45	34S										50	50	n/a
46	34V										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.

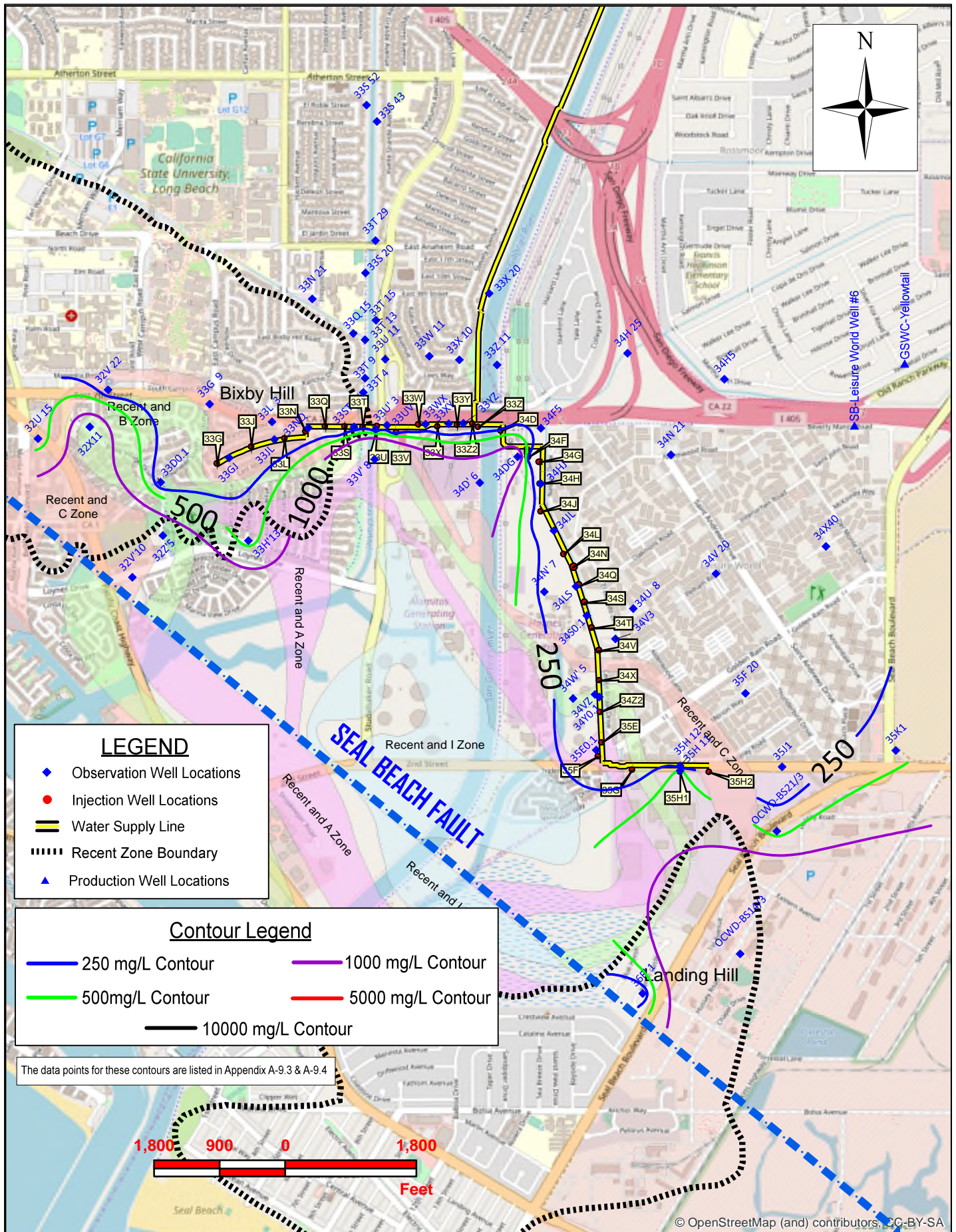




ALAMITOS BARRIER PROJECT
B-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE 18-19	Change in Chloride (FY19-20 - FY18-19)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 19-20		
1	32V10	483G	20200213	B ZONE	-62	3,100					3,100	2,890	210
2	32Z5	482W	20200213	B,A	-20	770	-30	960	-40	1,600	1,600	950	650
3	33JL	492BQ	20200311	B ZONE	3	100	-7	100			100	93	7
4	33NQ	492BN	20200304	B ZONE	-3	57	-14	57			57	83	-26
5	33Q 9	492CM	20200219	B ZONE	-85	71	-95	76	-105	95	95	873	-778
6	33ST	492BK	20200312	C,B	-25	64					64	68	-4
7	33T 3	492CL	20200220	B ZONE	-40	77	-57	75	-75	77	77	74	3
8	33T 4	492CS	20200318	B ZONE	-91	61					61	41	20
9	33T 9	492YY	20200318	B ZONE	-163	110					110	117	-7
10	33T 13	492AB	20200304	B ZONE	-254	980					980	358	622
11	33U0.5	492BZ	20200305	B ZONE	-57	74					74		n/a
12	33U 11	492AK	20200311	B ZONE	-260	88					88	93	-5
13	33W 11	502S	20200311	B ZONE	-241	110	-269	120			120	99	21
14	33X 10	502BC	20200225	B ZONE	-275	75					75	77	-2
15	33X 20	502K	20200305	B ZONE	-266	86					86	135	-49
16	33XY	502BM	20200309	B ZONE	-244	250					250	86	164
17	33YZ	502AC	20200331	B ZONE	-214	64	-263	63			64	81	-17
18	34D' 6	502BG	20200224	B ZONE	-180	150	-194	120			150	141	9
19	34DG	502Y	20200325	B ZONE	-232	86	-257	92			92	77	15
20	34F 5	502BS	20200325	B ZONE	-231	66	-260	69			69	109	-40
21	34HJ2	502CJ	20200323	B ZONE	-203	75	-215	70	-228	62	75	87	-12
22	34JL	503AQ	20200324	B ZONE	-195	1,800	-211	1,800			1,800	2,800	-1,000
23	34LS	503BE	20200324	B ZONE	-188	66					66	83	-17
24	34T0.1	503AC	20200319	B ZONE	-174	90	-207	84	-239	92	92	135	-43
25	34U 8	513E	20200318	B ZONE	-225	2,100					2,100	517	1,583
26	34V3	503CC	20200318	B ZONE	-208	4,700					4,700	683	4,017
27	34X40	513Q	20200401	B ZONE	-137	16					16	227	-211
28	35F 20	513K	20200316	B ZONE	-115	240					240	223	17
29	35J1	514M	20200415	B ZONE	-128	630	-143	720	-148	720	720	651	69
30	35K1	523A	20200401	B ZONE	-127	110	-142	120	-157	120	120	135	-15
31	OCWD-BS14/1		20200427	B ZONE		237					237	40	197
32	OCWD-BS21/2		20200427	B ZONE		307					307	310	-3
33	33Q1					DP1					50	50	n/a
34	33U3					DP2					50	50	n/a
35	33W					DP3					50	50	n/a
36	33X					DP4					50	50	n/a
37	33Y					DP5					50	50	n/a
38	33Z					DP6					50	50	n/a
39	34D					DP7					50	50	n/a
40	34E					DP8					50	50	n/a
41	34G2					DP9					50	50	n/a
42	34J2					DP10					50	50	n/a
43	34K					DP11					50	50	n/a
44	34L					DP12					50	50	n/a
45	34N					DP13					50	50	n/a
46	34Q					DP14					50	50	n/a
47	34S					DP15					50	50	n/a
48	34T					DP16					50	50	n/a
49	34V					DP17					50	50	n/a
50	34X					DP18					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.



LEGEND

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

Contour Legend

- 250 mg/L Contour
- 500mg/L Contour
- 1000 mg/L Contour
- 5000 mg/L Contour
- 10000 mg/L Contour

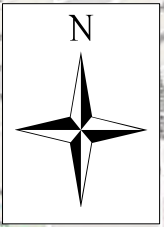
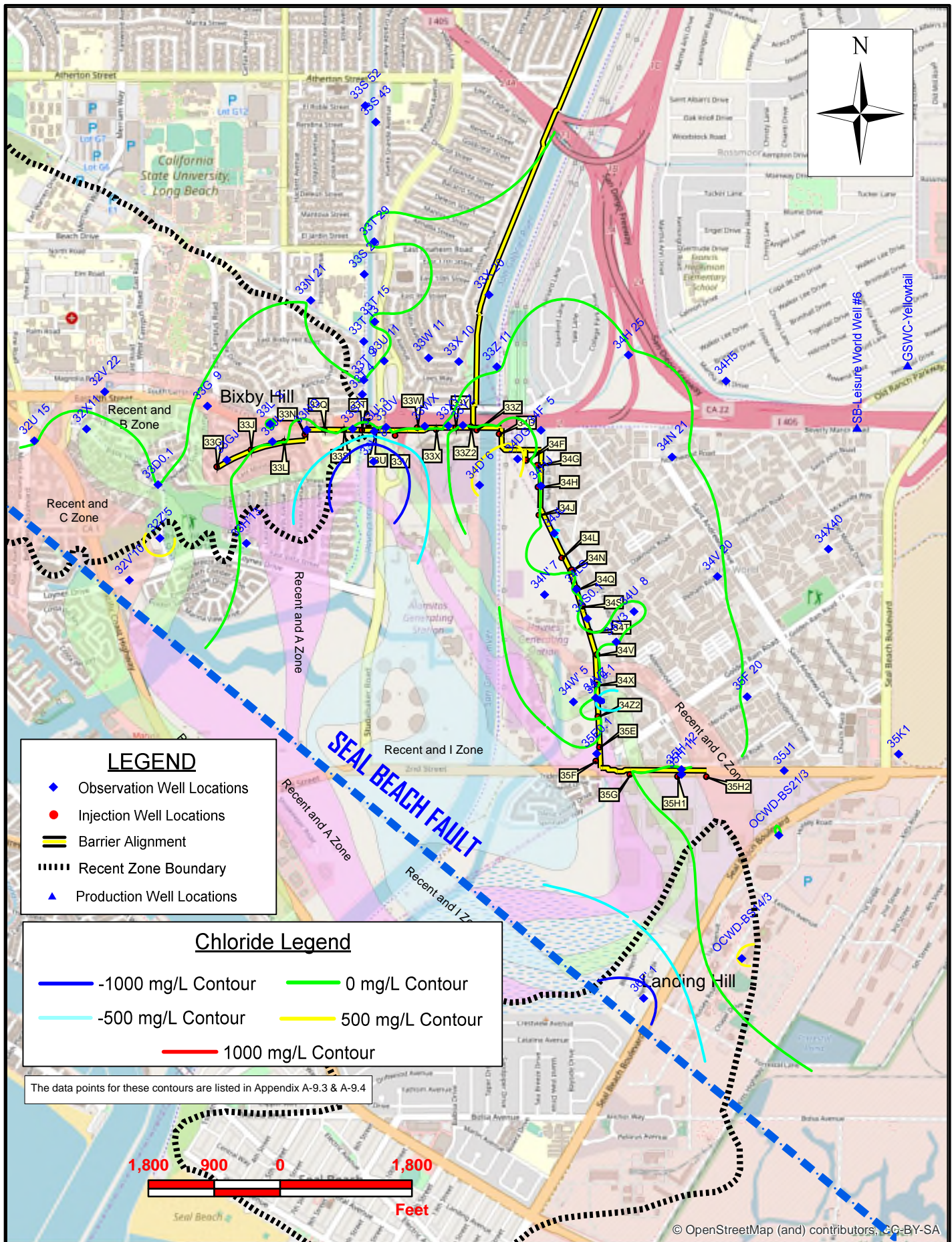
The data points for these contours are listed in Appendix A-9.3 & A-9.4



