

Alamitos Barrier Project

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Member Agencies:

Orange County Water District

Water Replenishment District of Southern California

Long Beach Water Department

Golden State Water Company

Los Angeles County Flood Control District

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Submitted by:

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Joint Management Committee

**Annual report on the control of seawater intrusion
2015 - 2016**

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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.

The County of Los Angeles Department of 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, groundwater and chloride concentrations, and project costs for Fiscal Year (FY) 2015-16 (i.e., July 1, 2015 through June 30, 2016).

SUMMARY

During FY 2015-16, a total of 6,807.7 acre-feet (AF) of water was injected into the ABP (an average rate of 9.4 cubic feet per second). Of that total, OCWD purchased 2,398.7 acre-feet (35 percent) and the Water Replenishment District of Southern California (WRD) purchased 4,409.0 acre-feet (65 percent). This total injected amount was 305 AF less than FY 2014-15, but was still approximately 1070 AF (20 percent) higher than the average injection of 5,739 AF for the previous five fiscal years. Injection rates continue to be higher than average to counteract lower groundwater elevations, which are most likely the result of historic drought conditions. No major shutdowns have occurred since FY 2006-07. All minor shutdowns for FY 2015-16 are detailed in Appendix A-18.

The total costs associated with the ABP in FY 2015-16 are summarized below:

- Total Cost in FY 2015-16: \$9,754,481
 - Injection Water costs: \$7,052,208 (OCWD: \$2,484,472; LACFCD: \$4,567,737)
 - Total Operations and Maintenance Costs: \$2,626,684
 - Injection-related costs: \$2,237,637 (OCWD: \$769,404; LACFCD: \$1,468,233
 - Equivalent cost per AF of water injected: \$328.69
 - Extraction-related costs: \$6,961 (LACFCD only)
 - Special Programs: \$382,085 (LACFCD only)
 - Liability Insurance cost: \$75,589 (OCWD: \$37,794; LACFCD: \$37,794)

Overall, groundwater levels decreased slightly or showed little change from the previous year. There were also localized decreases that were related to operational activities. In all cases, the southeast portion of the barrier remained below protective elevations due to the limited injection capabilities (quantity of wells, pressure limitations, maintenance, etc). West of the San Gabriel River, chloride concentrations generally decreased with

the exception of various localized increases. East of the San Gabriel River, widespread high chloride concentrations were still present and increased in most cases; some wells exhibited decreased chloride concentrations while remaining quite elevated. Detailed analyses of the reporting period's groundwater elevations and chloride concentrations are provided in the "Hydrogeologic Effects" and "Chlorides" sections below.

It is imperative that the barrier operate consistently and continuously to best prevent seawater intrusion. The JMC will continue to press forward to ensure that the ABP is operated and maintained efficiently, economically, and continuously protects the region's groundwater supplies. The inclusion of additional wells as part of OCWD's Unit 14 New Wells Project will significantly 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

This project is funded by LACFCD. LACFCD hired Tetra Tech to perform a telemetry system design, which consists of replacing the existing Geomation system with a state-of-the-art telemetry system that can be integrated with the existing Seawater Barrier Telemetry system. The ABP Telemetry Upgrade will also incorporate signals from injection wells 33U3 which is not currently on telemetry. This project will help improve the overall efficiency of ABP operations by providing real-time data, including flow, pressure and vault flooded status. The design phase of the project was completed in December 2015 and construction was approved by the County of Los Angeles Board of Supervisors in June 2016, and is anticipated to start in Fall 2016.

ABP Unit 14 Injection and Observation Wells

This project is jointly funded by OCWD and LACFCD and managed by OCWD. It consists of 17 new clustered injection wells, four nested observation wells and two shallow piezometers along the east leg of the ABP. Two injection well clusters and one nested observation well are proposed to be installed between points B and C. These new injection wells will provide additional capacity to maintain protective elevations along the east leg of the ABP. The observation wells will fill data gaps in each of the aquifer zones and improve injection operations. During this reporting period, OCWD re-advertised the project in August 2015, and awarded the contract for Phase 1, which includes the construction and equipping of injection and monitoring wells. Phase 2 involves connecting the injection wells to the ABP pipeline, construction of vaults, and installation of telemetry equipment. Construction began in early 2016 with construction of monitoring well 34V3 located within the Leisure World community.

Destruction of ABP Monitoring Wells

LACFCD hired Gregg Drilling, Inc. to destroy select monitoring wells that were identified as being in “poor condition” wells by the Alamitos Barrier Project Condition Assessment Study prepared by CH2MHill (2012). Additional wells to destroy were identified through LACFCD’s routine observation well cleanout program (see Maintenance on pg. 7). Wells were destroyed by the overdrilling technique. Wells with a total depth of less than 100 feet were destroyed using a hollow-stem auger, while wells deeper than 100 feet were destroyed using direct mud rotary. This project included destruction of the following LACFCD monitoring wells: 33T’24 (A), 33T’24(I), 33Y42(A), 33Y42(I), PZ5, 32S9, 33S18(A), 33S18(I), 34F’13(C), 34F’13(I).

INJECTION OPERATIONS

The total amount of water injected into the ABP during FY 2015-16 was 6,807.7 AF. Of this total, approximately 19 percent (1309.3 AF) was recycled water and 81 percent (5,498.4 AF) was imported water. The maximum monthly injection during this reporting period was 689.0 AF (573.6 AF imported and 115.4 AF reclaimed) which occurred in March 2016. The minimum monthly injection of 503.4 AF (450.8 AF imported and 52.6 AF reclaimed) occurred in September 2015 due to slightly higher groundwater levels most likely resulting from decreased pumping due to an unseasonably wet August and September in 2015.

The percentage of recycled injection increased considerably from the previous year primarily due to more consistent operation of the Leo J. Vander Lans Advanced Water Treatment Facility (AWTF) since completion of the 2014 plant expansion project. The AWTF continued to run intermittently between 3 and 4 million gallons per day (MGD).

The injection volumes and costs for FY 2014-15 and FY 2015-16 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 at the ABP during FY 2015-16 decreased by 4.3 percent from the previous year, however the amount of water injected at the ABP in FY 2015-16 is considerably higher than average volumes injected annually and is the third highest annual injection volume in the past 40 years. The volume injected is also about 19 percent higher than the average injection amount over the previous five fiscal years (5,739.3 AF).

All ABP shutdowns from FY 2015-16 are summarized in Appendix A-18. There were no major shutdowns during this reporting period.

TABLE 1. INJECTION OPERATIONS

	Imported Water Injections			Recycled Water Injections			Total Injections		
	FY14-15	FY15-16	Percent Change From Previous Year	FY14-15	FY15-16	Percent Change From Previous Year	FY14-15	FY15-16	Percent Change From Previous Year
<u>VOLUME OF WATER INJECTED IN ACRE-FEET</u>									
OCWD ¹	2,090.4	1,946.5	-6.9	145.8	452.2	210.2	2,236.2	2,398.7	7.3
WRD ²	4,554.4	3,551.9	-22.0	322.5	857.1	165.8	4,876.9	4,409.0	-9.6
TOTAL	6,644.8	5,498.4	-17.3	468.3	1,309.3	179.6	7,113.1	6,807.7	-4.3
<u>UNIT COST OF WATER PER ACRE-FEET ³</u>									
JULY - DEC	\$1,015.96	\$1,057.74	4.1	\$1,015.96	\$1,057.74	4.1			
JAN - JUN	\$1,058.78	\$1,090.95	3.0	\$1,058.78	\$1,081.74	2.2			
<u>COST OF WATER PURCHASED</u>									
OCWD ¹	\$2,152,920	\$2,020,012	-6.2	\$148,765	\$464,460	212.2	\$2,301,686	\$2,484,472	7.9
WRD ²	\$4,704,665	\$3,686,716	-21.6	\$329,452	\$881,020	167.4	\$5,034,117	\$4,567,737	-9.3
TOTAL	\$6,857,585	\$5,706,728	-16.8	\$478,217	\$1,345,480	181.4	\$7,335,803	\$7,052,208	-3.9
<u>AVERAGE INJECTION RATE IN CFS</u>									
OCWD ¹	2.9	2.7	-6.9	0.2	0.6	210.2	3.1	3.3	7.3
WRD ²	6.3	4.9	-22.0	0.4	1.2	165.8	6.7	6.1	-9.6
TOTAL	9.2	7.6	-17.3	0.6	1.8	179.6	9.8	9.4	-4.3

¹ Orange County Water District (OCWD)

² Water Replenishment District (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 presents the monthly amounts of water injected during FY 2015-16. Figure 2 illustrates the annual amounts of water injected over the last 20 years.

