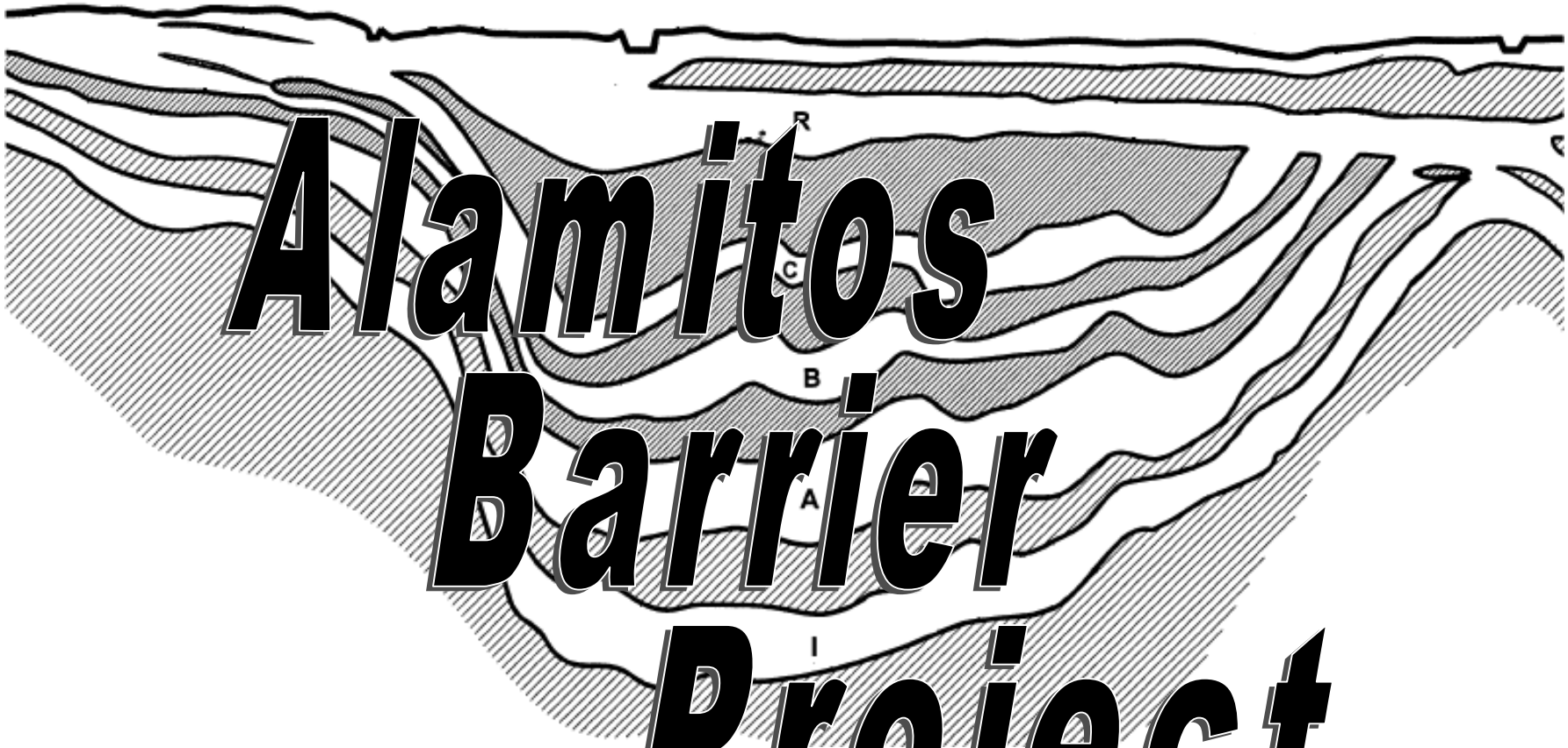

Alamitos Barrier Project

Alamitos Barrier Project

Annual report on the control of seawater intrusion

2018 - 2019

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

Author:

Jason St. Pierre
Los Angeles County Public Works

Submitted by:

Jason St. Pierre, Secretary
Joint Management Committee

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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) 2018-19 (i.e., July 1, 2018, through June 30, 2019).

SUMMARY

During FY 2018-19, a total of 5,295.2 acre-feet (AF) of water was injected into the ABP (an average rate of 7.3 cubic feet per second). Of that total, OCWD purchased 2,008.5 acre-feet (38 percent) and the Water Replenishment District of Southern California (WRD) purchased 3,286.7 acre-feet (62 percent). This total injected amount was 881.1 AF more than FY 2017-18, but was 922 AF lower than the average injection of 6,217 AF for the previous five fiscal years. Increases in regional groundwater levels due to a higher than average rain season is one reason for the decrease in injection. Also, during the months of September through December, LACPW had very limited access to the Alamitos Channel wells because they were covered with steel plates during Orange County Public Works (OCPW) Channel Restoration Project, which prevented the ability to make injection rate changes at these wells. The ABP experienced a full shutdown on June 24th which lasted about nine days. The last time the ABP experienced a major shutdown was during FY06-07. All minor shutdowns for FY 2018-19 are detailed in Appendix A-18.

The total costs associated with the ABP in FY 2018-19 are summarized below:

- Total Cost in FY 2018-19: $8,610,778
  - Injection Water costs: $6,251,368 (OCWD: $2,372,944; WRD: $3,878,424)
  - Total Operations and Maintenance Costs (not including liability): $2,295,086
    - Injection-related costs: $2,293,529 (OCWD: $830,119; LACFCD: $1,463,410)
      - Equivalent cost per AF of water injected: $433
    - Extraction-related costs: $1,556 (LACFCD only)
  - Liability Insurance cost: $64,324 (OCWD: $32,162; LACFCD: $32,162)

During the first half of the reporting period, the area between Los Cerritos Channel and San Gabriel River in Zones C, B, and A of the ABP west of the San Gabriel River showed groundwater levels lower than the previous year, with localized decreases related to operational activities. Groundwater elevations east of the San Gabriel River during the second half of FY18-19 showed significant increases due to OCWD's newly installed Unit

14 injection wells. West of the San Gabriel River, chloride concentrations increased slightly along the ABP with the exception of the B-Zone, which had a slight decrease. East of the San Gabriel River, chloride concentrations generally had a slight decrease along the ABP, with the exception of Zones B and I, 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. The inclusion of additional wells at the ABP Unit 14 Project will continue to aide in the protection of the region's groundwater resources.

PROJECTS AND STUDIES

Capital improvement projects and studies over this reporting period are briefly summarized below. The general location of each project is identified on the map in Appendix A-12.2 and further project details are included in Appendix A-17.

ABP Telemetry Upgrade

Construction of this project was completed in December 2017; however, LACFCD purchased two actuators for the pressure reducing valves under this contract. These actuators will be mounted on the pilot valves to allow the downstream pressure to be controlled remotely via telemetry. The actuators will be used to increase or decrease the downstream pressure when the Leo J. Vander Lans (LVL) halts or commences the supply of Advanced Treated Recycled Water to the ABP.

ABP Unit 14 Injection and Observation Wells

This project was completed in August 2018 and was jointly funded by OCWD and LACFCD and managed by OCWD. It consisted of 17 new clustered injection wells, four nested observation wells, and two shallow piezometers along the north-south alignment of the ABP. The addition of the newly constructed injection wells has raised groundwater levels along the Alamitos Channel, which is detailed in the groundwater maps located in the appendix section of this report. The additional observation wells have provided a better analysis of groundwater levels and chloride concentrations along the north-south alignment of the ABP by filling data gaps.

ABP Phase 1 Haynes Plant Telemetry Extension

This project lay downed the hardware necessary to bring the following wells onto telemetry: 34E, 34J, 34L and 34HJ. The project was completed in January 2019 by Tetra Tech and it added instrument panels at injection wells 34E, 34J, and 34L, for the purpose of housing telemetry pressure and flow sensors. This project also added conduit to run the necessary cables for the sensors.

ABP Unit 15 Injection and Observation Wells

During the reporting period, LACFCD submitted a full proposal to the State of California Proposition 1 Groundwater Grant Program and it is currently under review. The Unit 15 Project aims to 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 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 34GH2.

INJECTION OPERATIONS

The total amount of water injected into the ABP during FY 2018-19 was 5,295.2 AF. Of this total, approximately 2 percent (115.3 AF) was recycled water and 98% percent (5,179.9 AF) was imported water. The maximum monthly injection during this reporting period was 538.0 AF (100 percent imported) which occurred in October 2018. The minimum monthly injection of 339.3 AF (100 percent imported) occurred in June 2019. The typically 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 last week of June which is the reason for the low injection amount for that month. Also, more water was injected during the fall and winter months when the additional injection wells associated with the Unit 14 Project came online.

The percentage of recycled water injection decreased considerably from the previous year primarily due to lack of source water to operate the Leo J. Vander Lans Advanced Water Treatment Facility (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 2017-18 and FY 2018-19 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 2018-19 increased by 20 percent from the previous year, but was 91 AF lower than the average injection over the past thirty years (5,386 AF). The 20 percent increase is primarily due to OCWD’s Unit 14 Project, which commissioned 17 injection wells. The total amount of water injected into the ABP was anticipated to be higher as of a result of the additional wells; however, LACPW was not able to adjust injection rates at any of the wells along the Alamitos Channel for nearly four months because the wells were covered by steel plates during OCPW’s Channel Restoration Project.

All ABP shutdowns that occurred FY 2018-19 are summarized in Appendix A-18. There were no major shutdowns during this reporting period; however, there was a minor shutdown that took place during the last week of the reporting period at the request of the Metropolitan Water District (MWD). MWD requested a shutdown of their LB-7A connection, which is downstream of the ABP pressure reducing vault, to conduct a valve inspection.

TABLE 1. INJECTION OPERATIONS

	Imported Water Injections			Recycled Water Injections			Total Injections		
	FY17-18	FY18-19	Percent Change From Previous Year	FY17-18	FY18-19	Percent Change From Previous Year	FY17-18	FY18-19	Percent Change From Previous Year
	VOLUME OF WATER INJECTED IN ACRE-FEET								
OCWD[1]	850.3	1,965.9	131.2	59.8	42.6	-28.8	910.1	2,008.5	120.7
WRD[2]	3,163.1	3,214.0	1.6	340.9	72.7	-78.7	3,504.0	3,286.7	-6.2
TOTAL	4,013.4	5,179.9	29.1	400.7	115.3	-71.2	4,414.1	5,295.2	20.0
	UNIT COST OF WATER PER ACRE-FOOT[3]								
JULY - DEC	$1,132.19	$1,164.49	2.9	$1,132.19	$1,164.49	2.9			
JAN - JUN	$1,132.19	$1,199.45	5.9	$1,132.19	$1,199.45	5.9			
	COST OF WATER PURCHASED								
OCWD[1]	$886,967	$2,321,847	161.8	$61,188	$51,097	-16.5	$948,155	$2,372,944	150.3
WRD[2]	$3,286,231	$3,791,224	15.4	$348,796	$87,200	-75.0	$3,635,027	$3,878,424	6.7
TOTAL	$4,173,199	$6,113,071	46.5	$409,983	$138,296	-66.3	$4,583,182	$6,251,367	36.4
	AVERAGE INJECTION RATE IN CFS								
OCWD[1]	1.17	2.72	131.2	0.08	0.06	-28.8	1.26	2.77	120.7
WRD[2]	4.37	4.44	1.6	0.47	0.10	-78.7	4.84	4.54	-6.2
TOTAL	5.54	7.16	29.2	0.55	0.16	-71.2	6.10	7.31	20.0

[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

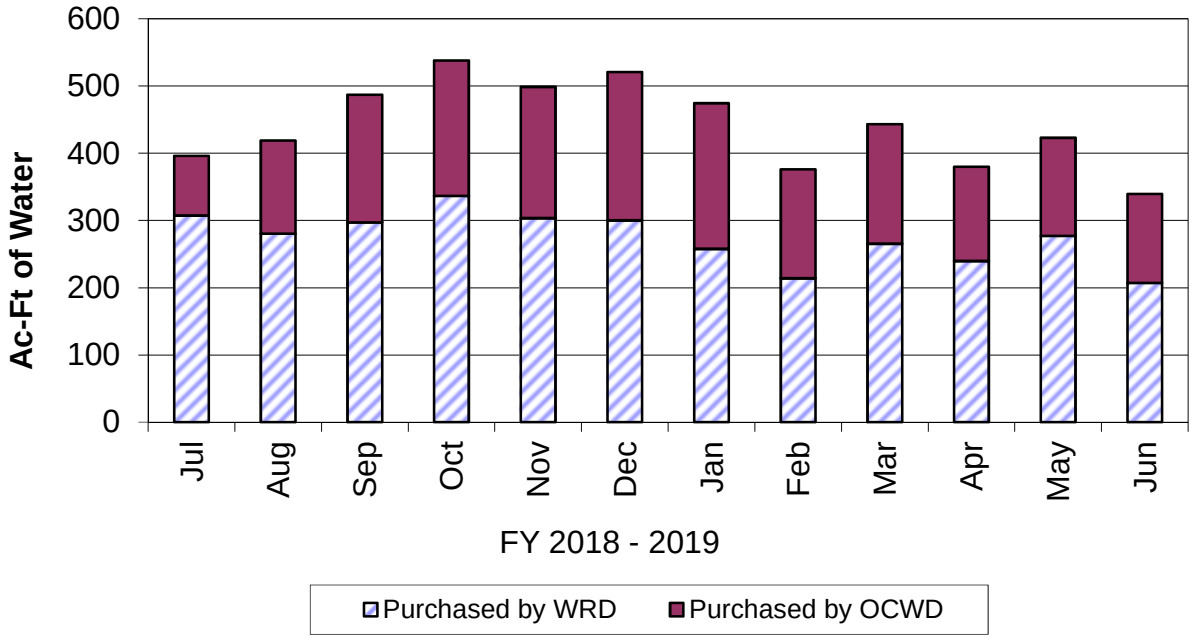
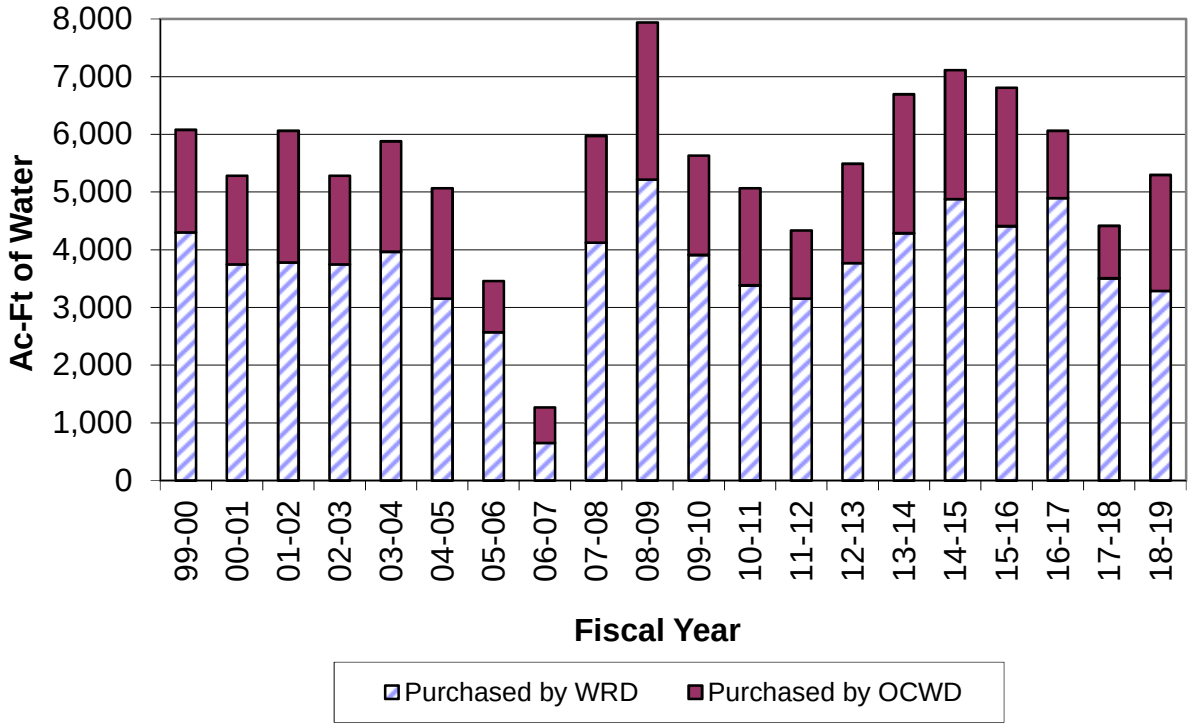


FIGURE 2 - ANNUAL AMOUNT OF WATER INJECTED



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 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 over three consecutive summers started in Summer 2017. The first shutdown was delayed considerably, and as a result, LVL 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 was scheduled to go back online in November 2018; however, maintenance issues at the LVL prevented the plant from suppling the ABP with recycled water. The plant did come 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. When in operation, the LVL operated intermittently at approximately 3.2 MGD due to Public Works directive to have the LVL only run during Public Works working hours until the LVL could provide continual flow to the ABP without

maintenance issues that would cause the plant to stop production. The LVL is currently offline to allow LACSAN to perform scheduled maintenance and it is anticipated to come online in November 2019.

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 2018-19, Public Works completed redevelopment activities at the following 15 well casings: 33G (A,I), 33J (A,I), 33L (A,I), 33N (A,I), 33Q (A,I), 33Q1 (C,B), 33S (A,I), 33S1 (C,B), 33X (C,B,A,I), 33Y (C,B,A,I), 33Z (C,B,A,I), 33Z2 (A,I), 34D (C,B,A,I), 34G (A), and 34J (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 2018-19, Public Works completed observation well cleanout activities at the following observation well casings: 33W110 (A) and 33Z'1 (A).

Figure 3 depicts the operating status of each injection and extraction well during FY 2018-19. Injection wells east of the San Gabriel River were in operation throughout the entire reporting period, except during the scheduled shutdown of the ABP. Injection wells along the western portion of the ABP underwent routine redevelopment activities. The full ABP shutdown that occurred during this reporting period allowed Metropolitan Water District to inspect their south coast feeder valve (LB-7A). During the shutdown, ABP maintenance crews were able to replace four isolation valves and three air relief 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 since being struck by an automobile 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. Injection well 33S1, also located west of the San Gabriel River, continues to operate at a limited flow due to potential surface leakage. Injection well 33Z2 (A,I) was kept offline after redevelopment due to faulty isolation valves, which were repaired during the ABP shutdown. Well 33G remains off due to a faulty header gasket and is scheduled to be repaired in September 2019.

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 re-assembled and placed back in service. It should be noted that injection well 34H(A) had been offline since Spring 2015 because it also has a hole that is not repairable. Injection well 34J (A,I) was kept offline after being redeveloped due to a leak in the lateral supply line. Public Works welders were able to repair the lateral and the injection well is in operation.

The ABP pressure reducing valves underwent maintenance in December 2018, which included replacing the diaphragms on all three valves. In March 2019, the pilot valves were relocated from the wall to directly on the pressure reducing valves. The relocation of the pilot valves will reduce the response time of the pressure reducing valves.

ABP maintenance crews are in the process of ordering vault lids for injection wells 34S and 34V. These well lids are in need of replacement due to normal wear and tear.

FIGURE 3 - ABP INJECTION AND EXTRACTION WELL STATUS
FY 2018-19

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

		2018																								2019																									
	Well No.	JUL				AUG				SEP				OCT				NOV				DEC				JAN					FEB				MAR				APR				MAY					JUN			
1	33G (A,I)						D	R	D																							X	X	X	X	V												X	X
2	33J (A,I)	D	R	D																																													X
3	33L (A,I)		D	R	D	D																																											X
4	33N (A,I)				D	R	D																																										X
5	33Q (A,I)																													D	R	R	R	D																	X
6	33Q1 (C,B)																																	D	R	D															X
7	33S (A,I)							D	R	R	D																																						X
8	33S1 (C,B)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	D	R	D	L	L	L	L	L	L	L	L	L	L	L	L	X
9	33T (A,I)																																																		X
10	33U (A,I)																																																		X
11	33U3 (C,B)	D																																																	X
12	33V (A,I)																																																		X
13	33W (C,B,A,I)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	D
14	33X (C,B,A,I)																																													D	R	R	R	D
15	33Y (C,B,A,I)																							D	D	R	R	R	R	D	D																				X
16	33Z (C,B,A,I)																	D	R	R	R	D	D																												X
17	33Z2 (A)																				O	O	O																					D	R	R	R	D	D	X	X	X
18	33Z2 (I)																				O	O	O																					D	R	R	R	D	D	X	X	X
19	34D (C,B,A,I)												D	R	R	R	R	D	O	O	O	O	O																												X
20	34E (C,B)																																																		X
21	34E (I)																																																		X
22	34F (A)																																																		X
23	34F (I)																																																		X
24	34G (A)																																								D	R	R	D	D			O	O		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	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X
28	34H (I)																																																		X
29	34J (A)																																					D	R	R	R	D	X	X	X	X	X				X
30	34J (I)																																					D	R	R	R	D	X	X	X	X	X				X
31	34J2 (C/B)	U	U	U	U	U	U	U																																											X
32	34K (C/B)	U	U	U	U	U	U	U																																											X
33	34L (C,B,A,I)																																																		X
34	34N (C/B)	U	U	U	U	U	U	U																																											X
35	34N (A)	U	U	U	U	U	U	U																																											X
36	34N (I)	U	U	U	U	U	U	U																																											X
37	34Q (C/B)	U	U	U	U	U	U	U																																											X
38	34Q (A)	U	U	U	U	U	U	U																																											X
39	34Q (I)	U	U	U	U	U	U	U																																											X
40	34S (A)																																																		X
41	34S (I)																																																		X
42	34S (C,B)																																																		X
43	34T (C/B)	U	U	U	U	U	U	U																																											X
44	34T (A)	U	U	U	U	U	U	U																																											X
45	34T (I)	U	U	U	U	U	U	U																																											X
46	34V (A)			V																																															X
47	34V (I)			V																																															X
48	34V (C,B)			V																																															X
49	34X (B)	U	U	U	U	U	U	U																																											X
50	34X (A)	U	U	U	U	U	U	U																														O	O	O	O	O	O									X
51	34X (I)	U	U	U	U	U	U	U																														O	O	O	O	O	O									X
52	34Z2 (A)	U	U	U	U	U	U	U			O																																								X
53	34Z2 (I)	U	U	U	U	U	U	U			O																																								X
54	34Z (I)																																																		X
55	35E (I)	U	U	U	U	U	U	U																																											X
56	35F (I)																																																		X
57	35G (A,I)																																																		X
58	35H1 (A)																					O	O																												X
59	35H1 (I)																																																		X
60	35H2 (A)																																																		X
61	33V'15P*	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	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	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	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	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	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	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

*Extraction Well

HYDROGEOLOGIC EFFECTS

Figures 4 through 8 (pp. 16-20) show the average monthly groundwater elevation relative to the average groundwater elevation of the 10 preceding years (FY 2008-09 to FY 2017-18) 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: wells west of the San Gabriel River and wells east of the San Gabriel River. It is important to note that the 10-year average does not represent a groundwater elevation goal nor does it specifically reflect the ABP 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 west of the San Gabriel River were generally lower than or very close to historical averages and groundwater elevations east of the San Gabriel were significantly higher than historical averages. Groundwater elevations west of the San Gabriel River were probably lower due to redevelopment activity of the western alignment wells. Higher groundwater elevations east of the San Gabriel River were 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