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Alamitos Barrier Project
A Zone Chloride Concentration (mg/L) Contours, Spring 2020



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Alamitos Barrier Project
A Zone Change Chloride Concentration, Spring 2019 to Spring 2020

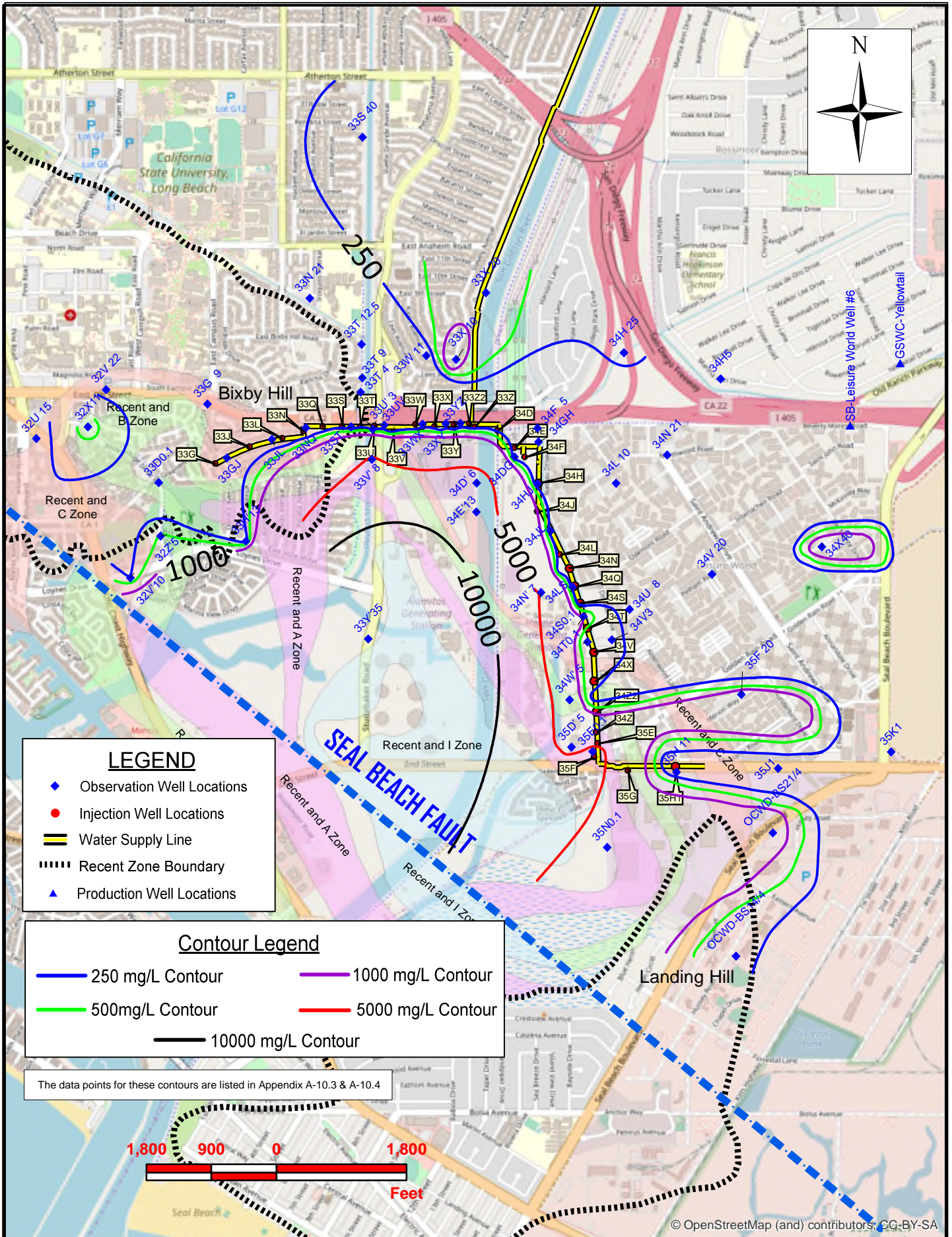
ALAMITOS BARRIER PROJECT
A-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE	Change in Chloride
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 19-20	18-19	(FY19-20 - FY18-19)
1	32U 15	482M	20200213	A ZONE	-17	260					260	266	-6
2	32V 22	482P	20200213	A ZONE	-11	64					64	154	-90
3	32V'10	483F	20200213	A ZONE	-90	3,500	-105	3,300			3,500	3,270	230
4	32X11	482S	20200309	A ZONE	-9	180	-24	1,500			1,500	1,430	70
5	32Z'5	482W	20200213	B,A	-20	770	-30	960	-40	1,600	1,600	950	650
6	33D0.1	482U	20200304	A,I	-24	80	-49	79	-74	78	80	87	-7
7	33G 9	482F	20200213	A ZONE	-3		-23	98			98	84	14
8	33GJ	482X	20200311	A ZONE	-35	63					63	18	45
9	33H'13	493YY	20200213	R,A	-18	370	-38	360	-58	350	370	415	-45
10	33JL	492BW	20200311	A,I	-41	60	-79	65	-116	63	65	54	11
11	33L 3	492	20200219	A ZONE	-60	70					70	78	-8
12	33N 21	492BU	20200218	A ZONE	-305	240	-330	240	-346	240	240	241	-1
13	33NQ	492BP	20200304	A ZONE	-48	63	-92	61	-136	63	63	133	-70
14	33Q 15	492AM	20200220	A ZONE	-337	87					87		n/a
15	33S 20	492BR	20200219	A ZONE	-317	89	-336	86	-355	96	96	245	-149
16	33S 43	491E	20200220	A ZONE	-333	87	-344				87	183	-96
17	33S 52	491H	20200219	A ZONE	-284	190	-289				190	291	-101
18	33ST	492BL	20200312	A ZONE	-65	64	-86	62	-100	64	64	94	-30
19	33T 4	492CR	20200318	A ZONE	-146	100	-166	67	-186	62	100	88	12
20	33T 9	492TT	20200318	A ZONE	-262	87					87	90	-3
21	33T 13	492ZZ	20200304	A ZONE	-128	110					110	207	-97
22	33T 15	492SS	20200220	A ZONE	-334	170					170	148	22
23	33T 29	491C	20200226	A ZONE	-350	180					180	157	23
24	33U 11	492AJ	20200311	A ZONE	-348	97					97	86	11
25	33U' 3	492WW	20200225	A ZONE	-89	100					100	354	-254
26	33UV	492BH	20200309	A ZONE	-106	120	-131	100	-155	99	120	151	-31
27	33V' 8	492BY	20200225	R,A	-24	2,900	-48	3,700			3,700	6,040	-2,340
28	33W 11	502T	20200311	A ZONE	-321	85	-349	90	-376	88	90	77	13
29	33WX	502AF	20200304	A ZONE	-258	61	-281	62	-297	110	110	85	25
30	33X 10	502BD	20200225	A ZONE	-320	110	-340	87	-356	86	110	84	26
31	33X 20	502J	20200305	A ZONE	-353	130					130	113	17
32	33XY	502BN	20200309	A ZONE	-278	69	-296	68	-311	61	69	81	-12
33	33YZ	502AD	20200331	A ZONE	-296	89	-327	89			89	85	4
34	33Z 11	502V	20200227	A ZONE	-321	83	-346	85			85	75	10
35	34D 6	502BH	20200224	A ZONE	-270	1,000	-303	1,100	-335	1,500	1,500	834	666
36	34DG	502Z	20200325	A ZONE	-292	120	-324	1,500			1,500	468	1,032
37	34F 5	502BR	20200325	A ZONE	-297	69	-322	130	-347	130	130	259	-129
38	34H 25	502AH	20200326	A ZONE	-297	140	-312	150	-331	160	160	164	-4
39	34H5	512E	20200326	A ZONE	-298	74	-313	75	-328	91	91	70	21
40	34HJ	502BX	20200323	A ZONE	-310	62	-321	62	-331	63	63	88	-25