FIGURE 1 - MONTHLY AMOUNT OF WATER INJECTED

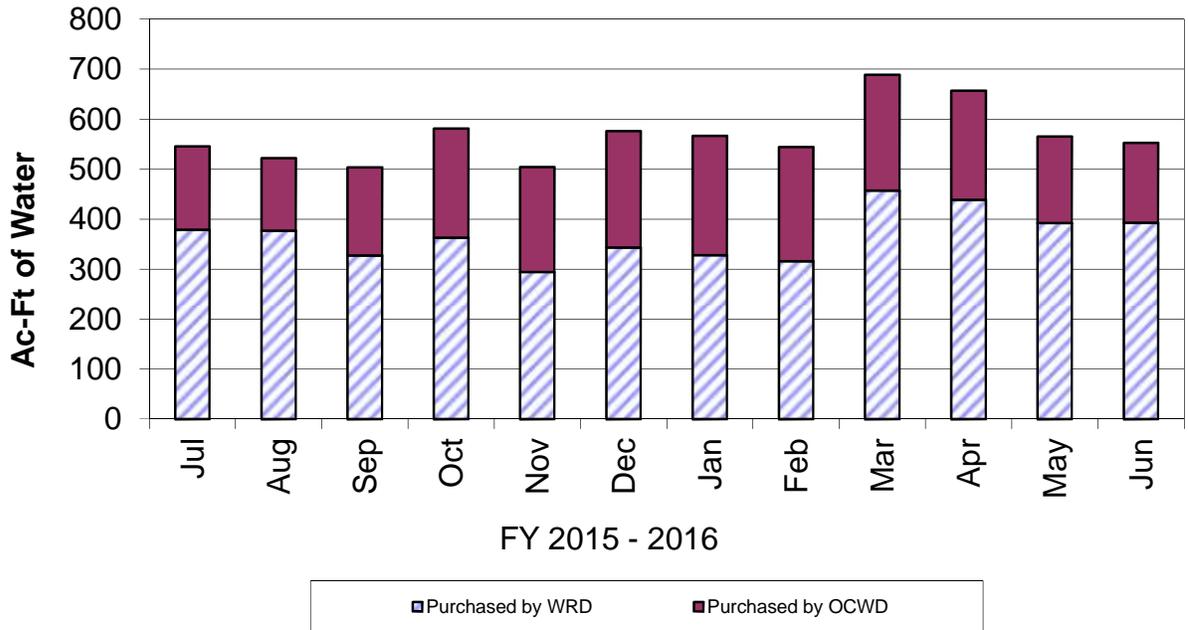
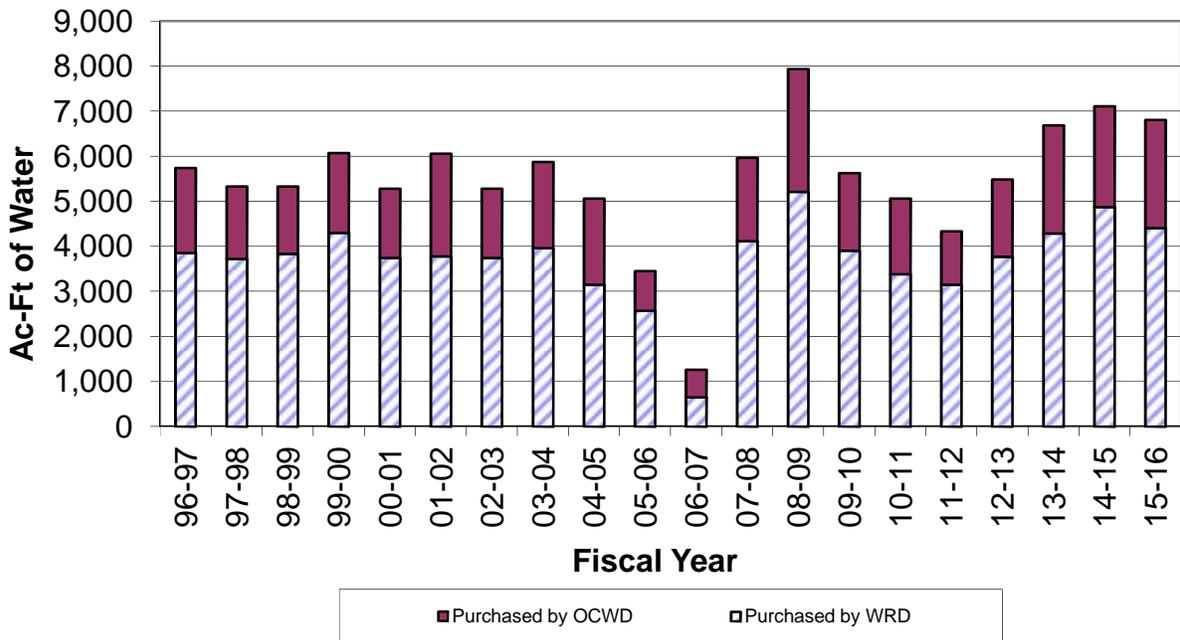


FIGURE 2 - ANNUAL AMOUNT OF WATER INJECTED



MAINTENANCE

Typical well maintenance at the ABP includes observation well cleanouts and injection well redevelopments. 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 41 injection well casings are routinely redeveloped once every two years. During FY 2015-16, Public Works completed redevelopment activities at the following 17 well casings¹: 33S, 33T, 33U, 33U3, 33V, 33W, 33X, 33Y, 33Z, 33Z2, 34D, 34G, 34J, 34L, 35H1(A), 35H1(I), 35H2.

Figure 3 depicts the operating status of each injection and extraction well during FY 2015-16 and demonstrates that the ABP was in operation throughout the entire reporting period. There were minimal ABP shutdowns, as explained in Appendix A-18. However, injection wells 33S1 and 33W operated at a limited flow due to surface leakage, and injection well 34H(A) continues to remain offline due to a hole in the casing.

Injection well 34G(A) suffered from surface leakage intermittently over the past 10 years. An investigation conducted by LACFCD in May 2015 concluded that the well was leaking in the blank casing less than 100' from the surface. To prevent this leakage, a packer was installed just above the perforations to isolate the injection zone, and the well has been operating at normal injection rates and pressures since packer installation in September 2015.

¹ The capital letters in parenthesis represent the aquifer(s) associated with that particular injection well casing. For example, (A) = A Zone aquifer, (A,I) = A and I Zone aquifers, and so forth.

FIGURE 3 - ABP INJECTION STATUS - FY 2015-16

Well No.	2015												2016											
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
33G (A,I)																								
33J (A,I)																					P	P		
33L (A,I)																								
33N (A,I)																								
33Q (A,I)				O	O																			
33Q1 (C,B)																								
33S (A,I)																								D R
33S1 (C,B)	S	S	O	O	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
33T (A,I)																								D R D
33U (A,I)																								D R D
33U3 (C,B)																								D R D D
33V (A,I)																						D	D	R R R D
33W (C,B,A,I)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	D	D	R R R	D D D D	D M M M M M M M M M M M M M M D D
33X (C,B,A,I)																					D	R	R	D
33Y (C,B,A,I)									D	R	R	R	D											
33Z (C,B,A,I)																								D D D D
33Z2 (A)																								
33Z2 (I)																								
34D (C,B,A,I)																								
34E (C,B)																								
34E (I)																								
34F (A)																								
34F (I)																								
34G (A)																								
34G2 (C,B)																								
34G2 (I)																								
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
34H (I)																								
34J (A)																								
34J (I)																								
34L (C,B,A,I)	R	R																						
34S (A)																								
34S (I)																								
34S (C,B)																								
34V (A)																								
34V (I)																								
34V (C,B)																								
34Z (I)																								
35F (I)																								
35G (A,I)																								
35H1 (A)																								
35H1 (I)																								
35H2 (A)																								
33V15P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
34H17P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
34H18P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
34S22P	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

- Well in Operation
- Casing Repair
- Disassembled
- Grouted
- Header Repair
- Misc. Repair
- Not Needed
- Other Circumstances
- Pressure Exceedance
- Redevelopment
- Surface Leakage (operating with reduced flowrate)
- Intermittent shutdown (operated part of the week)
- Under Construction
- Water Quality Sampling
- Waiting for Repair
- Barrier Shutdown
- Under Construction
- Water Quality Sampling
- Waiting for Repair
- Intermittent shutdown

HYDROGEOLOGIC EFFECTS

Figures 4 through 8 (pp. 12-16) show the average monthly groundwater elevation relative to the average groundwater elevation of the 10 preceding years (FY 2005-06 to 2014-15) in the vicinity of the barrier 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 barrier alignment: wells west of the San Gabriel River and wells east of the San Gabriel River. It is important to note that the 10-year average does not represent a groundwater elevation goal nor does it specifically reflect barrier performance, but is simply included for comparison purposes. For example, the 10-year historical average included in the graphs for the FY 2015-16 report is slightly lower than the one shown in the FY 2014-15 report because the FY 2015-16 data now included was generally lower than the FY 2004-05 data that it replaced. The graph includes all available semi-monthly, monthly, semi-annual, and annual data for wells within the barrier alignment and landward for approximately 2,000 feet from the barrier. As a result, semi-monthly values are “weighted” more heavily than the annuals in the calculation of the monthly average.

As shown in the graphs, groundwater elevations during FY 2015-16 were typically at or above historical averages. This was likely due to injection rates that were higher than the 10 year historical average. East of the San Gabriel River, groundwater elevations were above 10-year historical averages for most of the reporting period with the exception of April and May, which could be attributed to drought conditions resulting in more Spring pumping than usual. West of the San Gabriel River, groundwater elevations were at or above the 10-year historical averages for most of the reporting period. September, February 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. In general, all the figures show the expected seasonal trends of higher groundwater elevations in the winter months (decreased pumping) and lower groundwater elevations in the summer months (increased pumping).