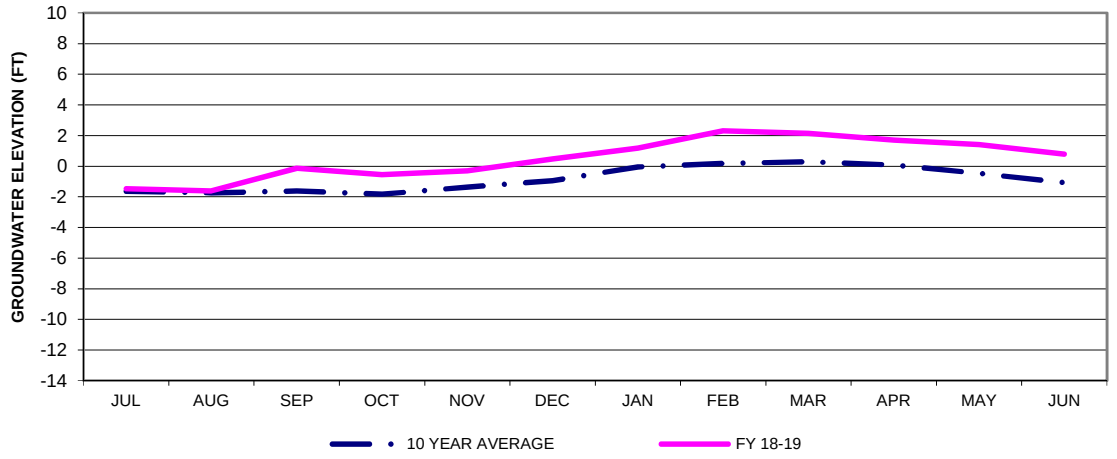


FIGURE 4b RECENT ZONE EAST OF THE SAN GABRIEL RIVER

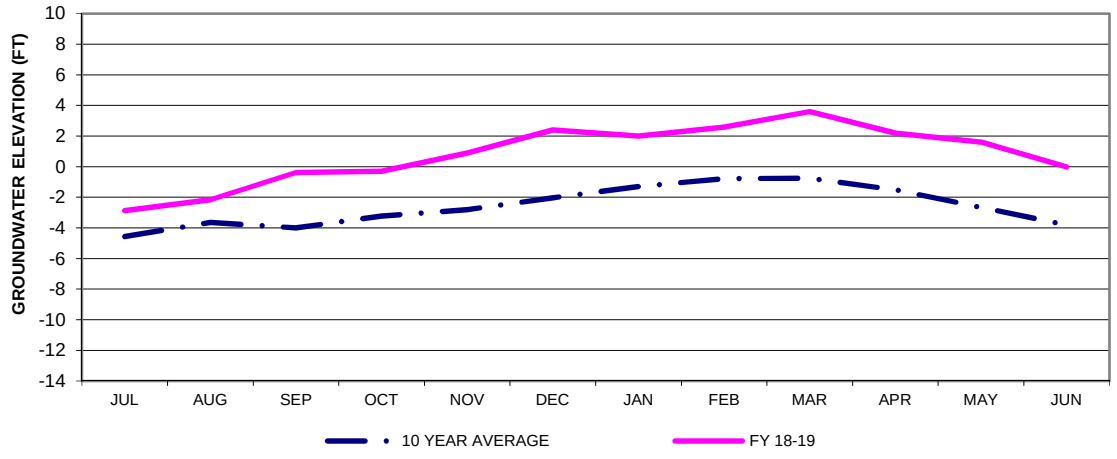


FIGURE 5a C-ZONE WEST OF THE SAN GABRIEL RIVER

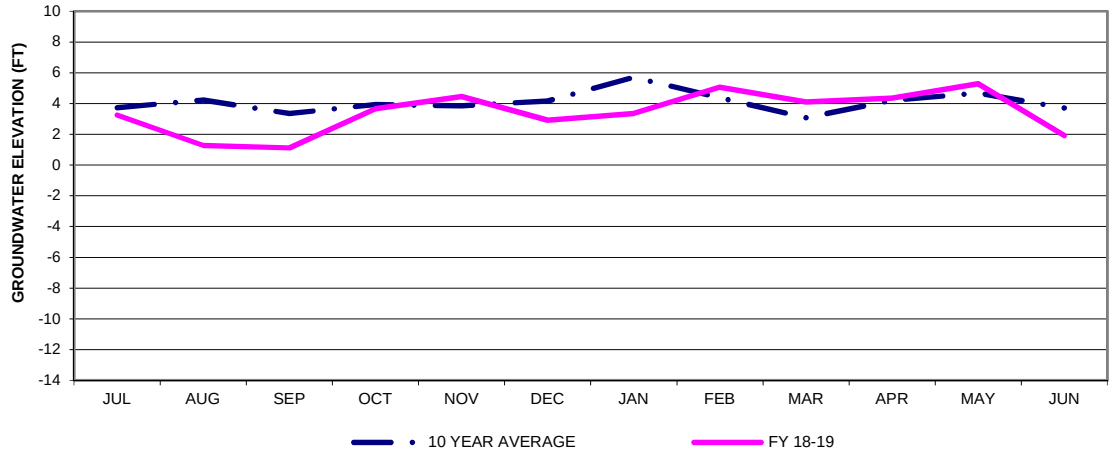


FIGURE 5b C-ZONE EAST OF THE SAN GABRIEL RIVER

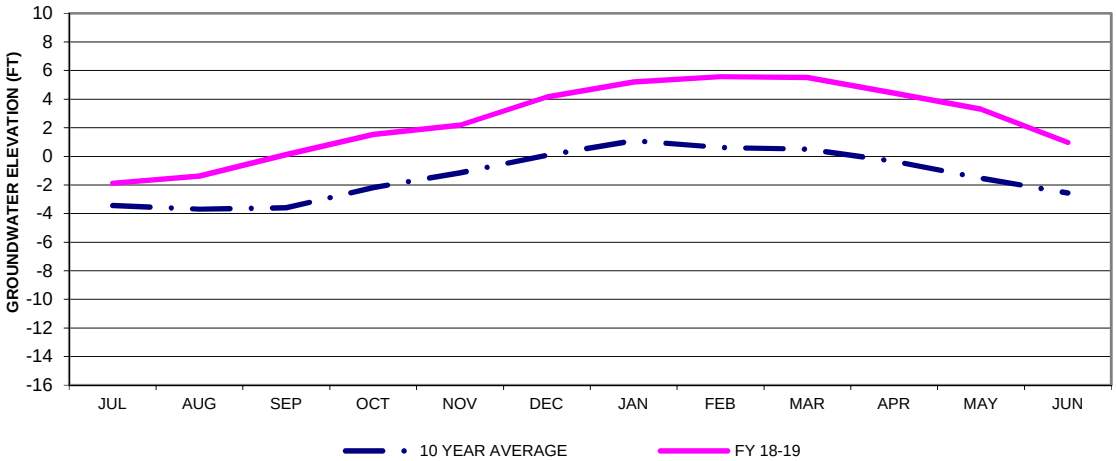


FIGURE 6a B-ZONE WEST OF THE SAN GABRIEL RIVER

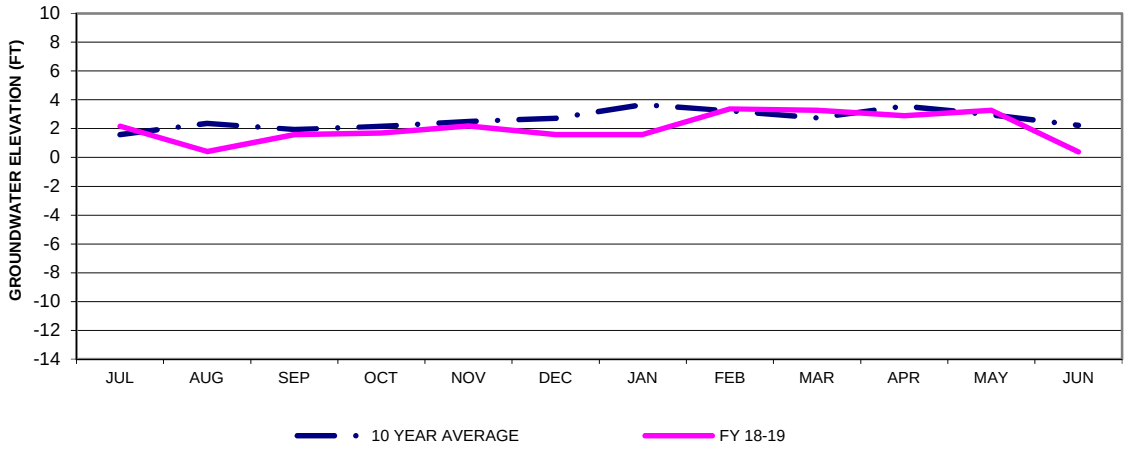


FIGURE 6b B-ZONE EAST OF THE SAN GABRIEL RIVER

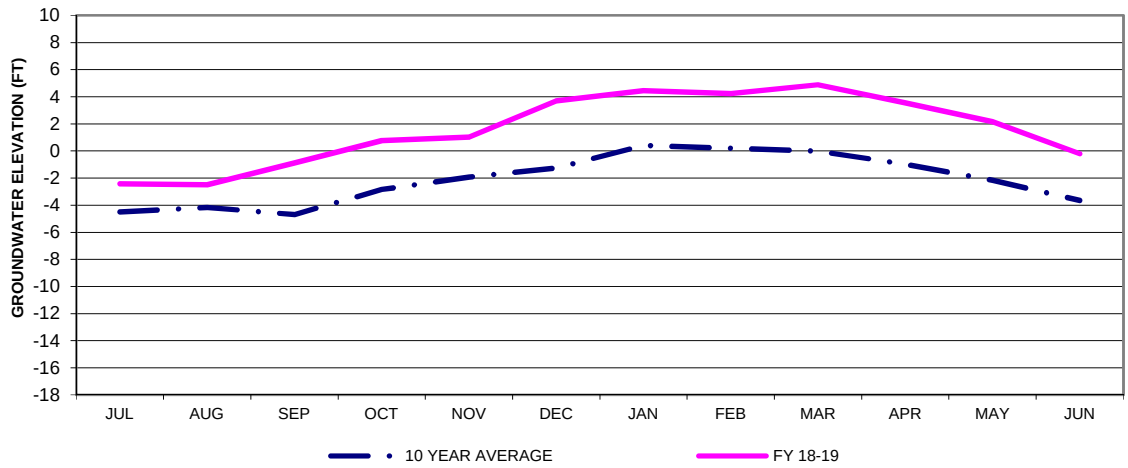


FIGURE 7a A-ZONE WEST OF THE SAN GABRIEL RIVER

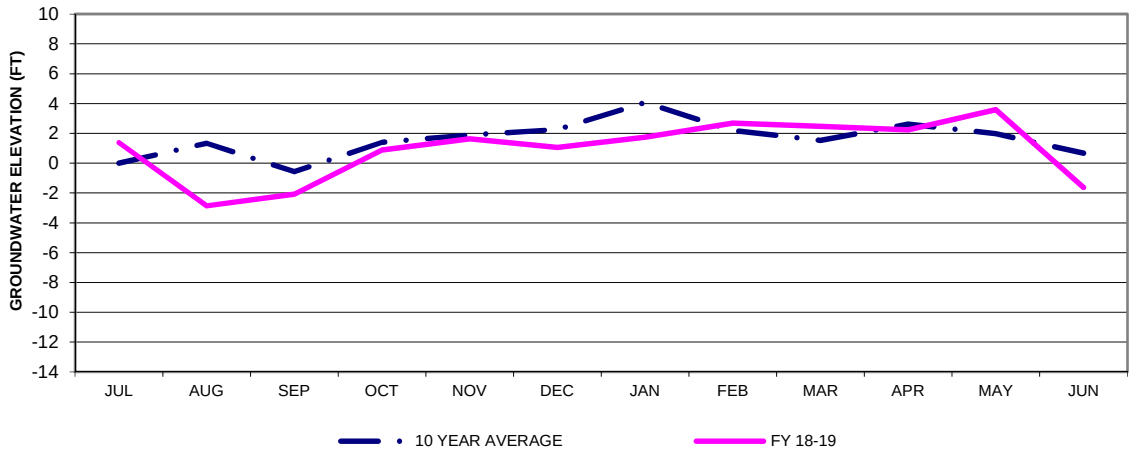


FIGURE 7b A-ZONE EAST OF THE SAN GABRIEL RIVER

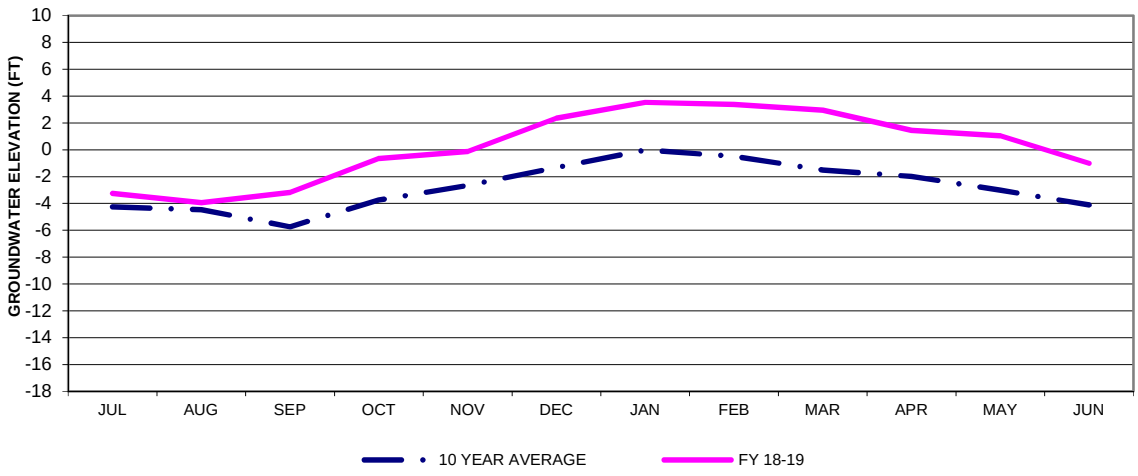


FIGURE 8a I-ZONE WEST OF THE SAN GABRIEL RIVER

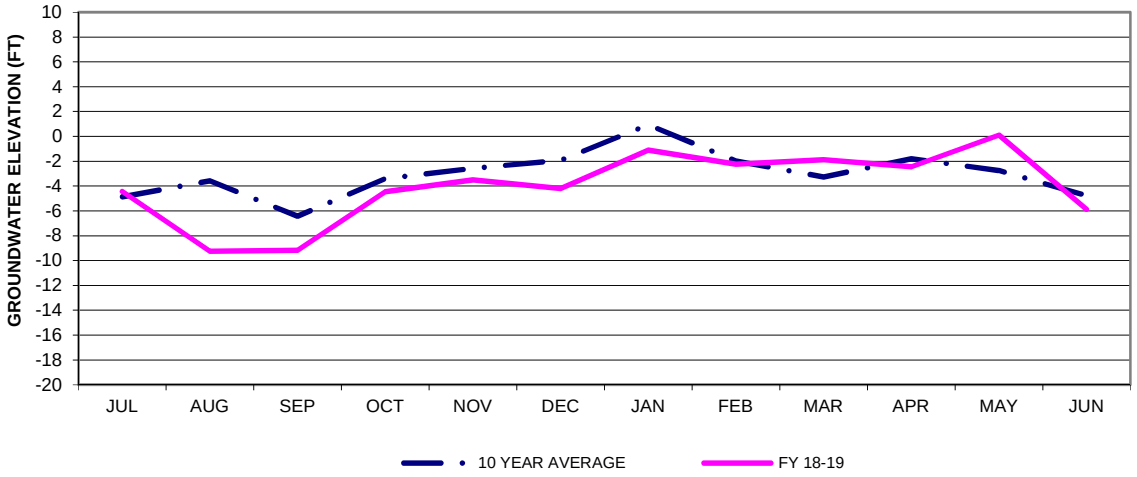
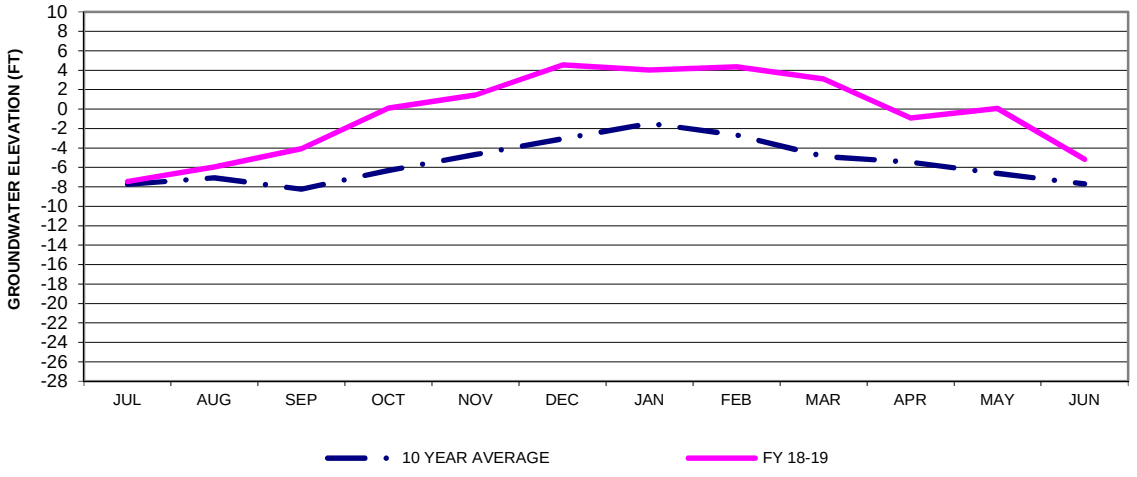


FIGURE 8b I-ZONE EAST OF THE SAN GABRIEL RIVER



Groundwater elevation contours for the R, C, B, A, and I Zones have been prepared from data collected in Spring 2019 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 of the ABP alignment 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. A probable conclusion for lower groundwater elevations west of the San Gabriel River is due to well redevelopment activity during this reporting period. The portion of the ABP in between Los Cerritos Channel and the San Gabriel River had issues with over injecting into aquifers C and B, while under injecting into aquifers A and I, since this section of the ABP has injection wells that are screened across the four aquifers.

Contours of changes in groundwater elevations for the R, C, B, A, and I Zones between Spring 2018 and Spring 2019 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 2018, which was then subtracted from the corresponding and available data from Spring 2019 (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 increases along the north-south alignment related to OCWD's Unit 14 Project. Below is a brief summary and discussion of each aquifer zone:

- <u>R Zone:</u>
    - Groundwater elevations along the ABP remained between 2 and 3 feet above sea level.
    - Compared to last, groundwater elevations generally increased about 1 to 2 feet west of the San Gabriel River and increased 2 to 4 feet east of the San

Gabriel River.

- C Zone:
    - Groundwater elevations along the western alignment were between 1 and 6 feet above sea level, with localized increases greater than 6 feet at observation wells 33XY and 33YZ. East of the San Gabriel River groundwater elevations were observed to be between 4 and 7 feet.
    - Compared to last year, groundwater elevations decreased between the Los Cerritos Channel and San Gabriel River by 1.5 to 3 feet. East of the San Gabriel River, groundwater levels increased 2 to 7 feet, primarily due to the additional injection wells added during OCWD's ABP Unit 14 Project.

- B Zone:
    - Groundwater elevations generally were between 2 and 4 feet above sea level along the entire ABP. Elevations greater than 4 feet occurred near the San Gabriel River and along the north-south alignment of the ABP.
    - Compared to last year, groundwater levels decreased from 2 to 4 feet west of the San Gabriel River. East of the San Gabriel, increases were observed to be generally between 2 to 4 feet, with a localized increase of greater than 6 feet at 34LS.

- A Zone:
    - Groundwater elevations between 1 foot and 4 feet above sea level occurred west of the Los Cerritos Channel. Groundwater elevations greater than 4 feet occurred between Los Cerritos Channel and observation well 34VZ.
    - Compared to last year, groundwater elevations generally decreased 1 to 2 feet along the western portion of the ABP. The north-south alignment was observed to have increases of 2 to 4 feet, with elevations greater than 4 feet occurring in between 34LS and 34Z2.

- I Zone:
    - Groundwater elevations were observed to be between 1 to 4 feet above sea level for the entire ABP with the exception of the area near the Unit 14 project, where elevations were greater than 4 feet.
    - Compared to last year, groundwater elevations west of the San Gabriel River generally increased 2 to 3 feet. Groundwater levels significantly increased between injection wells 34J and 34Z2, which had elevations greater than 4 feet.

Graphs showing the average, maximum, and minimum groundwater elevations at each internodal observation well throughout FY 2018-19 are included in Appendix A-13 through A-16. As shown in the graphs, the average groundwater elevation was below the protective elevation at many wells along the ABP during FY 2018-19, except for wells along the western portion of the Barrier for zones C and B. A comparison of FY 2018-19 graphs with FY 2017-18 graphs indicate that average elevations generally increased slightly in all zones along the western portion and increased significantly along the eastern portion of the Barrier.

CHLORIDES

Figures 9a through 13b (pp. 25-29) 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 2018-19. 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 18-19) is shown with respect to the freshwater condition (250 mg/L).

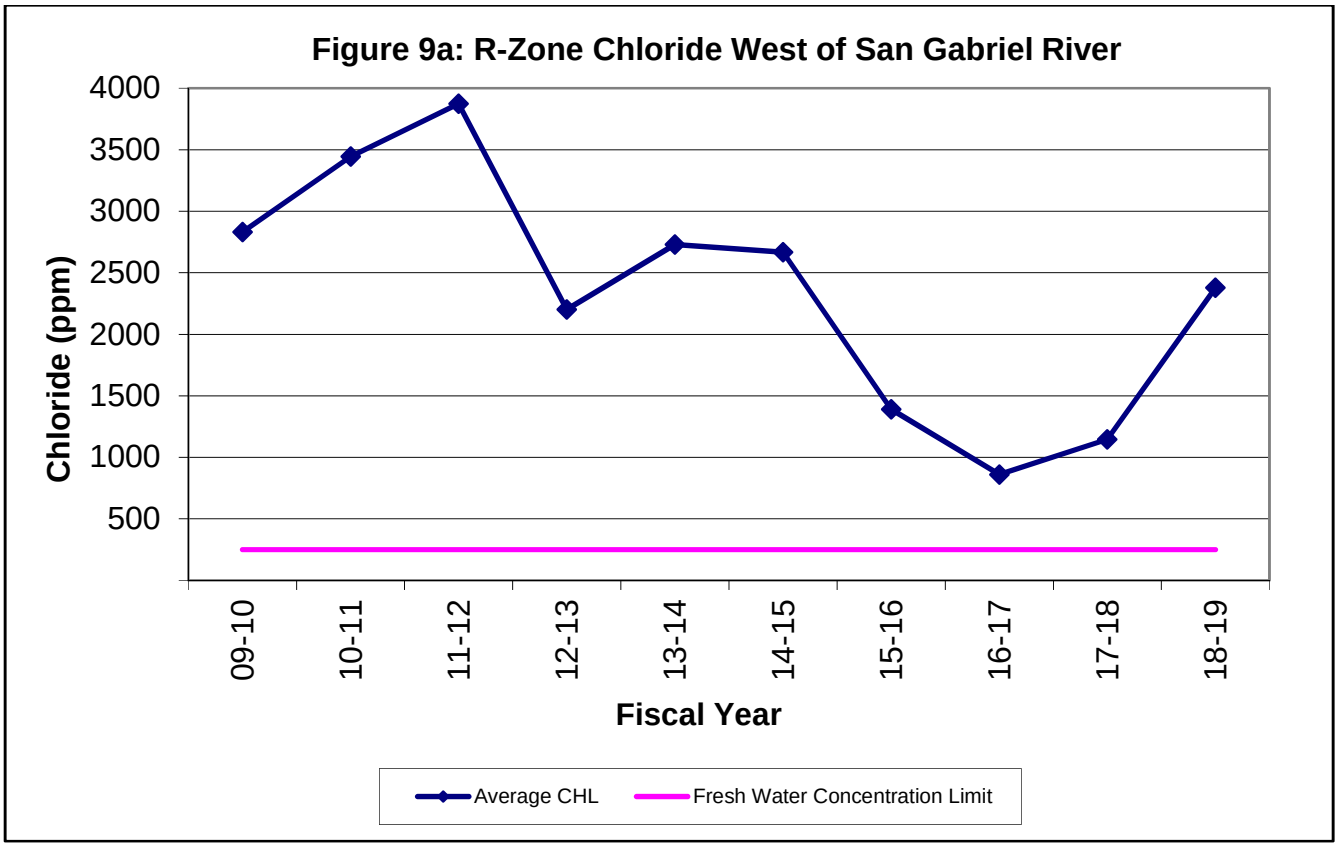


Figure 9a: R-Zone Chloride West of San Gabriel River
Chloride (ppm)
4000
3500
3000
2500
2000
1500
1000
500
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
Fiscal Year
Average CHL
Fresh Water Concentration Limit

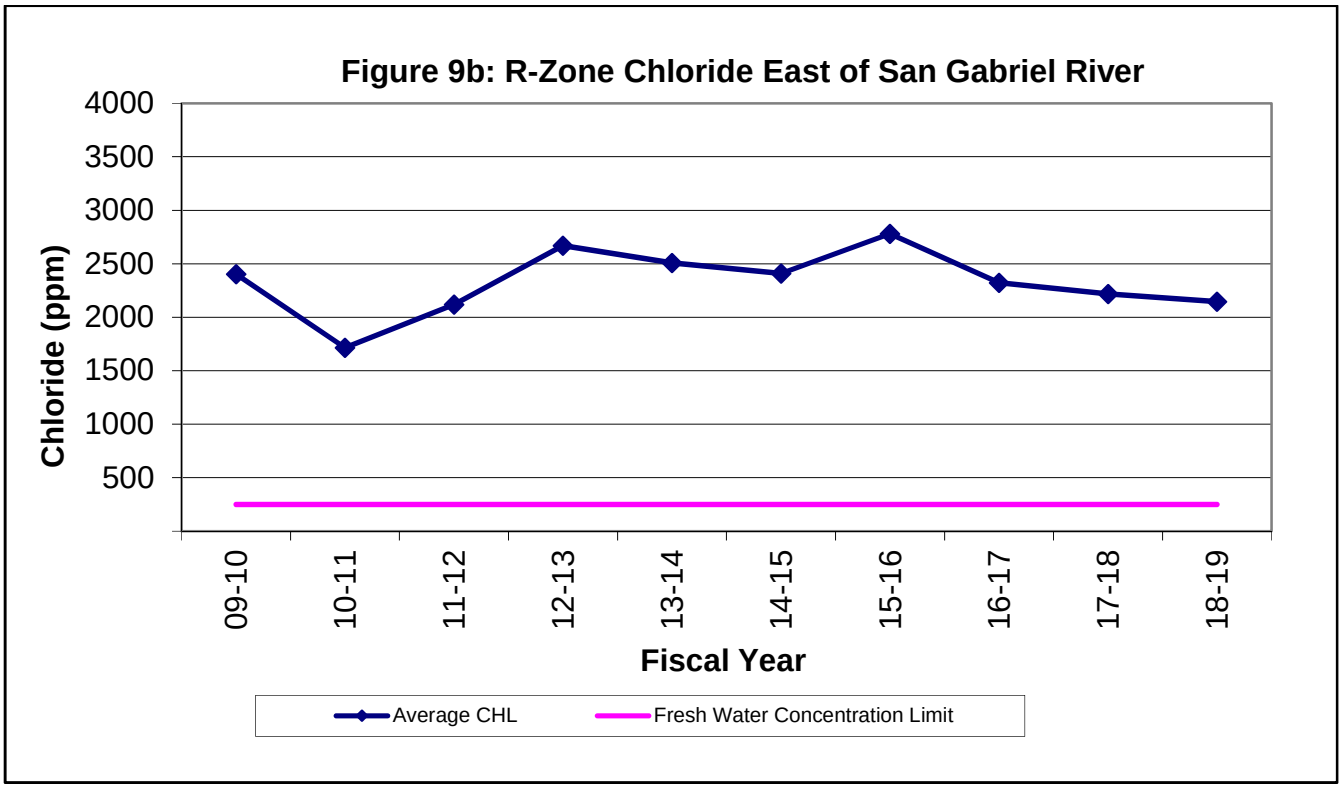


Figure 9b: R-Zone Chloride East of San Gabriel River
Chloride (ppm)
4000
3500
3000
2500
2000
1500
1000
500
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
Fiscal Year
Average CHL
Fresh Water Concentration Limit

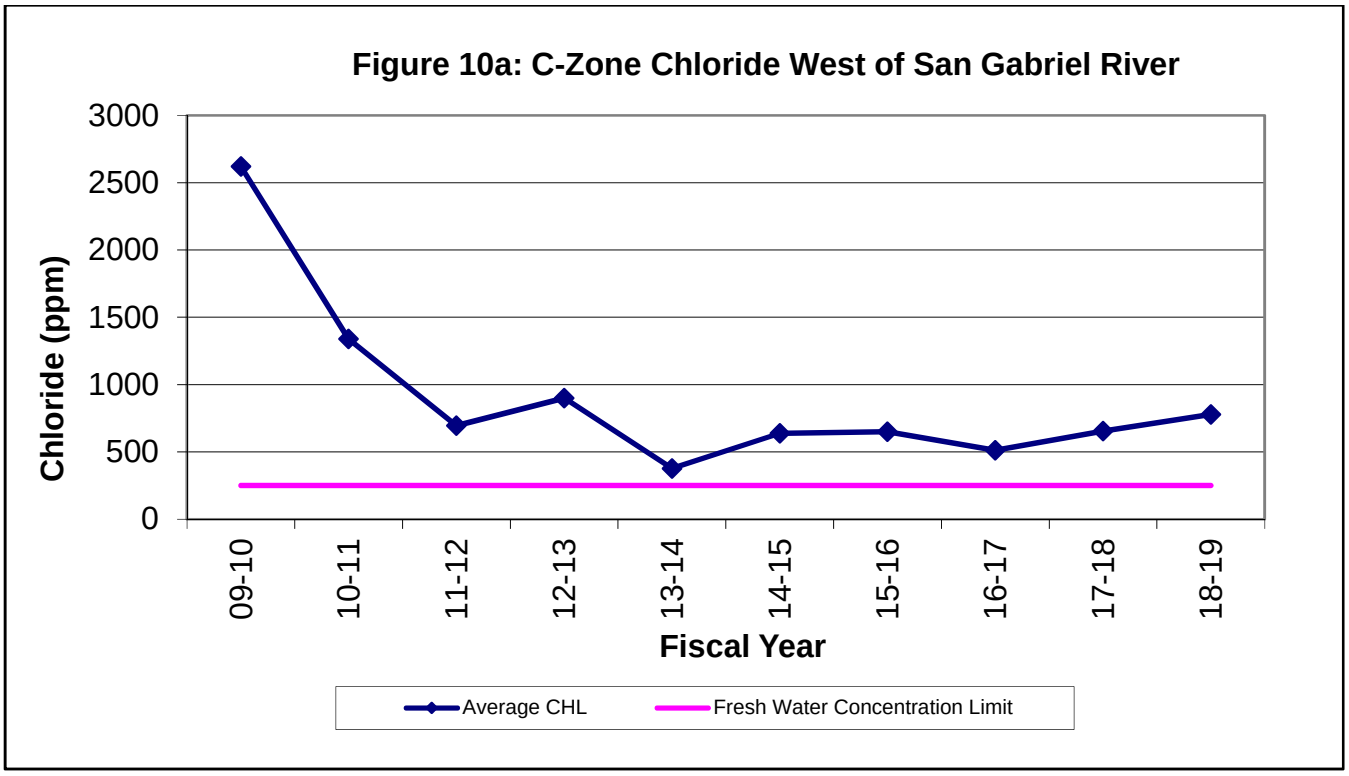


Figure 10a: C-Zone Chloride West of San Gabriel River
Chloride (ppm)
3000
2500
2000
1500
1000
500
0
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
Fiscal Year
Average CHL
Fresh Water Concentration Limit

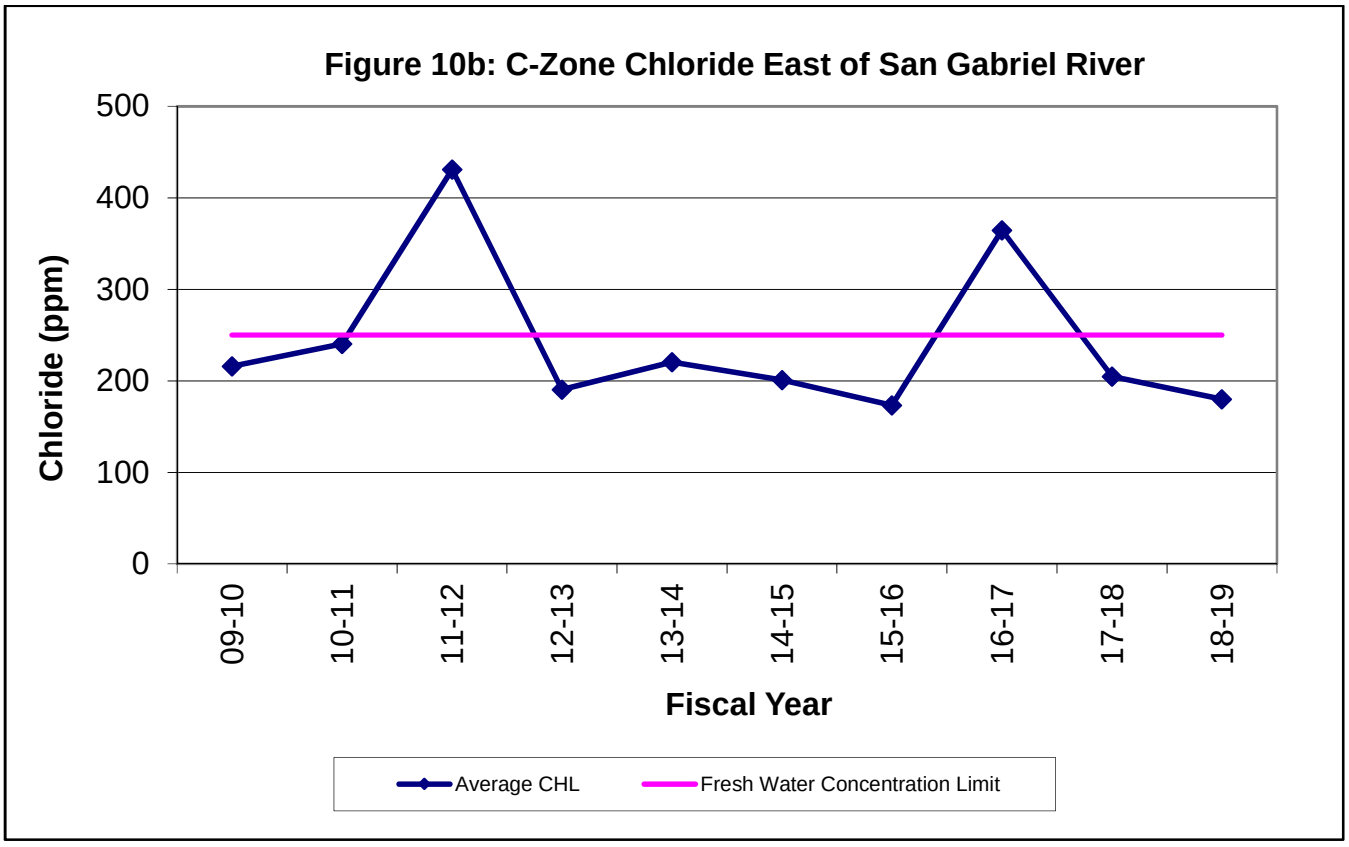


Figure 10b: C-Zone Chloride East of San Gabriel River
Chloride (ppm)
500
400
300
200
100
0
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
Fiscal Year
Average CHL
Fresh Water Concentration Limit

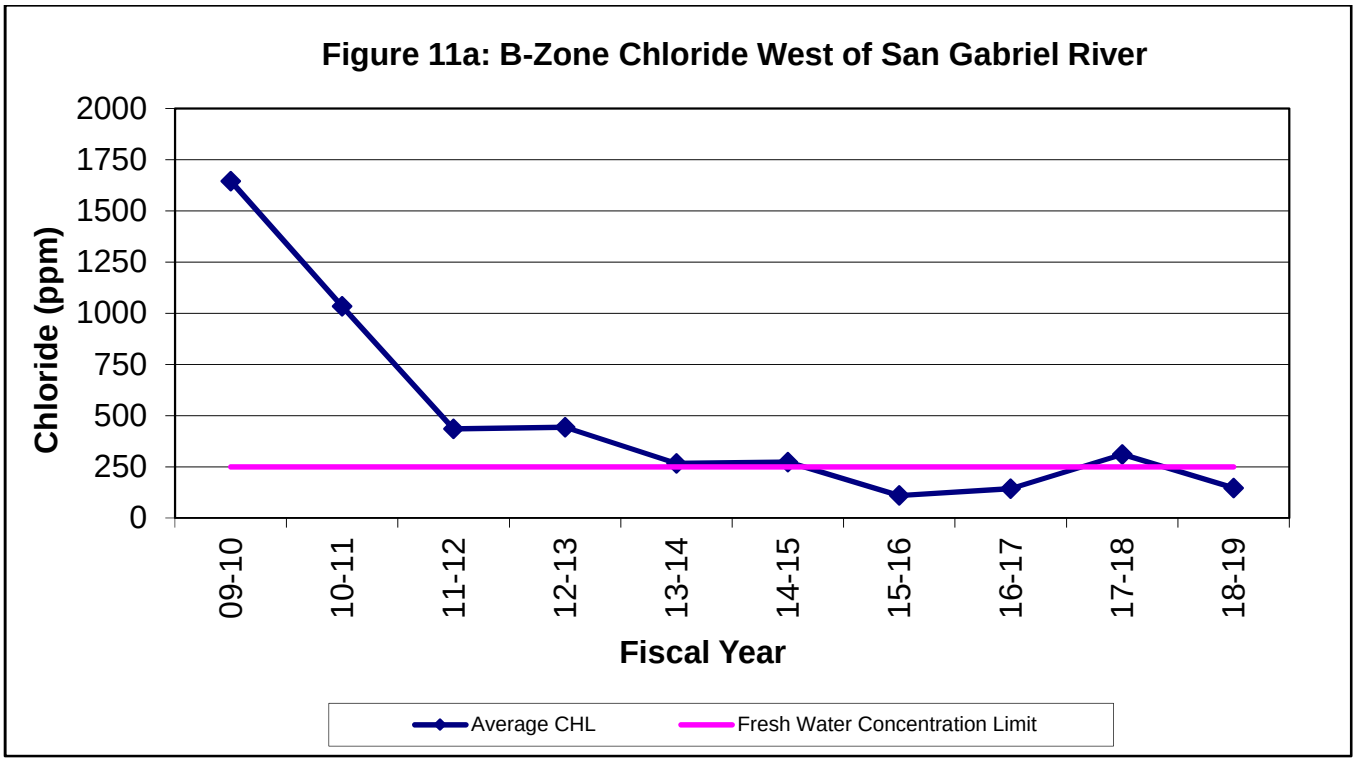


Figure 11a: B-Zone Chloride West of San Gabriel River
Chloride (ppm)
2000
1750
1500
1250
1000
750
500
250
0
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
Fiscal Year
Average CHL
Fresh Water Concentration Limit