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

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE	Change in Chloride
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 19-20	18-19	(FY19-20 - FY18-19)
41	34JL	503AP	20200324	A ZONE	-262	70	-288	170	-308	180	180	747	-567
42	34LS	503BD	20200324	A ZONE	-238	66	-283	67			67	87	-20
43	34N 21	512B	20200226	A ZONE	-328	91	-354	90			91	105	-14
44	34N 7	503AF	20200220	A ZONE	-106	110	-144	180	-176	73	180	77	103
45	34S0.1	503BV	20200319	A ZONE	-239	79	-249	80	-256	79	80	116	-36
46	34U 8	513F	20200318	A ZONE	-280	96	-310	110			110	90	20
47	34V3	503CD	20200318	A ZONE	-263	75					75	66	10
48	34V 20	513B	20200326	A ZONE	-234	130	-265	130	-292	130	130	138	-8
49	34VZ	503BH	20200323	A ZONE	-146	140	-156	110			140	80	60
50	34W 5	503AJ	20200220	A ZONE	-81	170	-101	160	-119	96	170	157	13
51	34X40	513P	20200401	A ZONE	-202	32	-232	180			180	64	116
52	34Y0.1	503CL	20200319	A ZONE	-107	180					180	1,410	-1,230
53	35E0.1	503BK	20200319	A ZONE	-74	62					62	87	-25
54	35F 20	513J	20200316	A ZONE	-129	84	-158	98			98	84	14
55	35H 11	514G	20200325	A ZONE	-123	93	-146	610			610	536	74
56	35H 12	514D	20200415	A ZONE	-137	79					79	75	4
57	35J1	514L	20200415	A ZONE	-193	80	-208	92	-228	97	97	85	12
58	35K1	523B	20200401	A ZONE	-197	16	-212	17	-227	390	390	290	100
59	36F 1	505D	20200226	A ZONE	-99	96					96	1,280	-1,184
60	OCWD-BS14/3		20200427	A ZONE		3,750					3,750	3,180	570
61	OCWD-BS21/3		20200427	A ZONE		371					371	374	-3
62	33G					DP1					50	50	n/a
63	33J					DP2					50	50	n/a
64	33L					DP3					50	50	n/a
65	33N					DP4					50	50	n/a
66	33Q					DP5					50	50	n/a
67	33S					DP6					50	50	n/a
68	33U					DP7					50	50	n/a
69	33V					DP8					50	50	n/a
70	33W					DP9					50	50	n/a
71	33X					DP10					50	50	n/a
72	33Y					DP11					50	50	n/a
73	33Z					DP12					50	50	n/a
74	33Z2					DP13					50	50	n/a
75	34D					DP14					50	50	n/a
76	34F					DP15					50	50	n/a
77	34H					DP16					50	50	n/a
78	34J					DP17					50	50	n/a
79	34L					DP18					50	50	n/a
80	34N					DP19					50	50	n/a
81	34Q					DP20					50	50	n/a
82	34S					DP21					50	50	n/a
83	34T					DP22					50	50	n/a
84	34V					DP23					50	50	n/a
85	34X					DP24					50	50	n/a
86	34Z2					DP25					50	50	n/a
87	35G					DP26					50	50	n/a
88	35H1					DP27					50	50	n/a
89	35H2					DP28					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.



LEGEND

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

Contour Legend

- 250 mg/L Contour
- 500mg/L Contour
- 1000 mg/L Contour
- 5000 mg/L Contour
- 10000 mg/L Contour

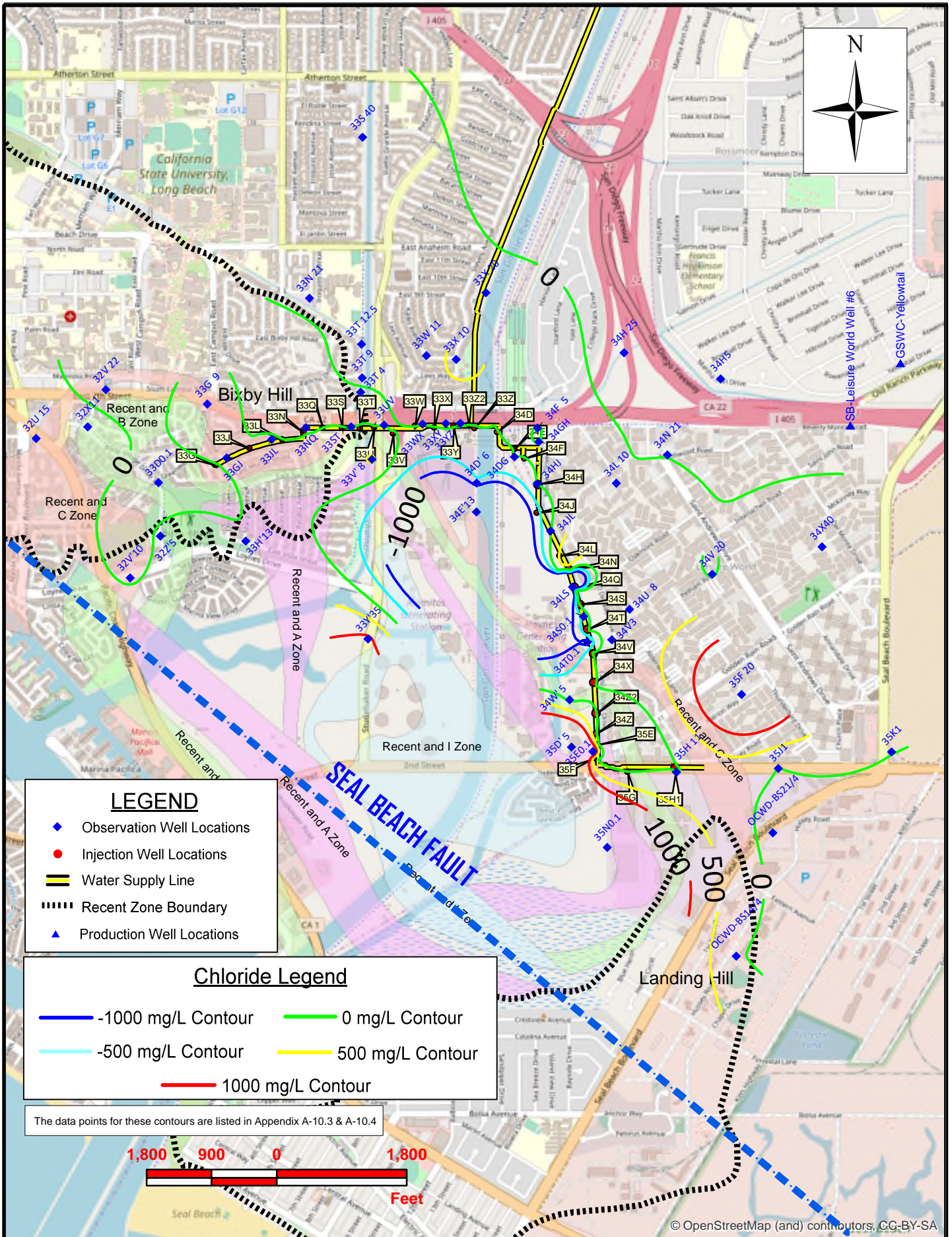
The data points for these contours are listed in Appendix A-10.3 & A-10.4



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**Alamitos Barrier Project
I Zone Chloride Concentration (mg/L) Contours, Spring 2020**