FIGURE 4a RECENT ZONE WEST OF THE SAN GABRIEL RIVER

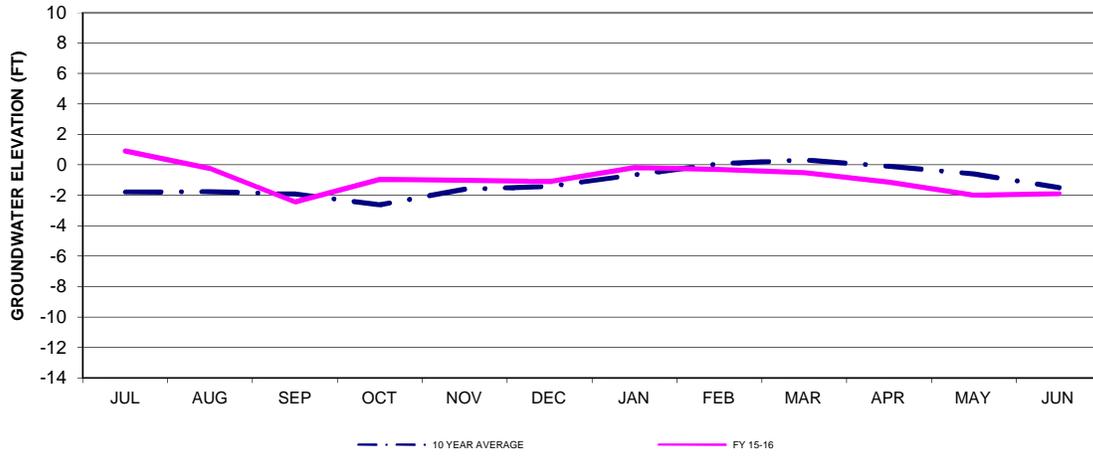


FIGURE 4b RECENT ZONE EAST OF THE SAN GABRIEL RIVER



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

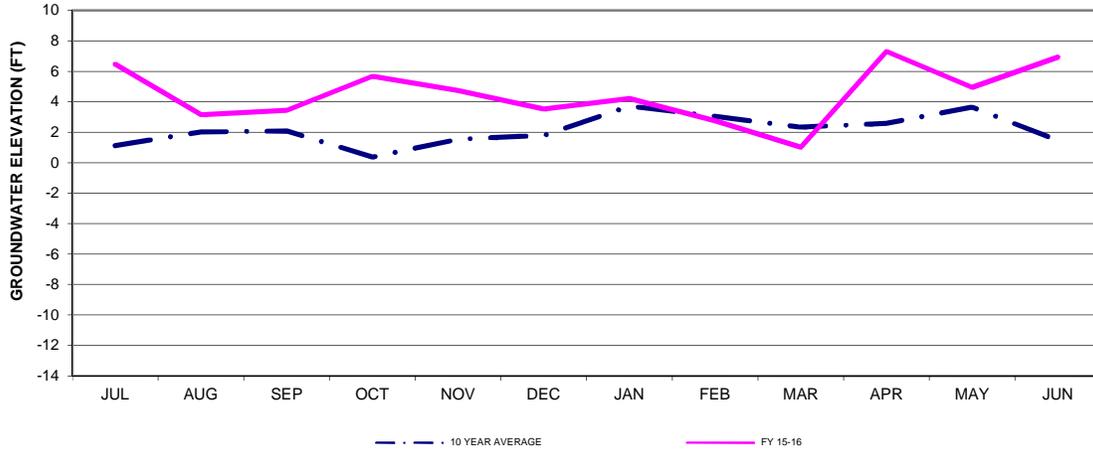


FIGURE 5b C-ZONE EAST OF THE SAN GABRIEL RIVER

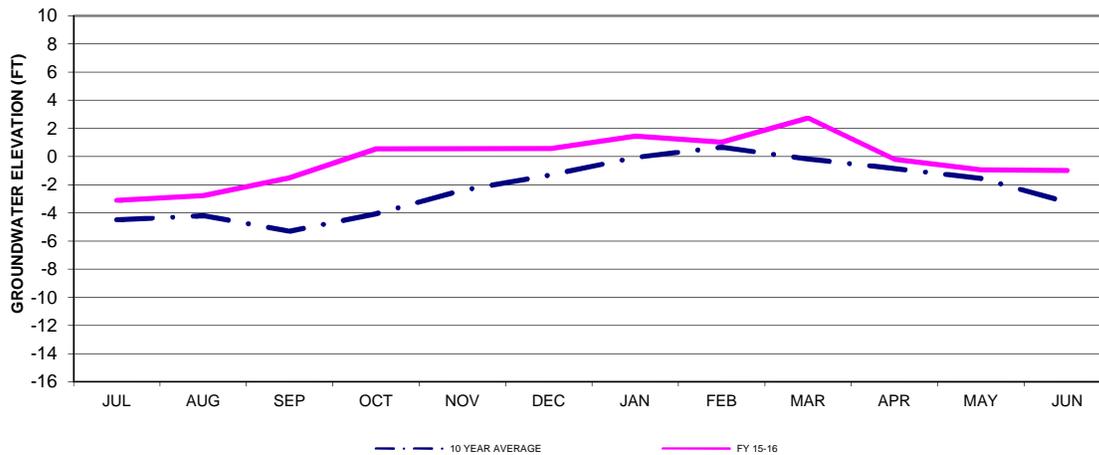


FIGURE 6a B-ZONE WEST OF THE SAN GABRIEL RIVER

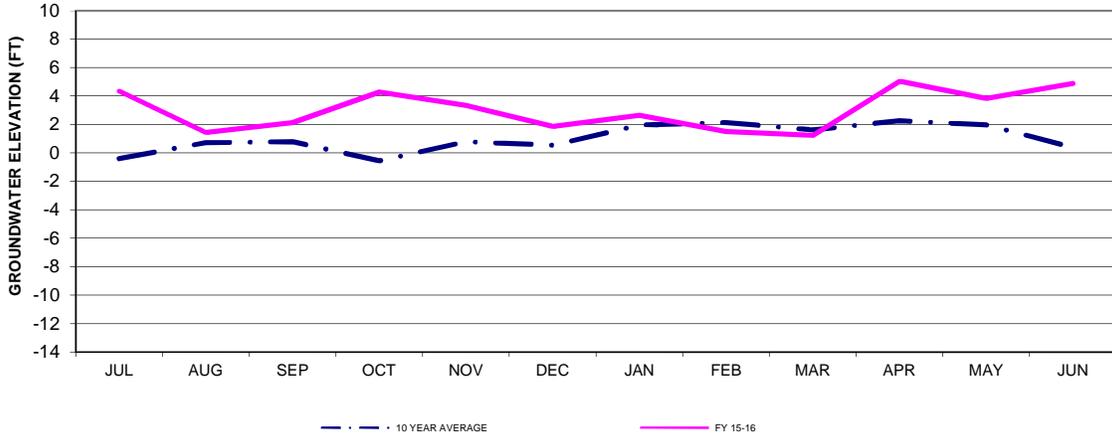


FIGURE 6b B-ZONE EAST OF THE SAN GABRIEL RIVER

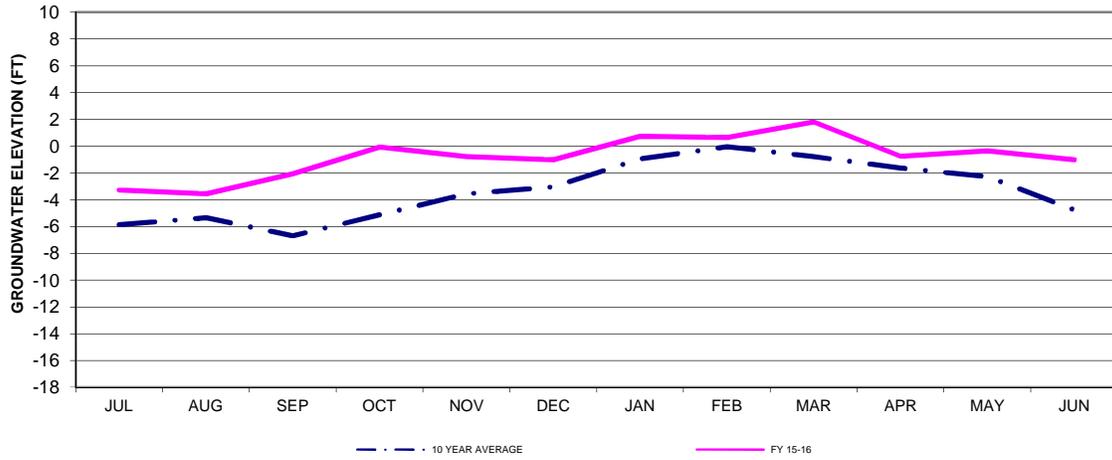


FIGURE 7a A-ZONE WEST OF THE SAN GABRIEL RIVER

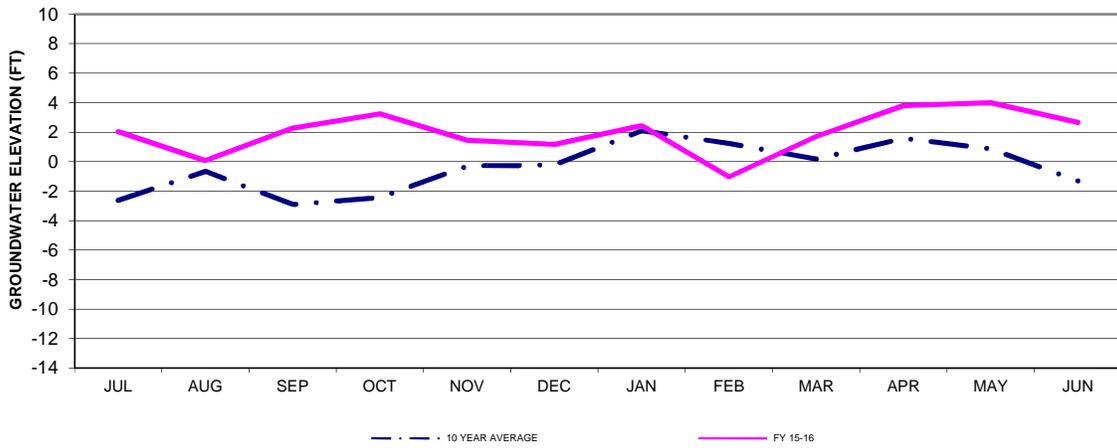


FIGURE 7b A-ZONE EAST OF THE SAN GABRIEL RIVER

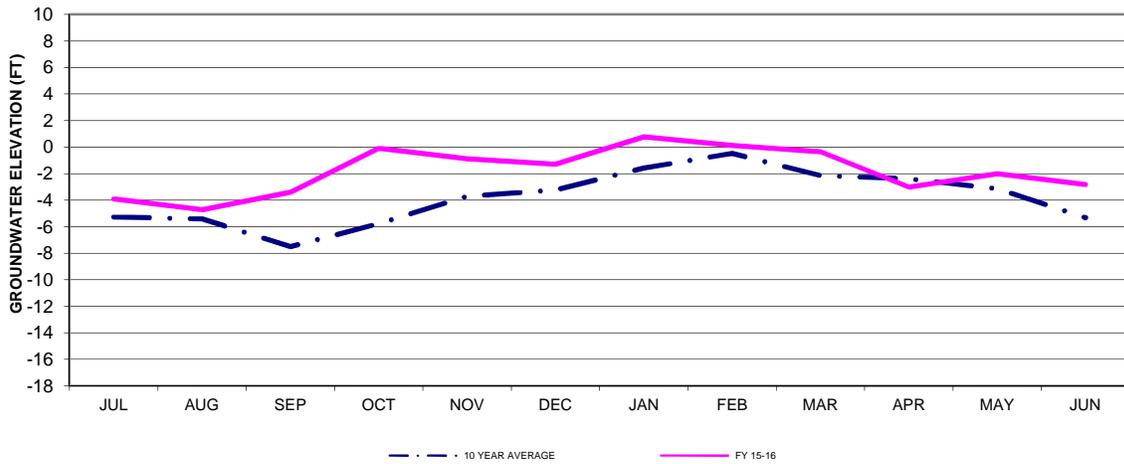


FIGURE 8a I-ZONE WEST OF THE SAN GABRIEL RIVER

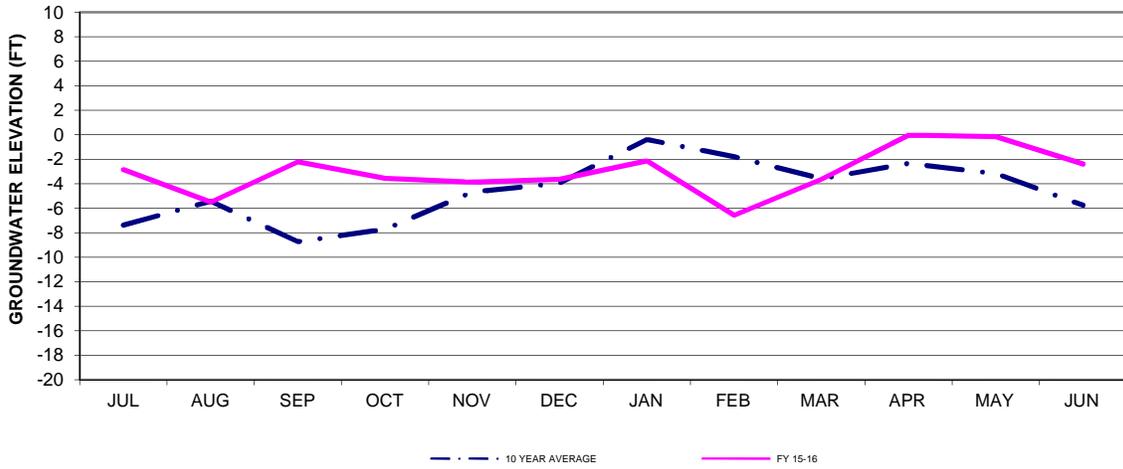
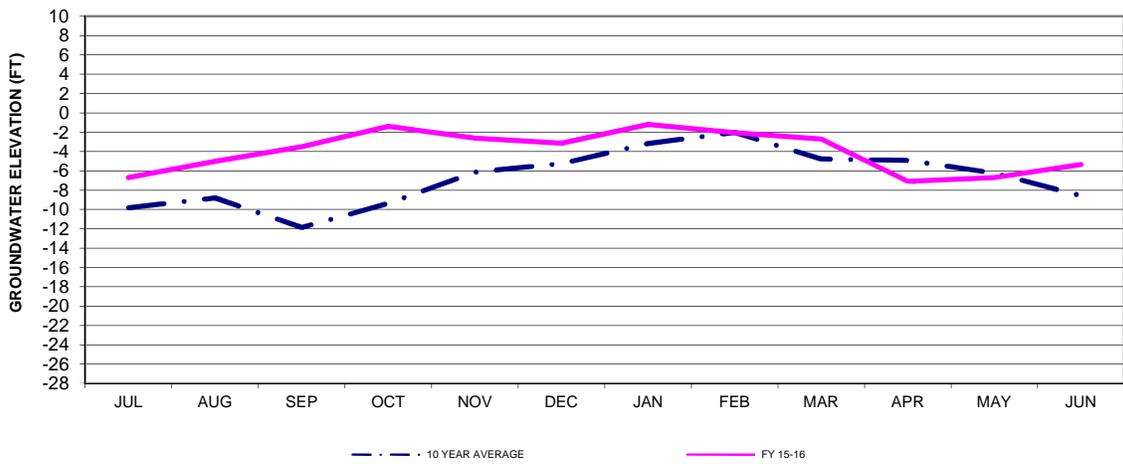


FIGURE 8b I-ZONE EAST OF THE SAN GABRIEL RIVER



Groundwater elevation contours for the R, C, B, A, and I Zones have been prepared from data collected in Spring 2016 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 barrier alignment, and typically decrease moving landward. The general shapes of each contour are similar to the previous year and some similar groundwater mounds are seen around certain injection wells. Areas historically having higher groundwater elevations in the C and B zones, especially near the bend at the San Gabriel River, continue to have higher groundwater elevations than their surroundings. The groundwater levels surrounding injection wells 34V and 34S show very large increases from the previous year due to these wells being offline due to the manifold repair in Spring of 2015. Other areas of historically elevated groundwater levels (e.g., near 33XY and 33YZ) remained relatively constant when compared to the same time last year. This is likely due to the barrier remaining in full operation during the entire reporting period.

Contours of changes in groundwater elevations for the R, C, B, A, and I Zones between Spring 2015 and Spring 2016 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 2016, which was then subtracted from the corresponding and available data from Spring 2015 (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, most areas saw very little changes in groundwater elevation. Below is a brief summary and discussion of each aquifer zone:

- R Zone:
 - Groundwater elevations remained fairly consistent in the vicinity of the ABP, with increases of about 1 foot along the west leg of the barrier.
 - Groundwater elevations decreased about 1 foot along the barrier alignment between the San Gabriel River and the Los Alamitos Channel, and increased about 2 feet along the east leg of the barrier.
- C Zone:

- Groundwater elevations decreased between 3 and 4 feet between Los Cerritos Channel and San Gabriel River.
- Groundwater elevations increased an average of 4.5 feet along the east leg of the barrier adjacent to Los Alamitos Channel due to 34S and 34V being offline for repairs in Spring of 2015, and remained constant near the furthest extent of the barrier's east leg.