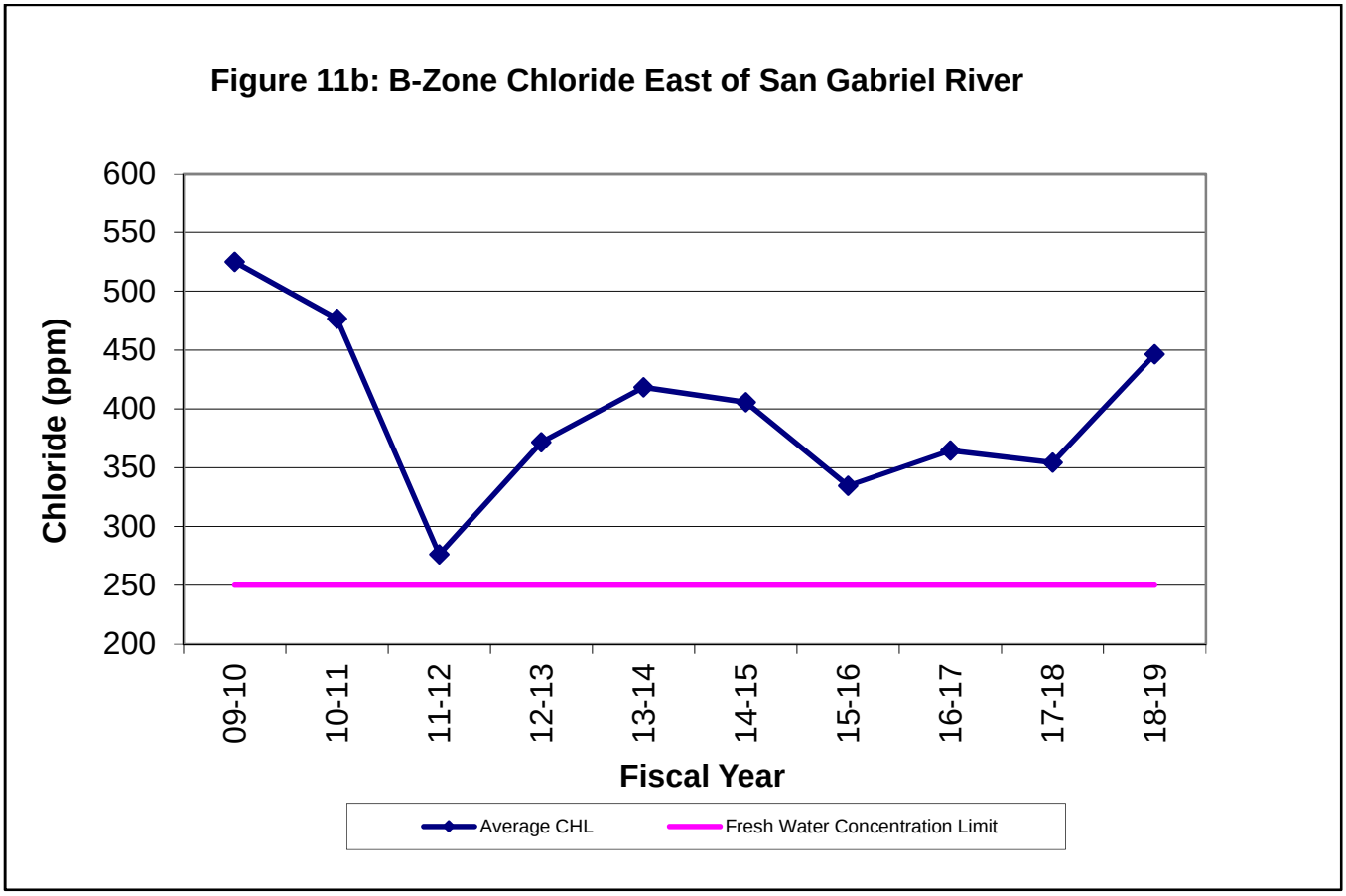


Figure 11b: B-Zone Chloride East of San Gabriel River
Chloride (ppm)
600
550
500
450
400
350
300
250
200
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
Fiscal Year
Average CHL
Fresh Water Concentration Limit

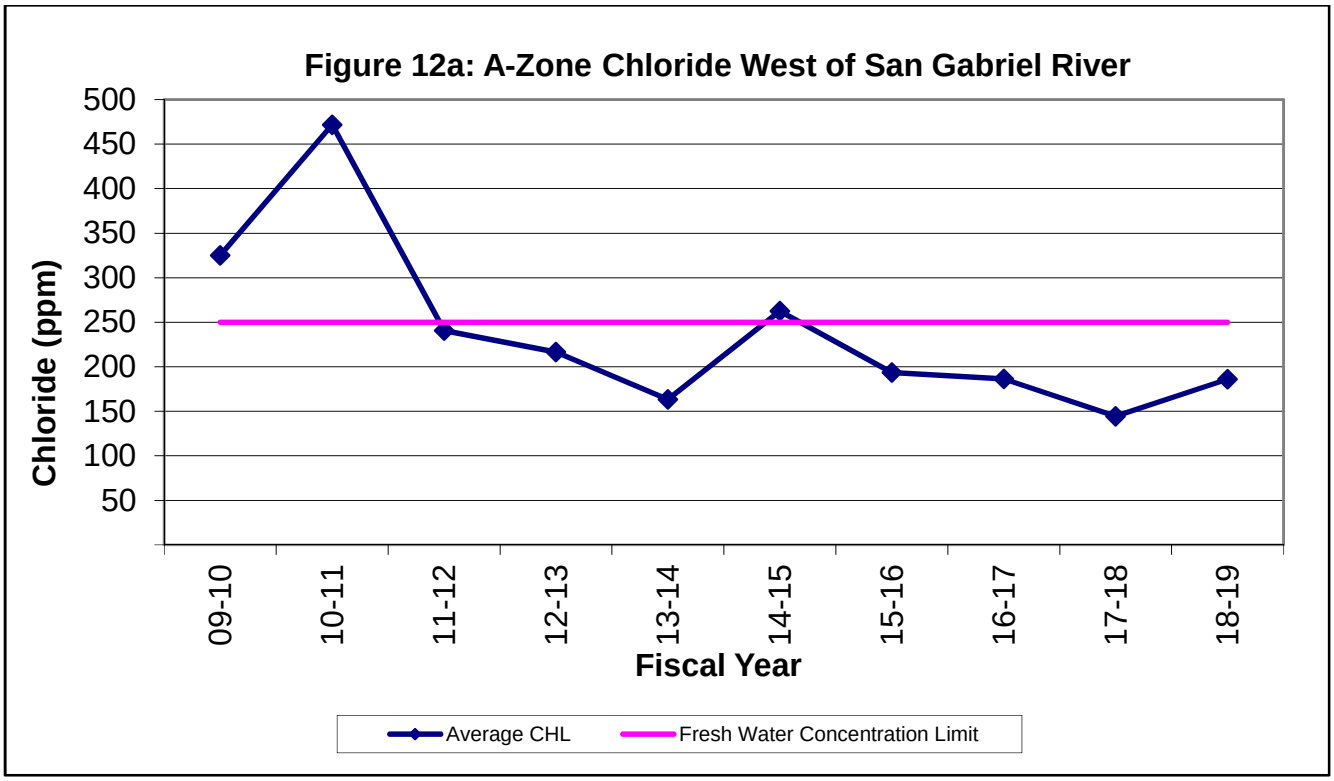


Figure 12a: A-Zone Chloride West of San Gabriel River
Chloride (ppm)
500
450
400
350
300
250
200
150
100
50
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
Fiscal Year
Average CHL
Fresh Water Concentration Limit

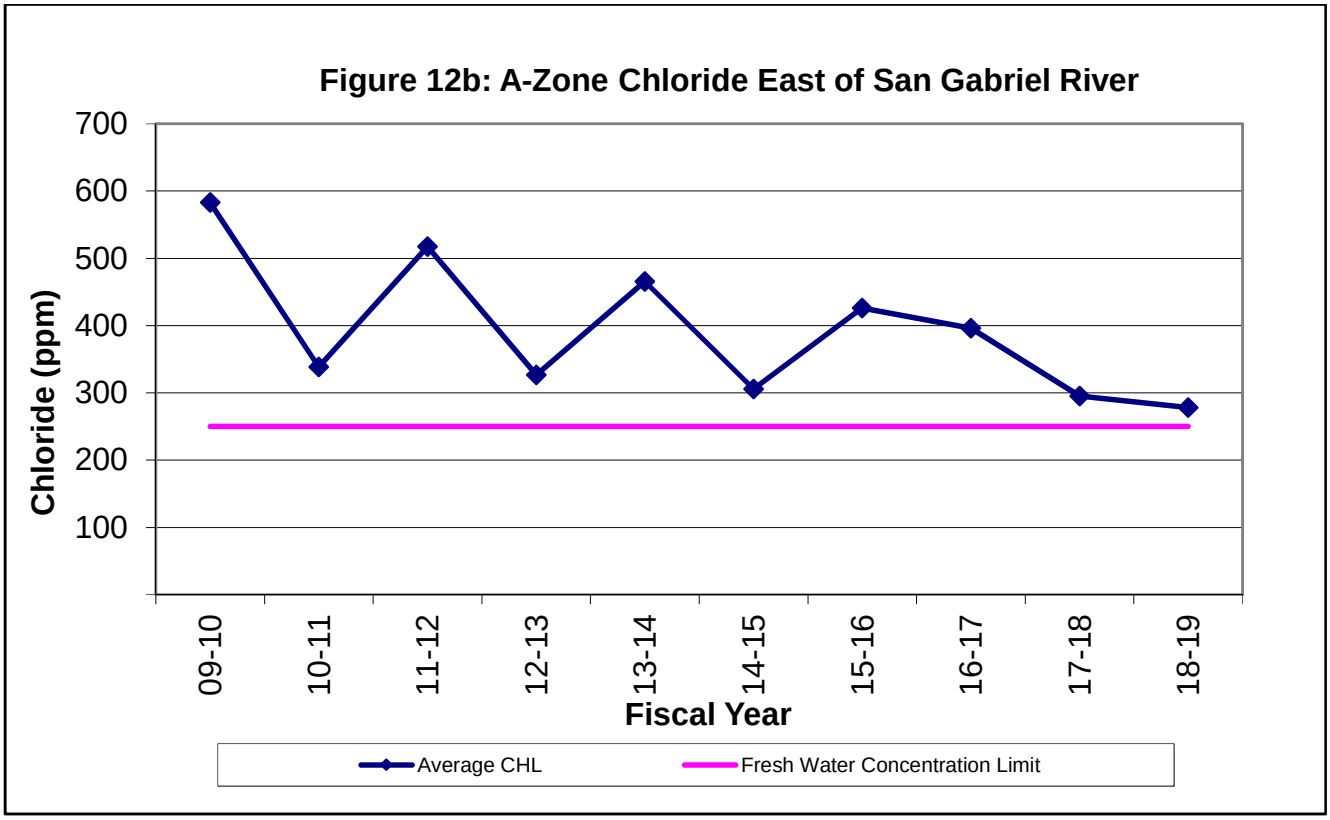


Figure 12b: A-Zone Chloride East of San Gabriel River
Chloride (ppm)
700
600
500
400
300
200
100
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
Fiscal Year
Average CHL
Fresh Water Concentration Limit

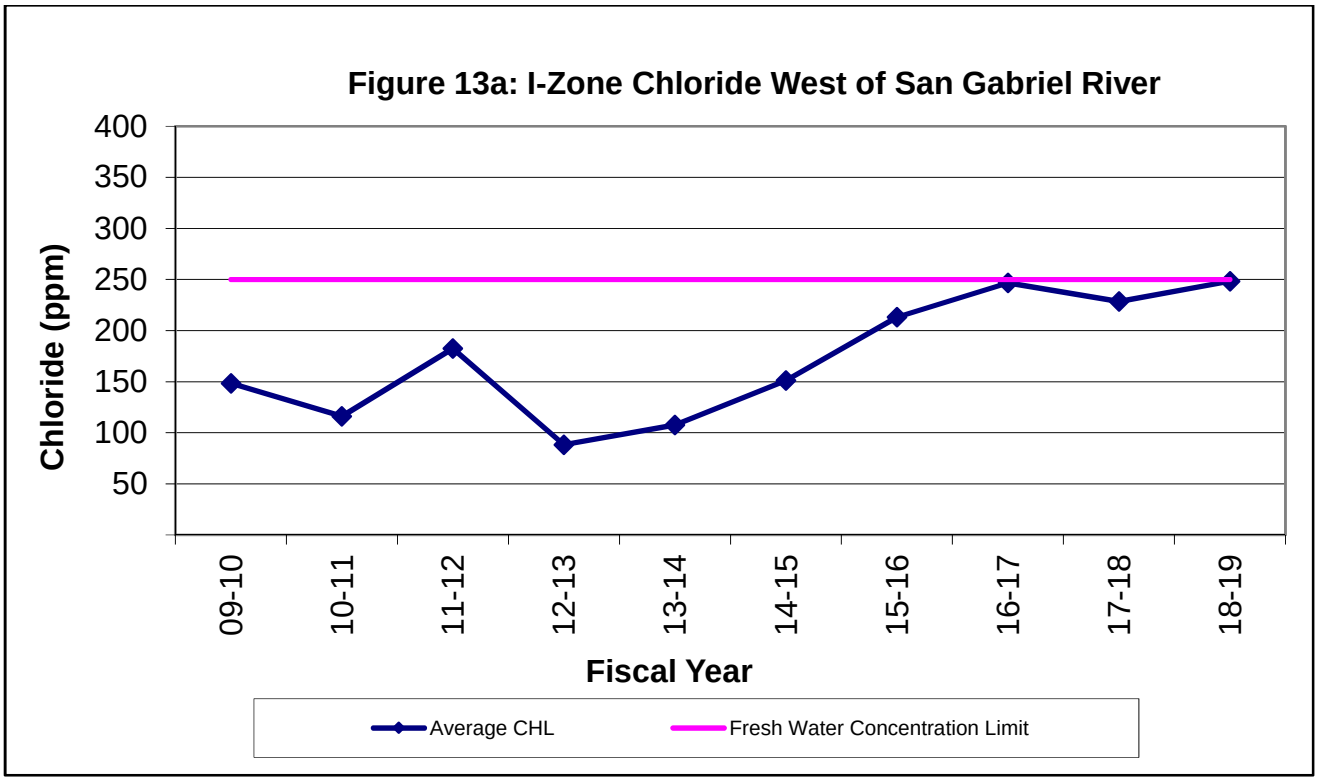


Figure 13a: I-Zone Chloride West of San Gabriel River
Chloride (ppm)
400
350
300
250
200
150
100
50
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
Fiscal Year
Average CHL
Fresh Water Concentration Limit

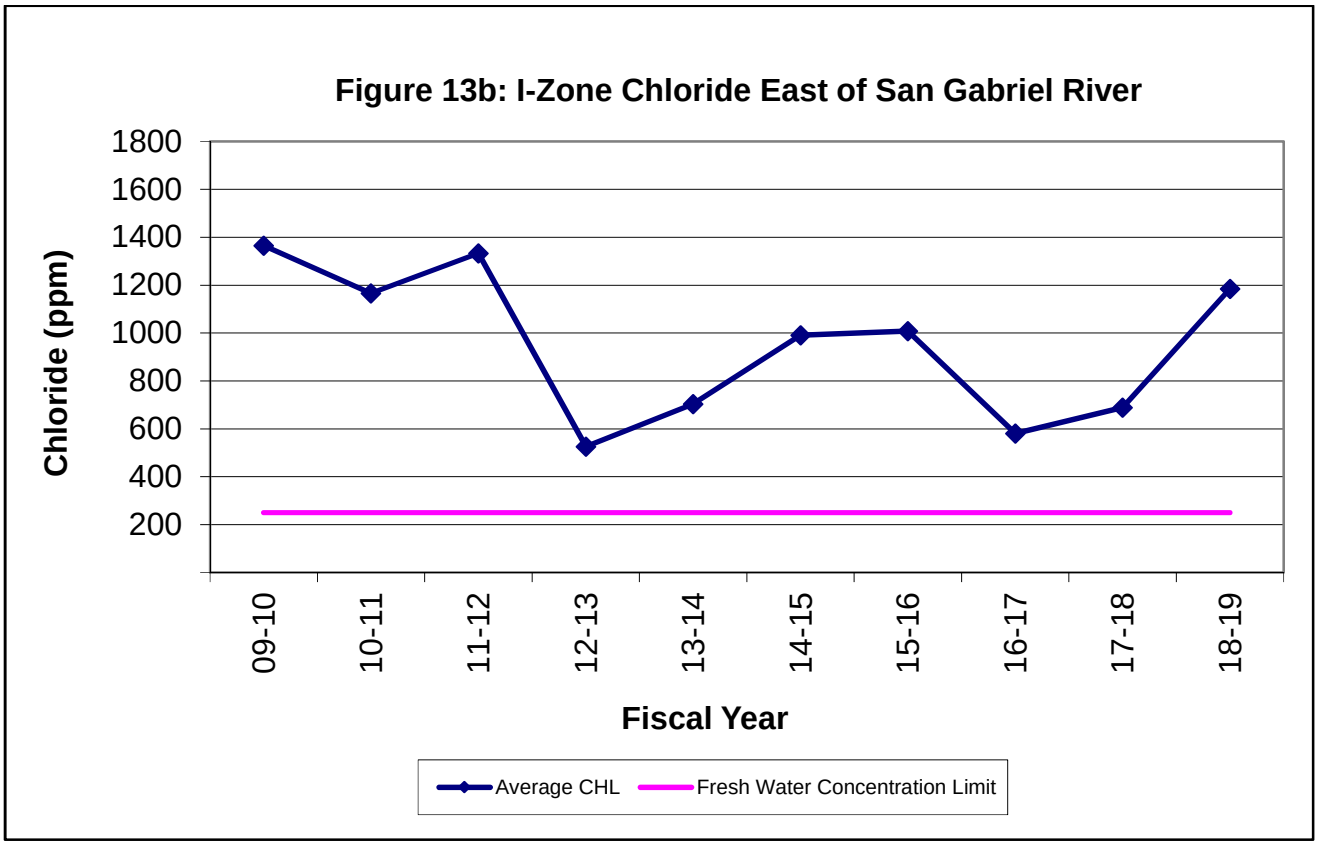


Figure 13b: I-Zone Chloride East of San Gabriel River
Chloride (ppm)
1800
1600
1400
1200
1000
800
600
400
200
09-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
18-19
Fiscal Year
Average CHL
Fresh Water Concentration Limit

West of the San Gabriel River, FY 2018-19 average maximum chloride concentrations increased in the R, C, A, and I Zones. R Zone chloride concentrations increased by more than 1230 mg/L, while increasing only slightly in the Zones C, A, and I. Average maximum chloride concentrations decreased slightly in Zone B.

East of the San Gabriel River, FY 2018-19 average maximum chloride concentrations increased in the B and I Zones. I Zone chloride concentrations increased by more than 450 mg/L. Average chloride concentrations decreased slightly in the zones R, C, and A, east of the San Gabriel River (less than 50 mg/L).

Chloride concentration contour maps for the R, C, B, A, and I Zones have been prepared from data collected in the Spring of 2019 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. 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 May 2019 and the annual event from February through March 2019.

Contours of **changes** in chloride concentration for the R, C, B, A, and I Zones between Spring 2018 and Spring 2019 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 2019 which is compared to data collected for Spring 2018. The Spring 2018 data is then subtracted from data collected in Spring 2019. These contours very clearly identify areas where chloride concentrations increased and decreased between these two reporting periods.

The current contours and the corresponding chloride concentration cross-section (A-11) for this reporting period indicate that the ABP continued to prevent seawater intrusion

west of the San Gabriel River. East of the San Gabriel River, several areas recorded elevated chloride concentrations indicating potential seawater intrusion. Additional areas of high chloride concentrations and/or notable changes in concentration (since the FY 2017-18 report) are as follows:

- R Zone:
    - Chloride concentrations remained elevated landward and seaward of the ABP.
    - In the vicinity of 34S0.1, chloride concentrations decreased over 1000 mg/L. Chloride levels west of the San Gabriel River remained relativity unchanged, with the exception of 33Z'1, which increased over 1000 mg/L.

- C Zone:
    - Chloride concentrations along the ABP remained at or just below 250 mg/L, except for 34T0.1, which had a chloride concentration greater than 500 mg/L.
    - Compared to the last reporting period, this zone had slight increases of chloride concentrations along the north-south portion of the alignment between wells 34JL and 34T0.1.

- B Zone:
    - Chloride concentrations within this zone remained below 250 mg/L along the entire ABP alignment, with the exception of 34JL, which had chloride concentrations greater than 2,000 mg/L.
    - West of the San Gabriel River, chloride concentrations along the ABP alignment slightly decreased compared to last year. East of the San Gabriel River, chloride concentrations slightly increased, with the exception of 34JL, which had a significant increase of greater than 1,500 mg/L compared to the last year.

- A Zone:
    - West of the San Gabriel River, chloride concentrations were below 250 mg/L and east of the San Gabriel River chlorides remained below 250 mg/L, with the exception of 34JL and 34Y0.1, which had concentrations greater than 500 mg/L and 1000 mg/L, respectively.
    - Chloride concentrations remain generally unchanged from FY 17-18, with a few areas of slight increases and decreases along the ABP. One exception was west of the ABP, where chloride concentrations at 32X11 increased significantly.

- I Zone:
    - Chloride concentrations remained consistent along much of the ABP since the last reporting period. Chloride concentrations remained persistent at 34LS and 34Y0.1 landward of the ABP.
    - East of the San Gabriel River, chloride concentrations decreased by 500 mg/L and south of 34LS, the chlorides at the internodal wells increased by at least 500 mg/L.

There continues to be three possible causes of the high chloride concentrations in all zones north of and northwest of the ABP, with the exception of the A Zone. These include the remaining seawater from previous intrusions, suspected 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 new observation wells constructed by LACPW in the 2012-13 reporting period. Elevated chlorides remain landward of the north-south alignment in the B, A, and I Zones due to previous saltwater intrusions prior to OCWD's Unit 14 project. The Unit 14 Project aims to raise groundwater levels above the protective elevation to prevent seawater intrusion.

BARRIER PROJECT COSTS

This section of the report is divided into four parts: Water Costs, Services and Supplies Costs (operation and maintenance), Fixed Assets Costs (capital outlay), and Budget. Under the terms of the 1964 Cooperative Agreement between LACFCD and OCWD, fixed assets are typically divided into facilities paid for by the LACFCD, facilities paid for by the OCWD, and joint facilities paid for by both agencies, depending on their location. Under the same agreement, water costs are divided between the LACFCD (whose portion is paid by the WRD per a separate agreement) and the OCWD. The total cost of the ABP in FY 2018-19 (not including liability insurance) was $8,546,454 which can be broken down as follows: water costs of $6,251,368, Operation and Maintenance costs of $2,295,086.

WATER COSTS

During FY 2018-19, 5,295.2 AF of water was injected at an estimated total cost of $6,251,368, as shown in Table 2. The monthly unit water cost (dollars per AF) from July 2018 to June 2019 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 3.

TABLE 2. QUANTITY OF WATER INJECTED AND COSTS

MONTH	AMT BY WRD (AF)	AMT BY OCWD (AF)	TOTAL AMT (AF)
Jul-18	307.3	88.7	396.0
Aug-18	280.5	138.4	418.9
Sep-18	297.2	189.9	487.1
Oct-18	336.7	201.3	538.0
Nov-18	303.5	195.2	498.7
Dec-18	300.2	220.7	520.9
Jan-19	257.9	216.4	474.3
Feb-19	214.1	161.9	376.0
Mar-19	265.5	177.8	443.3
Apr-19	239.7	140.1	379.8
May-19	276.9	146.0	422.9
Jun-19	207.2	132.1	339.3
TOTAL INJECTED	**3,286.7**	**2,008.5**	**5,295.2**
TOTAL COST [From Tbl. 1]	**$3,878,424**	**$2,372,944**	**$6,251,368**

OPERATIONS AND MAINTENANCE COSTS

A total of $2,295,085 was spent on Operations and Maintenance during FY 2018-19. 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 2018-19 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)	$1,463,410	$830,119	$2,293,529[1]
Service & Supplies of Extraction Facilities	$1,556	$0	$1,556[2]
Right of Way Acquisition	$0	$0	$0
SUBTOTAL	**$1,464,966**	**$830,119**	**$2,295,085**
Liability Insurance	$32,162	$32,162	$64,324
TOTAL	**$1,497,128**	**$862,281**	**$2,359,409**

The values in Table 3 come from the ABP FY 2018-19 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[1]

Fiscal Year	Volume of Water Injected (Ac-Ft)	Total Cost	Cost Per Ac-Ft Injected
2009-10	5,629.2	$3,135,608	$557.03
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	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

[1]The 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
2009-10	0.0	$20,223	N/A
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

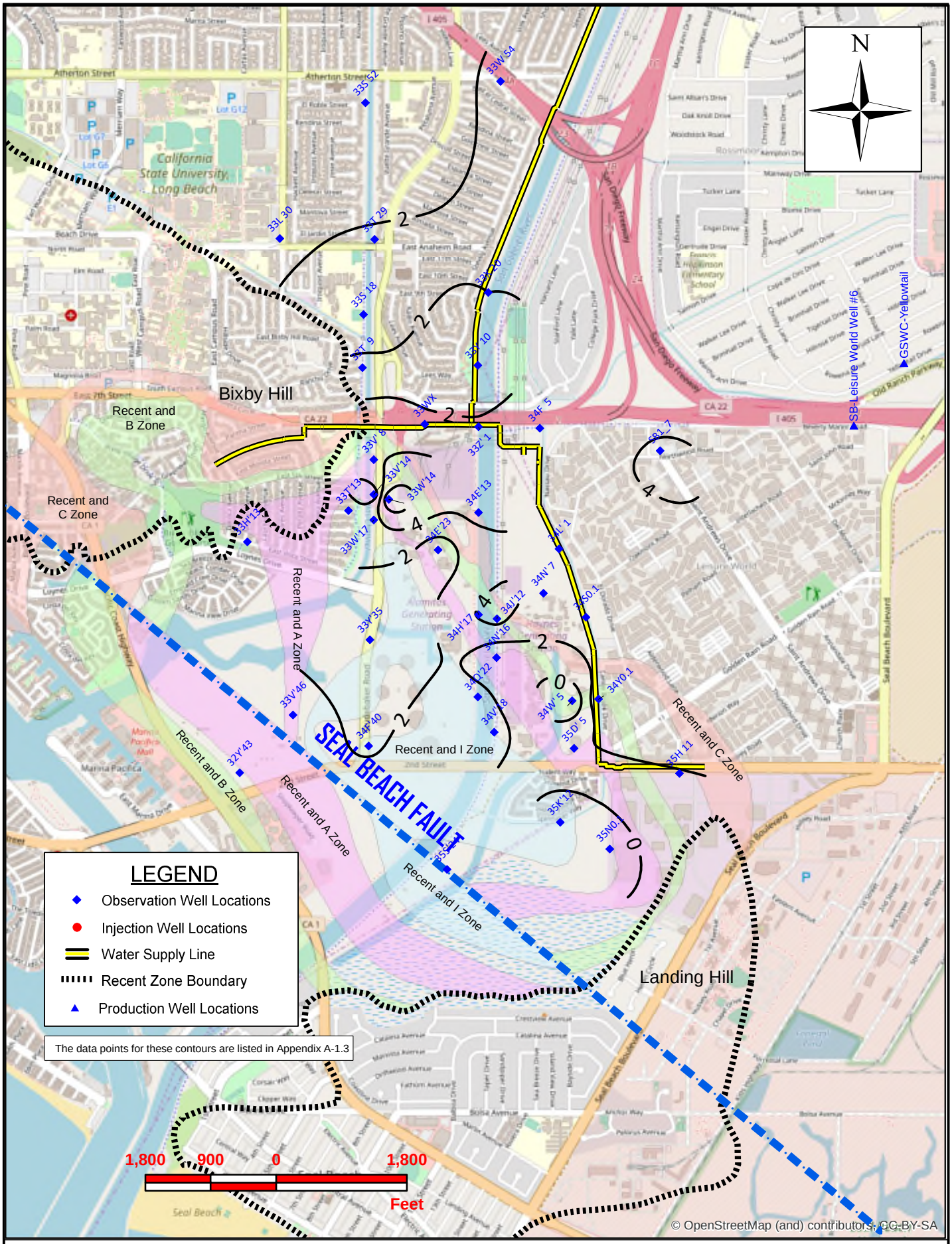
FIXED ASSETS

During FY 2018-19, OCWD commissioned Injection wells 34J2(C,B), 34K(C,B), 34N(C,B), 34N(A), 34N(I), 34Q(C,B), 34Q(A), 34Q(I), 34T(C,B), 34T(A), 34T(I), 34X(B), 34X(A), 34X(I), 34Z2(A), 34Z2(I), and 35E(A,I). In addition, each of the new injection and observation wells were integrated into LACFCD's existing Seawater ABP Telemetry System.

BUDGET

The FY 2020-21 budget for the cost of ABP Supplies and Services is $2,685,000. A breakdown of this amount, along with past expenditures per category, is shown in Appendix A-20.