LEGEND

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

Chloride Legend

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

The data points for these contours are listed in Appendix A-10.3 & A-10.4



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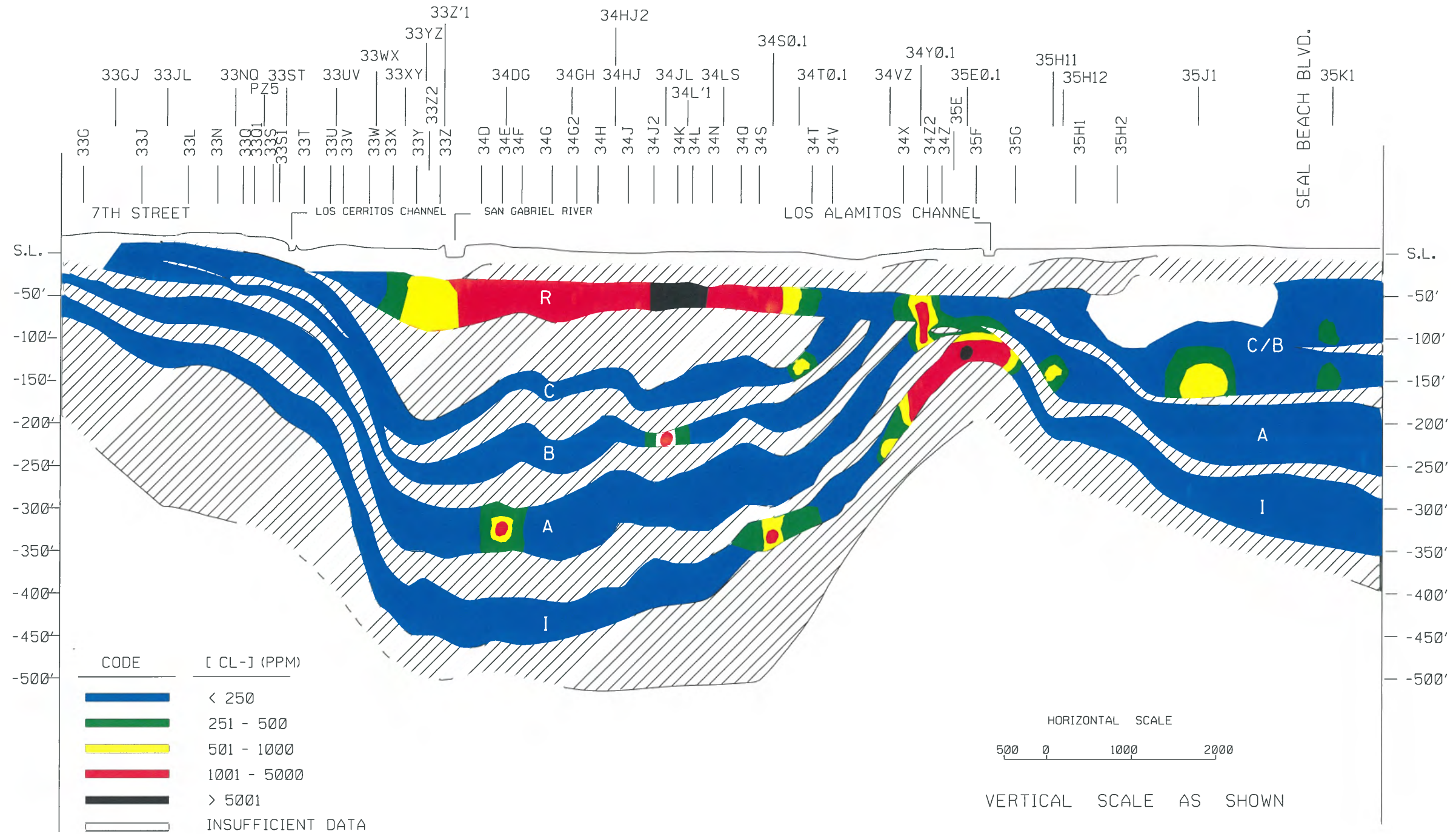
ALAMITOS BARRIER PROJECT
I-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE FY18-19	Change in Chloride (FY19-20 - FY18-19)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 19-20		
1	32U 15	482L	20200213	I ZONE	-74	140					140	99	41
2	32V 22	482N	20200213	I ZONE	-51	170					170	206	-36
3	32V10	483E	20200213	I ZONE	-140	250	-152	250	-165	230	250	297	-47
4	32X11	482R	20200309	I ZONE	-51	610	-61	620			620	583	37
5	32Z5	482V	20200213	I ZONE	-68	280	-83	470	-98	540	540	528	12
6	33D0.1	482U	20200304	A,I	-24	80	-49	79	-74	78	80	87	-7
7	33G 9	482G	20200213	I ZONE	-34	63	-68	73	-78	85	85	60	26
8	33GJ	482Y	20200311	I ZONE	-75	77	-95	78			78	72	6
9	33H'13	493XX	20200213	I ZONE	-89	150					150	137	13
10	33JL	492BW	20200311	A,I	-41	60	-79	65	-116	63	65	54	11
11	33N 21	492BV	20200218	I ZONE	-457	80	-468	80			80	73	7
12	33NQ	492BP	20200304	A,I	-48	63	-92	61	-136	63	63	133	-70
13	33S 40	491F	20200219	I ZONE	-470	480					480	422	58
14	33ST	492BM	20200312	I ZONE	-130	58	-148	63	-163	68	68	87	-19
15	33T 4	492CQ	20200318	I ZONE	-277	120	-292	100			120	181	-61
16	33T 9	492XX	20200318	I ZONE	-364	170					170	85	85
17	33T 12.5	492BT	20200220	I ZONE	-423	96	-438	96	-443	96	96	86	10
18	33U' 3	492QQ	20200225	I ZONE	-147	230					230		n/a
19	33UV	492BJ	20200309	I ZONE	-209	76	-228	76	-246	78	78	81	-3
20	33V' 8	492BX	20200225	I ZONE	-109	4,900	-130	5,500			5,500	4,920	580
21	33W 11	502U	20200311	I ZONE	-423	75	-446	80	-468	79	80	63	17
22	33WX	502AG	20200304	I ZONE	-374	66	-391	74	-405	77	77	68	9
23	33X 10	502BE	20200225	I ZONE	-420	1,000	-440	800	-460		1,000	225	775
24	33X 20	502H	20200305	I ZONE	-442	580					580	532	48
25	33XY	502BP	20200309	I ZONE	-403	66	-417	67	-431	150	150	72	78
26	33Y'35	493ZZ	20200219	I ZONE	-67	24,000					24,000	22,900	1,100
27	33YZ	502AE	20200331	I ZONE	-402	120	-433	78			120	92	28
28	34D' 6	502BI	20200224	I ZONE	-400	7,000	-410	7,500	-418		7,500	8,120	-620
29	34DG	502AA	20200325	I ZONE	-402	73	-432	83			83	77	6
30	34E'13	503AT	20200224	I ZONE	-289	6,400	-308	6,700			6,700	12,400	-5,700
31	34F 5	502BQ	20200325	I ZONE	-411	64	-426	65	-441	64	65	74	-9
32	34GH	502BV	20200325	I ZONE	-411	72	-427	74	-437	71	74	80	-6
33	34H 25	502AJ	20200326	I ZONE	-407	320	-427	320	-446		320	443	-123
34	34H5	512D	20200326	I ZONE	-408	140	-423	93	-443	86	140	212	-72
35	34HJ	502BW	20200323	I ZONE	-407	69	-417	81	-427	92	92	78	15
36	34JL	503AN	20200324	I ZONE	-382	88	-403	89			89	88	2
37	34L 10	502AN	20200226	I ZONE	-404	64	-426	62			64	60	4
38	34LS	503BC	20200324	I ZONE	-338	74	-368	110			110	9,910	-9,800
39	34N 21	512C	20200225	I ZONE	-423	79	-448	80			80	82	-2
40	34N' 7	503AG	20200220	I ZONE	-221	110	-254	4,800	-274	4,300	4,800		n/a
41	34S0.1	503BW	20200319	I ZONE	-306	1,000	-310	1,000			1,000	1,340	-340
42	34T0.1	503AD	20200319	I ZONE	-289	150	-312	190	-334	420	420	1,630	-1,210

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

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE	Change in Chloride
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 19-20	FY18-19	(FY19-20 - FY18-19)
43	34U 8	513G	20200318	I ZONE	-360	100	-375	95			100	91	9
44	34V 20	513C	20200326	I ZONE	-386	56					56	89	-33
45	34V3	503CE	20200326	I ZONE	-328	360					360	83	277
46	34W' 5	503AK	20200220	I ZONE	-156	3,500					3,500	3,590	-90
47	34X40	513N	20200401	I ZONE	-331	1,400	-346	1,600			1,600	1,430	170
48	35D' 5	503AM	20200220	I ZONE	-89	3,800					3,800	591	3,209
49	35E0.1	503BJ	20200319	I ZONE	-114	5,600					5,600	3,420	2,180
50	35F 20	513H	20200316	I ZONE	-235	1,500	-245	3,700	-255	3,700	3,700	1,470	2,230
51	35H 11	514H	20200325	I ZONE	-203	120					120	115	5
52	35J1	513M	20200415	I ZONE	-261	86	-271	86	-281	88	88	97	-9
53	35K1	523C	20200401	I ZONE	-363	41	-373	40			41	31	10
54	35N0.1	504N	20200226	I ZONE	-71	3,600					3,600	385	3,215
55	OCWD-BS14/4		20200427	I ZONE		299					299	261	38
56	OCWD-BS21/4		20200427	I ZONE		1,320					1,320	1,450	-130
57	33G					DP1					50	50	n/a
58	33J					DP2					50	50	n/a
59	33L					DP3					50	50	n/a
60	33N					DP4					50	50	n/a
61	33Q					DP5					50	50	n/a
62	33U					DP6					50	50	n/a
63	33V					DP7					50	50	n/a
64	33W					DP8					50	50	n/a
65	33X					DP9					50	50	n/a
66	33Y					DP10					50	50	n/a
67	33Z					DP11					50	50	n/a
68	33Z2					DP12					50	50	n/a
69	34D					DP13					50	50	n/a
70	34E					DP14					50	50	n/a
71	34F					DP15					50	50	n/a
72	34G2					DP16					50	50	n/a
73	34H					DP17					50	50	n/a
74	34L					DP18					50	50	n/a
75	34N					DP19					50	50	n/a
76	34Q					DP20					50	50	n/a
77	34S					DP21					50	50	n/a
78	34T					DP22					50	50	n/a
79	34V					DP23					50	50	n/a
80	34X					DP24					50	50	n/a
81	34Z2					DP25					50	50	n/a
82	34Z					DP26					50	50	n/a
83	35E					DP27					50	50	n/a
84	35F					DP28					50	50	n/a
85	35G					DP29					50	50	n/a
86	35H1					DP30					50	50	n/a

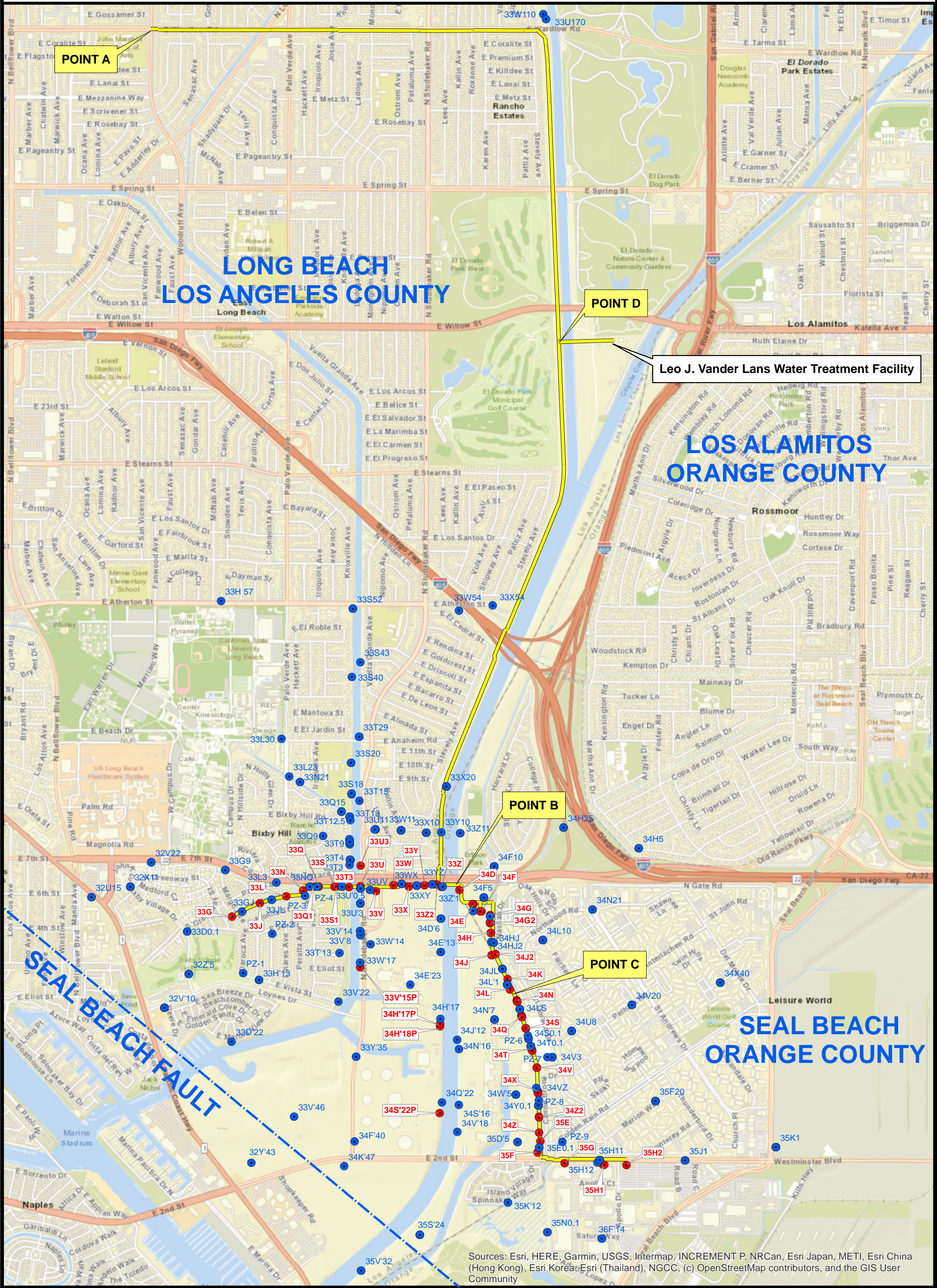
DP = Dummy Point with an assumed chloride concentration of 50 mg/L. Placed at wells that were injecting into this zone during this reporting period.