- B Zone:
 - Groundwater elevations remained constant or decreased along the west leg, and decreased 2 feet in the vicinity of the San Gabriel River (e.g. 33XY).
 - Groundwater elevations increased slightly at the eastern end of the barrier (e.g. 34JL and 34LS)
- A Zone:
 - Groundwater elevations remained constant or decreased slightly along both the west leg of the Barrier and just east of the San Gabriel River.
 - Groundwater elevations increased along the east leg, with localized increases over 5 feet (e.g. 34VZ).
- I Zone:
 - Groundwater elevations remained constant along the west leg near the Los Cerritos Channel, and decreased to the west end of the barrier.
 - Groundwater elevations increased from 0 to 6 feet along the Los Alamitos Channel (e.g. 35E0.1).

Graphs showing the average, maximum and minimum groundwater elevations at each internodal observation well throughout FY 2015-16 are included in Appendix A13 through A-16. As shown in the graphs, the average groundwater elevation was below the protective elevation at many wells along the barrier during FY 2015-16. However, areas of high chloride concentrations did not necessarily correlate with areas where the average elevations were below the protective elevation. A comparison of FY 2015-16 graphs with FY 2014-15 graphs indicate that overall elevations decreased slightly along the west leg, and remained constant or decreased slightly along the east leg, which

coincides with the slight decrease in injection volume from FY 2014-15 to FY 2015-16. In all cases, the southeastern portion of the barrier remained below protective elevations due to the limited injection capabilities in this area (quantity of wells, pressure limitations, maintenance, repairs, etc.). It is important to note that the JMC is seeking to remediate the limited injection capabilities in the southeastern region through additional wells, modeling studies, grouting operations, and condition assessments to plan for and minimize shutdowns.

CHLORIDES

Figures 9a through 13b (pp. 21-25) 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 (i.e. east or west of the San Gabriel River) throughout FY 2015-16. The data includes all available information from the annual and semi-annual chloride sampling events for wells within the barrier alignment and landward for approximately 2,000 feet from the barrier. As a result, the semi-annual values are “weighted” more heavily than the annuals in the calculation of the annual average. Two sets of graphs were created for each aquifer to account for changes in chloride concentration trends in the areas to the west and east of the San Gabriel River, respectively. In each figure, the average of the maximum chloride concentrations per well per event over the last 10 fiscal years (including this year) is shown with respect to the freshwater condition (250 mg/L).