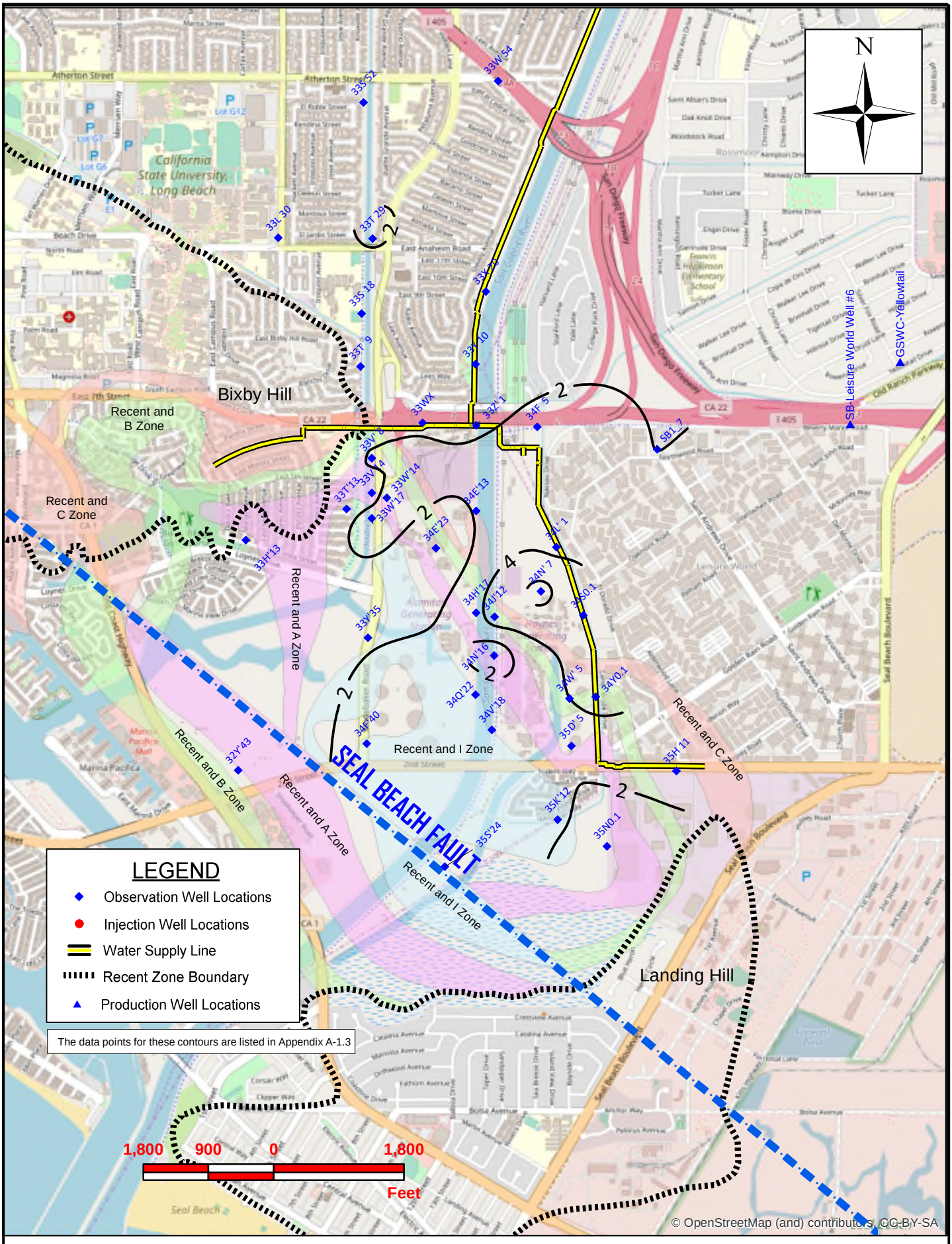
APPENDIX



Alamitos Barrier Project
R Zone Groundwater Elevation (ft) Contours, Spring 2019

A-1.1

R Zone GW.srf



Alamitos Barrier Project
R Zone Change in Elevation (ft), Spring 2018 to Spring 2019

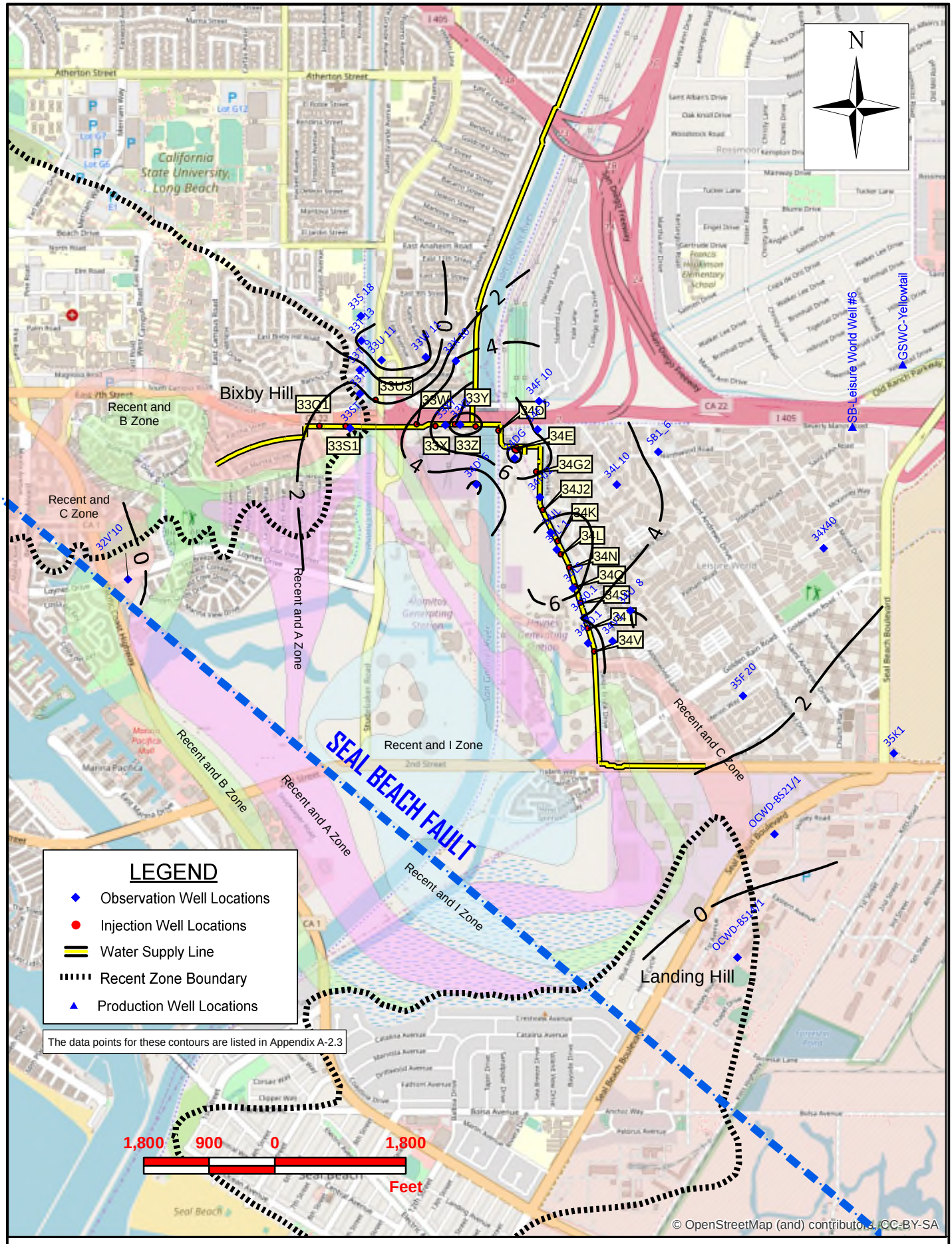
A-1.2

R zone GW.srf

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

POINT	PROJ	FCD	AQUIFER	DATE	FY 18-19 ELEV	P.E.[1]	Δ[2]	FY 17-18 ELEV	CHANGE IN ELEV
1	32Y'43	493WW	RECENT	20190918	1.7			1.1	0.6
2	33H'13	493YY	R,A	20190214	2.3			1.0	1.3
3	33L 30	491G	RECENT	20190221	1.5			-0.2	1.7
4	33S 18	492AH	RECENT	20190307	3.6			2.3	1.3
5	33S 52	491J	RECENT	20190306	0.5			-1.1	1.6
6	33T 9	492CV	RECENT	20190312	1.5			0.5	1.0
7	33T 29	491D	RECENT	20190311	2.2			0.1	2.1
8	33T'13	492AU	RECENT	20190214	2.9			1.5	1.4
9	33V' 8	492BY	R,A	20190305	3.7			1.7	2.0
10	33V'14	492JJ	RECENT	20190304	0.6			0.3	0.3
11	33V'46	493UU	RECENT	20180918	2.8				n/a
12	33W 54	501C	RECENT	20190225	2.3			0.4	1.9
13	33W'14	492AT	RECENT	20190311	8.0			4.5	3.5
14	33W'17	493PP	RECENT	20190304	3.3			0.3	3.0
15	33WX	502AZ	RECENT	20190326	2.4			0.6	1.8
16	33X 20	502L	RECENT	20190214	2.0			0.4	1.6
17	33Y 10	502BA	RECENT	20180925	0.3			0.3	0.0
18	33Y'35	493AB	RECENT	20190226	0.5			-1.4	1.9
19	33Z' 1	502AU	RECENT	20190326	2.3			0.5	1.8
20	34E'13	503AU	RECENT	20190404	4.6			2.5	2.1
21	34E'23	503X	RECENT	20180920	0.5			0.6	-0.1
22	34F 5	502BT	RECENT	20190418	3.7			1.0	2.7
23	34F'40	483J	RECENT	20190226	1.8			-0.7	2.5
24	34H'17	503Y	RECENT	20190304	4.2			0.9	3.3
25	34J'12	503U	RECENT	20190304	4.6			-0.5	5.1
26	34L' 1	503P	RECENT	20190408	3.3			-0.1	3.4
27	34N' 7	503AE	RECENT	20190228	3.8			-3.0	6.8
28	34N'16	503W	RECENT	20180925	0.3			0.1	0.2
29	34Q'22	503T	RECENT	20190305	2.8			-1.2	4.0
30	34S0.1	503BT	RECENT	20190314	3.2			-0.8	4.0
31	34V'18	503V	RECENT	20190307	2.8			0.0	2.8
32	34W' 5	503AH	RECENT	20180920	3.6			-0.4	4.0
33	34Y0.1	503CK	RECENT	20190314	3.6			-1.3	4.9
34	35D' 5	503AL	RECENT	20190226	2.0			0.0	2.0
35	35H 11	514F	RECENT	20190318	1.9			-0.8	2.7
36	35K'12	504R	RECENT	20190226	-1.8			-4.1	2.3
37	35N0.1	504M	RECENT	20190226	-0.6			-1.3	0.7
38	35S'24	504K	RECENT	20190305	4.0			0.7	3.3
39	SB1_7		RECENT	20190415	4.1			2.1	2.0
				AVG=	2.5		AVG=	0.2	

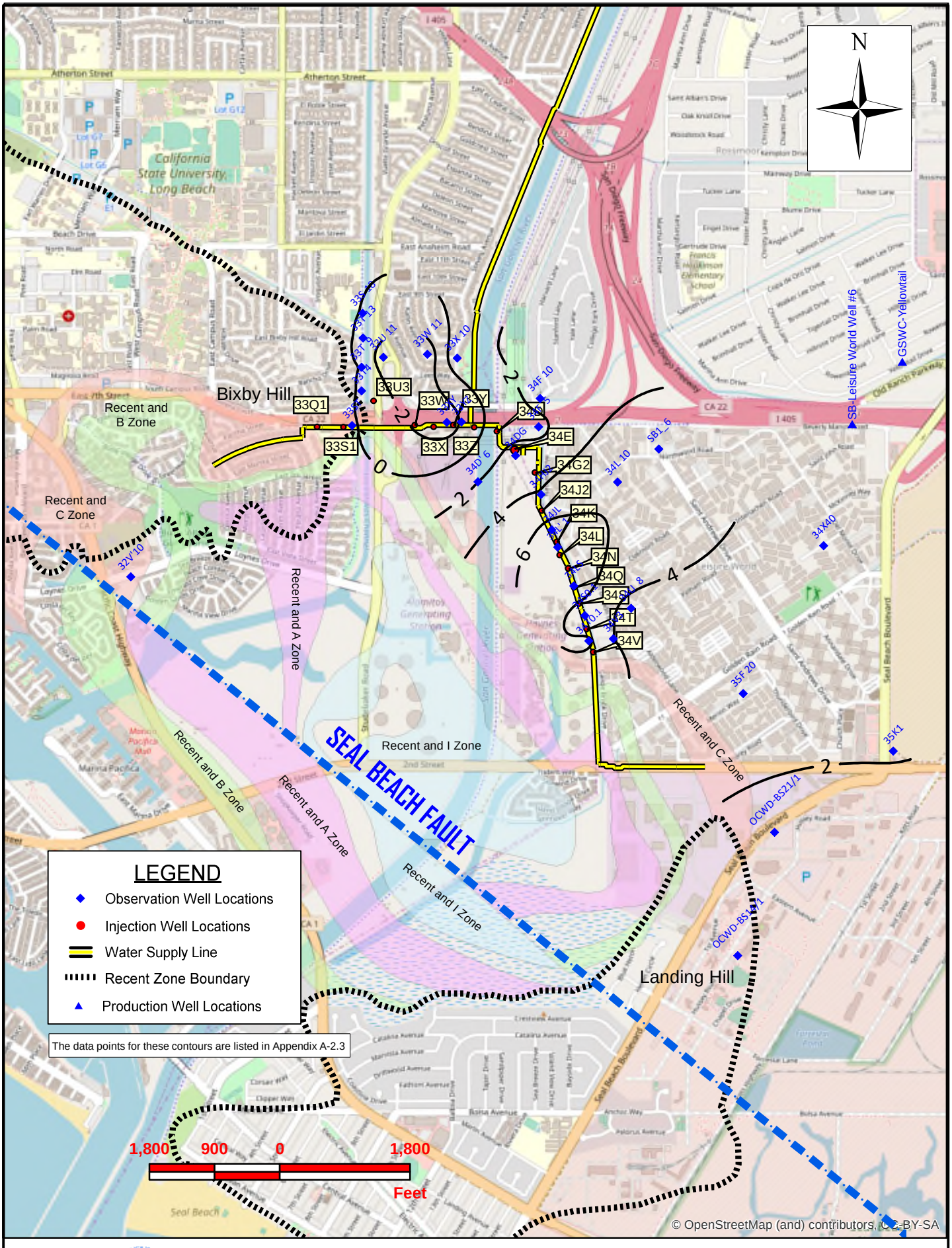
[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.
[ ] = A max. or min. elevation during that period.



Alamitos Barrier Project
C Zone Groundwater Elevation (ft) Contours, Spring 2019

A-2.1

C Zone GW.srf



Alamitos Barrier Project
C Zone Change in Elevation (ft), Spring 2018 to Spring 2019

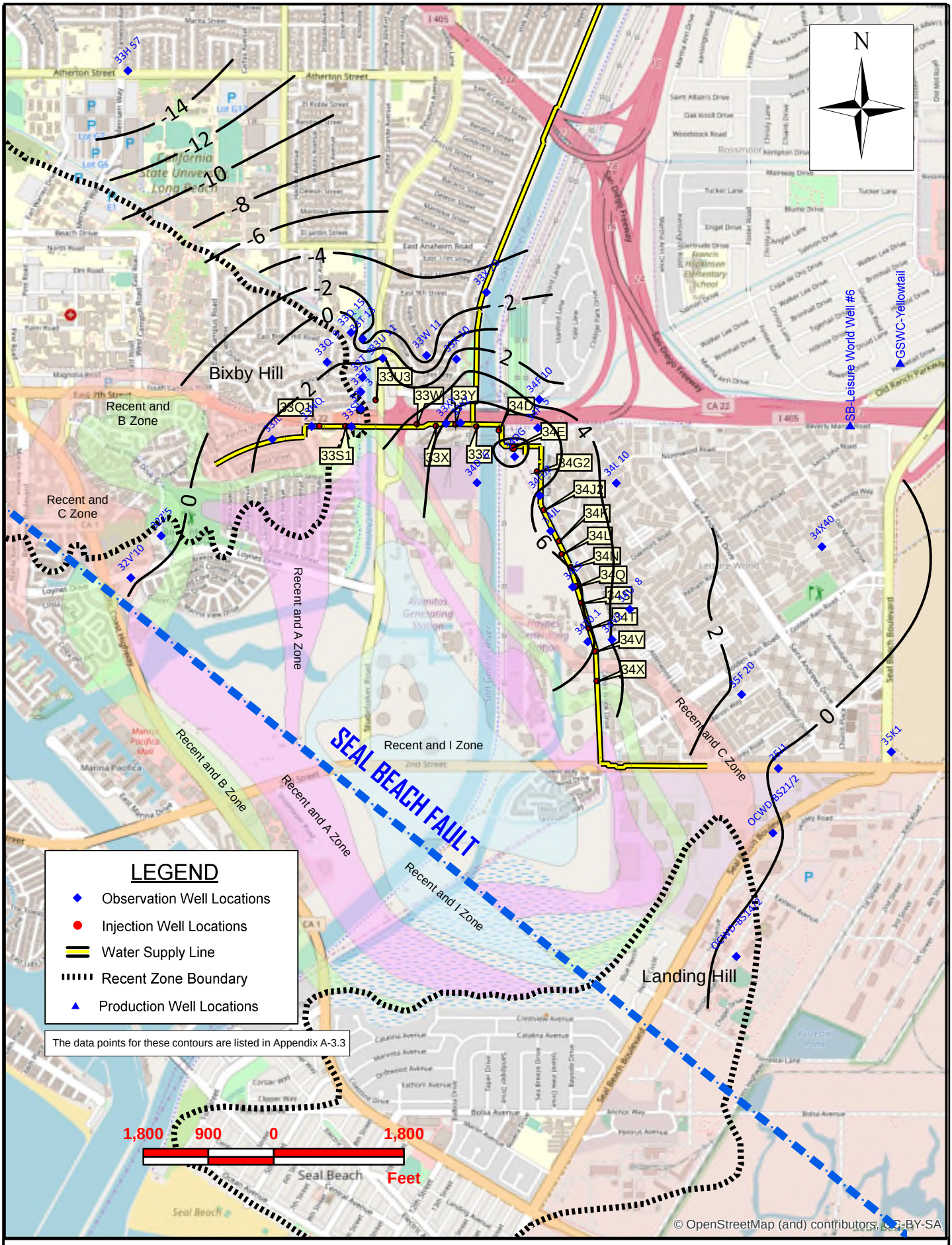
A-2.2

C zone GW.srf

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

POINT	PROJ	FCD	AQUIFER	DATE	FY 18-19 ELEV	P.E.[1]	Δ[2]	FY 17-18 ELEV	CHANGE IN ELEV
1	32V'10	483H	C ZONE	20190211	-0.2			-1.2	1.0
2	33S 18	492AG	C ZONE	20190307	-0.5			-0.4	-0.1
3	33ST	492BK	C,B	20190320	2.5	0.9	1.6	2.3	0.2
4	33T 9	492CU	C ZONE	20190312	1.6			1.7	-0.1
5	33T 13	492AC	C ZONE	20190328	-2.7			-2.3	-0.4
6	33T4	492CT	C ZONE	20190312	2.3			2.5	-0.2
7	33U 11	492AL	C ZONE	20180927	-3.4			-0.2	-3.2
8	33W 11	502R	C ZONE	20180913	-3.0			0.2	-3.2
9	33X 10	502BB	C ZONE	20190305	4.3			2.7	1.6
10	33XY	502BL	C ZONE	20190408	7.8	5.4	2.4	10.9	-3.1
11	33YZ	502AB	C ZONE	20190408	8.9	5.4	3.5	10.6	-1.8
12	34D' 6	502BF	C ZONE	20190305	1.5			-0.5	2.0
13	34DG	502X	C ZONE	20190411	8.6	5.4	3.2	5.7	2.9
14	34F 5	502BU	C ZONE	20190418	5.7			4.4	1.3
15	34F 10	502AP	C ZONE	20190328	5.0			2.2	2.8
16	34HJ2	502CH	C ZONE	20190422	4.5	4.1	0.4	0.4	4.1
17	34JL	503AR	C ZONE	20190314	6.9	4.2	2.7	0.2	6.7
18	34L' 1	503N	C ZONE	20190314	7.2	4.8	2.4	0.4	6.8
19	34L 10	502AK	C ZONE	20190305	5.3			-0.5	5.8
20	34LS	503BF	C ZONE	20190314	6.6	4.5	2.1	-0.9	7.5
21	34S0.1	503BU	C ZONE	20190408	3.9	3.7	0.2	-0.9	4.8
22	34T0.1	503AB	C ZONE	20190408	6.1	3.6	2.5	-0.2	6.3
23	34U 8	513D	C ZONE	20190409	2.0			-1.3	3.3
24	34V3	503CB	C ZONE	20190409	2.5			-1.5	4.0
25	34X40	513R	C ZONE	20190319	2.8			-0.4	3.2
26	35F 20	513L	C ZONE	20190318	2.8			-0.2	3.0
27	35K1	523D	C ZONE	20190314	0.5	4.3	-3.8	-1.6	2.1
28	SB1_6		C ZONE	20190314	3.5			-1.2	4.7
29	OCWD-BS14/1		C ZONE	20190306	-0.9			-1.2	0.3
30	OCWD-BS21/1		C ZONE	20190306	0.6			-0.7	1.3
				AVG=	3.1		AVG=	1.0	

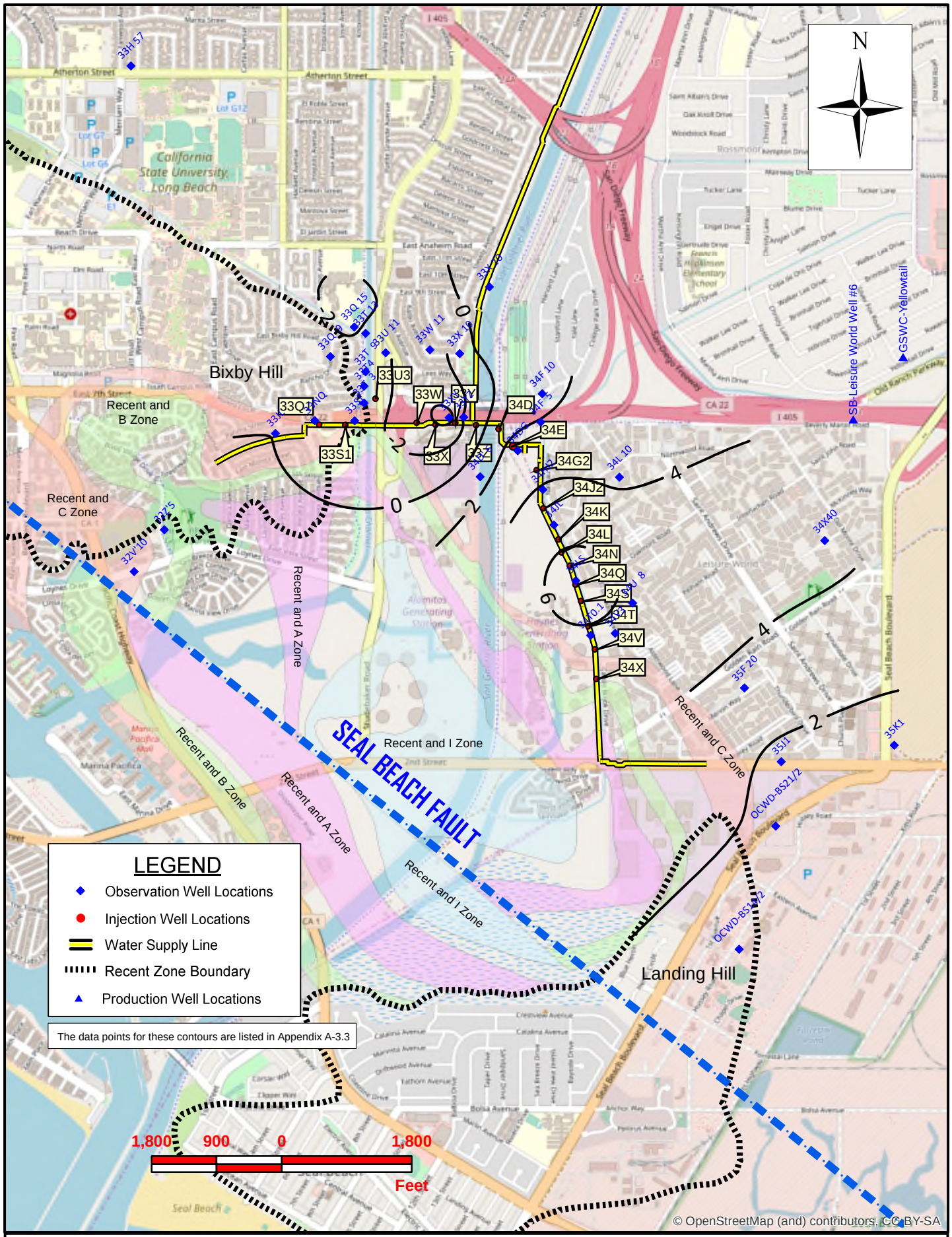
[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.
= A max. or min. elevation during that period.



Alamitos Barrier Project
B Zone Groundwater Elevation (ft) Contours, Spring 2019

A-3.1

B Zone GW.srf



Alamitos Barrier Project
B Zone Change in Elevation (ft), Spring 2018 to Spring 2019

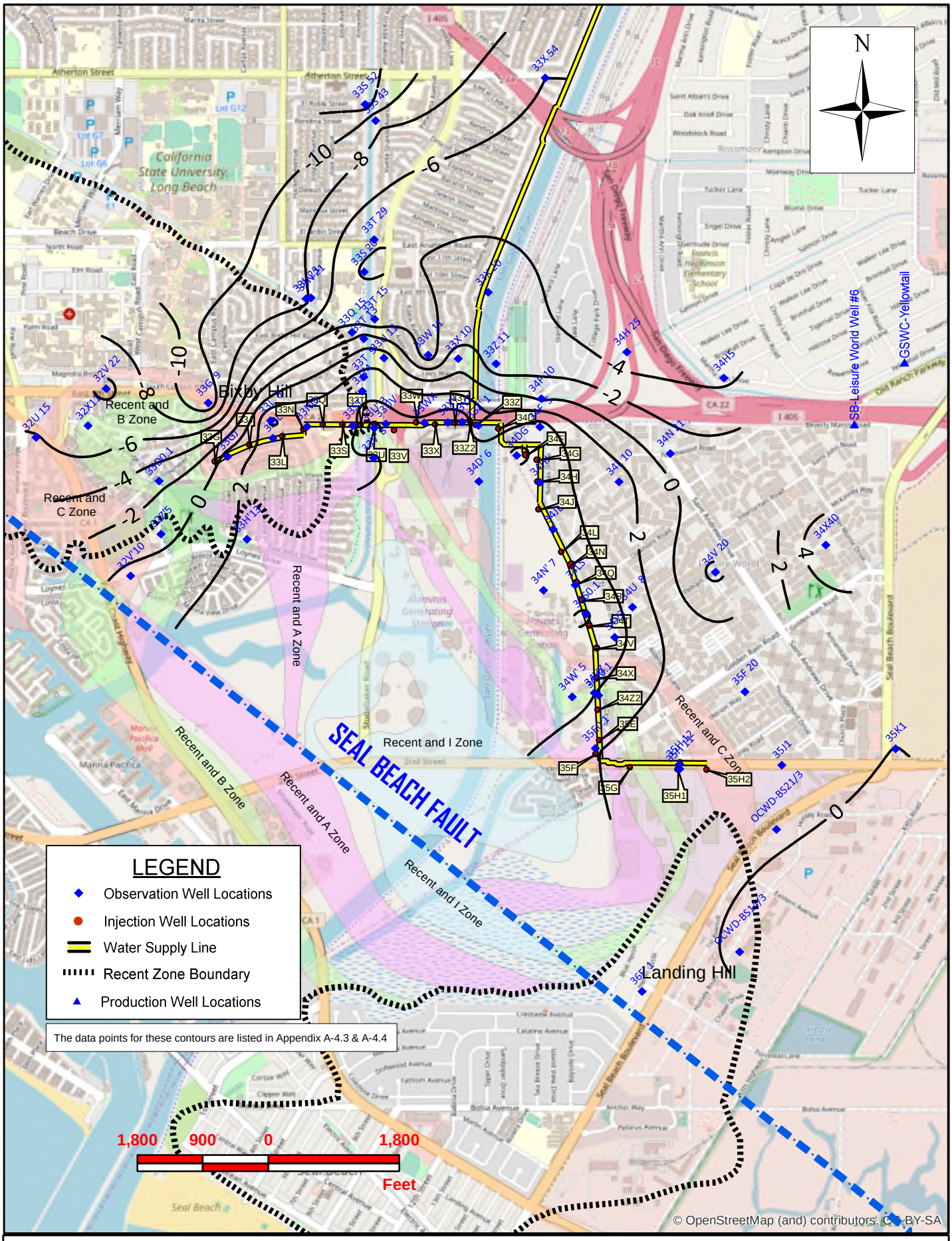
A-3.2

B zone GW.srf

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

POINT	PROJ	FCD	AQUIFER	DATE	FY 18-19 ELEV	P.E.[1]	Δ[2]	FY 17-18 ELEV	CHANGE IN ELEV
1	32V'10	483G	B ZONE	20190211	-0.1			-1.5	1.4
2	32Z'5	482W	B,A	20190211	-0.7			-1.2	0.5
3	33H 57	481	B ZONE	20190319	-17.1			-15.6	-1.5
4	33JL	492BQ	B ZONE	20190327	2.5	0.8	1.7	2.5	0.0
5	33NQ	492BN	B ZONE	20190327	2.7	0.7	2.0	3.0	-0.3
6	33Q 9	492CM	B ZONE	20190404	0.8			1.0	-0.2
7	33Q 15	492AN	B ZONE	20180919	2.0			5.1	-3.1
8	33ST	492BK	C,B	20190314	0.8	0.9	-0.1	2.3	-1.5
9	33T 3	492CL	B ZONE	20190404	1.8			2.4	-0.6
10	33T 9	492YY	B ZONE	20190509	3.6			4.3	-0.7
11	33T 13	492AB	B ZONE	20190328	-3.0			-2.3	-0.7
12	33T4	492CS	B ZONE	20190312	3.2			3.3	-0.1
13	33U 11	492AK	B ZONE	20190328	2.3			4.0	-1.7
14	33W 11	502S	B ZONE	20180913	-3.6			0.2	-3.8
15	33X 10	502BC	B ZONE	20190409	3.4			3.9	-0.5
16	33X 20	502K	B ZONE	20190305	-3.1			-4.7	1.6
17	33XY	502BM	B ZONE	20190328	6.2	6.3	-0.1	10.9	-4.7
18	33YZ	502AC	B ZONE	20190408	7.5	7.1	0.4	9.2	-1.8
19	34D' 6	502BG	B ZONE	20190404	6.8			5.4	1.4
20	34DG	502Y	B ZONE	20190411	8.5	6.6	1.9	5.5	3.0
21	34F 5	502BS	B ZONE	20190408	7.6			5.5	2.1
22	34F 10	502AQ	B ZONE	20190328	2.8			1.4	1.4
23	34HJ2	502CJ	B ZONE	20190408	5.7	5.9	-0.2	1.6	4.1
24	34JL	503AQ	B ZONE	20190327	5.6	5.3	0.3	0.2	5.4
25	34L 10	502AL	B ZONE	20190409	3.3			-0.3	3.6
26	34LS	503BE	B ZONE	20190314	6.5	5.4	1.1	-0.4	6.9
27	34T0.1	503AC	B ZONE	20190408	6.8	6.1	0.7	1.0	5.8
28	34U 8	513E	B ZONE	20190305	2.4			-3.3	5.7
29	34V3	503CC	B ZONE	20190319	3.8			-1.8	5.6
30	34X40	513Q	B ZONE	20190319	1.8			-2.8	4.6
31	35F 20	513K	B ZONE	20190318	1.9			-1.5	3.4
32	35J1	514M	B ZONE	20190408	-0.3	5.8	-6.1	-1.8	1.5
33	35K1	523A	B ZONE	20190408	-1.1	5.8	-6.9	-2.3	1.2
34	OCWD-BS14/2		B ZONE	20190306	-0.3			-1.6	1.2
35	OCWD-BS21/2		B ZONE	20190306	0.2			-1.6	1.8
				AVG=	2.0		AVG=	0.9	

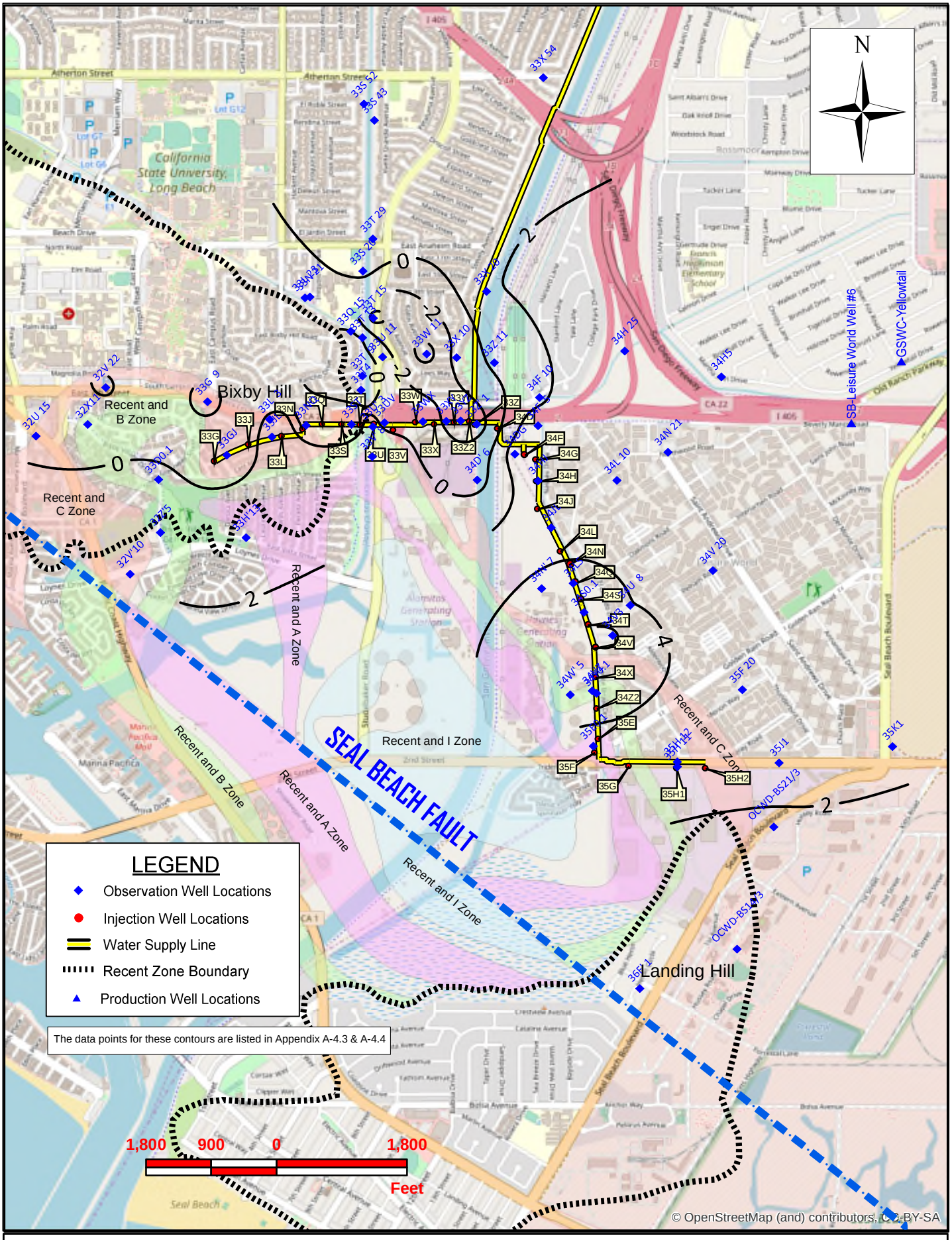
[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.
= A max. or min. elevation during that period.