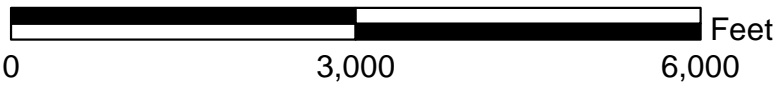
CHLORIDE SECTION ALONG THE BARRIER

Spring 2020

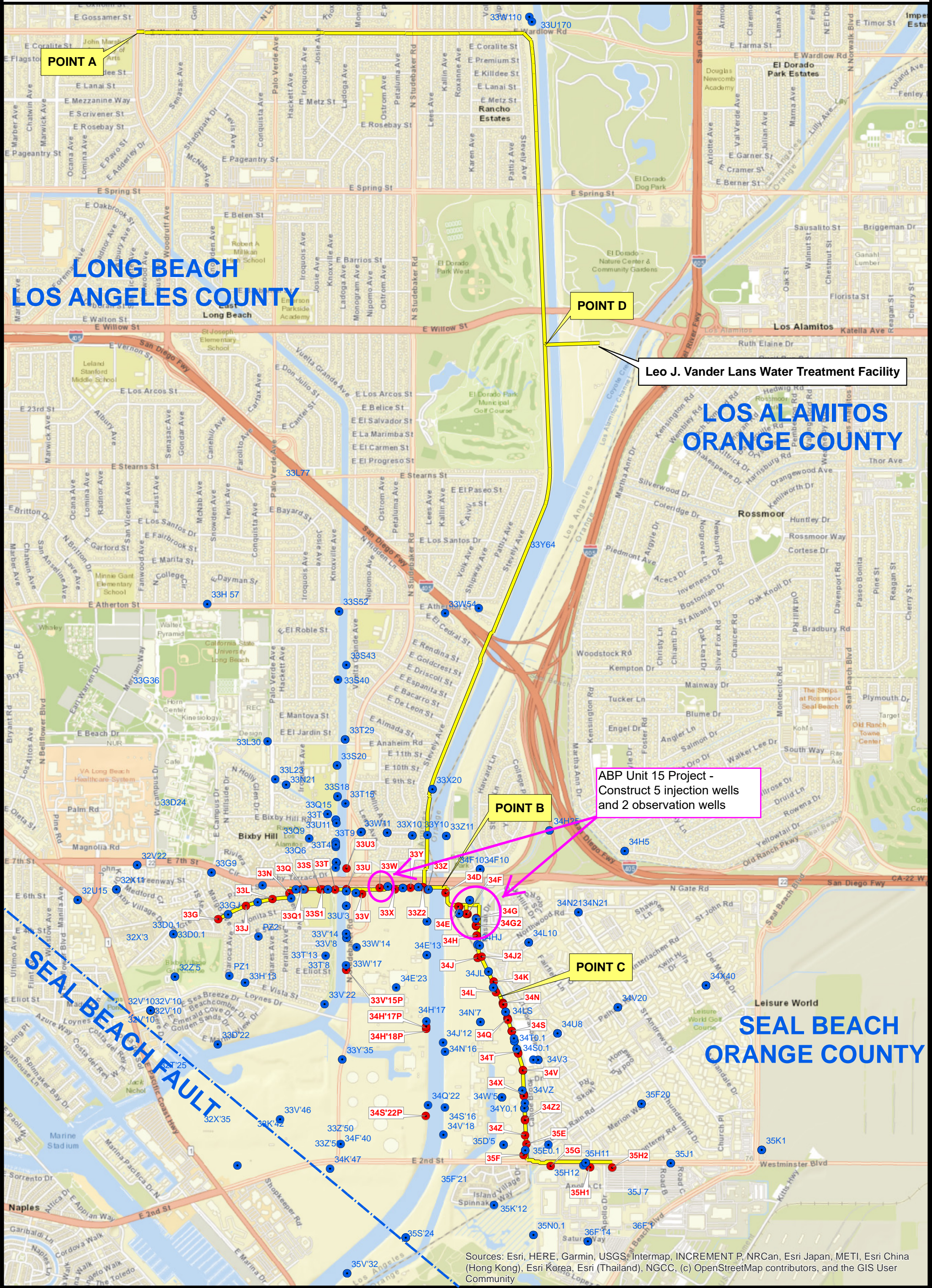
Note: The data points used to create this section are listed in the Appendix A-6.3, 7.3, 8.3, 9.3, 9.4, 10.3, & 10.4



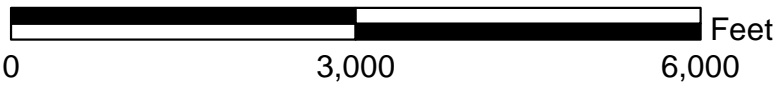
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community



Legend	
●	Alamos Observation Wells
●	Alamos Injection Wells
—	Alamos Water Supply Line



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

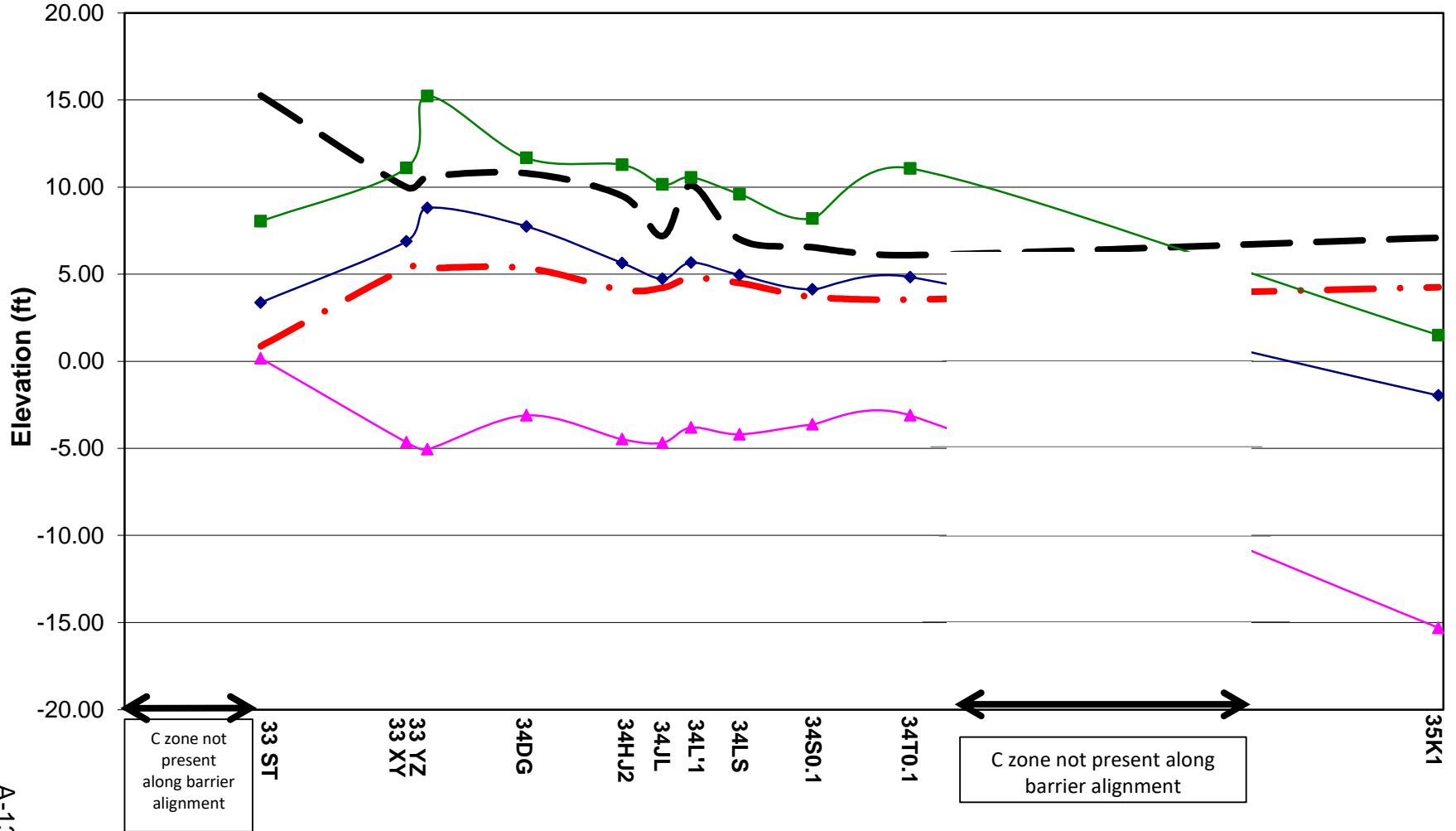


Legend

- Alamitos_Observation_Wells
- Alamitos_Injection_Wells
- Alamitos Water Supply Line