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

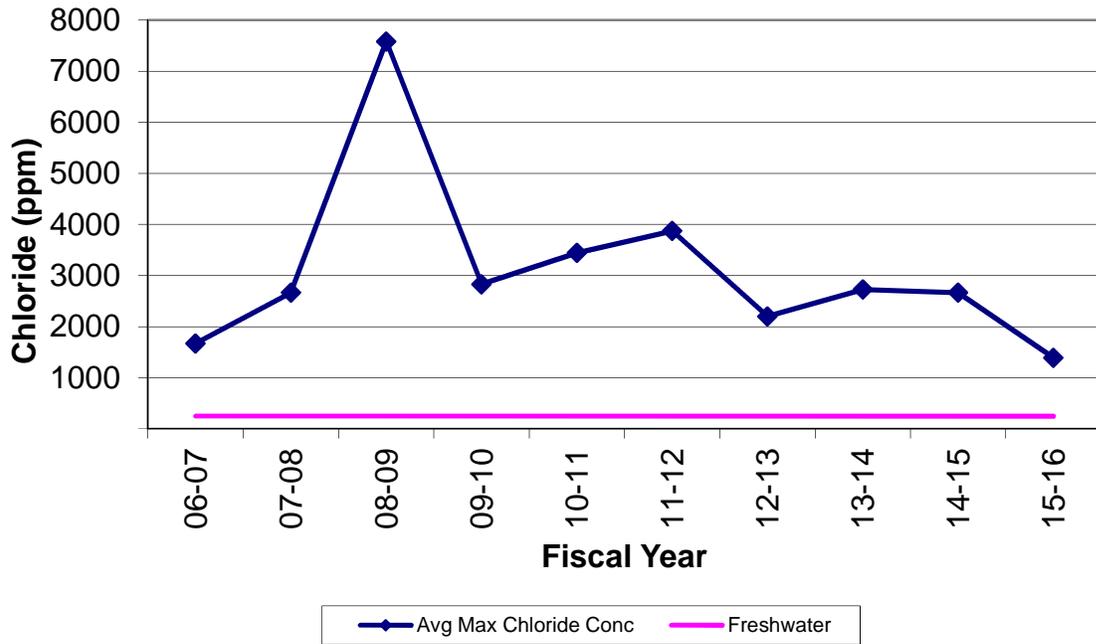


Figure 9b: R-Zone Chloride East of San Gabriel River

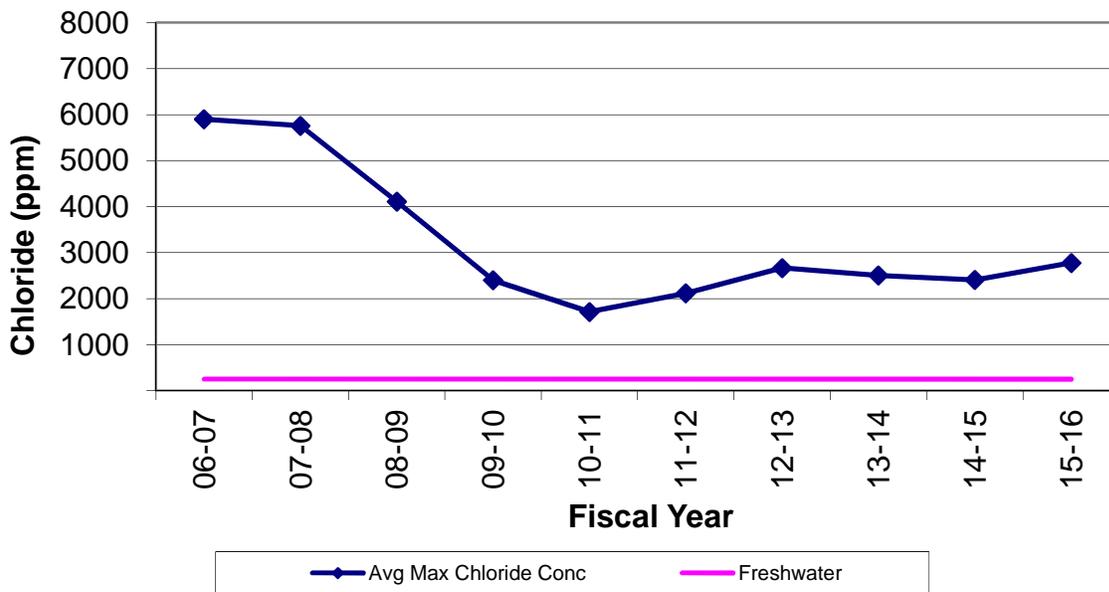


Figure 10a: C-Zone Chloride West of San Gabriel River

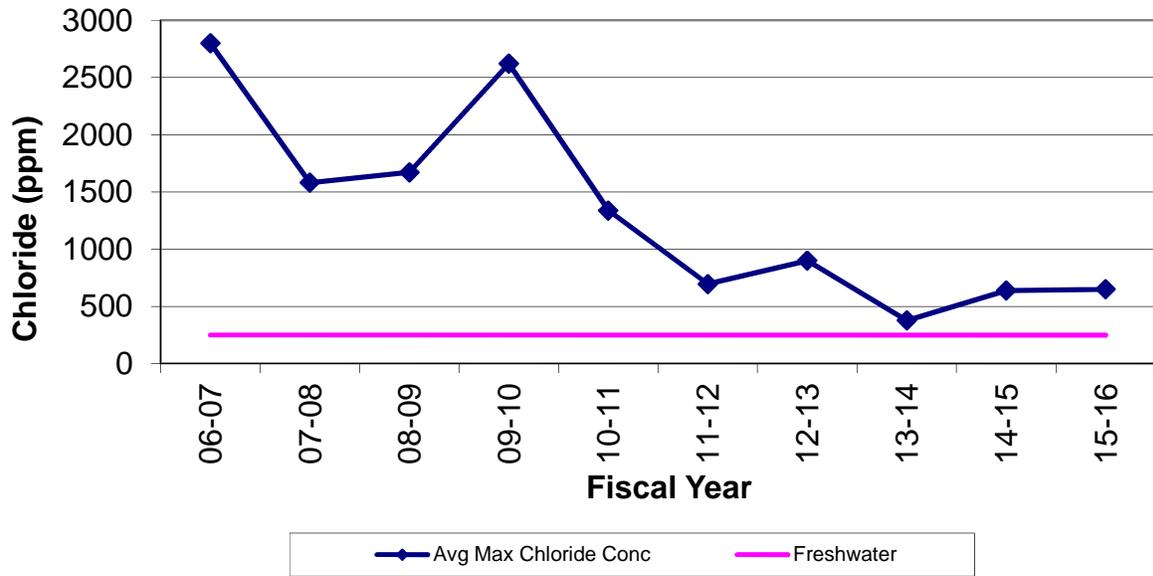


Figure 10b: C-Zone Chloride East of San Gabriel River

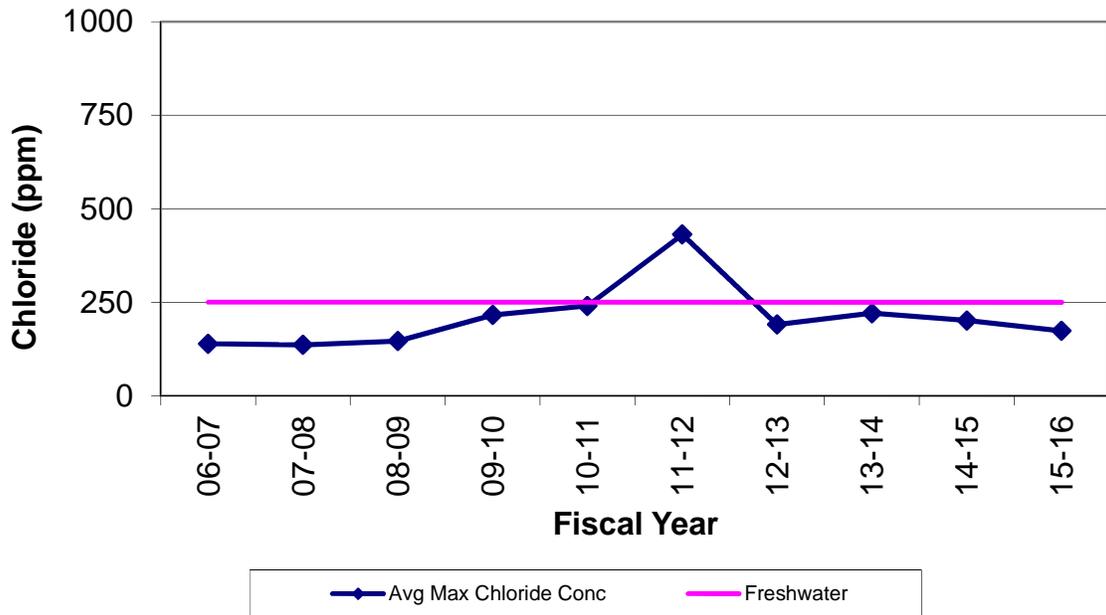


Figure 11a: B-Zone Chloride West of San Gabriel River

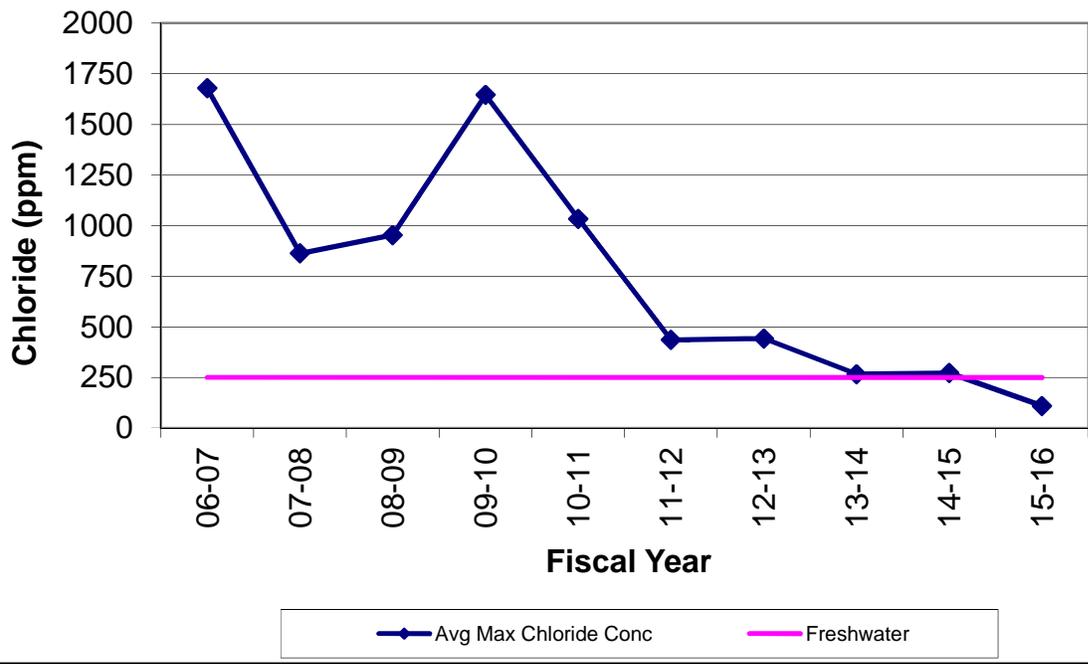


Figure 11b: B-Zone Chloride East of San Gabriel River

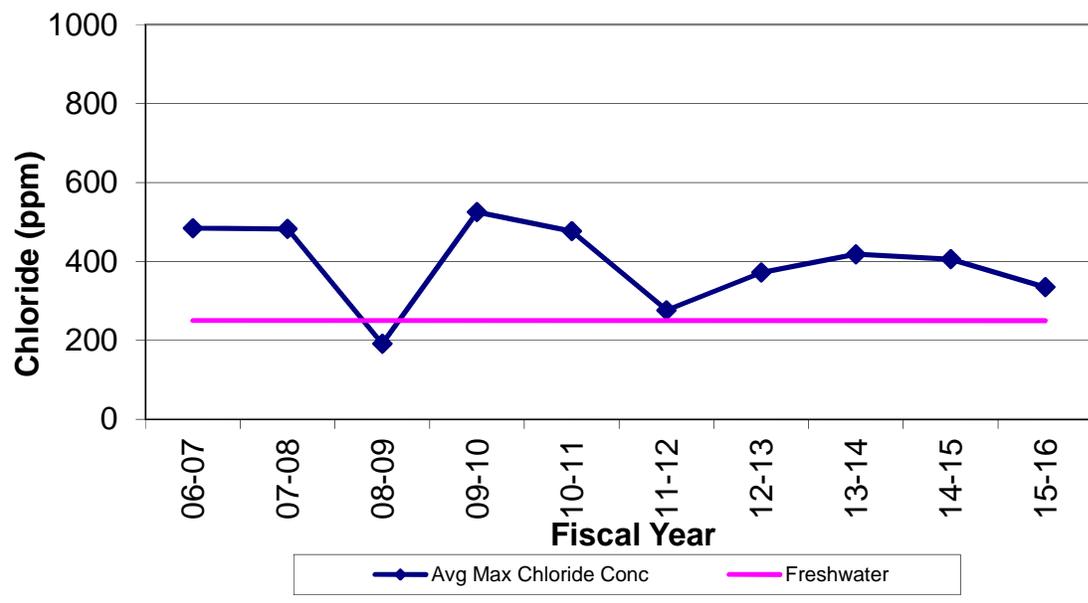


Figure 12a: A-Zone Chloride West of San Gabriel River

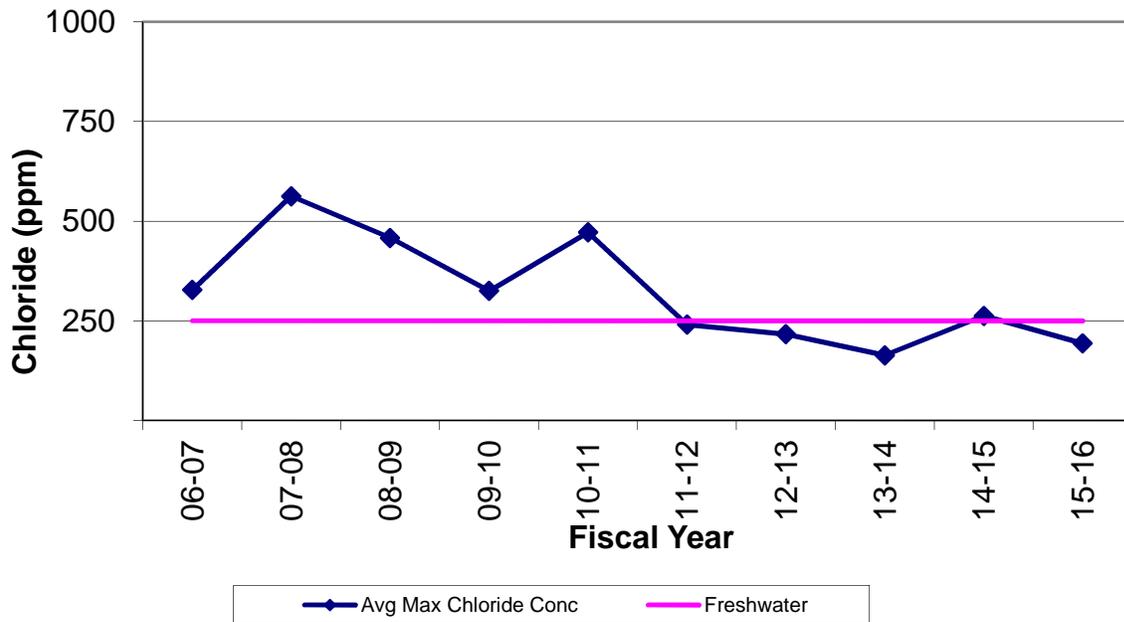


Figure 12b: A-Zone Chloride East of San Gabriel River

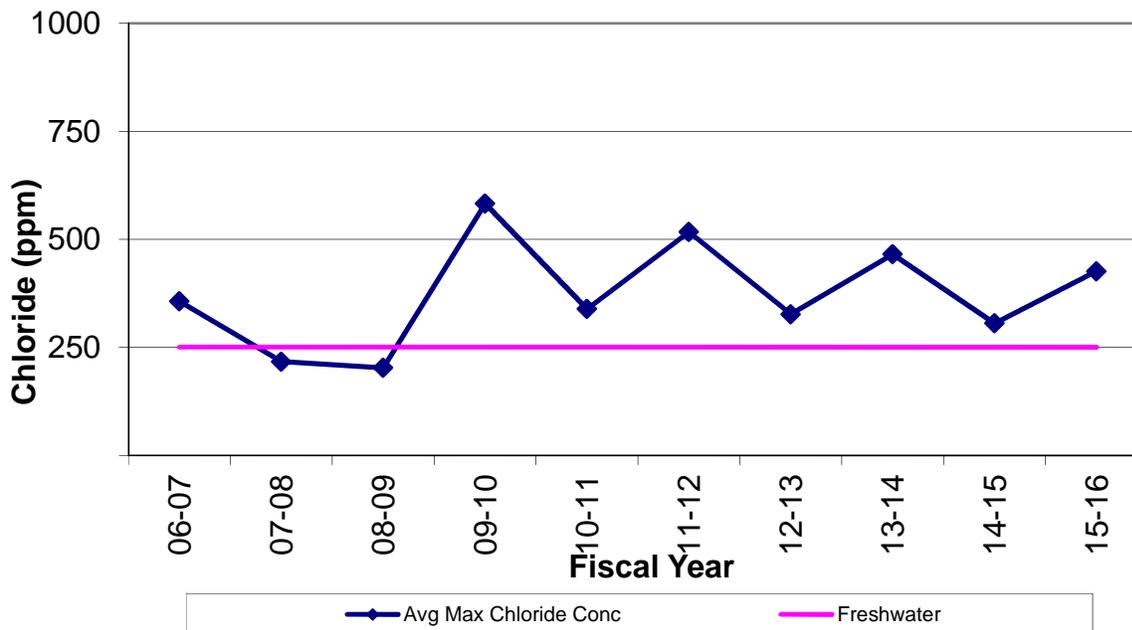


Figure 13a: I-Zone Chloride West of San Gabriel River

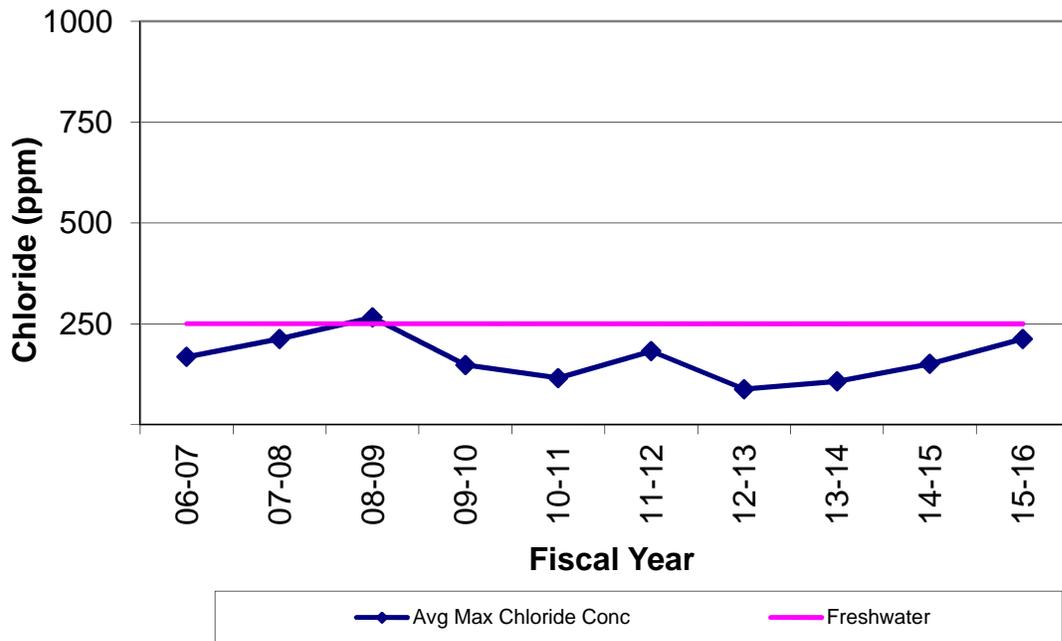
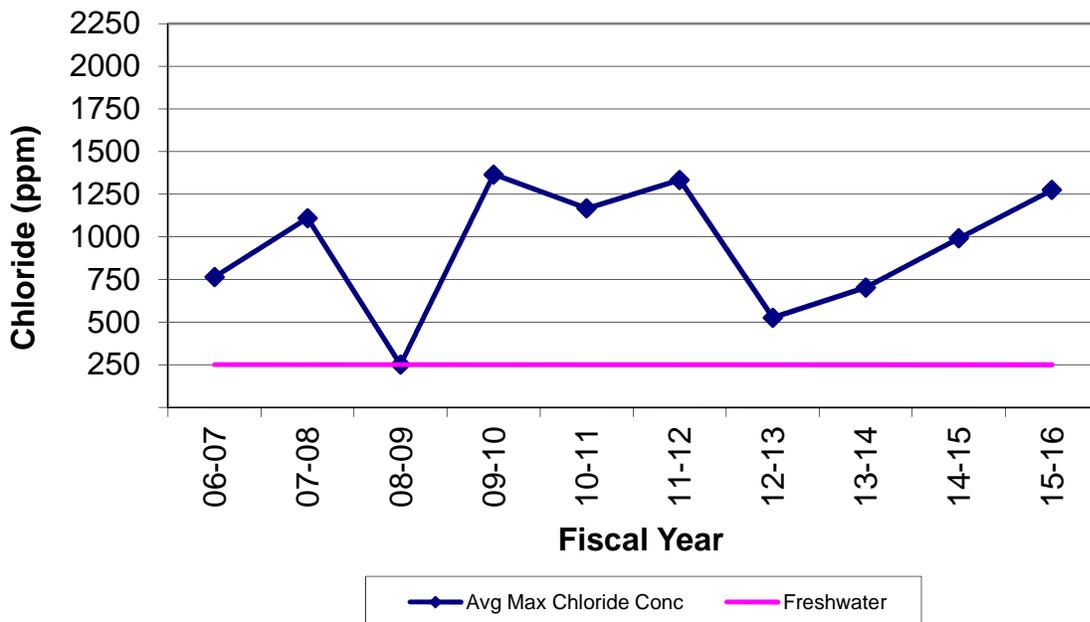


Figure 13b: I-Zone Chloride East of San Gabriel River



West of the San Gabriel River, FY 2015-16 average maximum chloride concentrations in the C and I Zones increased. I Zone chloride concentrations increased by more than 250 mg/L, while increasing only slightly in the C Zone. Average maximum chloride concentrations decreased slightly in the B and A Zones, and decreased over 1000 mg/L in the R zone.

East of the San Gabriel River, FY 2015-16 average maximum chloride concentrations remained constant or slightly decreased in the C and B zones, respectively. Chloride concentrations increased in the R, A, and I Zones. The increase was greatest in the I zone, where chloride concentrations increased by approximately 300 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 2016 and are included in Appendix A-6.1, A-7.1, A-8.1, A-9.1, and A-10.1, respectively. The chloride contour maps are based on the maximum chloride ion concentration (mg/L) measured at each observation well. Chloride data was gathered from observation wells located within the immediate vicinity of the barrier and does not represent basin-wide conditions for the groundwater basin protected by the barrier. 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 in March and April 2016 and the annual event in February and March 2016.

Contours of **changes** in chloride concentration for the R, C, B, A, and I Zones between Spring 2014 and Spring 2015 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 2015, which was then subtracted from the corresponding data for Spring 2014. These contours very clearly identify areas where chloride concentrations increased and decreased between these two reporting periods.

The chloride concentration contours for FY 2015-16 are similar in shape and pattern to those of the previous year. The current contours and the corresponding chloride

concentration cross-section (A-11) for this reporting period indicate that intrusion of seawater across the barrier continued to be controlled west of the San Gabriel River. East of the San Gabriel River, several areas recorded elevated chloride concentrations indicating seawater intrusion. Additional areas of high chloride concentrations and/or notable changes in concentration (since the FY 2014-15 report) are as follows:

- R Zone – High chloride concentrations continued to remain present north of the west leg along Los Cerritos Channel, although concentrations decreased significantly at wells 33S18 and 33Y10, on the order of 10,000 and 3,000 mg/L respectively. Chloride concentrations increased to the north and east of the barrier, including notable increase of approximately 1,000 mg/L at well 34F5. High chloride concentrations also remained present the immediate vicinity of well 34L'1 on the east leg.
- C Zone –Chloride concentrations continue to increase north of the Barrier near Los Cerritos Channel, although the rate of increase has slowed dramatically. While chloride concentrations remained low along most of the east leg, elevated concentrations remained near observation well 35K1 during FY 2015-16. Chloride concentrations decreased significantly at well 32V'10, while remaining elevated.
- B Zone – West of the Los Cerritos Channel, Chloride concentrations were consistent with the previous reporting period along the Barrier alignment. Further west beyond the barrier, Chloride concentrations decreased dramatically, especially at well 32Z'5 which decreased by almost 4,000 mg/L. Along the east leg of the barrier, chloride concentrations at well 34JL remained elevated, although decreasing slightly from the previous reporting period. Additionally, chloride concentrations decreased approximately 500 mg/L at 35J1. Elevated chloride concentrations continue to be present in the area surrounding well 34U8.
- A Zone – The elevated chloride concentrations northwest of the ABP's west leg continued to be present from the previous reporting period. West and seaward of the barrier, high chloride concentrations remained relatively unchanged at ABP wells 32V'10 and 32Z'5 while decreasing slightly at well 33H'13. Chloride

concentrations decreased significantly between the Los Cerritos and Los Alamitos Channels, particularly at wells 33U'3, 34DG and 34D'6 that exhibited large increases over the previous reporting period. Chloride concentrations increased consistently along and landward of the east leg of the Barrier, with the exception of wells 34HJ, 35H12, 35K1 and 35J1.

- I Zone – Chloride concentrations remained below 250 mg/L along the west leg and northward of the barrier, with the exception of wells 33X10 and 33X20 which remains elevated. In addition, well 33X20 exhibited an increase of nearly 2000 mg/L. Along the east leg of the barrier, chloride concentrations increased at wells 34JL, 34VZ, and 35E0.1. Chloride concentrations decreased dramatically at 34LS while remaining high. Consistent high concentrations at 35F20 and 34X40 suggest that the barrier continues to be breached in this area.