Alamitos Barrier Project
A Zone Groundwater Elevation (ft) Contours, Spring 2019

A-4.1

A Zone GW.srf



Alamitos Barrier Project
A Zone Change in Elevation (ft), Spring 2018 to Spring 2019

A-4.2

A zone GW.srf

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

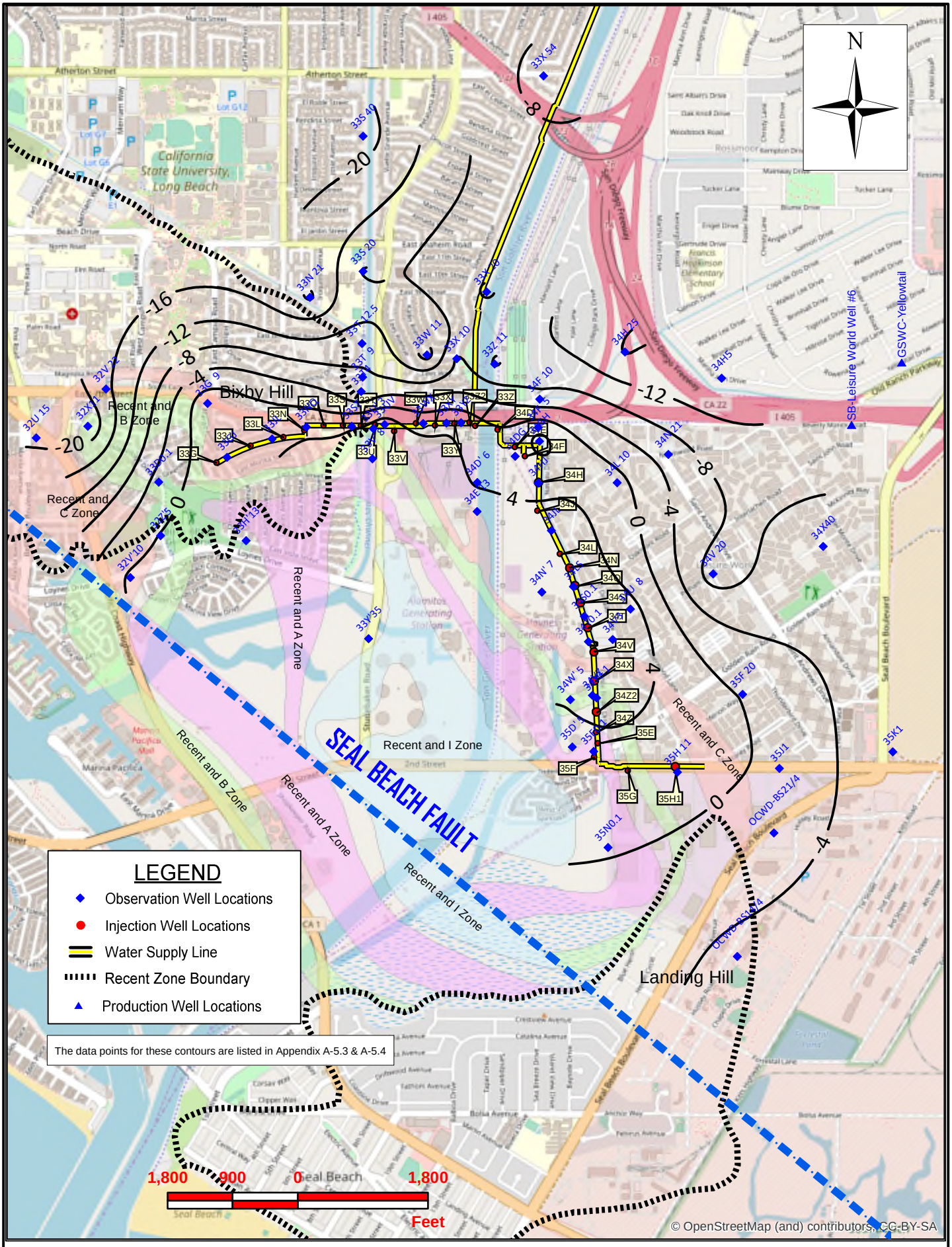
POINT	PROJ	FCD	AQUIFER	DATE	FY 18-19 ELEV	P.E.[1]	Δ[2]	FY 17-18 ELEV	CHANGE IN ELEV
1	32U 15	482M	A ZONE	20190226	-5.9			-5.6	-0.3
2	32V 22	482P	A ZONE	20190226	-5.3			-5.5	0.2
3	32V'10	483F	A ZONE	20190211	0.6			-1.6	2.2
4	32X11	482S	A ZONE	20190307	-7.8			-7.1	-0.7
5	32Z'5	482W	B,A	20190211	-0.7			-1.2	0.5
6	33D0.1	482U	A,I	20190306	-2.5			-3.1	0.6
7	33G 9	482F	A ZONE	20190214	-11.7			-9.2	-2.5
8	33GJ	482X	A ZONE	20190327	0.9	1.4	-0.5	1.9	-1.0
9	33H'13	493YY	R,A	20190214	2.3			1.0	1.3
10	33JL	492BW	A,I	20190422	2.8	3.1	-0.3	2.3	0.5
11	33L 3	492	A ZONE	20190226	4.4			4.2	0.2
12	33L 23	492RR	A ZONE	20190221	-8.7			-7.7	-1.0
13	33N 21	492BU	A ZONE	20190221	-7.2			-6.4	-0.8
14	33NQ	492BP	A ZONE	20190408	3.2	3.6	-0.4	3.6	-0.4
15	33Q 15	492AM	A ZONE	20190227	-3.2			-3.3	0.1
16	33S 20	492BR	A ZONE	20190311	-3.6			-4.2	0.6
17	33S 43	491E	A ZONE	20190311	-8.4			-9.1	0.7
18	33S 52	491H	A ZONE	20190306	-13.0			-13.4	0.4
19	33ST	492BL	A ZONE	20190408	3.3	2.8	0.5	4.8	-1.5
20	33T 9	492TT	A ZONE	20190509	2.6			0.9	1.7
21	33T 13	492ZZ	A ZONE	20190328	-1.0			-0.9	-0.1
22	33T 15	492SS	A ZONE	20180918	-5.6			-0.9	-4.7
23	33T 29	491C	A ZONE	20190311	-4.2			-5.2	1.0
24	33T4	492CR	A ZONE	20190312	3.4			2.5	0.9
25	33U 11	492AJ	A ZONE	20190328	1.2			2.2	-1.0
26	33U' 3	492WW	A ZONE	20190305	7.1			6.0	1.1
27	33UV	492BH	A ZONE	20190327	4.8	4.0	0.8	5.6	-0.8
28	33V' 8	492BY	R,A	20190305	3.7			1.7	2.0
29	33W 11	502T	A ZONE	20180913	-5.1			-0.3	-4.8
30	33WX	502AF	A ZONE	20190422	4.3	7.6	-3.3	4.8	-0.5
31	33X 10	502BD	A ZONE	20190409	-0.3			1.0	-1.3
32	33X 20	502J	A ZONE	20190305	-2.6			-4.4	1.8
33	33X 54	501	A,I	20190319	-6.0			-6.4	0.4
34	33XY	502BN	A ZONE	20190408	5.5	8.0	-2.5	7.9	-2.4
35	33YZ	502AD	A ZONE	20190408	5.4	8.7	-3.3	8.1	-2.7
36	33Z' 1	502G	A ZONE	20190404	2.4			5.5	-3.1
37	33Z 11	502V	A ZONE	20190416	-3.2			-3.6	0.4
38	34D' 6	502BH	A ZONE	20190404	4.1			4.9	-0.8
39	34DG	502Z	A ZONE	20190314	6.6	8.5	-1.9	3.5	3.1

[1] P.E. represents the protective elevations calcuated 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 18-19 ELEV	P.E.[1]	Δ[2]	FY 17-18 ELEV	CHANGE IN ELEV
40	34F 5	502BR	A ZONE	20190305	5.1			1.6	3.5
41	34F 10	502AR	A ZONE	20190328	-0.3			-1.8	1.5
42	34H 25	502AH	A ZONE	20190404	-5.2			-8.7	3.5
43	34H5	512E	A ZONE	20190326	-4.4			-8.3	3.9
44	34HJ	502BX	A ZONE	20190408	4.3	8.6	-4.3	1.3	3.0
45	34JL	503AP	A ZONE	20190408	4.5	7.8	-3.3	1.1	3.4
46	34L 10	502AM	A ZONE	20190409	2.9			0.1	2.8
47	34LS	503BD	A ZONE	20190408	5.0	7.7	-2.7	0.5	4.5
48	34N 21	512B	A ZONE	20190307	-0.9			-4.6	3.7
49	34N' 7	503AF	A ZONE	20190408	5.0			0.5	4.5
50	34S0.1	503BV	A ZONE	20190408	6.2	6.7	-0.5	0.4	5.8
51	34U 8	513F	A ZONE	20190409	3.2			-0.9	4.1
52	34V 20	513B	A ZONE	20190416	-2.6			-4.6	2.0
53	34V3	503CD	A ZONE	20190409	4.8			-1.5	6.3
54	34VZ	503BH	A ZONE	20190422	4.1	4.4	-0.3	-0.4	4.5
55	34W' 5	503AJ	A ZONE	20190228	5.1			0.0	5.1
56	34X40	513P	A ZONE	20190319	5.9				n/a
57	34Y0.1	503CL	A ZONE	20190320	3.7	2.8	0.9	-1.4	5.1
58	35E0.1	503BK	A ZONE	20190410	2.1	2.4	-0.3	-1.1	3.2
59	35F 20	513J	A ZONE	20190318	1.3			-1.6	2.9
60	35H 11	514G	A ZONE	20190318	1.2	3.8	-2.6	-1.3	2.5
61	35H 12	514D	A ZONE	20190314	-0.1	3.8	-3.9	-2.3	2.2
62	35J1	514L	A ZONE	20190314	0.7	6.2	-5.5	-1.8	2.5
63	35K1	523B	A ZONE	20190313	0.0	6.2	-6.2	-2.2	2.2
64	36F' 1	505D	A ZONE	20190228	3.1			2.8	0.3
65	OCWD-BS14/3		A ZONE	20190306	-0.7			-1.9	1.2
66	OCWD-BS21/3		A ZONE	20190306	0.2			-1.6	1.8
				AVG=	0.3		AVG=	-1.0	

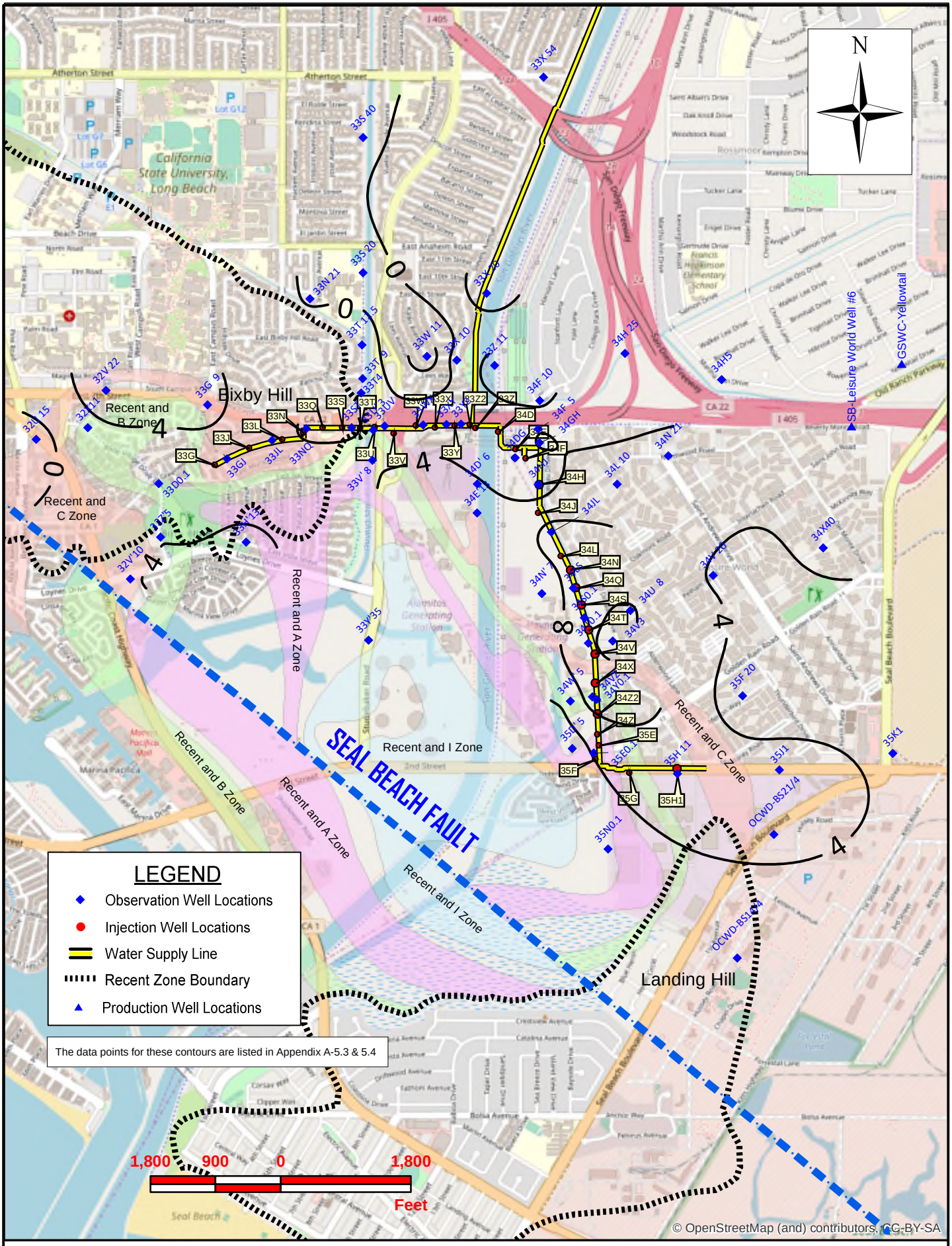
[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.
[ ] = A max. or min. elevation during that period.



Alamitos Barrier Project
I Zone Groundwater Elevation (ft) Contours, Spring 2019

A-5.1

I Zone GW.srf



Alamitos Barrier Project
I Zone Change in Elevation (ft), Fall 2018 to Fall 2019

A-5.2

I zone GW.srf

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

POINT	PROJ	FCD	AQUIFER	DATE	FY 18-19 ELEV	P.E.[1]	Δ[2]	FY 17-18 ELEV	CHANGE IN ELEV
1	32U 15	482L	I ZONE	20190226	-20.7			-19.4	-1.3
2	32V 22	482N	I ZONE	20190226	-16.8			-23.3	6.5
3	32V'10	483E	I ZONE	20190211	0.6			-3.3	3.9
4	32Z'5	482V	I ZONE	20190211	0.2			-3.7	3.9
5	33D0.1	482U	A,I	20190404	-2.5			-3.1	0.6
6	33G 9	482G	I ZONE	20190214	2.9			-2.3	5.2
7	33GJ	482Y	I ZONE	20190327	2.4	2.6	-0.2	-0.2	2.6
8	33H'13	493XX	I ZONE	20190214	2.0			-2.7	4.7
9	33JL	492BW	A,I	20190408	3.2	3.1	0.1	2.3	0.9
10	33N 21	492BV	I ZONE	20190221	-20.5			-20.2	-0.3
11	33NQ	492BP	A,I	20190408	3.2	3.6	-0.4	3.6	-0.4
12	33S 20	492BS	I ZONE	20190311	-11.7			-11.0	-0.7
13	33S 40	491F	I ZONE	20190306	-21.7			-21.4	-0.3
14	33ST	492BM	I ZONE	20190327	3.5	4.2	-0.7	4.7	-1.2
15	33T 9	492XX	I ZONE	20190509	-7.0			-9.4	2.4
16	33T 12.5	492BT	I ZONE	20190311	-9.6			-11.5	1.9
17	33T4	492CQ	I ZONE	20190312	-8.2			-9.9	1.7
18	33U' 3	492QQ	I ZONE	20190305	5.4			3.7	1.7
19	33UV	492BJ	I ZONE	20190314	6.4	6.1	0.3	5.2	1.2
20	33V' 8	492BX	I ZONE	20190305	5.7			2.0	3.7
21	33W 11	502U	I ZONE	20180913	-17.6			-10.5	-7.1
22	33WX	502AG	I ZONE	20190227	2.0	10.4	-8.4	-0.6	2.6
23	33X 10	502BE	I ZONE	20190305	-7.5			-9.5	2.0
24	33X 20	502H	I ZONE	20190305	-7.4			-13.5	6.1
25	33X 54	501	A,I	20190319	-6.0			-6.4	0.4
26	33XY	502BP	I ZONE	20190227	3.2	11.0	-7.9	0.3	2.9
27	33Y'35	493ZZ	I ZONE	20190226	0.2			-1.5	1.7
28	33YZ	502AE	I ZONE	20190314	2.7	11.1	-8.4	-0.4	3.1
29	33Z 11	502W	I ZONE	20190416	-12.4			-10.9	-1.5
30	34D' 6	502BI	I ZONE	20190305	3.5			-1.0	4.5
31	34DG	502AA	I ZONE	20190327	0.7	11.1	-10.4	1.0	-0.3
32	34E'13	503AT	I ZONE	20190305	6.4			0.2	6.2
33	34F 5	502BQ	I ZONE	20190314	2.6			-1.1	3.7
34	34F 10	502AS	I ZONE	20190328	-6.5			-5.5	-1.0
35	34GH	502BV	I ZONE	20190321	5.5	11.3	-5.8	0.9	4.6
36	34H 25	502AJ	I ZONE	20190404	-16.2			-17.0	0.8
37	34H5	512D	I ZONE	20190326	-15.6			-19.1	3.5

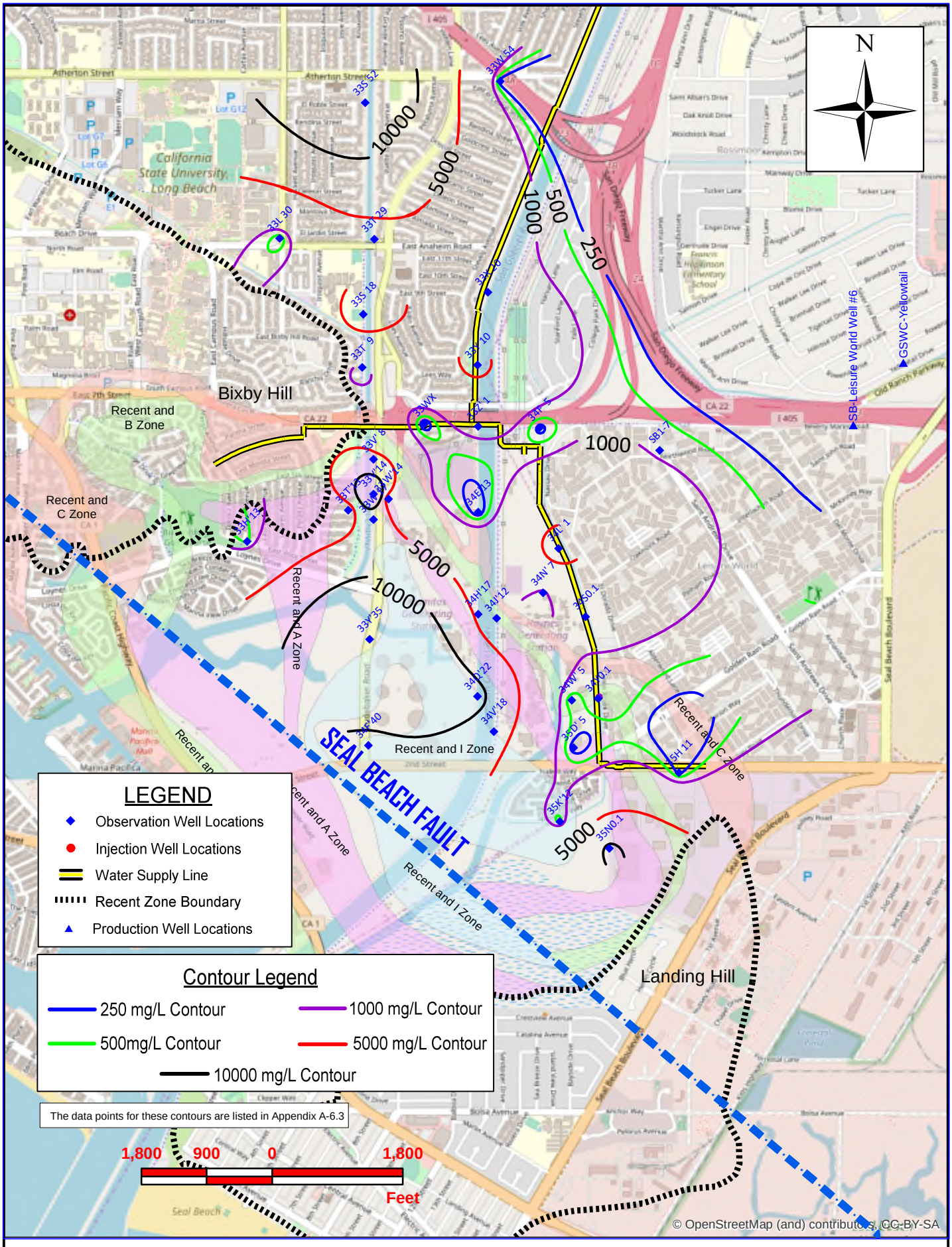
[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.
= A max. or min. elevation during that period.

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

POINT	PROJ	FCD	AQUIFER	DATE	FY 18-19 ELEV	P.E.[1]	Δ[2]	FY 17-16 ELEV	CHANGE IN ELEV
38	34HJ	502BW	I ZONE	20190529	2.5	11.0	-8.5	0.6	1.9
39	34JL	503AN	I ZONE	20190327	6.2	10.5	-4.3	-3.2	9.4
40	34L 10	502AN	I ZONE	20190305	1.3			-4.4	5.7
41	34LS	503BC	I ZONE	20190422	5.6	9.5	-3.9	-3.9	9.5
42	34N 21	512C	I ZONE	20190307	-5.5			-10.5	5.0
43	34N' 7	503AG	I ZONE	20190410	5.5			0.8	4.7
44	34S0.1	503BW	I ZONE	20190408	6.2	8.1	-1.9	-4.0	10.2
45	34T0.1	503AD	I ZONE	20190408	8.0	8.4	-0.4	-3.4	11.4
46	34U 8	513G	I ZONE	20190305	5.3			-7.2	12.5
47	34V 20	513C	I ZONE	20190416	-9.8			-13.1	3.3
48	34V3	503CE	I ZONE	20190305	7.9			-5.0	13.0
49	34VZ	503BG	I ZONE	20190410	6.7	5.9	0.8	-3.5	10.2
50	34W' 5	503AK	I ZONE	20190228	4.4			-0.4	4.8
51	34X40	513N	I ZONE	20190320	-5.0			-9.6	4.6
52	34Y0.1	503CM	I ZONE	20190408	5.4	4.8	0.6	-4.8	10.2
53	35D' 5	503AM	I ZONE	20190226	2.2			0.0	2.2
54	35E0.1	503BJ	I ZONE	20190314	3.3	3.0	0.3	-1.0	4.3
55	35F 20	513H	I ZONE	20190409	-0.2			-1.5	1.3
56	35H 11	514H	I ZONE	20190409	1.6	5.5	-3.9	-5.4	7.0
57	35J1	513M	I ZONE	20190408	-0.7	4.8	-5.5	-6.2	5.5
58	35K1	523C	I ZONE	20190325	-6.9	4.8	-11.7	-10.6	3.7
59	35N0.1	504N	I ZONE	20190226	0.3			-1.4	1.7
60	OCWD-BS14/4		I ZONE	20190306	-4.9			-6.8	1.9
61	OCWD-BS21/4		I ZONE	20190306	-2.4			-7.0	4.6
				AVG=	-1.8		AVG=	-5.3	

[1] P.E. represents the protective elevations calcuated for internodal wells.
[2] Δ (+/-) represents how much groundwater level is above/below respective P.E.

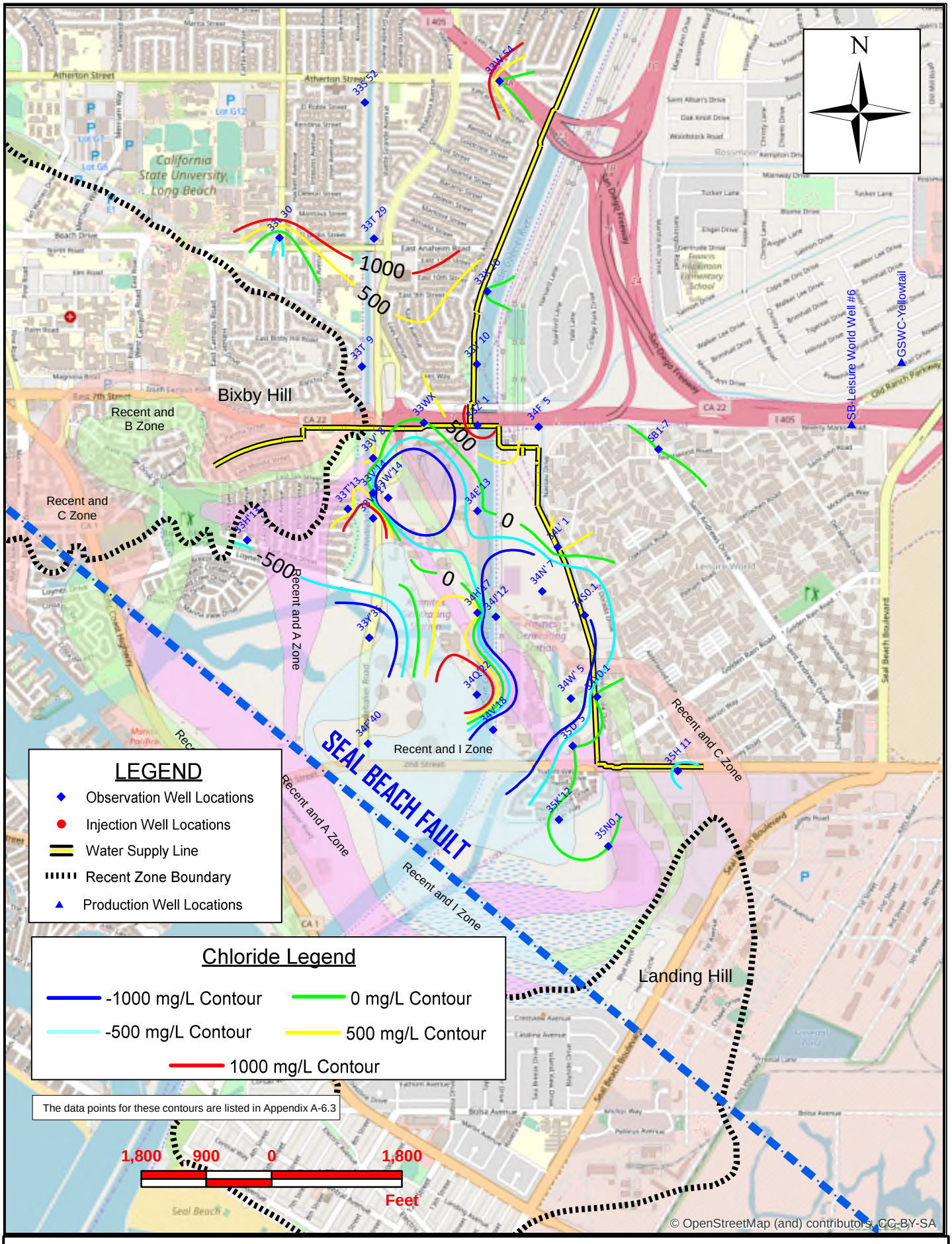
= A max. or min. elevation during that period.