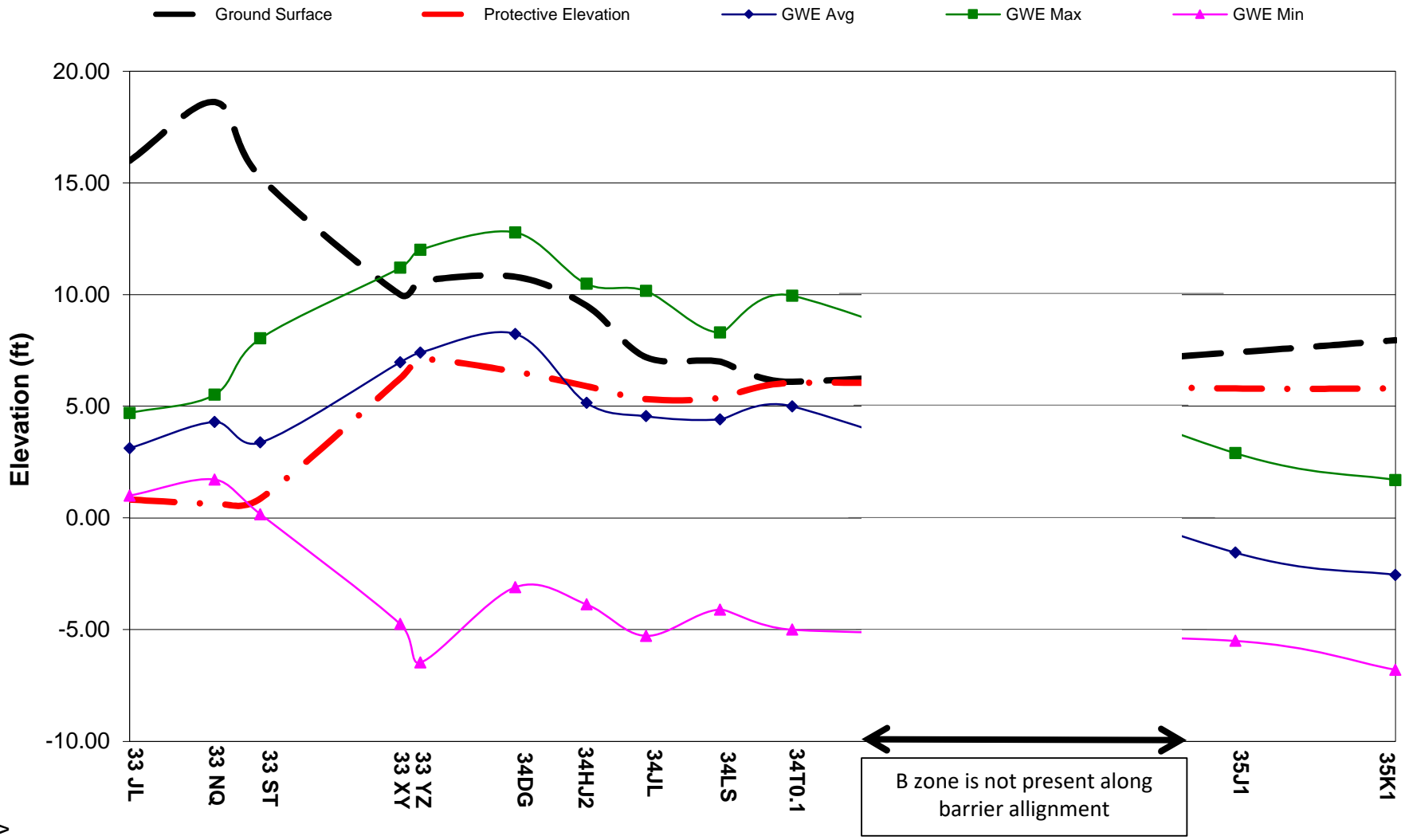
C Zone - Groundwater Elevation (GWE) Along the ABP FY19-20

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

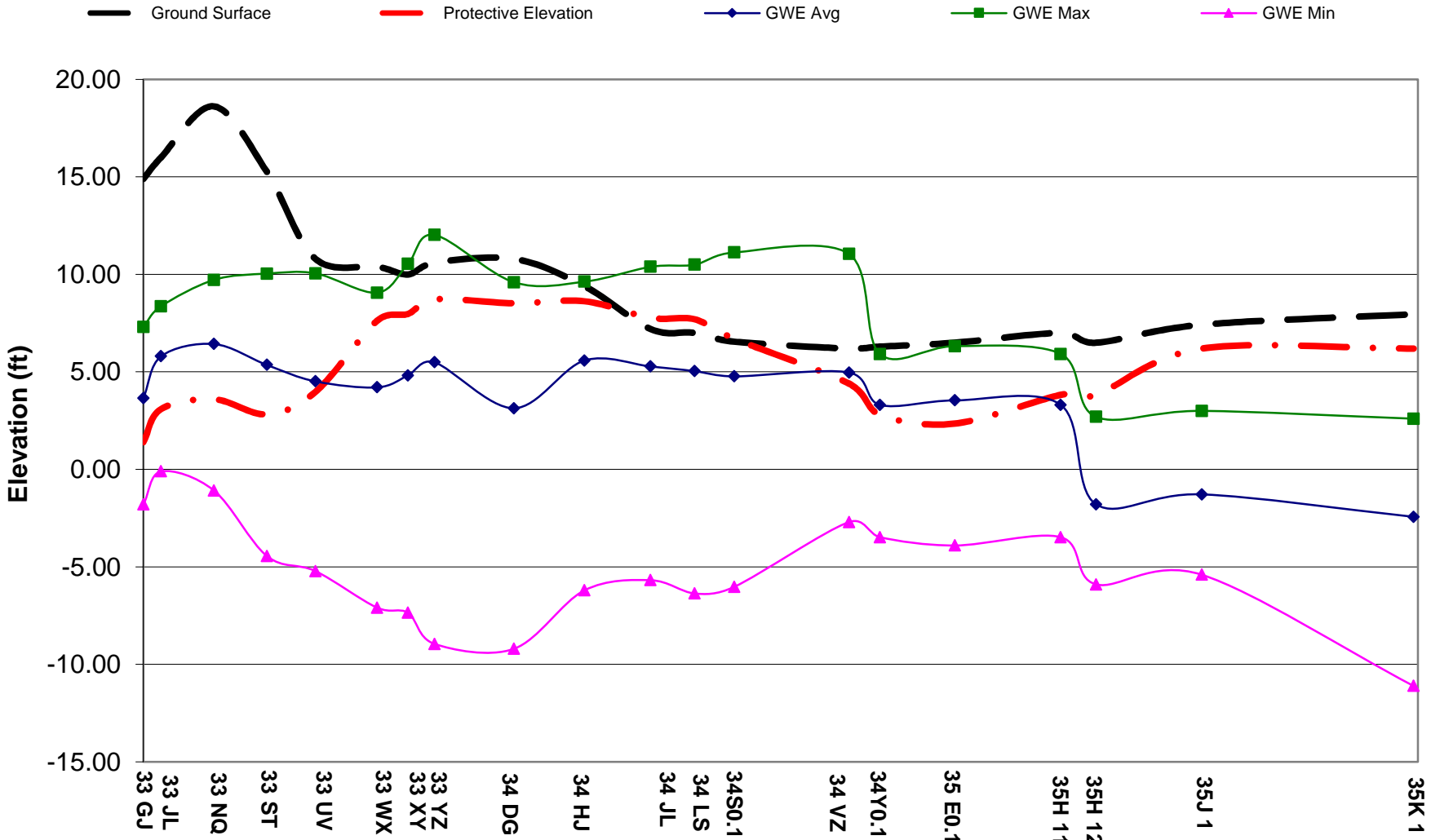


A-13

B Zone - Groundwater Elevation (GWE) Along the ABP FY19-20

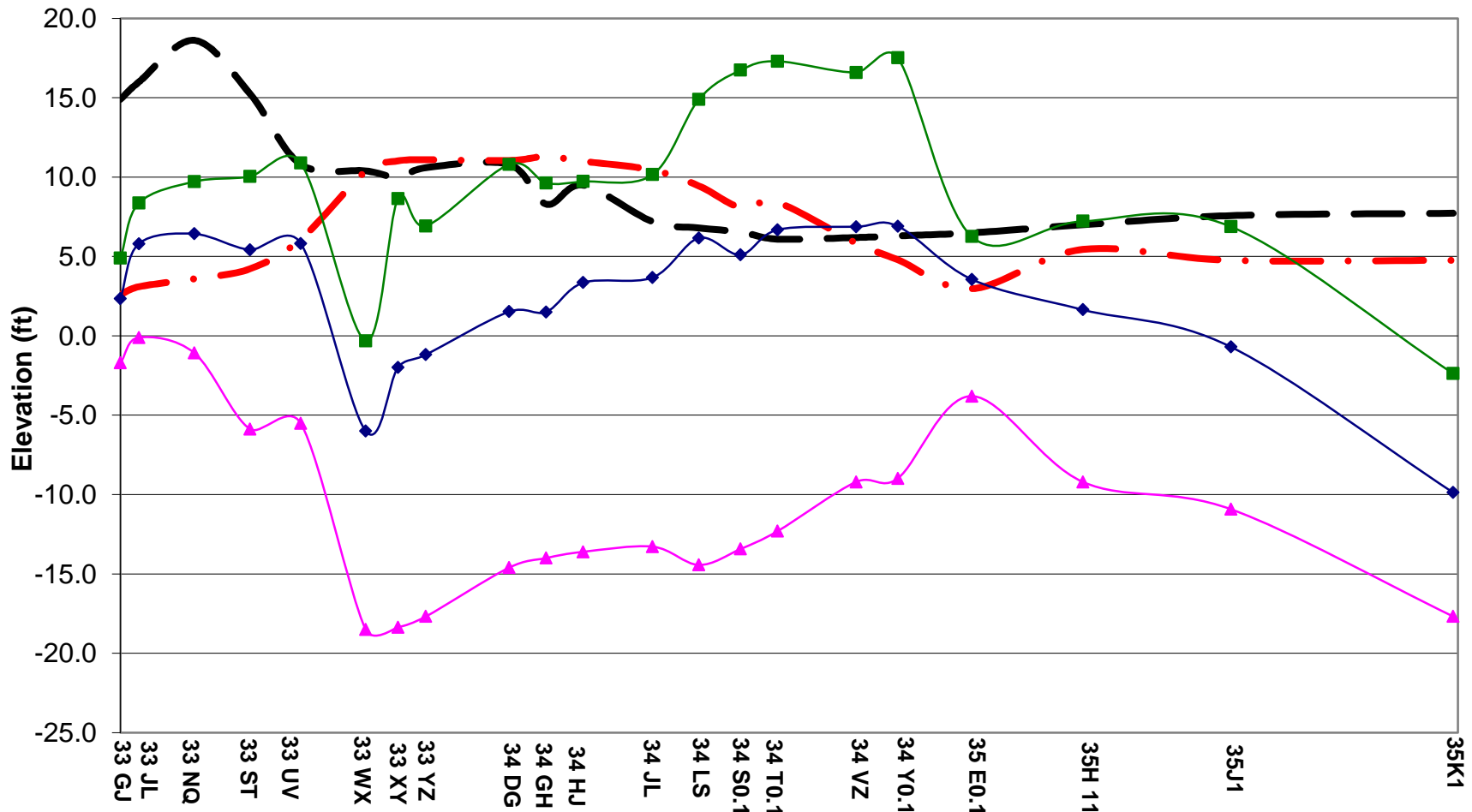


A Zone - Groundwater Elevation (GWE) Along the ABP FY19-20



I Zone - Groundwater Elevation (GWE) Along the ABP FY19-20

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



Capital Improvement Projects and Contracts (July 2019 through June 2020)