There continue to be three possible causes of the high chloride concentrations in all zones north of, northwest of, and along portions of the ABP west leg (which was in steady operation during this reporting period). These include the remaining seawater from previous intrusions, migration of seawater inland by the Los Cerritos Channel, and suspected intrusion around the west end of the barrier. Elevated chloride concentrations in the area immediately north of the west leg and west of the Barrier will continue to be monitored using the new observation wells constructed by LACDPW in the 2012-13 reporting period.

OCWD is in the process of improving the north-south barrier alignment east of the San Gabriel River with the installation of 17 new clustered injection wells. OCWD is also planning the installation of four multi-depth observation wells along the ABP east leg to improve the monitoring well network in that area.

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 2015-16 (not including liability insurance) was \$9,754,208, which can be broken down as follows: water costs of \$7,052,208, Operations and Maintenance costs of \$2,244,598, and Special Program expenses of \$382,085. The cost of joint liability insurance for the ABP was split evenly between the LACFCD and OCWD for a total cost of \$75,589.

WATER COSTS

During FY 2015-16, 6,807.7 AF of water were injected at an estimated total cost of \$7,052,208. The monthly unit water cost (dollars per AF) from July 2015 to June 2016 varied periodically as shown earlier in Table 1. The monthly quantity of water injected and total water costs paid by each agency are shown below in Table 2.

TABLE 2. QUANTITY OF WATER INJECTED AND COSTS

MONTH	AMT BY WRD (AF)	AMT BY OCWD (AF)	TOTAL AMT (AF)
Jul-14	393.2	159.3	552.5
Aug-14	392.2	173.4	565.6
Sep-14	439.0	218.1	657.1
Oct-14	457.3	231.7	689.0
Nov-14	315.7	228.8	544.5
Dec-14	328.1	238.4	566.5
Jan-15	343.2	232.7	575.9
Feb-15	294.3	209.9	504.2
Mar-15	363.3	218.0	581.3
Apr-15	327.2	176.2	503.4
May-15	376.9	145.4	522.3
Jun-15	378.6	166.8	545.4
TOTAL INJECTED	4,409.0	2,398.7	6,807.7
TOTAL COST (\$) [From Tbl. 1]	\$4,567,737	\$2,484,472	\$7,052,208

OPERATIONS AND MAINTENANCE COSTS

A total of \$2,626,684 was spent on Operations and Maintenance and special programs during the 2015-16. 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 District. The distribution of FY 2015-16 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	\$1,466,287	771,350	\$2,237,637
Service & Supplies of Extraction Facilities ²	\$6,961	\$0	\$6,961
Special Programs ³	\$382,085	\$0	\$382,085
SUBTOTAL	\$1,855,333	\$771,350	\$2,626,684
Liability Insurance	\$37,794	\$37,794	\$75,589
TOTAL	\$1,893,128	\$809,145	\$2,702,273

The values in Table 3 come from the ABP FY 2015-16 Costs (see A-19) as follows:

¹ The sum of Items 1, 2, 3, 7, 8, 9, 10, 11, 12, 14, and 15. OCWD is responsible for 35.2% of all costs for these items except for Item 10 (35.2% of total expenditures split between LACFCD and OCWD by agreement)

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

³ Item 13. OCWD is not responsible for any portion of the cost for this item.