Alamitos Barrier Project
R Zone Chloride Concentration (mg/L) Contours, Spring 2019

A-6.1

R Zone Cl.srf



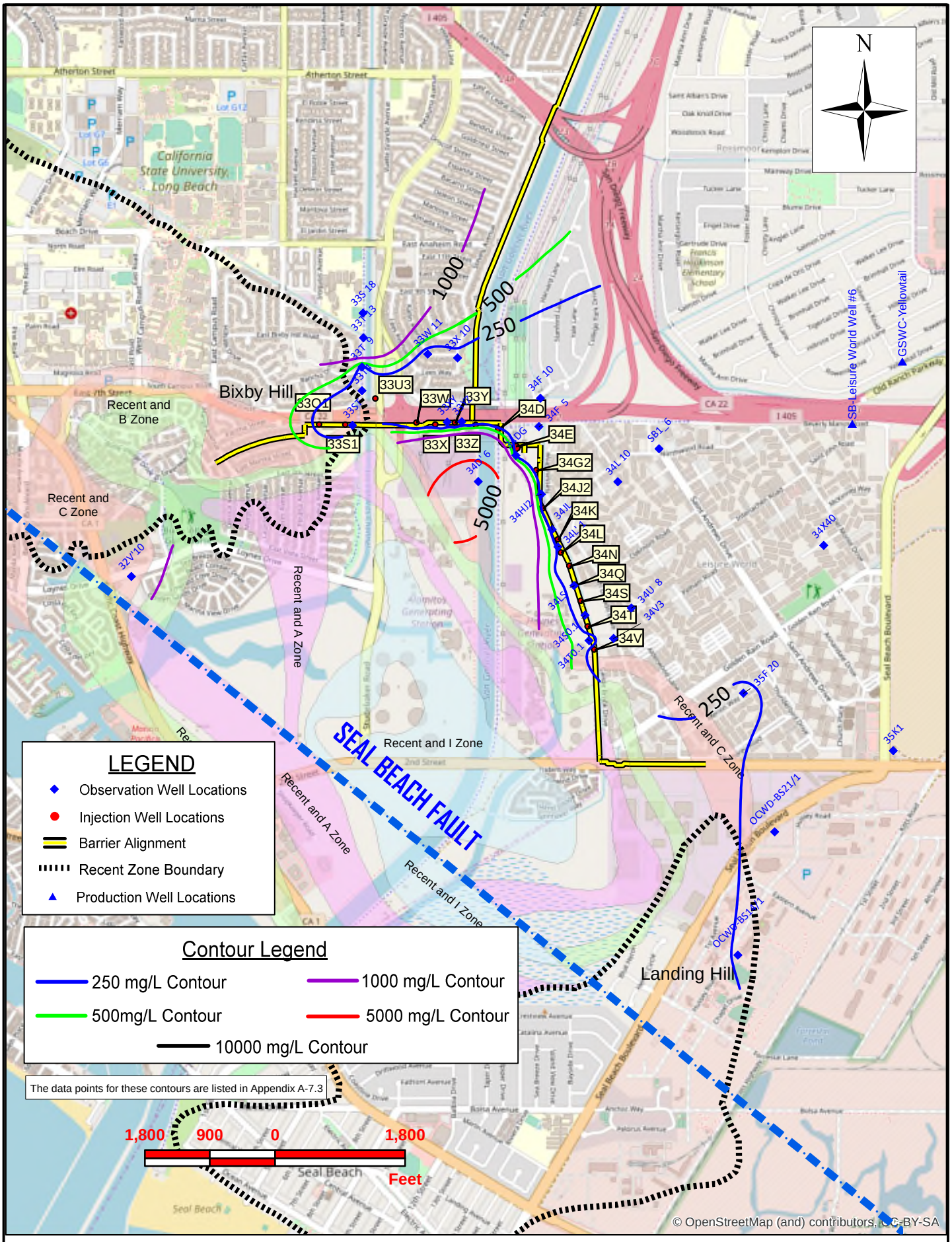
Alamitos Barrier Project
R Zone Change in Chloride Concentration, Spring 2018 to Spring 2019

A-6.2

R Zone Cl.srf

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

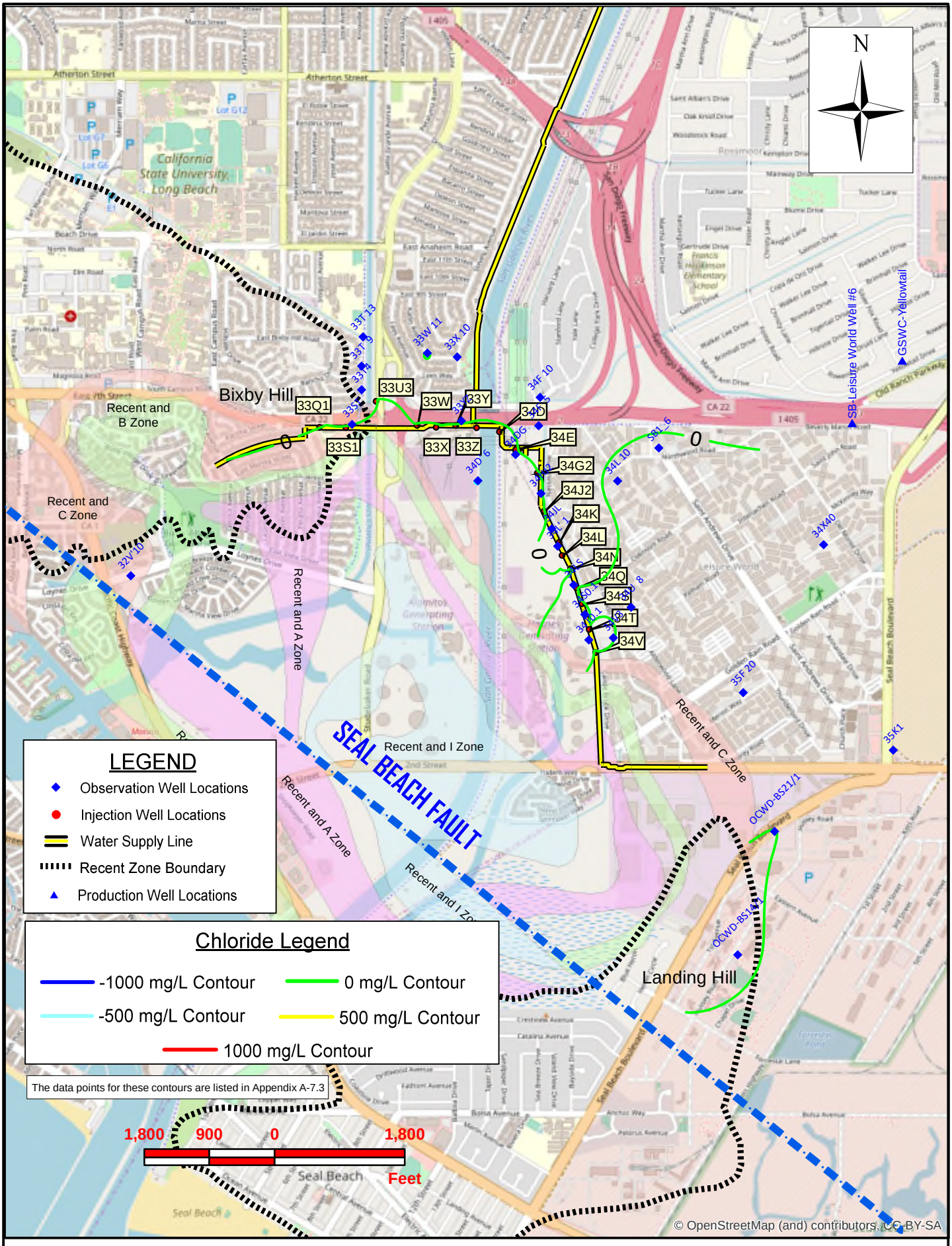
No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in **Bold**)						For Contours	MAX CHLORIDE	Change in Chloride
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 18-19	17-16	(FY18-19 - FY17-18)
1	33H'13	493YY	20190214	R,A	-17.8	415	-37.8	346	-57.8	339	415	876	-461
2	33L 30	491G	20190221	RECENT	-50	199					199	750	-551
3	33S 18	492AH	20190307	RECENT	-67	7,180					7,180		n/a
4	33S 52	491J	20190306	RECENT	-54	16,700					16,700	2,850	13,850
5	33T 9	492CV	20190312	RECENT	-21	522					522	198	324
6	33T 29	491D	20190311	RECENT	-56	3,940					3,940	2,030	1,910
7	33T'13	492AU	20190214	RECENT	-41	2,140	-51	2,320			2,320	2,300	20
8	33V' 8	492BY	20190305	R,A	-24	6,040	-48	5,220			6,040	5,490	550
9	33V'14	492JJ	20190304	RECENT	-67	18,300					18,300	18,200	100
10	33W 54	501C	20190225	RECENT	-33	101	-53	97			101	123	-22
11	33W'14	492AT	20190311	RECENT	-46	1,830	-66	2,290			2,290	8,740	-6,450
12	33W'17	493PP	20190304	RECENT	-41	8,140	-51	4,730			8,140	4,570	3,570
13	**33WX**	**502AZ**	**20190326**	**RECENT**	**-45**	**0**					**0**	**48**	**-48**
14	33X 20	502L	20190328	RECENT	-68	1,620					1,620	1,660	-40
15	33Y 10	502BA	20190305	RECENT	-58	6,180	-83	6,050			6,180	5,470	710
16	33Y'35	493AB	20190226	RECENT	-36	19,600					19,600	22,100	-2,500
17	**33Z' 1**	**502AU**	**20190326**	**RECENT**	**-46**	**1,450**	**-56**	**1,480**			**1,480**	**30**	**1,450**
18	34E'13	503AU	20190304	RECENT	-19	23	-52	30			30	75	-45
19	34F 5	502BT	20190418	RECENT	-136	111	-146	104	-156	84	111	67	44
20	34F'40	483J	20190226	RECENT	-40	8,390					8,390	9,540	-1,150
21	34H'17	503Y	20190304	RECENT	-46	4,380					4,380	3,380	1,000
22	34J'12	503U	20190304	RECENT	-28	288	-36	1,320			1,320	6,100	-4,780
23	**34L' 1**	**503P**	**20190321**	**RECENT**	**-57**	**6,950**					6,950	**6,270**	**680**
24	34N' 7	503AE	20190228	RECENT	-51	334	-61	743	-70	107	743	5,110	-4,367
25	34Q'22	503T	20190304	RECENT	-42	9,540	-57	11,500			11,500	8,360	3,140
26	**34S0.1**	**503BT**	**20190404**	**RECENT**	**-59**	**661**	**-69**	**1,510**			**1,510**	**2,620**	**-1,110**
27	34V'18	503V	20190307	RECENT	-48	6,790					6,790	9,290	-2,500
28	34W' 5	503AH	20190228	RECENT	-51	208					208	2,670	-2,462
29	**34Y0.1**	**503CK**	**20190320**	**RECENT**	**-60**	**881**	**-70**	**1,070**			**1,070**	**876**	**194**
30	35D' 5	503AL	20190226	RECENT	-57	109					109	120	-11
31	**35H 11**	**514F**	**20190318**	**RECENT**	**-42**	**93**	**-65**	**160**			**160**	**745**	**-585**
32	35K'12	504R	20190226	RECENT	-44	271	-54	322			322	125	197
33	35N0.1	504M	20190226	RECENT	-38	10,900	-62	10,900			10,900	10,900	0
34	SB1-7		20190415	RECENT		820					820	825	-5



Alamitos Barrier Project
C Zone Chloride Concentration (mg/L) Contours, Spring 2019

A-7.1

C Zone Cl.srf



Alamitos Barrier Project
C Zone Change in Chloride Concentration, Spring 2018 to Spring 2019

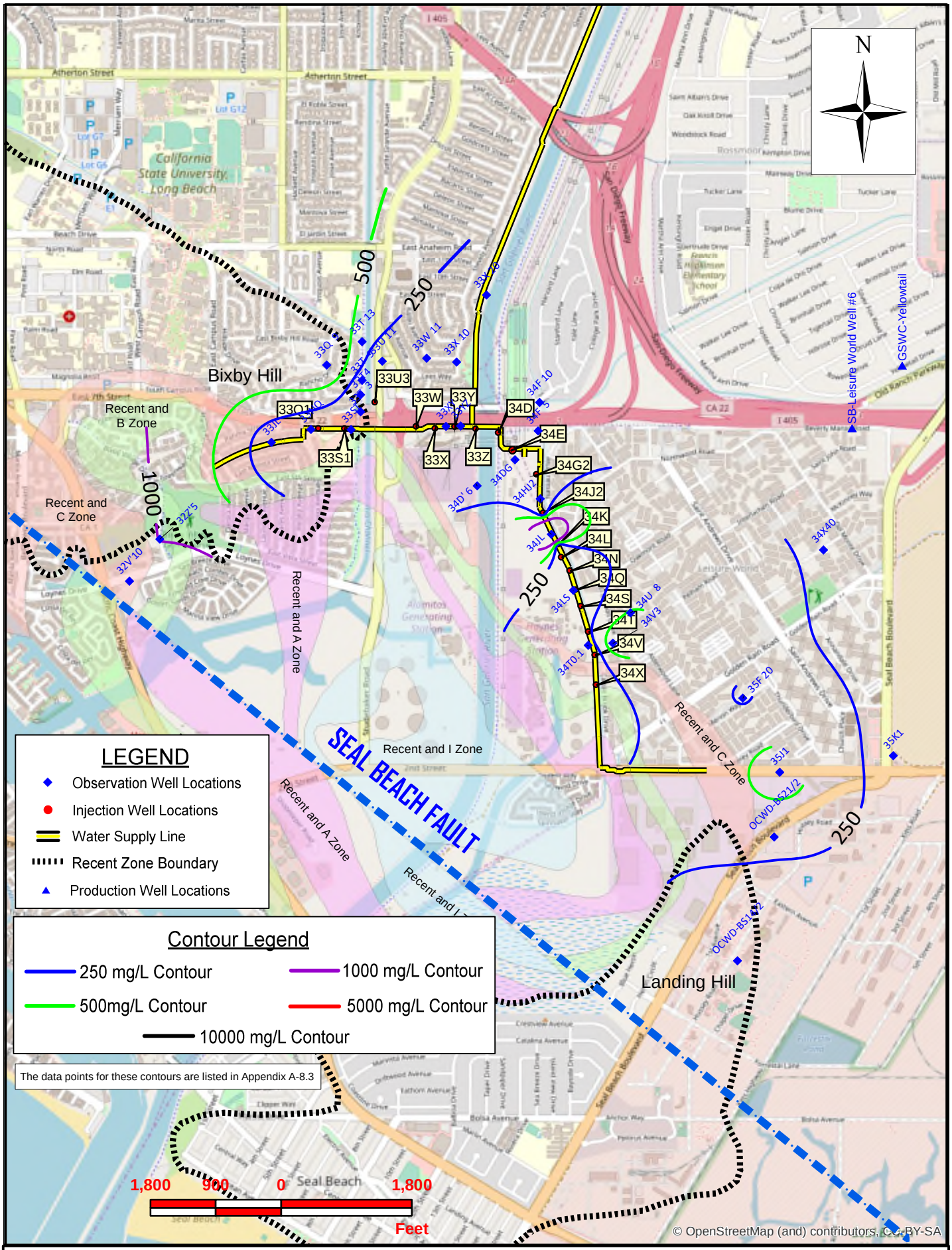
A-7.2

C Zone Cl.srf

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 17-18	Change in Chloride (FY18-19 - FY17-18)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 18-19		
1	32V'10	483H	20190211	C ZONE	-37	860					860	941	-81
2	33S 18	492AG	20190307	C ZONE	-225	2,250					2,250		n/a
3	**33ST**	**492BK**	**20190320**	**C,B**	**-25**	**68**					**68**	**67**	**1**
4	33T 9	492CU	20190312	C ZONE	-129	130	-144	147			147	108	39
5	33T 13	492AC	20190328	C ZONE	-199	2,950					2,950	2,590	360
6	33T4	492CT	20190312	C ZONE	-56	194					194	66	128
7	33W 11	502R	20190321	C ZONE	-183	56	-216	67			67	79	-12
8	33X 10	502BB	20190225	C ZONE	-190	63	-215	186			186	74	113
9	**33XY**	**502BL**	**20190328**	**C ZONE**	**-194**	**76**	**-210**	**77**			**77**		**n/a**
10	**33YZ**	**502AB**	**20190326**	**C ZONE**	**-195**	**74**	**-210**	**73**			**74**	**61**	**13**
11	34D' 6	502BF	20190305	C ZONE	-125	9,190					9,190	9,710	-520
12	**34DG**	**502X**	**20190321**	**C ZONE**	**-190**	**72**	**-205**	**70**			**72**	**81**	**-9**
13	34F 5	502BU	20190418	C ZONE	-191	77	-201	86	-211	100	100	78	21
14	34F 10	502AP	20190328	C ZONE	-211	72					72	69	3
15	**34HJ2**	**502CH**	**20190509**	**C ZONE**	**-148**	**76**	**-158**	**85**			**85**	**87**	**-2**
16	**34JL**	**503AR**	**20190320**	**C ZONE**	**-160**	**145**					**145**	**130**	**15**
17	**34L' 1**	**503N**	**20190321**	**C ZONE**	**-162**	**198**					**198**	**71**	**128**
18	34L 10	502AK	20190228	C ZONE	-166	63					63	79	-15
19	**34LS**	**503BF**	**20190320**	**C ZONE**	**-133**	**92**	**-151**	**92**	**-163**	**119**	**119**	**109**	**10**
20	**34S0.1**	**503BU**	**20190409**	**C ZONE**	**-129**	**89**	**-139**	**88**			**89**	**85**	**4**
21	**34T0.1**	**503AB**	**20190417**	**C ZONE**	**-134**	**523**					**523**	**359**	**164**
22	34U 8	513D	20190319	C ZONE	-150	84	-165	85			85	95	-10
23	34V3	503CB	20190319	C ZONE	-168	98					98	95	3
24	34X40	513R	20190319	C ZONE	-85	46	-101	46			46	72	-25
25	35F 20	513L	20190318	C ZONE	-70	283	-78	142	-85	96	283	519	-236
26	**35K1**	**523D**	**20190313**	**C ZONE**	**-88**	**17**	**-98**	**52**			**52**	**367**	**-315**
27	OCWD-BS14/1		20190306	C ZONE		237					237	225	12
28	OCWD-BS21/1		20190306	C ZONE		202					202	198	4
29	SB1 6		20190415	C ZONE		74					74	83	-9
30	33Q1	DP1									50	50	n/a
31	33S1	DP2									50	50	n/a
32	33U3	DP3									50	50	n/a
33	33W	DP4									50	50	n/a
34	33X	DP5									50	50	n/a
35	33Y	DP6									50	50	n/a
36	33Z	DP7									50	50	n/a
37	34D	DP8									50	50	n/a
38	34E	DP9									50	50	n/a
39	34G2	DP10									50	50	n/a
40	34J2	DP11									50	50	n/a
41	34K	DP12									50	50	n/a
42	34L	DP13									50	50	n/a
43	34N	DP14									50	50	n/a
44	34Q	DP15									50	50	n/a
45	34T	DP16									50	50	n/a
46	34S	DP17									50	50	n/a
47	34V	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.

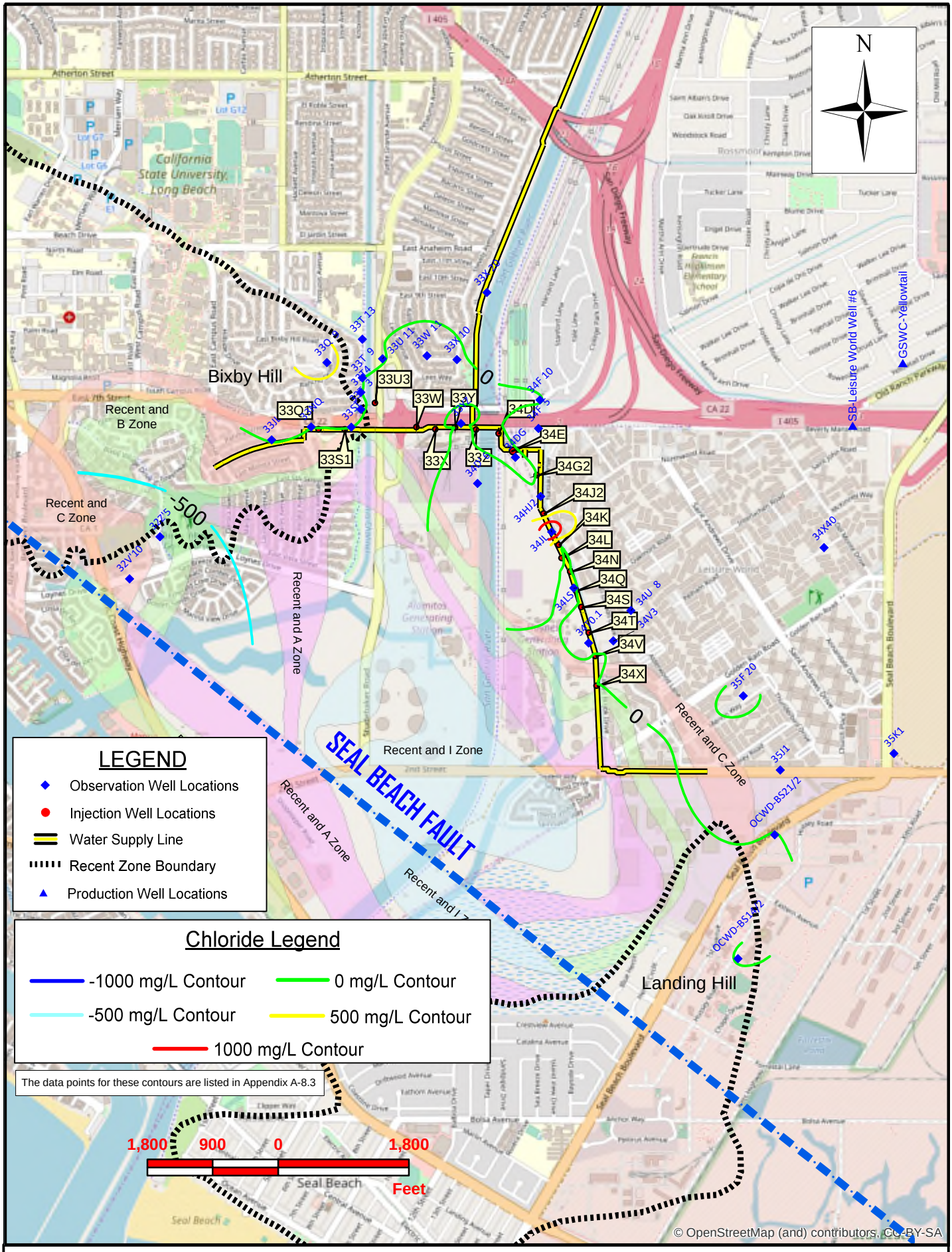


Public Works
LOS ANGELES COUNTY

Alamitos Barrier Project
B Zone Chloride Concentration (mg/L) Contours, Spring 2019

A-8.1

B zone Cl.srf



Alamitos Barrier Project
B Zone Change in Chloride Concentration, Spring 2018 to Spring 2019

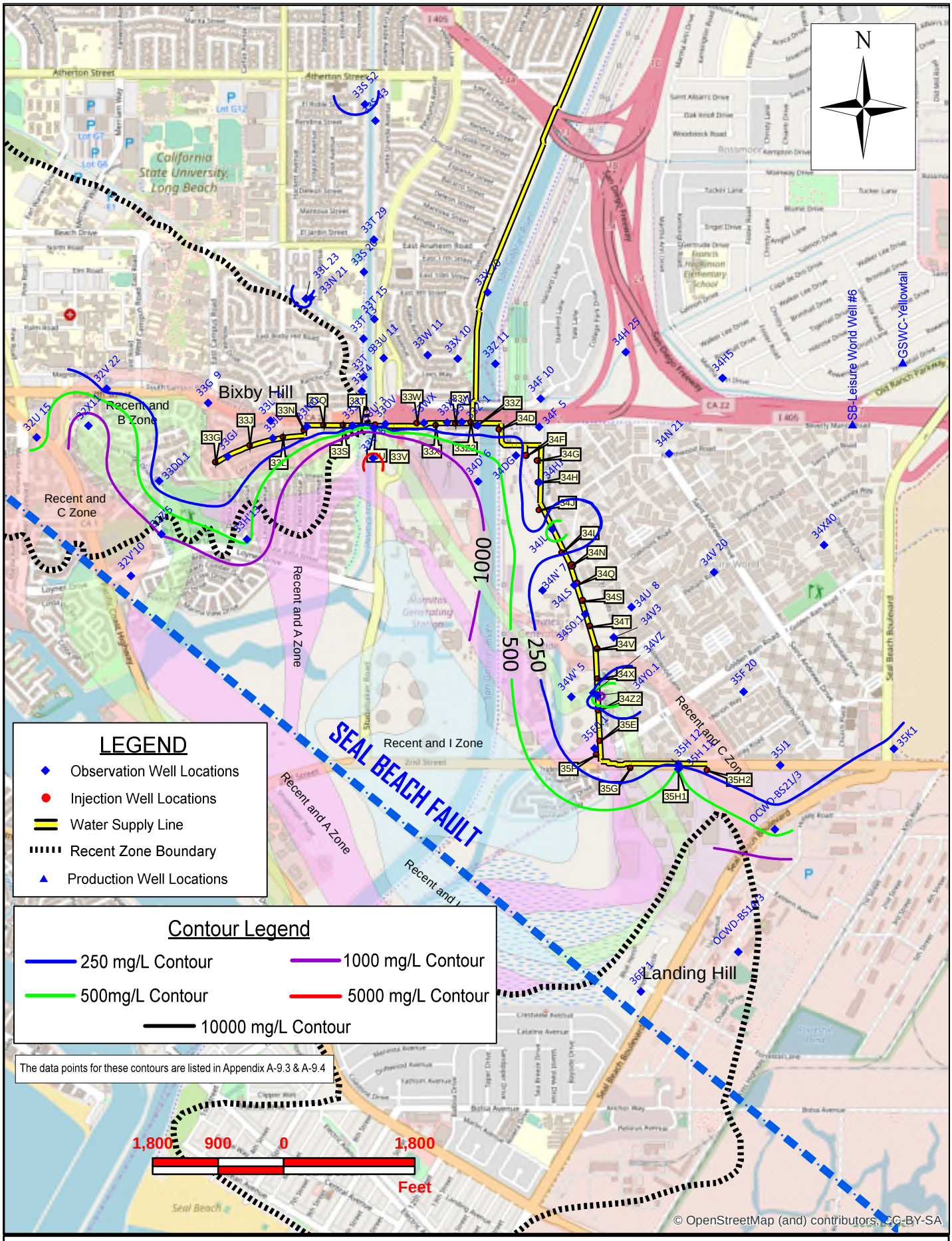
A-8.2

B Zone Cl.srf

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	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. 18-19	17-18	(FY18-19 - FY17-18)
1	32V'10	483G	20190211	B ZONE	-62	2,890					2,890	3,620	-730
2	32Z'5	482W	20190211	B,A	-20	745	-30	837	-40	950	950	1,680	-730
3	**33JL**	**492BQ**	**20190507**	**B ZONE**	**3**	**76**	**-7**	**93**			**93**	**80**	**13**
4	**33NQ**	**492BN**	**20190507**	**B ZONE**	**-3**	**83**	**-14**	**83**			**83**	**82**	**1**
5	33Q 9	492CM	20190221	B ZONE	-85	120	-95	154	-105	873	873	134	739
6	**33ST**	**492BK**	**20190320**	**C,B**	**-25**	**68**					**68**	**67**	**1**
7	33T 3	492CL	20190306	B ZONE	-40	74	-57	69	-75	65	74	67	6
8	33T 9	492YY	20190509	B ZONE	-163	117					117	116	1
9	33T 13	492AB	20190328	B ZONE	-254	358					358	320	38
10	33T4	492CS	20190312	B ZONE	-91	41					41	38	3
11	33U 11	492AK	20190328	B ZONE	-260	93					93	81	11
12	33W 11	502S	20190321	B ZONE	-241	96	-269	99			99	164	-65
13	33X 10	502BC	20190225	B ZONE	-275	77					77	82	-6
14	33X 20	502K	20190328	B ZONE	-266	135					135	65	70
15	**33XY**	**502BM**	**20190328**	**B ZONE**	**-244**	**86**					**86**		**n/a**
16	**33YZ**	**502AC**	**20190326**	**B ZONE**	**-214**	**81**	**-263**	**81**			**81**	**60**	**21**
17	34D' 6	502BG	20190305	B ZONE	-180	141	-194	114			141	112	29
18	**34DG**	**502Y**	**20190321**	**B ZONE**	**-232**	**77**	**-257**	**76**			**77**	**80**	**-4**
19	34F 5	502BS	20190415	B ZONE	-231	76	-260	109			109	75	34
20	34F 10	502AQ	20190328	B ZONE	-269	68					68	72	-4
21	**34HJ2**	**502CJ**	**20190509**	**B ZONE**	**-203**	**84**	**-215**	**87**	**-228**	**87**	**87**	**72**	**15**
22	**34JL**	**503AQ**	**20190320**	**B ZONE**	**-195**	**2,800**	**-211**	**84**			**2,800**	**934**	**1,866**
23	**34LS**	**503BE**	**20190320**	**B ZONE**	**-188**	**83**					**83**	**99**	**-16**
24	**34T0.1**	**503AC**	**20190320**	**B ZONE**	**-174**	**94**	**-207**	**107**	**-239**	**135**	**135**	**86**	**49**
25	34U 8	513E	20190319	B ZONE	-225	517					517	85	432
26	34V3	503CC	20190319	B ZONE	-208	683					683	680	3
27	34X40	513Q	20190319	B ZONE	-137	227					227	18	209
28	35F 20	513K	20190318	B ZONE	-115	223					223	272	-49
29	**35J1**	**514M**	**20190508**	**B ZONE**	**-128**	**651**	**-143**	**622**	**-148**	**622**	**651**	**444**	**207**
30	**35K1**	**523A**	**20190313**	**B ZONE**	**-127**	**132**	**-142**	**135**	**-157**	**122**	**135**	**123**	**12**
31	OCWD-BS14/2		20190306	B ZONE		40					40	36	4
32	OCWD-BS21/2		20190306	B ZONE		310					310	317	-7
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

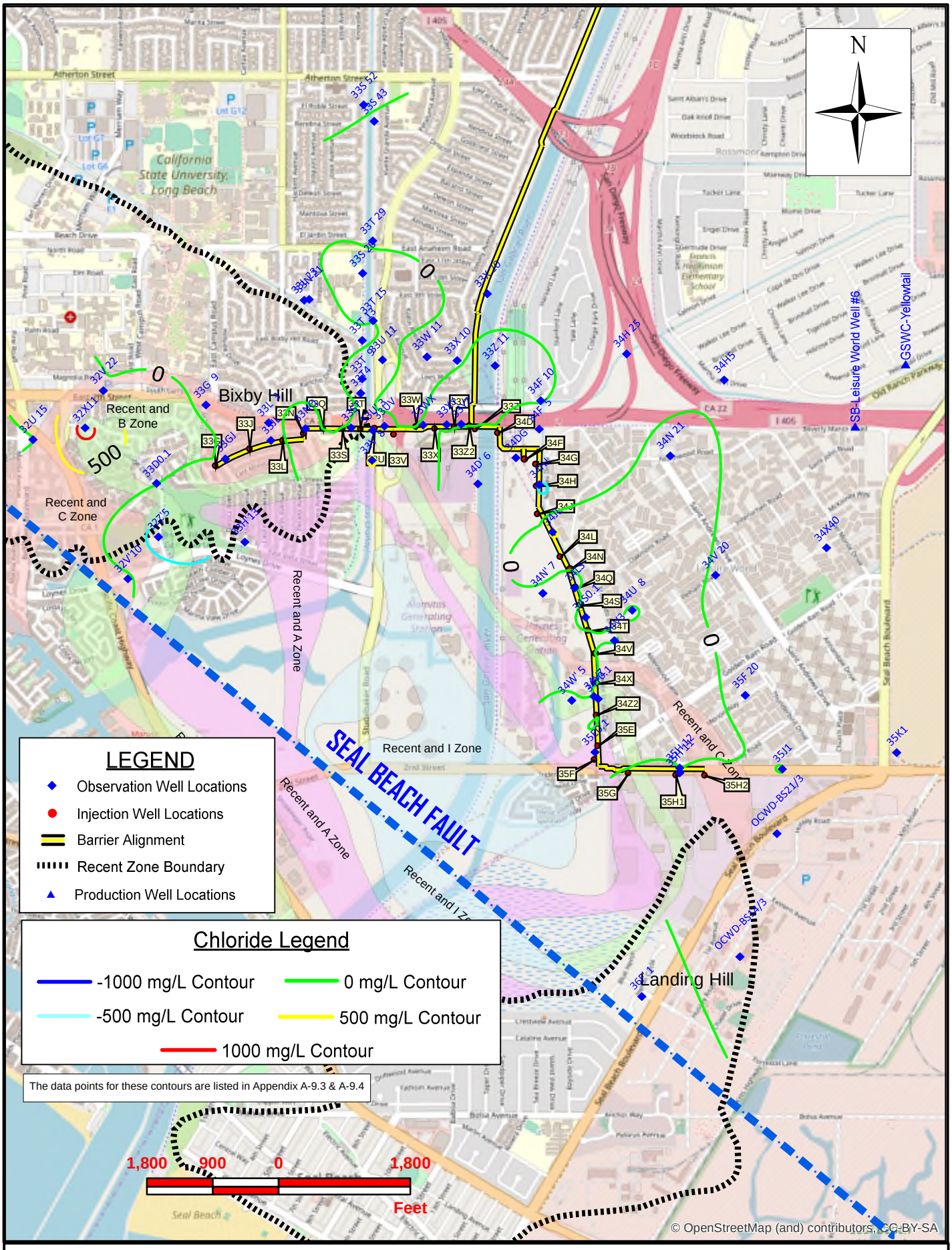
DP = Dummy Point with an assumed chloride concentration of 50 mg/L. Placed at wells that were injecting into this zone during this reporting period.