Board Award Date	Project Title	Description	Contractor	Final Contract Amount	Field Acceptance
TBD	ABP Unit 15 Injection and Observation Wells	Construction of 5 new injection wells and 2 nested observation wells	TBD	TBD	February 2023 [Estimated]

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

Summary of the Alamos Barrier Project Shutdowns (July 2019 through June 2020)

Shutdown	Startup	Duration (days)	Impacted Portion of ABP	Reason	Addressed By	Means of Repair/Remediation
5/15/2014	N/A	N/A	34H (A)	Well is filled with sediment due to hole near top of perforations and will not take water.	LACPW	Well remains off and is slated to be destroyed.
9/5/2014	N/A	N/A	33S1 (C,B)	Surface leakage	LACPW	Will remain on at reduced flow rate
11/6/2017	N/A	N/A	33W (C,B,A,I)	Surface leakage	LACPW	Will remain on at reduced flow rate
6/11/2019	9/4/2019	85	33G (A,I)	It was reported by Stormwater Maintenance Division (SWMD) that the well head was leaking and in need of a gasket replacement.	LACPW	Long Beach street occupancy permit issued. Well has been repaired. Resumed injection.
6/3/2019	7/3/2019	30	33Z2 (A,I)	Faulty isolation valves. Left offline after redevelopment.	LACPW	Isolation valves replaced during Barrier shutdown. Resumed injection.
7/1/2019	10/3/2019	94	34D (C,B,A,I)	Injection well is in need of an orifice plate and vault piping repair. Maintenance crew did not have orifice plate on hand.	LACPW	Well repaired and injection resumed.
1/7/2020	N/A	N/A	34G (A)	Well is off due to surface leakage. Ground around well was pressure grouted in 2000 and in 2004. Surface leaking still occurring at injections rates ~0.05 cfs	LACPW	Well remains offline
7/1/2019	9/30/2019	91	34T (I)	SWMD turned off the well due to telemetry high pressure alarm.	LACPW	Well brought back online. Resumed injection.
7/1/2019	8/31/2019	61	34Z2 (I)	SWMD turned off the well due to telemetry high pressure alarm.	LACPW	Well brought back online. Resumed injection.
10/28/2019	10/29/2019	1	34N, 34Q, 34S, 34T, 34V, 34X, 34Z2, 34Z, 35E, 35F, 35F, 35H1, 35H2	A shutdown of Point C was needed to repair the isolation valve at injection well 34Z.	LACPW	Isolation valve replaced and resumed injection.
2/25/2020	N/A	N/A	35G (A)	Possible high groundwater table. Vault consistently fills up with water when well is online.	LACPW	Well remains offline
5/13/2020	5/28/2020	15	34V (C/B, A, I)	Vault piping repair due to water hammer that went through the line during a drop in flow during PRV Maintenance.	LACPW	Well vault piping repaired. Resumed injection
5/19/2020	5/22/2020	3	Entire Barrier	Barrier shutdown. As part of installation and testing of new actuators for PRV pilot valves	LACPW	Flow restored to Barrier

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.

**ABP EXPENDITURES
FY 2019-20**

ITEM NO.	DESCRIPTION	JOB NO.	DESCRIPTION	SERVICES AND SUPPLIES	FY 2019-20 BUDGET	% BUDGET FY 19-20	OCWD SHARE 37.9%	OCWD BUDGET FY 19-20	% OCWD BUDGET FY 19-20	LADPW SHARE	LADPW BUDGET FY 19-20	% LADPW BUDGET FY 19-20		
1.	Analysis and direction of injection operations	H0321550 H0321551	BARRIER PROJECT OPERATION-GEN ABP ANALY/DIR OF INJECTION O	145,903.70 66,454.88										
			Subtotal #1	212,358.58	100,000	212.4%	80,483.90	45,000	178.9%	131,874.68	55,000	239.8%		
2.	Maintenance and repair of injection wells	F5009760F F5064011 F6004011 F6980080F H0321911 H032151000	DRILL EQPT-MAINT/TEST - Eaton Yard INJECT. WELLS-MAINTAIN(ALAMITO) MAINT INJECTION WELLS - ABP MAINT ENGR - BARRIER PROJ Alamitos Barrier Proj-Telemetry Maint. OCWP Automated System OCWP Permit No. F220-0024	127,930.91 100,462.69 234,974.13 14,005.78 17,320.66 31,083.40 1,606.60										
			Subtotal #2	527,384.17	450,000	117.2%	199,878.66	202,500	98.7%	327,505.57	247,500	132.3%		
3.	Operation of injection	F6004000	RECHARGE OPER U/S - ABP	65,018.07										
			Subtotal #3	65,018.07	70,000	92.9%	24,641.85	31,500	78.2%	40,376.22	38,500	104.9%		
4.	Analysis and direction of extraction operations (No cost to OCWD)	H0321555	ABP ANALY/DIR OF EXTRACT OPE	0.00		0.0%	0.00	0.0	0.0%	0.00	0.0	0.0%		
			Subtotal #4	0.00	0.0	0.0%	0.00	0.0	0.0%	0.00	0.0	0.0%		
5.	Maintenance, and repair of extraction wells	F6000090	NON-LABOR EXP BARRIER (ALMT)	1,512.33										
			Subtotal #5	1,512.33	5,000	30.2%	0.00	0.0	0.0%	1,512.33	5,000	30.2%		
6.	Operation of extraction wells (No cost to OCWD)	F6000090	NON-LABOR EXP BARRIER (ALMT)	1,512.33										
			Subtotal #6	1,512.33	5,000	30.2%	0.00	0.0	0.0%	1,512.33	5,000	30.2%		
7.	Maintenance and repair of distribution system	F6001907 F6004010 F6004012 F6004014F F6009118 H0321016 H0321569	INSPECT CRANE PRES REDUCE - ABP MAINT AIR/VAC-BLOWF U/S - ABP MAINT PRES - ABP ABP Locate & Mark Barrier Proj; U/grd. Lines Disassemble/Reassemble of Wells ABP Seawater Barriers Administrative Support ALAMITOS BARRIER PROJECT	5,609.65 3,503.10 67,218.69 36,220.79 47,211.99 72,018.47 143,323.25										
			Subtotal #7	373,105.94	300,000	124.4%	141,407.15	135,000	104.7%	231,698.79	165,000	140.4%		
8.	Maintenance of observation wells	F5064044	OBSERV. WELLS-CLEANOUT(ALAMITO)	24,517.33										
			Subtotal #8	24,517.33	150,000	16.3%	9,292.07	67,500	13.8%	15,225.26	82,500	18.5%		
9.	Collection of groundwater data	H0321552	ABP COLL OF GR WTR DATA FOR OCWP Permit No. F219-0169 Seal Beach Permit No. DPW03961 Seal Beach Permit No. DPW04058 OCWP Permit No. F219-0191	158,784.14 422.96 492.07 532.87 688.05										
			Subtotal #9	160,920.09	175,000	92.0%	60,988.71	78,750	77.4%	99,931.38	96,250	103.8%		
10.	Yard Maintenance	F6001904 F6001900 F6001123 F6001124 F6000643 F6001107	CONDUCT QUARTERLY INSPECTION CONDUCT QUARTERLY INSPECTION BUILDING MAINTENANCE-NONRESI BUILDING MAINTENANCE-NONRESI ALAMITOS Yard Remodel Facility Maintenance Alamitos Yd #107	563.72 740.66 11,503.94 30,897.66 26,639.44 21,842.51										
			Subtotal #10	92,207.93	65,000	141.9%	34,946.81	29,250	119.5%	57,261.12	35,750	160.2%		
11.	Well redevelopment	F4046861 F4046862 F4046861 F4046862 F4046883 F4046887 F4046890 F4046896 F4046897 F4046898 F4046899 F4046906 F4046907 F4046923 F4046924 F4046929 F4046940 F4046941 F4046942 F4046945 F4046949 F4046950 F4046951 F4046952 F4046958 F4046959 F4046960 F4046961 F4046962 F4046963 F4046967 F4046968 F4046975 F4046976 F4046985 F4046953 F4046954 F5064022 H0321554 H0321565	Redevelop injection well 33X - ABP Redevelop injection well 33W - ABP Redevelop injection well 34G2 (Zones B&C) - ABP Redevelop injection well 34G2 (Zone I) - ABP Redevelop injection well 35F - ABP Redevelop injection well 34E - ABP Redevelop injection well 34E - ABP Redevelop injection well 34E C&B Zones - ABP Redevelop injection well 34E I Zone - ABP Redevelop injection well 34F A Zone - ABP Redevelop injection well 34F I Zone - ABP Redevelop injection well 33U - ABP Redevelop injection well 33V - ABP Redevelop injection well 35E - ABP Redevelop injection well 34Z - ABP Redevelop injection well 34H - ABP Redevelop injection well 34Q CB Zone - ABP Redevelop injection well 34Q A Zone - ABP Redevelop injection well 34Q I Zone - ABP Redevelop injection well 34J2 - ABP Redevelop injection well 34E - ABP Redevelop injection well 34W (C/B) - ABP Redevelop injection well 34NX (A) - ABP Redevelop injection well 34NY (I) - ABP Redevelop injection well 34V (C/B) - ABP Redevelop injection well 34X (B) - ABP Redevelop injection well 34XX (A) - ABP Redevelop injection well 34X (I) - ABP Redevelop injection well 34Z2 (A) - ABP Redevelop injection well 34Z2 (I) - ABP Redevelop injection well 35E (I) - ABP Redevelop injection well 33T (A,I) - ABP Redevelop injection well 33U3 - ABP Redevelop injection well 33E - ABP Redevelop injection well 33E1 - ABP Redevelop injection well 33G - ABP Redevelop injection well 34TX (A) - ABP Redevelop injection well 34TY (I) - ABP Redevelop injection wells - ABP ABP WELL REDEVELOPMENT PROGRAM ABP NPDES MONI & REPORT INJ WE OCWP Permit No. F219-0189	3,384.69 54,389.95 6.35 7.62 25,848.71 5,275.71 42,476.11 19,503.22 22,573.05 25,546.85 23,559.86 49,204.16 48,924.03 25,629.68 32,601.27 25,953.30 7,212.91 1,964.83 4,091.09 10,666.36 8,650.43 3,376.68 1,867.90 2,475.21 2,836.23 6,820.71 7,146.50 4,555.70 6,908.21 5,552.40 5,918.14 33,117.01 30,227.71 31,082.35 15,102.49 21,008.35 2,218.19 2,746.79 97,303.39 128,947.35 35,302.74 1,607.46										
			Subtotal #11	883,592.39	1,000,000	88.4%	334,881.52	450,000	74.4%	548,710.87	550,000	99.8%		
12.	Processing of data and preparation of reports	H0321553	ABP DATA PRO & PRE OF REPORT	57,337.04										
			Subtotal #12	57,337.04	80,000	71.7%	21,730.74	36,000	60.4%	35,606.30	44,000	80.9%		
13.	Reclaim Water Program	H0321556	ABP RECLAIMED WATER SUPPLY	7,752.14										
			Subtotal #13	7,752.14	50,000	15.5%	2,938.06	22,500	13.1%	4,814.08	27,500	17.5%		
14.	Projects & Studies (Reimbursable amounts include labor expenses, plus approved contract expenses that are not addressed under a separate agreement).	H0321550	ALAMITOS BARRIER PROJECT TELEMETRY SYSTEM UPGRADE	60,442.04										
			Subtotal #14	60,442.04	10,000	604.4%	0.00	4,500	0.0%	60,442.04	5,500	1098.9%		
15.	ABP Liability Insurance Premiums paid separately by OCWD	N/A	ABP General Liability Coverage	66,575.35										
			Subtotal #15	66,575.35	80,000	83.2%	33,287.68	40,000	83.2%	33,287.67	40,000	83.2%		
			TOTAL	2,532,723.39	2,545,000.00	99.5%	944,477.08	1,142,500.00	82.7%	1,588,246.31	1,402,500.00	113.2%		

NOTES:
1 OCWD share represents 37.9% 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 LACPCD 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 since the work occurred on LACPW wells.
4 Per Agreement No. 8458 between the LACPCD and the OCWD, the cost of liability insurance (item 15) shall be split equally among the Parties.

TOTAL OPERATION AND MAINTENANCE COST (not including insurance premium)	\$ 2,466,148.04
ORANGE COUNTY'S SHARE OF THE OPERATION AND MAINTENANCE COST (not including insurance premium)	\$ 911,189.40
Less: Los Angeles County's Share of the FY19-20 Liability Insurance	\$ 33,287.68
Less: Permit fees paid by OCWD	\$ 5,350.01
Less: Advance Deposit Paid by OCWD	\$ 551,250.00
BALANCE DUE FROM ORANGE COUNTY WATER DISTRICT	\$ 321,301.71

ABP FY 2021-22 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 (\$)								
	2017-18	65,000	85,629	35,000	22,216			100,000	107,845
	2018-19	65,000	97,978	35,000	59,797			100,000	157,775
	2019-20	55,000	132,029	45,000	80,578			100,000	212,607
	2020-21	90,000		60,000				150,000	
	2021-22	120,000		80,000				200,000	
2.	Maintenance and repair of injection wells (\$)								
	2017-18	292,500	390,733	157,500	101,374			450,000	492,107
	2018-19	292,500	263,657	157,500	160,912			450,000	424,569
	2019-20	247,500	327,656	202,500	199,970			450,000	527,626
	2020-21	270,000		180,000				450,000	
	2021-22	330,000		220,000				550,000	
3.	Operations of Injection Well Facilities (\$)								
	2017-18	32,500	54,179	17,500	14,057			50,000	68,236
	2018-19	32,500	37,411	17,500	22,832			50,000	60,243
	2019-20	38,500	40,376	31,500	24,642			70,000	65,018
	2020-21	42,000		28,000				70,000	
	2021-22	42,000		28,000				70,000	
4.	Analysis and direction of extraction operation (\$)								
	2017-18	0	0	0	0			0	0
	2018-19	0	0	0	0			0	0
	2019-20	0	0	0	0			0	0
	2020-21	0	0	0	0			0	0
	2021-22	0	0	0	0			0	0
5.	Redevelopment, maintenance, and repair of extraction wells (\$)								
	2017-18	10,000	0	0	0			10,000	0
	2018-19	10,000	0	0	0			10,000	0
	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
6.	Operations of Extraction Wells (\$)								
	2017-18	5,000	1,538	0	0			5,000	1,538
	2018-19	5,000	1,556	0	0			5,000	1,556
	2019-20	5,000	1,512	0	0			5,000	1,512
	2020-21	5,000	0	0	0			5,000	0
	2021-22	5,000	0	0	0			5,000	0
7.	Maintenance and repair of ABP (\$)								
	2017-18	227,500	243,510	122,500	63,178			350,000	306,688
	2018-19	195,000	224,174	105,000	136,815			300,000	360,989
	2019-20	165,000	231,775	135,000	141,454			300,000	373,229
	2020-21	222,000		148,000				370,000	
	2021-22	225,000		150,000				375,000	
8.	Maintenance of Observation Wells (\$)								
	2017-18	130,000	102,389	70,000	26,564			200,000	128,953
	2018-19	32,500	6,403	17,500	3,908			50,000	10,310
	2019-20	82,500	15,225	67,500	9,292			150,000	24,517
	2020-21	30,000		20,000				50,000	
	2021-22	90,000		60,000				150,000	
9.	Collection of groundwater data (\$)								
	2017-18	130,000	137,535	70,000	35,683			200,000	173,218
	2018-19	130,000	111,940	70,000	68,318			200,000	180,257
	2019-20	96,250	99,931	78,750	60,989			175,000	160,920
	2020-21	120,000		80,000				200,000	
	2021-22	120,000		80,000				200,000	
10.	Yard Maintenance (\$)								
	2017-18	70,760	38,503	9,240	9,989			80,000	48,492
	2018-19	66,250	54,965	8,750	8,750			75,000	63,715
	2019-20	35,750	58,686	29,250	35,816			65,000	94,503
	2020-21	65,000		10,000				75,000	
	2021-22	65,000		10,000				75,000	
11.	Injection Well Redevelopment (\$)								
	2017-18	650,000	416,790	350,000	108,134			1,000,000	524,924
	2018-19	325,000	551,322	175,000	336,475			500,000	887,796
	2019-20	550,000	548,711	450,000	334,882			1,000,000	883,592
	2020-21	600,000		400,000				1,000,000	
	2021-22	600,000		400,000				1,000,000	
12.	Processing of data and preparation of reports (\$)								
	2017-18	39,000	69,081	21,000	17,923			60,000	87,004
	2018-19	39,000	42,207	21,000	25,759			60,000	67,967
	2019-20	44,000	35,606	36,000	21,731			80,000	57,337
	2020-21	48,000		32,000				80,000	
	2021-22	42,000		28,000				70,000	
13.	Oversight of Reclaim Water Program (\$)								
	2017-18	29,250	34,005	15,750	8,822			45,000	42,827
	2018-19	32,500	10,701	17,500	6,531			50,000	17,232
	2019-20	27,500	4,814	22,500	2,938			50,000	7,752
	2020-21	30,000		20,000				50,000	
	2021-22	18,000		12,000				30,000	
14.	Projects and Studies (\$)								
	2017-18	6,500	125,552	3,500	32,574			10,000	158,126
	2018-19	6,500	62,613	3,500	0			10,000	62,613
	2019-20	5,500	60,442	4,500	0			10,000	60,442
	2020-21	12,000		8,000				20,000	
	2021-22	55,000		8,000				63,000	
15.	ABP Liability Insurance (\$)								
	2017-18	38,000	38,951	38,000	38,951			76,000	77,902
	2018-19	38,000	32,162	38,000	32,162			76,000	64,324
	2019-20	40,000	33,375	40,000	33,375			80,000	66,750
	2020-21	35,000		35,000				70,000	
	2021-22	40,000		40,000				80,000	
16.	Total ABP Expenditure (\$)								
	2017-18	1,726,010	1,738,394	909,990	479,465			2,636,000	2,217,859
	2018-19	1,269,750	1,497,089	666,250	862,257			1,936,000	2,359,346
	2019-20	1,402,500	1,590,139	1,142,500	945,666			2,545,000	2,535,805
	2020-21	1,579,000		1,021,000				2,600,000	
	2021-22	1,762,000		1,116,000				2,878,000	
TOTALS	Total ABP Operations and Maintenance (\$ [Item 16-Item 15])								
	2017-18	1,688,010	1,699,443	871,990	440,515			2,560,000	2,139,958
	2018-19	1,231,750	1,464,927	628,250	830,095			1,860,000	2,295,023
	2019-20	1,362,500	1,556,764	1,102,500	912,291			2,465,000	2,469,055
	2020-21	1,544,000		986,000				2,530,000	
	2021-22	1,722,000		1,076,000				2,798,000	
	Volume of Water (ac-ft)								
	2017-18			2,450	910	4,550	3,504	7,000	4,414
	2018-19			2,960	2,009	4,440	3,287	7,400	5,295
	2019-20			2,800	2,100	4,200	3,437	7,000	5,537
	2020-21			3,000		4,500		7,500	
	2021-22			2,800		4,200		7,000	