Alamitos Barrier Project
A Zone Chloride Concentration (mg/L) Contours, Spring 2019

A-9.1

A Zone Cl.srf



Alamitos Barrier Project
A Zone Change Chloride Concentration, Spring 2018 to Spring 2019

A-9.2

A Zone Cl.srf

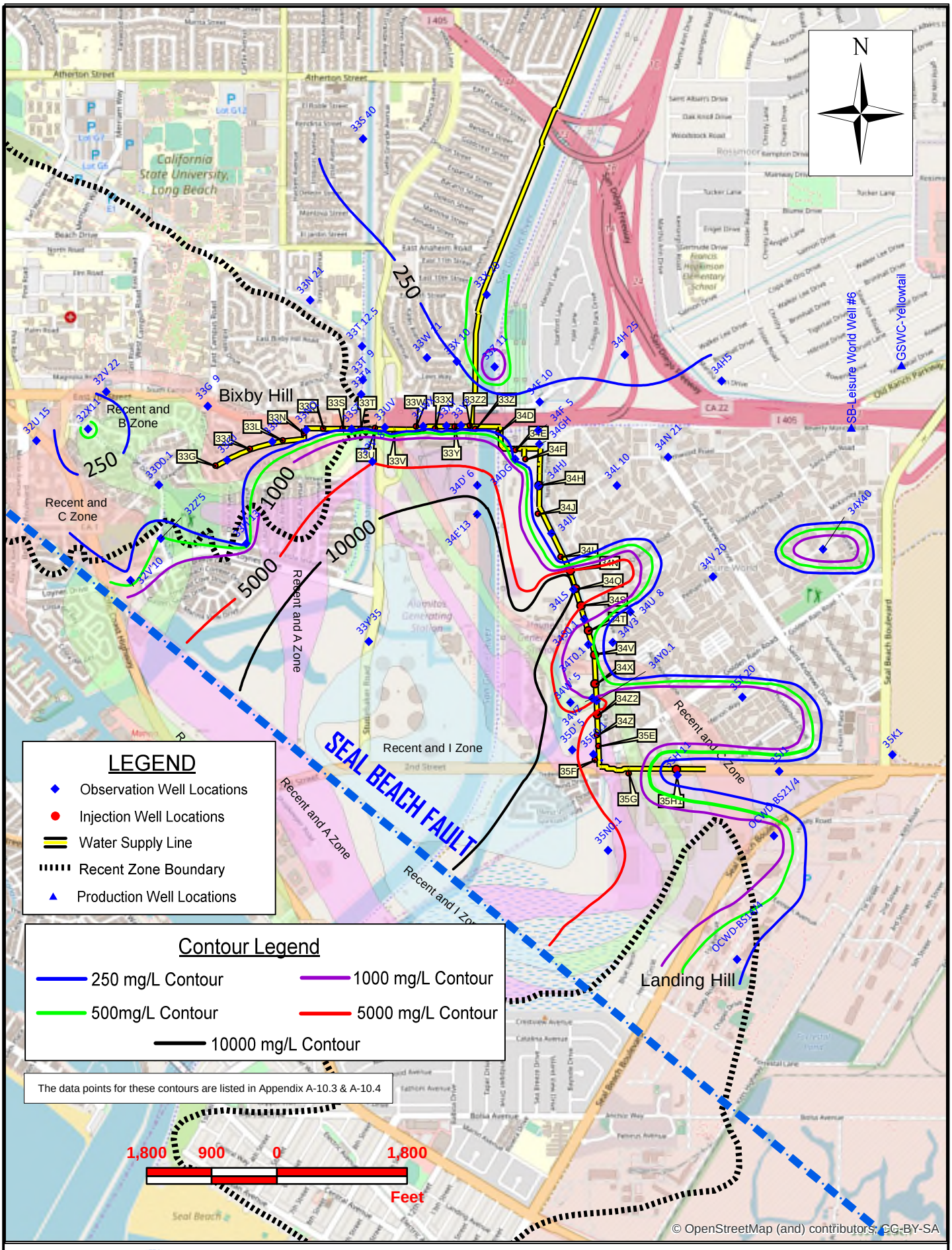
ALAMITOS BARRIER PROJECT
A-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in **Bold**)						For Contours	MAX CHLORIDE 17-18	Change in Chloride (FY18-19 - FY17-18)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 18-19		
1	32U 15	482M	20190226	A ZONE	-17	266					266	287	-21
2	32V 22	482P	20190226	A ZONE	-11	154					154	119	35
3	32V'10	483F	20190211	A ZONE	-90	2,970	-105	3,270			3,270	3,200	70
4	32X11	482S	20190307	A ZONE	-9	247	-24	1,430			1,430	212	1,218
5	32Z'5	482W	20190211	A,B	-20	745	-30	837	-40	950	950	1,680	-730
6	33D0.1	482U	20190307	A,I	-24	81	-49	87	-74	85	87	75	12
7	33G 9	482F	20190214	A ZONE			-23	84			84	123	-39
8	**33GJ**	**482X**	**20190311**	**A ZONE**	**-35**	**18**					**18**	**54**	**-36**
9	33H'13	493YY	20190214	R,A	-18	415	-38	346	-58	339	415	876	-461
10	**33JL**	**492BW**	**20190507**	**A,I**	**-41**	**54**	**-79**	**54**	**-116**	**54**	**54**	**78**	**-24**
11	33L 3	492	20190226	A ZONE	-60	78					78	94	-16
12	33L 23	492RR	20190221	A ZONE	-344	302					302	321	-19
13	33N 21	492BU	20190221	A ZONE	-305	207	-330	233	-346	241	241	311	-70
14	**33NQ**	**492BP**	**20190311**	**A ZONE**	**-48**	**65**	**-92**	**133**	**-136**	**113**	**133**	**85**	**48**
15	33S 20	492BR	20190311	A ZONE	-317	98	-336	205	-355	245	245	124	121
16	33S 43	491E	20190311	A ZONE	-333	183	-344	128			183	267	-84
17	33S 52	491H	20190306	A ZONE	-284	241	-289	291			291	195	96
18	**33ST**	**492BL**	**20190320**	**A ZONE**	**-65**	**86**	**-86**	**94**	**-100**	**90**	**94**	**77**	**16**
19	33T 9	492TT	20190509	A ZONE	-262	90					90	70	20
20	33T 13	492ZZ	20190328	A ZONE	-128	207					207	211	-4
21	33T 15	492SS	20190311	A ZONE	-334	148					148	148	0
22	33T 29	491C	20190311	A ZONE	-350	157					157	191	-34
23	33T4	492CR	20190312	A ZONE	-146	79	-166	88	-186	78	88	76	12
24	33U 11	492AJ	20190328	A ZONE	-348	86					86	75	11
25	33U' 3	492WW	20190305	A ZONE	-89	354					354	109	245
26	**33UV**	**492BH**	**20190416**	**A ZONE**	**-106**	**103**	**-131**	**127**	**-155**	**151**	**151**	**70**	**81**
27	33V' 8	492BY	20190305	R,A	-24	6,040	-48	5,220			6,040	5,490	550
28	33W 11	502T	20190321	A ZONE	-321	65	-349	70	-376	77	77	90	-13
29	**33WX**	**502AF**	**20190326**	**A ZONE**	**-258**	**83**	**-281**	**85**	**-297**	**84**	**85**	**78**	**7**
30	33X 10	502BD	20190225	A ZONE	-320	76	-340	84	-356	81	84	88	-4
31	33X 20	502J	20190328	A ZONE	-353	113					113	121	-8
32	**33XY**	**502BN**	**20190328**	**A ZONE**	**-278**	**75**	**-296**	**75**	**-311**	**81**	**81**	**60**	**21**
33	**33YZ**	**502AD**	**20190328**	**A ZONE**	**-296**	**85**	**-327**	**84**			**85**	**77**	**9**
34	**33Z' 1**	**502G**	**20190326**	**A ZONE**	**-320**	**160**					**160**		**n/a**
35	33Z 11	502V	20190416	A ZONE	-321	68	-346	75			75	64	11
36	34D' 6	502BH	20190305	A ZONE	-270	787	-303	834	-335	676	834	1,060	-226
37	**34DG**	**502Z**	**20190321**	**A ZONE**	**-292**	**468**	**-324**	**466**			**468**	**859**	**-391**
38	34F 5	502BR	20190411	A ZONE	-297	87	-322	197	-347	259	259	293	-34
39	34F 10	502AR	20190328	A ZONE	-311	57	-326	57			57	55	2
40	34H 25	502AH	20190404	A ZONE	-297	141	-312	142	-331	164	164	191	-27

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 16-17	Change in Chloride (FY17-18 - FY16-17)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 17-18		
41	34H5	512E	20190326	A ZONE	-298	68	-313	70	-328	70	70	75	-5
42	**34HJ**	**502BX**	**20190415**	**A ZONE**	**-310**	**88**	**-321**	**88**	**-331**	**88**	**88**	**809**	**-721**
43	**34JL**	**503AP**	**20190415**	**A ZONE**	**-262**	**63**	**-288**	**71**	**-308**	**747**	**747**	**156**	**591**
44	**34LS**	**503BD**	**20190320**	**A ZONE**	**-238**	**87**	**-283**	**86**			**87**	**173**	**-86**
45	34N 21	512B	20190307	A ZONE	-328	90	-354	105			105	86	19
46	34N' 7	503AF	20190228	A ZONE	-106	56	-144	74	-176	77	77	100	-22
47	**34S0.1**	**503BV**	**20190319**	**A ZONE**	**-239**	**84**	**-249**	**116**	**-256**	**88**	**116**	**91**	**25**
48	34U 8	513F	20190410	A ZONE	-280	90	-310	89			90	95	-5
49	34V3	503CD	20190410	A ZONE	-263	66					66	69	-4
50	34V 20	513B	20190416	A ZONE	-234	137	-265	138	-292	137	138	143	-5
51	**34VZ**	**503BH**	**20190410**	**A ZONE**	**-146**	**80**	**-156**	**74**			**80**	**84**	**-4**
52	34W' 5	503AJ	20190228	A ZONE	-81	157	-101	118	-119	93	157	117	40
53	34X40	513P	20190319	A ZONE	-202	64	-232	31			64	149	-85
54	**34Y0.1**	**503CL**	**20190320**	**A ZONE**	**-107**	**1,410**					**1,410**	**875**	**535**
55	**35E0.1**	**503BK**	**20190318**	**A ZONE**	**-74**	**87**					**87**	**66**	**21**
56	35F 20	513J	20190318	A ZONE	-129	84	-158	81			84	122	-38
57	**35H 11**	**514G**	**20190318**	**A ZONE**	**-123**	**92**	**-146**	**536**			**536**	**693**	**-157**
58	**35H 12**	**514D**	**20190508**	**A ZONE**	**-137**	**75**					**75**	**72**	**3**
59	**35J1**	**514L**	**20190508**	**A ZONE**	**-193**	**82**	**-208**	**85**	**-228**	**82**	**85**	**84**	**2**
60	**35K1**	**523B**	**20190313**	**A ZONE**	**-197**	**21**	**-212**	**18**	**-227**	**290**	**290**	**362**	**-72**
61	36F' 1	505D	20190228	A ZONE	-99	1,280					1,280	915	365
62	OCWD-BS14/3		20190306	A ZONE		3,180					3,180	3,550	-370
63	OCWD-BS21/3		20190306	A ZONE		374					374	398	-24
64	33G	DP1									50	50	n/a
65	33J	DP2									50	50	n/a
66	33L	DP3									50	50	n/a
67	33N	DP4									50	50	n/a
68	33Q	DP5									50	50	n/a
69	33S	DP6									50	50	n/a
70	33U	DP7									50	50	n/a
71	33V	DP8									50	50	n/a
72	33W	DP9									50	50	n/a
73	33X	DP10									50	50	n/a
74	33Y	DP11									50	50	n/a
75	33Z	DP12									50	50	n/a
76	33Z2	DP13									50	50	n/a
77	34D	DP14									50	50	n/a
78	34F	DP15									50	50	n/a
79	34H	DP16									50	50	n/a
80	34J	DP17									50	50	n/a
81	34L	DP18									50	50	n/a
82	34N	DP19									50	50	n/a
83	34Q	DP20									50	50	n/a
84	34S	DP21									50	50	n/a
85	34T	DP22									50	50	n/a
86	34V	DP23									50	50	n/a
87	34X	DP24									50	50	n/a
88	34Z2	DP25									50	50	n/a
89	35G	DP26									50	50	n/a
90	35H1	DP27									50	50	n/a
91	35H2	DP28									50	50	n/a

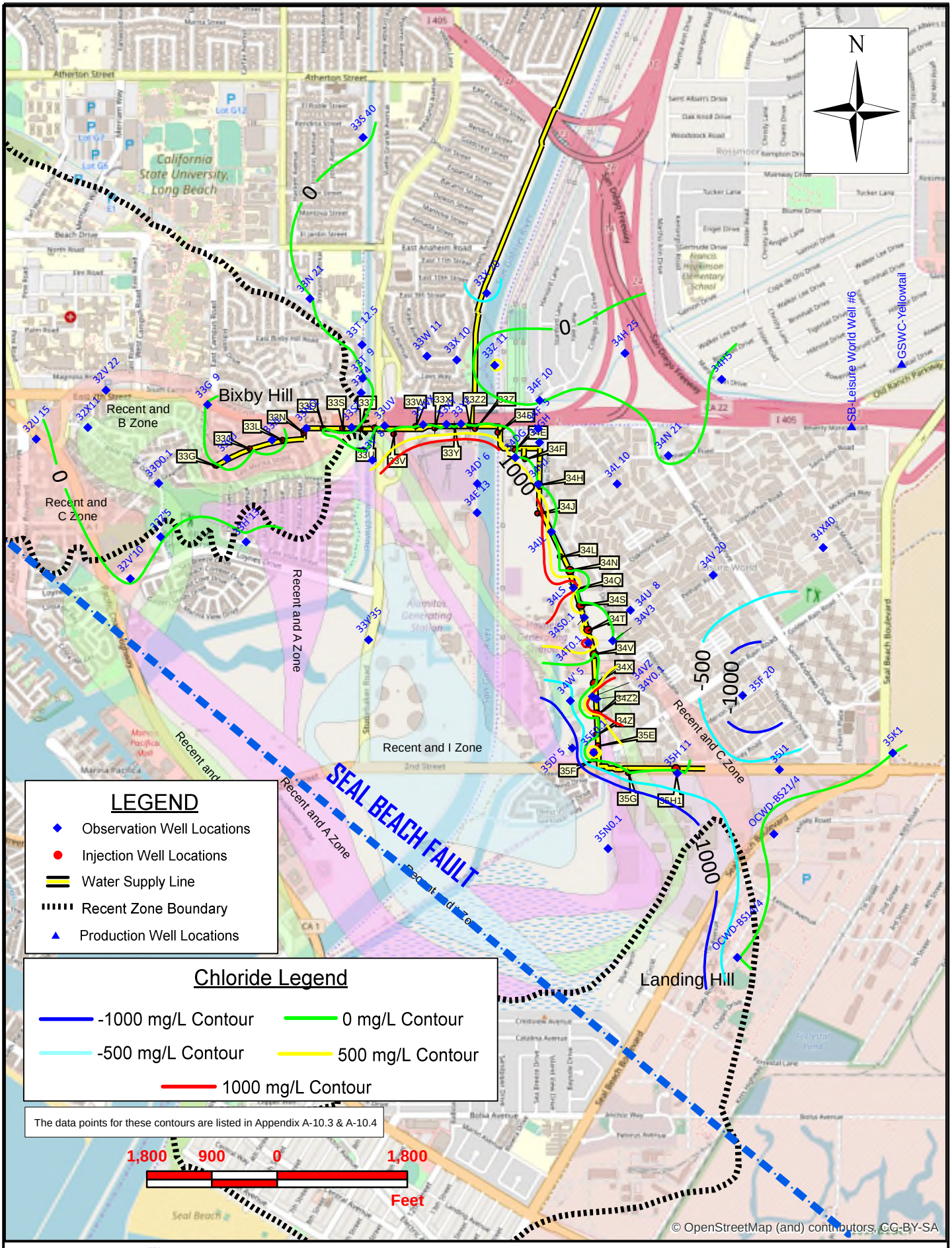
DP = Dummy Point with an assumed chloride concentration of 50 mg/L. Placed at wells that were injecting into this zone during this reporting period.



Alamitos Barrier Project
I Zone Chloride Concentration (mg/L) Contours, Spring 2019

A-10.1

I Zone Cl.sif



Alamitos Barrier Project
I Zone Change in Chloride Concentration, Spring 2018 to Spring 2019

A-10.2

I Zone Cl.sif

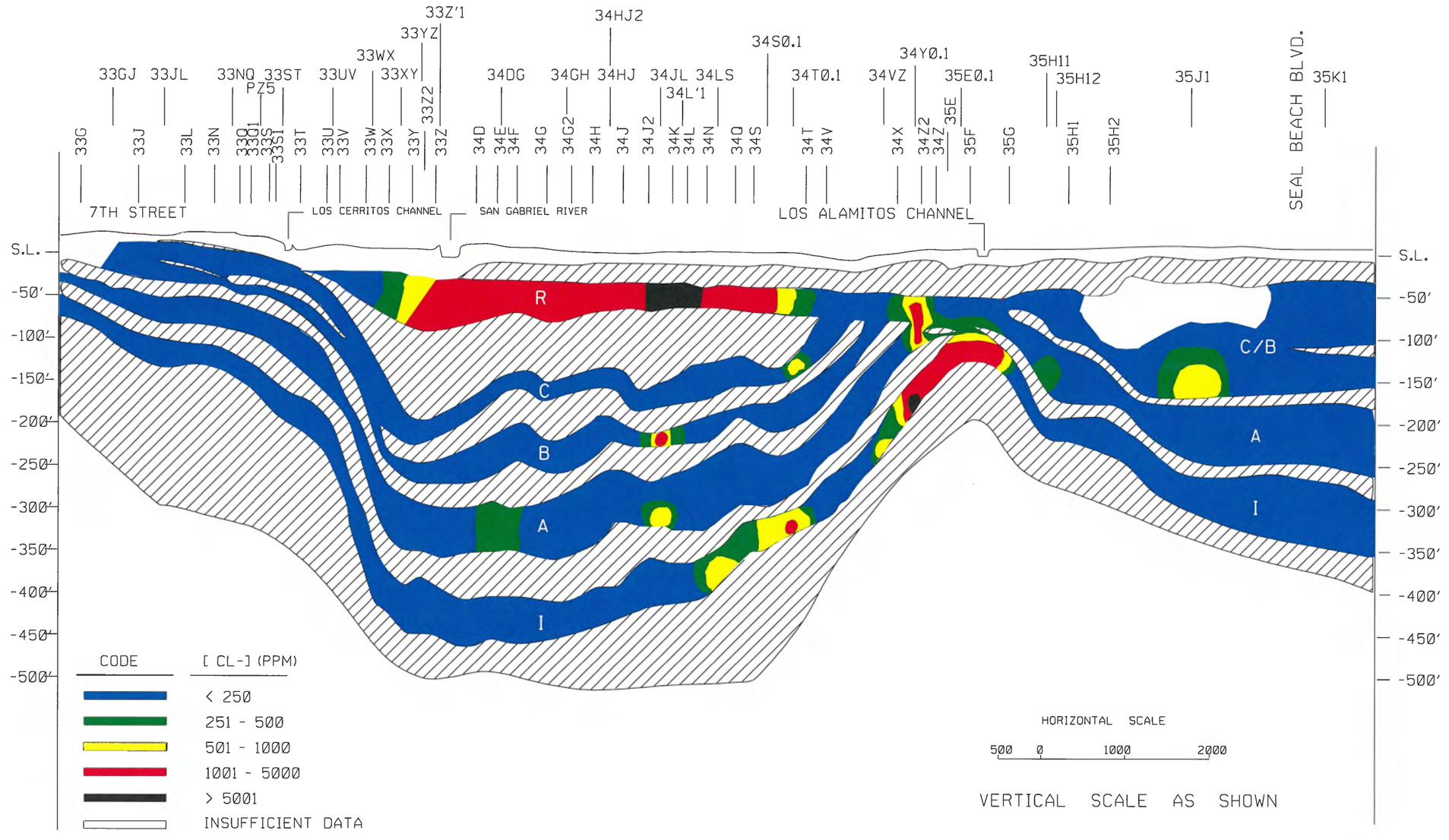
ALAMITOS BARRIER PROJECT
I-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in **Bold**)						For Contours	MAX CHLORIDE FY17-18	Change in Chloride (FY18-19 - FY17-18)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 18-19		
1	32U 15	482L	20190226	I ZONE	-74	99					99	140	-41
2	32V 22	482N	20190226	I ZONE	-51	206					206	123	83
3	32V'10	483E	20190211	I ZONE	-140	297	-152	284	-165	283	297	232	65
4	32X11	482R	20190311	I ZONE	-51	565	-61	583			583	481	102
5	32Z'5	482V	20190211	I ZONE	-68	292	-83	365	-98	528	528	517	11
6	33D0.1	482U	20190307	A,I	-24	81	-49	87	-74	85	87	75	12
7	33G 9	482G	20190214	I ZONE	-34	59	-68	59	-78	60	60	62	-2
8	**33GJ**	**482Y**	**20190311**	**I ZONE**	**-75**	**72**	**-95**	**72**			**72**	**93**	**-21**
9	33H'13	493XX	20190214	I ZONE	-89	137					137	165	-28
10	**33JL**	**492BW**	**20190507**	**A,I**	**-41**	**54**	**-79**	**54**	**-116**	**54**	**54**	**78**	**-24**
11	33N 21	492BV	20190221	I ZONE	-457	73	-468				73	70	3
12	**33NQ**	**492BP**	**20190311**	**A,I**	**-48**	**65**	**-92**	**133**	**-136**	**113**	**133**	**85**	**48**
13	33S 40	491F	20190306	I ZONE	-470	422					422	402	20
14	**33ST**	**492BM**	**20190320**	**I ZONE**	**-130**	**85**	**-148**	**86**	**-163**	**87**	**87**	**72**	**15**
15	33T 9	492XX	20190509	I ZONE	-364	85					85	78	7
16	33T 12.5	492BT	20190311	I ZONE	-423	86	-438	86	-443		86	99	-13
17	33T4	492CQ	20190312	I ZONE	-277	172	-292	181			181	84	97
18	**33UV**	**492BJ**	**20190416**	**I ZONE**	**-209**	**74**	**-228**	**81**	**-246**	**76**	**81**	**75**	**7**
19	33V' 8	492BX	20190305	I ZONE	-109	4,130	-130	4,920			4,920	4,840	80
20	33W 11	502U	20190321	I ZONE	-423	63	-446	62	-468	61	63	78	-15
21	**33WX**	**502AG**	**20190326**	**I ZONE**	**-374**	**65**	**-391**	**68**	**-405**	**67**	**68**	**66**	**2**
22	33X 10	502BE	20190225	I ZONE	-420	225	-440		-460		225	591	-366
23	33X 20	502H	20190328	I ZONE	-442	532					532	1,140	-608
24	**33XY**	**502BP**	**20190328**	**I ZONE**	**-403**	**72**	**-417**	**63**	**-431**	**60**	**72**	**80**	**-8**
25	33Y'35	493ZZ	20190226	I ZONE	-67	22,900					22,900	25,900	-3,000
26	**33YZ**	**502AE**	**20190328**	**I ZONE**	**-402**	**92**	**-433**	**85**			**92**	**73**	**19**
27	33Z 11	502W	20190416	I ZONE	-417	343	-437	395	-457	1,060	1,060	442	618
28	34D' 6	502BI	20190305	I ZONE	-400	5,920	-410	6,930	-418	8,120	8,120	1,110	7,010
29	**34DG**	**502AA**	**20190321**	**I ZONE**	**-402**	**75**	**-432**	**77**			**77**	**75**	**2**
30	34E'13	503AT	20190305	I ZONE	-289	3,910	-308	12,400			12,400	863	11,537
31	34F 5	502BQ	20190418	I ZONE	-411	61	-426	73	-441	74	74	69	6
32	34F 10	502AS	20190328	I ZONE	-416	67	-442	69			69	63	6
33	**34GH**	**502BV**	**20190321**	**I ZONE**	**-411**	**80**	**-427**	**80**	**-437**	**79**	**80**	**65**	**16**
34	34H 25	502AJ	20190404	I ZONE	-407	152	-427	443	-446		443	309	134
35	34H5	512D	20190326	I ZONE	-408	117	-423	119	-443	212	212	226	-14
36	**34HJ**	**502BW**	**20190415**	**I ZONE**	**-407**	**78**	**-417**	**77**	**-427**	**77**	**78**	**78**	**0**
37	**34JL**	**503AN**	**20190415**	**I ZONE**	**-382**	**87**	**-403**	**88**			**88**	**84**	**3**
38	34L 10	502AN	20190228	I ZONE	-404	60	-426	50			60	85	-25
39	**34LS**	**503BC**	**20190423**	**I ZONE**	**-338**	**275**	**-368**	**9,910**			**9,910**	**7,970**	**1,940**
40	34N 21	512C	20190307	I ZONE	-423	82	-448	72			82	69	14
41	**34S0.1**	**503BW**	**20190509**	**I ZONE**	**-306**	**770**	**-310**	**1,340**			**1,340**	**658**	**682**
42	**34T0.1**	**503AD**	**20190509**	**I ZONE**	**-289**	**225**	**-312**	**1,630**	**-334**	**1,630**	**1,630**	**150**	**1,480**

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 FY16-17	Change in Chloride (FY17-18 - FY16-17)
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 17-18		
43	34U 8	513G	20190410	I ZONE	-360	87	-375	91			91	122	-31
44	34V 20	513C	20190416	I ZONE	-386	89					89	105	-16
45	34V3	503CE	20190410	I ZONE	-328	83					83	96	-14
46	**34VZ**	**503BG**	**20190422**	**I ZONE**	**-214**	**103**	**-224**	**997**			**997**	**106**	**891**
47	34W' 5	503AK	20190228	I ZONE	-156	3,590					3,590	4,150	-560
48	34X40	513N	20190320	I ZONE	-331	1,380	-346	1,430			1,430	1,690	-260
49	**34Y0.1**	**503CM**	**20190418**	**I ZONE**	**-175**	**2,460**	**-185**	**5,410**			**5,410**	**192**	**5,218**
50	35D' 5	503AM	20190226	I ZONE	-89	591					591	2,220	-1,629
51	**35E0.1**	**503BJ**	**20190318**	**I ZONE**	**-114**	**3,420**					**3,420**	**1,860**	**1,560**
52	35F 20	513H	20190318	I ZONE	-235	886	-245	1,300	-255	1,470	1,470	3,370	-1,900
53	**35H 11**	**514H**	**20190318**	**I ZONE**	**-203**	**115**					**115**	**162**	**-47**
54	**35J1**	**513M**	**20190508**	**I ZONE**	**-261**	**96**	**-271**	**96**	**-281**	**97**	**97**	**385**	**-288**
55	**35K1**	**523C**	**20190325**	**I ZONE**	**-363**	**31**					**31**	**31**	**0**
56	35N0.1	504N	20190226	I ZONE	-71	385					385	5,780	-5,395
57	OCWD-BS14/4		20190306	I ZONE		261					261	276	-15
58	OCWD-BS21/4		20190306	I ZONE		1,450					1,450	1,270	180
59	33G	DP1									50	50	n/a
60	33J	DP2									50	50	n/a
61	33L	DP3									50	50	n/a
62	33N	DP4									50	50	n/a
63	33Q	DP5									50	50	n/a
64	33U	DP6									50	50	n/a
65	33V	DP7									50	50	n/a
66	33W	DP8									50	50	n/a
67	33X	DP9									50	50	n/a
68	33Y	DP10									50	50	n/a
69	33Z	DP11									50	50	n/a
70	33Z2	DP12									50	50	n/a
71	34D	DP13									50	50	n/a
72	34E	DP14									50	50	n/a
73	34F	DP15									50	50	n/a
74	34G2	DP16									50	50	n/a
75	34H	DP17									50	50	n/a
76	34L	DP18									50	50	n/a
77	34N	DP19									50	50	n/a
78	34Q	DP20									50	50	n/a
79	34S	DP21									50	50	n/a
80	34T	DP22									50	50	n/a
81	34V	DP23									50	50	n/a
82	34X	DP24									50	50	n/a
83	34Z2	DP25									50	50	n/a
84	34Z	DP26									50	50	n/a
85	35E	DP27									50	50	n/a
86	35F	DP28									50	50	n/a
87	35G	DP29									50	50	n/a
88	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 2019

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

ALAMITOS BARRIER PROJECT
Overview Map

Public Works
LOS ANGELES COUNTY

N

POINT A

POINT B

POINT C

POINT D

Leo J. Vander Lans Water Treatment Facility

LONG BEACH
LOS ANGELES COUNTY

LOS ALAMITOS
ORANGE COUNTY

SEAL BEACH
ORANGE COUNTY

33W110
33U170
33L77
33Y64
33H 57
33S52
33W54
33S43
33G36
33S40
33T29
33L30
33S20
33L23
33N21
33X20
33S18
33T15
33D24
33Q15
33T
33U11
33W11
33X10
33Y10
33Z11
34H25
33Q9
33T9
34H5
33T4
33U3
33Q6
32V22
33Y
34F10
34D10
33G9
33N
33Q
33S
33T
33U
33W
33Z
34D
34F
32X11
33L
32U15
34N2134N21
33GJ
34G
33G
33Q1
33S1
33U'3
33V
33X
33Z2
34G2
33D0.1
33J
PZ2
34E
34HJ
34L10
32X'3
33D0.1
33V'14
33V'8
33W'14
34H
34E'13
33T'13
34J2
33T'8
33W'17
34J
34JL
34K
32Z'5
PZ1
33H'13
34E'23
34X40
33V'22
33V'15P
34L
34N
34V20
32V'10
32V'10
32V'10
34H'17
34N'7
34LS
34H'17P
34S
34U8
33D'22
34H'18P
34J'12
34Q
34T0.1
33Y'35
34N'16
34S0.1
34T
32T'25
34V3
34V
34X
34VZ
34Q'22
34W'5
35F20
33V'46
34Y0.1
34Z2
34S'22P
34S'16
32X'35
33K'42
34V'18
34Z
35E
33Z'50
35D'5
34F'40
33Z'5
35E0.1
35G
35K1
35F
35H11
35H2
35J1
34K'47
35H12
35F'21
35H1
35J 7
35K'12
35N0.1
36F'14
36F'1
35S'24
35V'32

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

0 3,000 6,000 Feet

Legend

- Alamitos_Observation_Wells
- Alamitos_Injection_Wells
- Alamitos Water Supply Line

A-12.1

ALAMITOS BARRIER PROJECT
Project Location Map

Public Works
LOS ANGELES COUNTY

N

POINT A

POINT B

POINT C

POINT D

Leo J. Vander Lans Water Treatment Facility

LONG BEACH
LOS ANGELES COUNTY

LOS ALAMITOS
ORANGE COUNTY

SEAL BEACH
ORANGE COUNTY

ABP Telemetry System Upgrade - Replacement of existing Geomation hardware with Siemens-based telemetry equipment, and integration into the Seawater Barrier Telemetry System.

ABP Phase 1 Haynes Telemetry Expansion

33W110 33U170 33L77 33H 57 33S52 33W54 33Y64 33S43 33S40 33G36 33T29 33L30 33S20 33L23 33N21 33X20 33S18 33T15 33D24 33Q15 33T 33U11 33W11 33X10 33Y10 33Z11 34H25 34H5 33Q9 33T9 33T4 33U3 33Q6 32V22 33G9 34F10 34F4 32X11 32U15 33N 33Q 33S 33T 33U 33W 33Z 34F 33L 33GJ 33G 33Q1 33S1 33U'3 33V 33X 33Z2 34E 34G 34G2 33D0.1 33J PZ2 33V'14 33V'8 33W'14 34H 34HJ 34J2 32X'3 33D0.1 33T'13 33T'8 33W'17 34E'13 34E'23 34J 34JL 34K 34L 34N 32Z'5 PZ1 33H'13 33V'15P 34H'17 34N'7 34LS 32V'10 32V'10 32V'10 34H'17P 34S 34U8 33D'22 34H'18P 34J'12 34Q 34T0.1 34S0.1 33Y'35 34N'16 34T 34V3 32T'25 34V 34X 34VZ 34Q'22 34W'5 35F20 33V'46 34S'22P 34S'16 34Y0.1 34Z2 32X'35 33K'42 34V'18 34Z 35E 33Z'50 34F'40 35D'5 35E.1 35G 35K1 33Z'5 35F 35H11 35H2 35J1 34K'47 35H12 35F'21 35H1 35J 7 35K'12 35N0.1 36F'14 36F'1 35S'24 35V'32 34X40 34V20

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

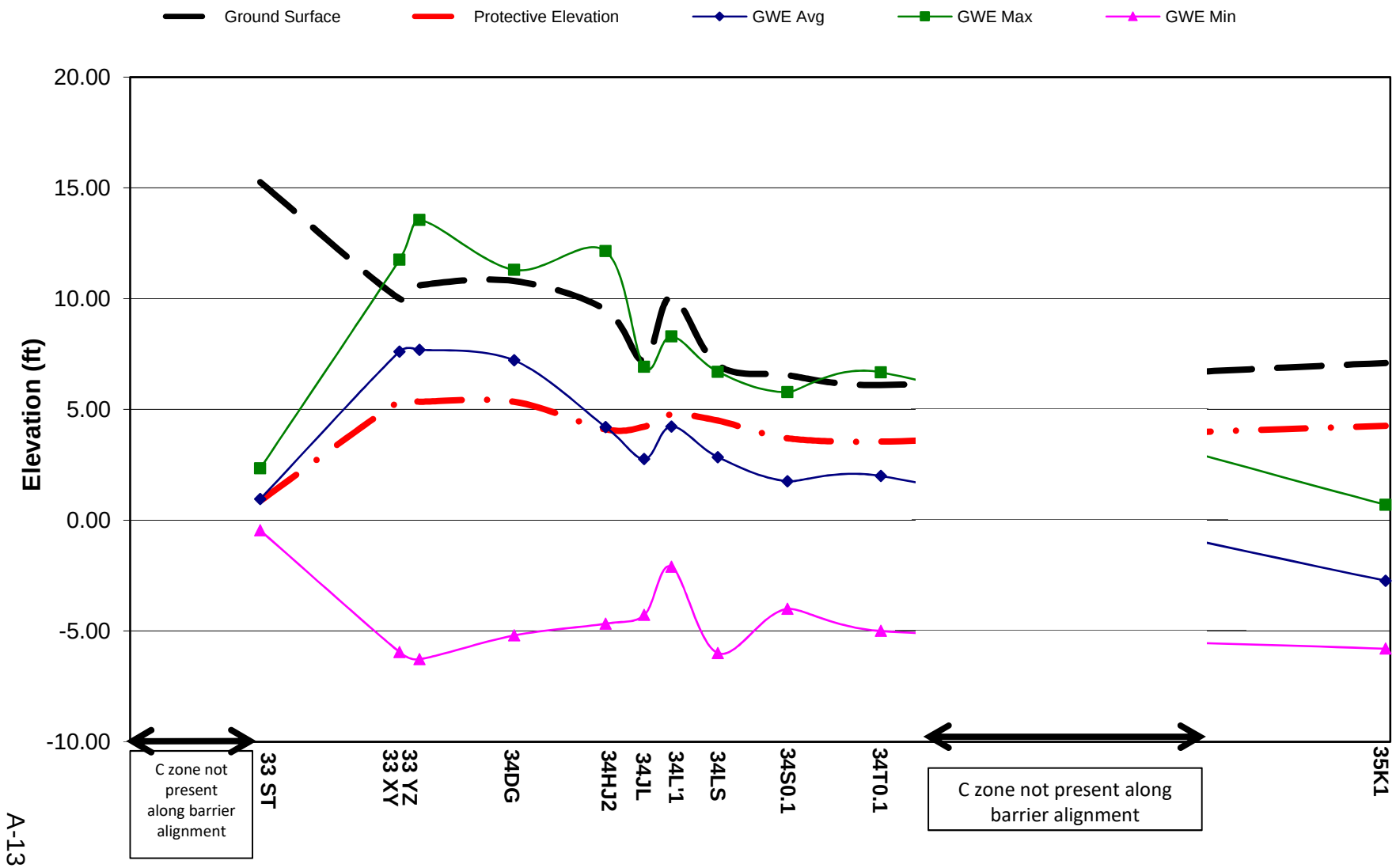
0 3,000 6,000 Feet

Legend

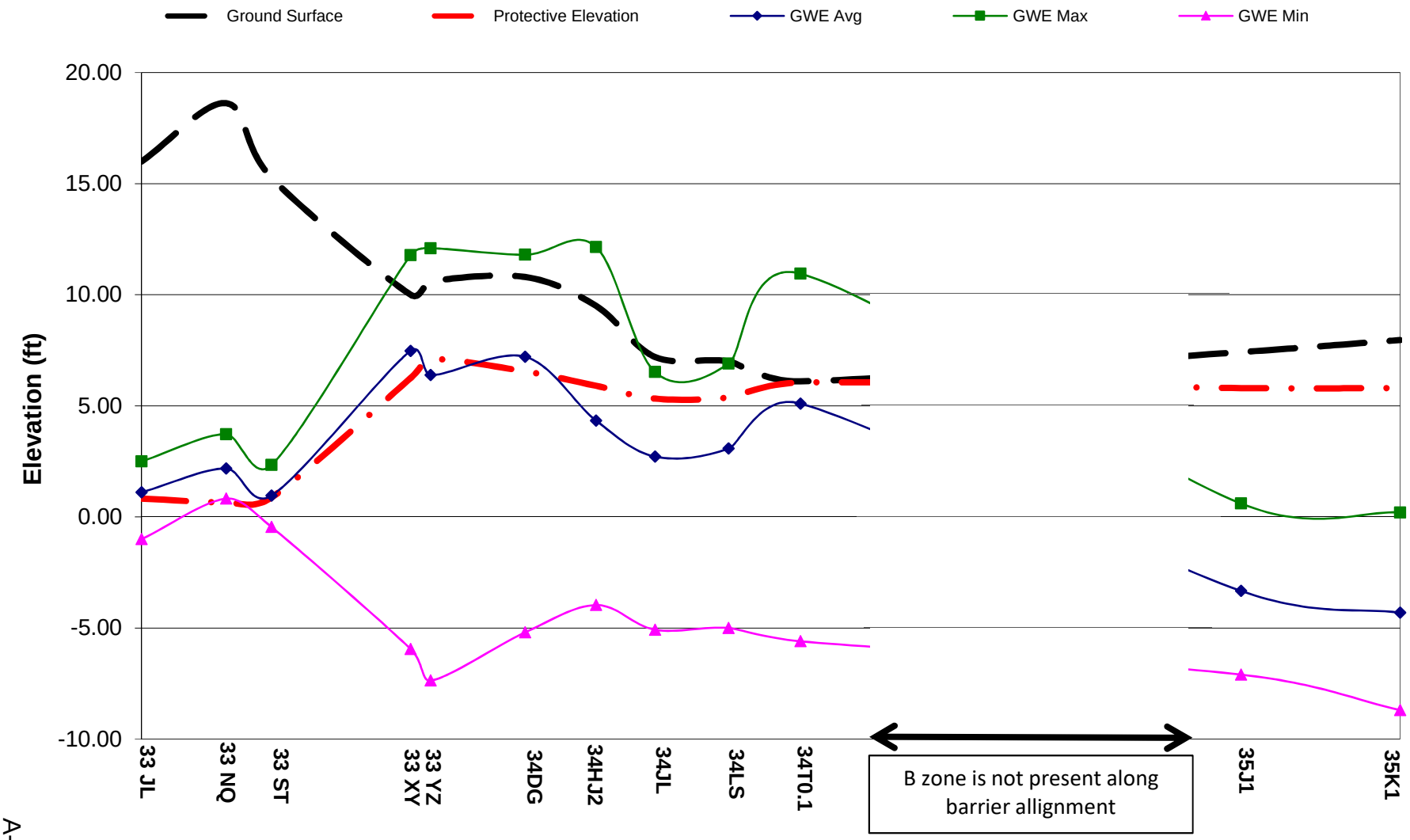
- Alamitos_Observation_Wells
- Alamitos_Injection_Wells
- Alamitos Water Supply Line

A-12.2

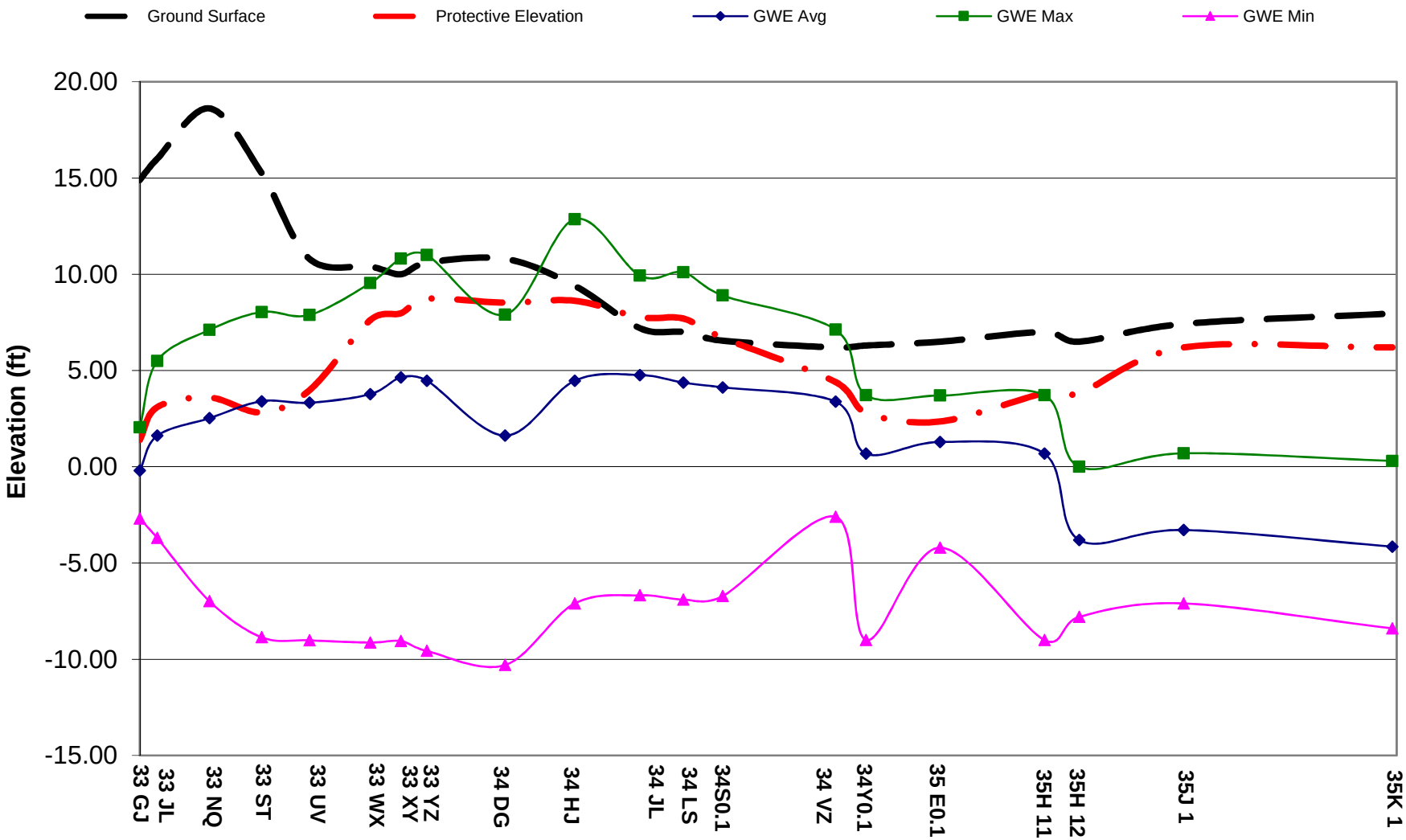
C Zone - Groundwater Elevation (GWE) Along the ABP FY18-19



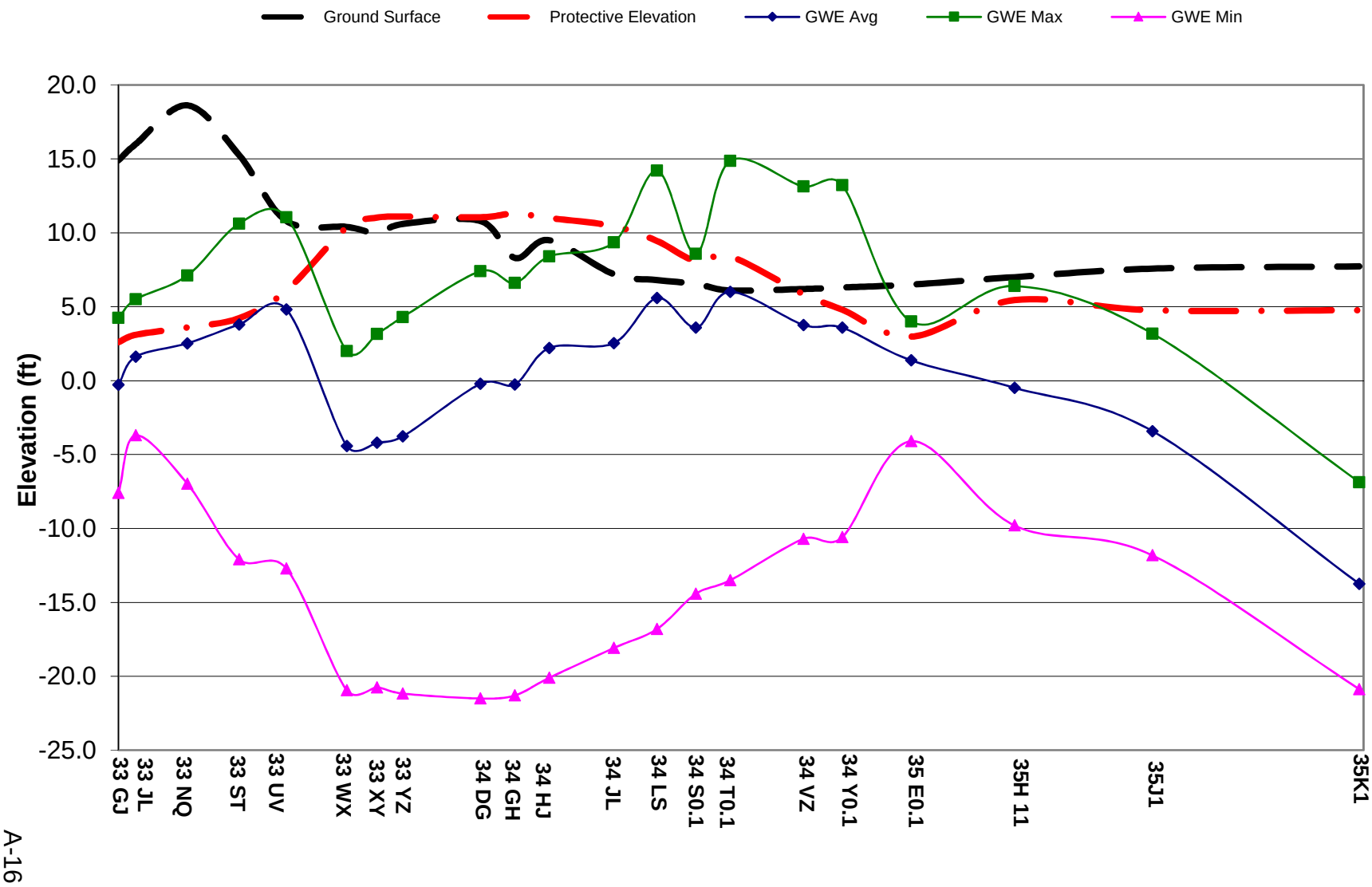
B Zone - Groundwater Elevation (GWE) Along the ABP FY18-19



A Zone - Groundwater Elevation (GWE) Along the ABP FY18-19



I Zone - Groundwater Elevation (GWE) Along the ABP FY18-19



Capital Improvement Projects and Contracts (July 2018 through June 2019)

Board Award Date	Project Title	Description	Contractor	Final Contract Amount	Field Acceptance
6/16/2017	ABP Telemetry	Replace existing Geomation system with Siemens based system, also incorporate signal from well 33U3	Leed Electric, Inc.	$388,308 Awarded	Jun-19
May-17	ABP Unit 14 - Phase 2 Wellhead Improvement	Installation of injection well vaults, piping, and telemetry equipment	Kiewit	$3,550,000 Awarded	Aug-18
5/23/2018	ABP - Phase 1 Haynes Plant Telemetry Extension	Install conduit, above ground intrument panels and run twisted shielded pair for wells 34E, 34J, and 34L. Replace old well vaults at 34HJ.	Tetra Tech	$77,250 Awarded	Jan-19

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

Summary of the Alamitos Barrier Project Shutdowns (July 2018 through June 2019)

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
11/13/2018	12/18/2018	35	34D (C,B,A,I)	Left disassembled after redevelopment for video well survey. Maintenance crew reported a possible hole or bent casing. Maintenance Crews kept losing a tool at the same depth.	LACPW	Video survey did not indicate any issues with the well casing. Resumed injection.
2/20/2019	3/12/2019	20	33G (A,I)	Barriers Crew damaged the PVC piping above the header while they were vaccuming out the below grade vault.	LACPW	Barrier Crews replaced PVC piping. Resumed injection.
3/27/2019	5/7/2019	41	34X (A) 34X (I)	Flooding at observation well 34VZ, A and I zones.	LACPW	Wells turned off to lower groundwater levels to stop flooding at observatoin wells 34VZ. Resumed injection at a lower flowrate.
5/7/2019	6/4/2019	28	34J (A,I)	Barriers Crews detected a hole in the lateral piping.	LACPW	LACPW welders were able to repair the lateral. Resumed injection.
5/14/2019	7/3/2019	50	33Z2 (A,I)	Faulty isolation valves. Left offline after redevelopment.	LACPW	Isolation valves replaced during Barrier shutdown. Resumed injection.
6/11/2019	N/A	N/A	33G (A,I)	It was reported by Stormwater Maintenance Division that the well head was leaking and is in need of a gasket replacement.	LACPW	Long Beach street occupancy permit issued. Well is scheduled for repair (9/4/19) and will resume injection once completed.
6/24/2019	7/3/2019	9	Entire Barrier	Metropolitan Water District shutdown of LB-7A Connection for a valve inspection on 6/27/19.	MWD\LACPW	Reopened PRV on 6/27 and began charging segments of the barrier on 6/27 through 7/3. Operation of Barrier Resumed on 7/3.

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 2018-19

ITEM NO.	DESCRIPTION	JOB NO.	DESCRIPTION	SERVICES AND SUPPLIES	FY 2018-19 BUDGET	% BUDGET FY 18-19	OCWD SHARE 37.9%	OCWD BUDGET FY 18-19	% OCWD BUDGET FY 18-19	LADPW SHARE	LACPW BUDGET FY 18-19	% LACPW BUDGET FY 18-19
1.	Analysis and direction of injection operations	H0321550	BARRIER PROJECT OPERATION-GEN	107,539.41								
		H0321551	ABP ANALY&DIR OF INJECTION O	50,235.10								
			Subtotal #1	**157,774.51**	100,000	157.8%	**59,796.54**	35,000	170.8%	97,977.97	65,000	150.7%
2.	Maintenance and repair of injection wells	F5009760F	DRILL EQPT-MAINT&TEST - Eaton Yard	89,107.41								
		F5064011	INJECT. WELLS-MAINTAIN(ALAMITO	48,051.91								
		F6004011	MAINT INJECTION WELLS - ABP	160,271.72								
		F6980080F	MAINT ENGR - BARRIER PROJ	18,509.53								
		H0321911	Alamitos Barrier Proj-Telemetry Maint.	71,589.85								
		HF01511000	DGBP Automated System	37,038.62								
			Subtotal #2	**424,569.04**	450,000	94.3%	**160,911.66**	157,500	102.2%	263,657.37	292,500	90.1%
3.	Operation of injection	F6004000	RECHARGE OPER U/S - ABP	60,243.23								
			Subtotal #3	**60,243.23**	50,000	120.5%	**22,832.18**	17,500	130.5%	37,411.05	32,500	115.1%
4.	Analysis and direction of extraction operations (No cost to OCWD)	H0321555	ABP ANALY&DIR OF EXTRACT OPE	0.00								
			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			0.00								
			Subtotal #5	**0.00**	10,000	0.0%	**0.00**	0.0	0.0	0.00	10,000	0.0%
6.	Operation of extraction wells (No cost to OCWD)	F6000090	NON-LABOR EXP BARRIER (ALMT)	1,556.46								
			Subtotal #6	**1,556.46**	5,000	31.1%	**0.00**	0.0	0.0	1,556.46	5,000	31.1%
7.	Maintenance and repair of distribution system	F6001907	INSPECT CRANE PRES REDUCE - ABP	2,842.93								
		F6004010	MAINT AIR/VAC-BLWOFF U/S - ABP	6,668.07								
		F6004012	MAINT PRS - ABP	85,067.31								
		F600401 4F	ABP Locate & Mark Barrier Proj. U/grd. Lines	31,904.96								
		F6009118	Disassemble/Reassemble of Wells ABP	31,359.38								
		H0321016	Seawater Barriers Administrative Support	49,411.97								
		H0321569	ALAMITOS BARRIER PROJECT	153,734.12								
			Subtotal #7	**360,988.74**	300,000	120.3%	**136,814.73**	105,000	130.3%	224,174.01	195,000	115.0%
8.	Maintenance of observation wells	F5064044	OBSERV. WELLS-CLEANOUT(ALAMITO	10,310.42								
			Subtotal #8	**10,310.42**	50,000	20.6%	**3,907.65**	17,500	22.3%	6,402.77	32,500	19.7%
9.	Collection of groundwater data	H0321552	ABP COLL OF GR WTR DATA FOR	179,037.72								
			OCPW Permit No. 2018-00574	360.50								
			Seal Beach Permit No. DPW03691	429.62								
			Seal Beach Permit No. DPW03797	492.62								
			Subtotal #9	**180,320.46**	200,000	90.2%	**68,341.45**	70,000	97.6%	111,979.01	130,000	86.1%
10.	Yard Maintenance	FFM34107	Facility Maintenance Alamitos Yd F107	43,427.98								
		FPM34107OS	Planned Maint. Alamitos Yd F107-OSD	968.60								
		F6001904	CONDUCT QUARTERLY INSPECTION	66.53								
		F6001906	CONDUCT QUARTERLY INSPECTION	78.18								
		F6001920	CONDUCT QUARTERLY INSPECTION	379.27								
		F6003123	BUILDING MAINTENANCE NONRESI	9,513.13								
		F6003124	BUILDING MAITENANCE-NONRESI	9,281.31								
			Subtotal #10	**63,715.00**	75,000	85.0%	**8,750.00**	8,750	100.0%	54,965.00	66,250	83.0%
11.	Well redevelopment	F4046791	Redevelop Injection Well 33S - ABP	22,209.42								
		F4046792	Redevelop Injection Well 33Z - ABP	78,255.22								
		F4046815	Redevelop Injection Well 33Y - ABP	75,594.37								
		F4046818	Redevelop Injection Well 33Q and 33Q1 - ABP	42,053.44								
		F4046850	Redevelop Injection Well 33S1 - ABP	34,164.34								
		F4046851	Redevelop Injection Well 34J - ABP	45,393.69								
		F4046854	Redevelop Injection Well 34G - ABP	36,388.75								
		F4046855	Redevelop Injection Well 33Z2 - ABP	48,896.28								
		F4046861	Redevelop Injection Well 33X - ABP	44,709.09								
		F4046862	Redevelop Injection Well 33W - ABP	485.70								
		F5064022	Redevelop injections wells - ABP	79,428.16								
		F55950193	REDEVELOP INJECTION WELL 34D - A.B.P.	98,148.20								
		F55950200	REDEVELOP INJECTION WELL 33N - A.B.P.	19,006.53								
		F55950203	REDEVELOP INJECTION WELL 33J - A.B.P.	23,173.30								
		F55950206	REDEVELOP INJECTION WELL 33G - A.B.P.	19,276.35								
		F55950207	REDEVELOP INJECTION WELL 33L - A.B.P.	19,029.65								
		H0321554	ABP WELL REDEVELOPMENT PROGRAM	156,155.30								
		H0321565	ABP NPDES MONI & REPORT INJ WE	43,154.07								
			OCPW Permit No. 2018-00642	1,545.00								
			Seal Beach Permit No. DPW03658	729.62								
			Subtotal #11	**887,796.48**	500,000	177.6%	**336,474.87**	175,000	192.3%	551,321.61	325,000	169.6%
12.	Processing of data and preparation of reports	H0321553	ABP DATA PRO & PRE OF REPORT	67,966.51								
			Subtotal #12	**67,966.51**	60,000	113.3%	**25,759.31**	21,000	122.7%	42,207.20	39,000	108.2%
13.	Reclaim Water Program	H0321556	ABP RECLAIMED WATER SUPPLY	17,232.08								
			Subtotal #13	**17,232.08**	50,000	34.5%	**6,530.96**	17,500	37.3%	10,701.12	32,500	32.9%
14.	Projects & Studies (Reimbursable amounts include labor expenses, plus approved contract expenses that are not addressed under a separate agreement).	HF01515001	ALAMITOS BARRIER PROJECT TELEMETRY SYSTEM UPGRADE	62,612.91								
			Subtotal #14	**62,612.91**	10,000	626.1%	**0.00**	3,500	0.0%	62,612.91	6,500	963.3%
15.	ABP Liability Insurance Premiums paid separately by OCWD	N/A	ABP General Liability Coverage	49,479.24								
			ABP Excess Liability Coverage	14,844.29								
			Subtotal #15	**64,323.53**	76,000	84.6%	**32,161.77**	38,000	84.6%	32,161.77	38,000	84.6%
			TOTAL	**2,359,409.37**	**1,936,000.00**	121.9%	**862,281.12**	666,250.00	129.4%	1,497,128.25	1,269,750.00	117.9%

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 LACFCD and the OCWD, all costs included in Items 4, 5, and 6 are not reimburseable 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 LACFCD 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)	$ 2,295,085.84
ORANGE COUNTY'S SHARE OF THE OPERATION AND MAINTENANCE COST (not including insurance premium)	$ 830,119.35
Less: Los Angeles County's Share of the FY18-19 Liability Insurance	$ 32,161.77
Less: Permit fees paid by OCWD	$ 3,557.36
Less: Advance Deposit Paid by OCWD	$ 314,125.00
BALANCE DUE FROM ORANGE COUNTY WATER DISTRICT	**$ 480,275.22**

ABP FY 2020-21 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 ($)					
	2016-17	55,250	67,944	29,750	16,145			85,000	84,089
	2017-18	65,000	85,629	35,000	22,216			100,000	107,845
	2018-19	65,000	97,978	35,000	59,797			100,000	157,775
	2019-20	55,000		45,000				100,000	
	2020-21	*90,000*		*60,000*				*150,000*	
2.				Maintenance and repair of injection wells ($)					
	2016-17	292,500	294,809	157,500	70,054			450,000	364,863
	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		202,500				450,000	
	2020-21	*270,000*		*180,000*				*450,000*	
3.				Operations of Injection Well Facilities ($)					
	2016-17	26,000	38,379	14,000	9,120			40,000	47,499
	2017-18	32,500	54,179	17,500	14,057			50,000	68,236
	2018-19	32,500	37,411	17,500	22,832			50,000	60,243
	2019-20	38,500		31,500				70,000	
	2020-21	*42,000*		*28,000*				*70,000*	
4.				Analysis and direction of extraction operation ($)					
	2016-17	0	0	0	0			0	0
	2017-18	0	0	0	0			0	0
	2018-19	0	0	0	0			0	0
	2019-20	0		0				0	
	2020-21	*0*		*0*				*0*	
5.				Redevelopment, maintenance, and repair of extraction wells ($)					
	2016-17	10,000	0	0	0			10,000	0
	2017-18	10,000	0	0	0			10,000	0
	2018-19	10,000	0	0	0			10,000	0
	2019-20	10,000		0				10,000	
	2020-21	*10,000*		*0*				*10,000*	
6.				Operations of Extraction Wells ($)					
	2016-17	6,000	1,510	0	0			6,000	1,510
	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		0				5,000	
	2020-21	*5,000*		*0*				*5,000*	
7.				Maintenance and repair of ABP ($)					
	2016-17	227,500	224,063	122,500	53,243			350,000	277,306
	2017-18	227,500	243,510	122,500	63,178			350,000	306,688
	2018-19	195,000	224,174	105,000	136,815			300,000	360,989
	2019-20	165,000		135,000				300,000	
	2020-21	*222,000*		*148,000*				*370,000*	
8.				Maintenance of Observation Wells ($)					
	2016-17	45,500	1,058	24,500	252			70,000	1,310
	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		67,500				150,000	
	2020-21	*30,000*		*20,000*				*50,000*	
9.				Collection of groundwater data ($)					
	2016-17	130,000	143,655	70,000	34,136			200,000	177,791
	2017-18	130,000	137,535	70,000	35,683			200,000	173,218
	2018-19	130,000	111,979	70,000	68,341			200,000	180,320
	2019-20	96,250		78,750				175,000	
	2020-21	*120,000*		*80,000*				*200,000*	
10.				Yard Maintenance ($)					
	2016-17	75,380	68,518	4,620	4,635			80,000	73,153
	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		29,250				65,000	
	2020-21	*65,000*		*10,000*				*75,000*	
11.				Injection Well Redevelopment ($)					
	2016-17	260,000	403,333	140,000	95,842			400,000	499,175
	2017-18	650,000	416,790	350,000	108,134			1,000,000	524,924
	2018-19	325,000	551,322	175,000	336,475			500,000	887,796
	2019-20	550,000		450,000				1,000,000	
	2020-21	*600,000*		*400,000*				*1,000,000*	
12.				Processing of data and preparation of reports ($)					
	2016-17	39,000	46,570	21,000	11,066			60,000	57,636
	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		36,000				80,000	
	2020-21	*48,000*		*32,000*				*80,000*	
13.				Oversight of Reclaim Water Program ($)					
	2016-17	19,500	35,663	10,500	8,474			30,000	44,138
	2017-18	29,250	34,005	15,750	8,822			45,000	42,827
	2018-19	32,500	10,701	17,500	6,531			50,000	17,232
	2019-20	27,500		22,500				50,000	
	2020-21	*30,000*		*20,000*				*50,000*	
14.				Projects and Studies ($)					
	2016-17	6,500	19,171	3,500	4,556			10,000	23,727
	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		4,500				10,000	
	2020-21	*12,000*		*8,000*				*20,000*	
15.				ABP Liability Insurance ($)					
	2016-17	37,500	37,794	37,500	37,794			75,000	75,588
	2017-18	38,000	38,951	38,000	38,951			76,000	77,902
	2018-19	38,000	32,162	38,000	32,162			76,000	64,324
	2019-20	40,000		40,000				80,000	
	2020-21	*35,000*		*35,000*				*70,000*	
16.				Total ABP Expenditure ($)					
	2016-17	1,230,630	1,382,469	635,370	345,315			1,866,000	1,727,784
	2017-18	1,726,010	1,738,394	909,990	479,465			2,636,000	2,217,859
	2018-19	1,269,750	1,497,128	666,250	862,281			1,936,000	2,359,409
	2019-20	1,402,500		1,142,500				2,545,000	
	2020-21	*1,579,000*		*1,021,000*				*2,600,000*	
TOTALS				Total ABP Operations and Maintenance ($) [Item 16-Item 15]					
	2016-17	1,193,130	1,344,675	597,870	307,521			1,791,000	1,652,196
	2017-18	1,688,010	1,699,443	871,990	440,515			2,560,000	2,139,958
	2018-19	1,231,750	1,464,966	628,250	830,119			1,860,000	2,295,086
	2019-20	1,362,500		1,102,500				2,465,000	
	2020-21	*1,544,000*		*986,000*				*2,530,000*	
				Volume of Water (ac-ft)					
	2016-17			2,450	1,165	4,550	4,895	7,000	6,060
	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		4,200		7,000	
	2020-21			*3,000*		*4,500*		*7,500*	