The yearly cost of the services and supplies (including special programs but excluding water and extraction costs) for the last 20 years of ABP operations are shown in Table 4.

TABLE 4. COSTS OF SERVICES AND SUPPLIES FOR INJECTION

Fiscal Year	Volume of Water Injected (Ac-Ft)	Total Cost	Cost Per Ac-Ft Injected
1996-97	5,739.4	\$408,064	\$71.10
1997-98	5,335.8	\$923,342	\$173.05
1998-99	5,330.4	\$795,044	\$149.15
1999-00	6,077.9	\$589,168	\$96.94
2000-01	5,398.8	\$961,649	\$178.12
2001-02	6,061.7	\$713,299	\$117.67
2002-03	5,012.3	\$1,555,921	\$310.42
2003-04	5,879.7	\$730,652	\$124.27
2004-05	5,066.1	\$918,020	\$181.21
2005-06	3,457.8	\$1,605,456	\$464.30
2006-07	1,265.1	\$2,309,300	\$1,825.39
2007-08	5,971.1	\$3,513,957	\$588.49
2008-09	7,936.2	\$1,875,902	\$236.37
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

¹ The higher costs per AF injected since FY05-06 are typically because these years included costs for multiple repairs and/or capital improvement projects which were not included in previous years. The cost per AF is especially high in FY06-07 because of improvement projects, observation well cleanouts, costs related to the reclaimed water program, and various fixed costs that were incurred in a year of reduced injections due to the extended shutdowns for repairs.

The costs of the services and supplies for extraction operations for the last 20 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
1995-96	998.4	\$130,901	\$131.11
1996-97	1,200.9	\$51,077	\$42.53
1997-98	883.5	\$64,774	\$73.32
1998-99	775.6	\$52,043	\$67.10
1999-00	679.9	\$41,320	\$60.77
2000-01	404.8	\$49,769	\$122.95
2001-02	495.0	\$53,153	\$107.38
2002-03	262.7	\$63,165	\$240.45
2003-04	0.0	\$6,068	N/A
2004-05	0.0	\$3,043	N/A
2005-06	0.0	\$2,857	N/A
2006-07	0.0	\$3,224	N/A
2007-08	0.0	\$4,224	N/A
2008-09	0.0	\$14,742	N/A
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

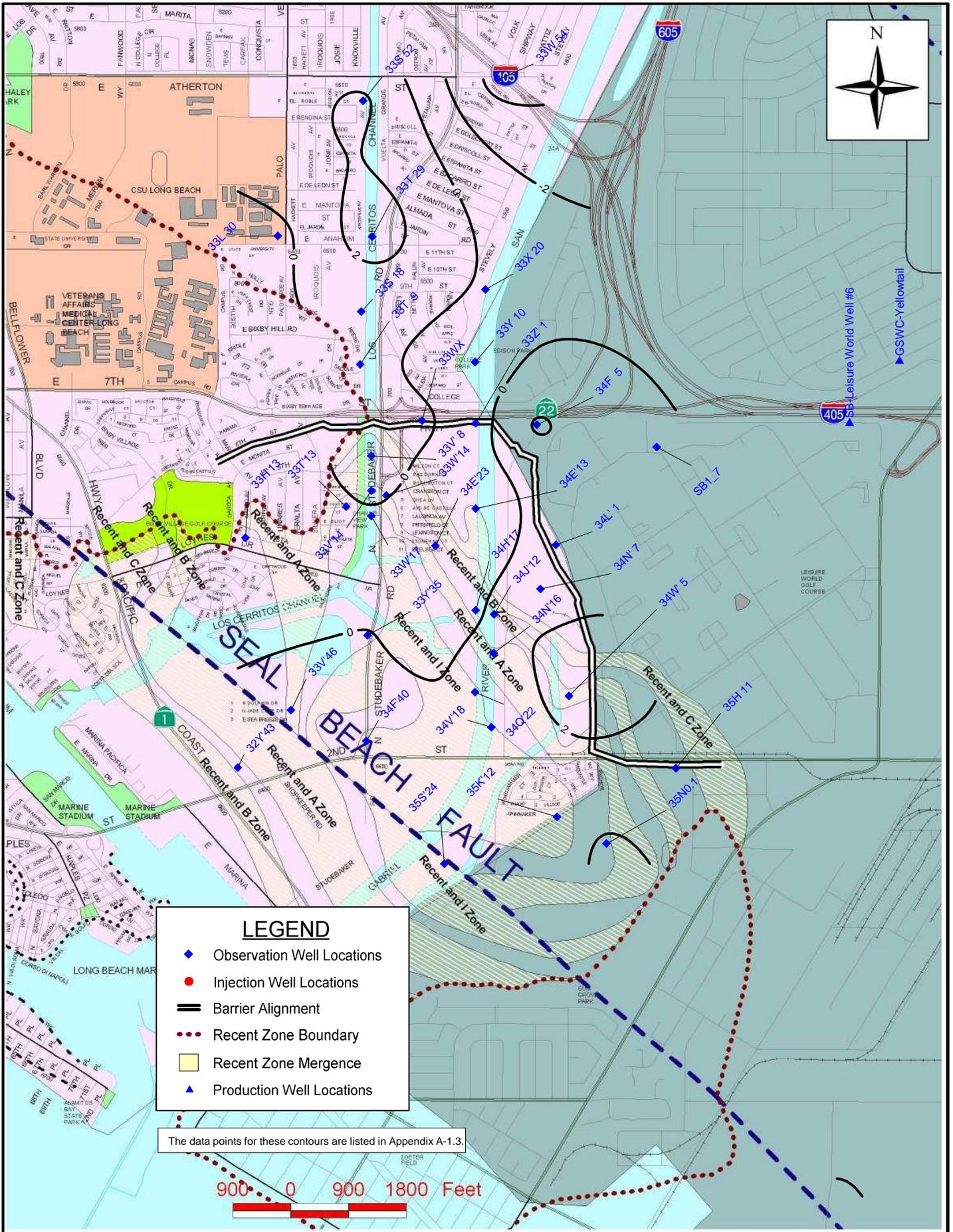
FIXED ASSETS

During Fiscal Year 2015-16 OCWD constructed new facilities as part of the Unit 14 injection and observation wells project. Monitoring well 34V3 and two shallow piezometers were installed within Leisure World during this reporting period.

BUDGET

The FY 2017-18 budget for the ABP Supplies and Services and fixed Assets Costs is \$2,686,000. A breakdown of this amount, along with past expenditures per category, is shown in Appendix A-20. Note that amounts for WRD are shown in addition to those for LACFCD and OCWD.

APPENDIX



LEGEND

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

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



Alamitos Barrier Project
 R Zone: Change in Elevation(ft), Spring 2015 to Spring 2016

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

POINT	PROJ	FCD	AQUIFER	DATE	FY 15-16 ELEV	P.E. ¹	Δ ²	FY 14-15 ELEV	CHANGE IN ELEV
1	32Y'43	493WW	R	20150909	1.3			0.8	0.5
2	33H'13	493YY	R,A	20160308	1.2			2.4	-1.2
3	33L 30	491G	R	20160309	-1.6			-1.0	-0.6
4	33S 18	492AH	R	20160309	1.0			0.6	0.4
5	33S 52	491J	R	20160309	-2.2			-4.5	2.3
6	33T 9	492CV	R	20160324	0.5			0.4	0.1
7	33T 29	491D	R	20160308	0.8			-2.3	3.1
8	33T'13	492AU	R	20160309	2.2			2.8	-0.6
9	33T'24	493SS	R	20150908	0.1				n/a
10	33V' 8	492BY	R,A	20160307	1.8			1.4	0.4
11	33V'14	492JJ	R	20160310	1.2			0.1	1.1
12	33V'46	493UU	R	20160301	3.2			2.6	0.6
13	33W 54	501C	R	20160315	-5.7			-0.9	-4.8
14	33W'14	492AT	R	20160316	6.3			6.2	0.1
15	33W'17	493PP	R	20150903	1.4			2.1	-0.7
16	33WX	502AZ	R	20160322	0.3			0.0	0.3
17	33X 20	502L	R	20160209	-0.7			-0.5	-0.2
18	33Y 10	502BA	R	20160303	-1.4			-0.2	-1.2
19	33Y'35	493AB	R	20160307	-1.1			-1.2	0.1
20	33Z' 1	502AU	R	20160329	-0.5			0.1	-0.6
21	34E'13	503AU	R	20160208	3.1			4.9	-1.8
22	34E'23	503X	R	20150901	0.4			1.7	-1.3
23	34F 5	502BT	R	20160322	3.1			0.8	2.3
24	34F'40	483J	R	20160315	0.3			-0.4	0.7
25	34H'17	503Y	R	20160314	0.0			1.2	-1.2
26	34J'12	503U	R	20160316	2.1			0.6	1.5
27	34L' 1	503P	R	20160323	0.4			-0.8	1.2
28	34N' 7	503AE	R	20160302	0.9			-0.2	1.1
29	34N'16	503W	R	20150929	1.2			-0.1	1.3
30	34Q'22	503T	R	20160315	-0.2			-0.4	0.2
31	34V'18	503V	R	20150908	-1.0			-1.0	0.0
32	34W' 5	503AH	R	20160315	1.8			-1.0	2.8
33	35H 11	514F	R	20160307	-1.6			-3.0	1.4
34	35K'12	504R	R	20160316	-3.3			-4.6	1.3
35	35N0.1	504M	R	20160316	-4.4			-4.1	-0.3
36	35S'24	504K	R	20160209	1.3			0.6	0.7
37	SB1_7	N/A	R	20160316	1.8			1.5	0.3

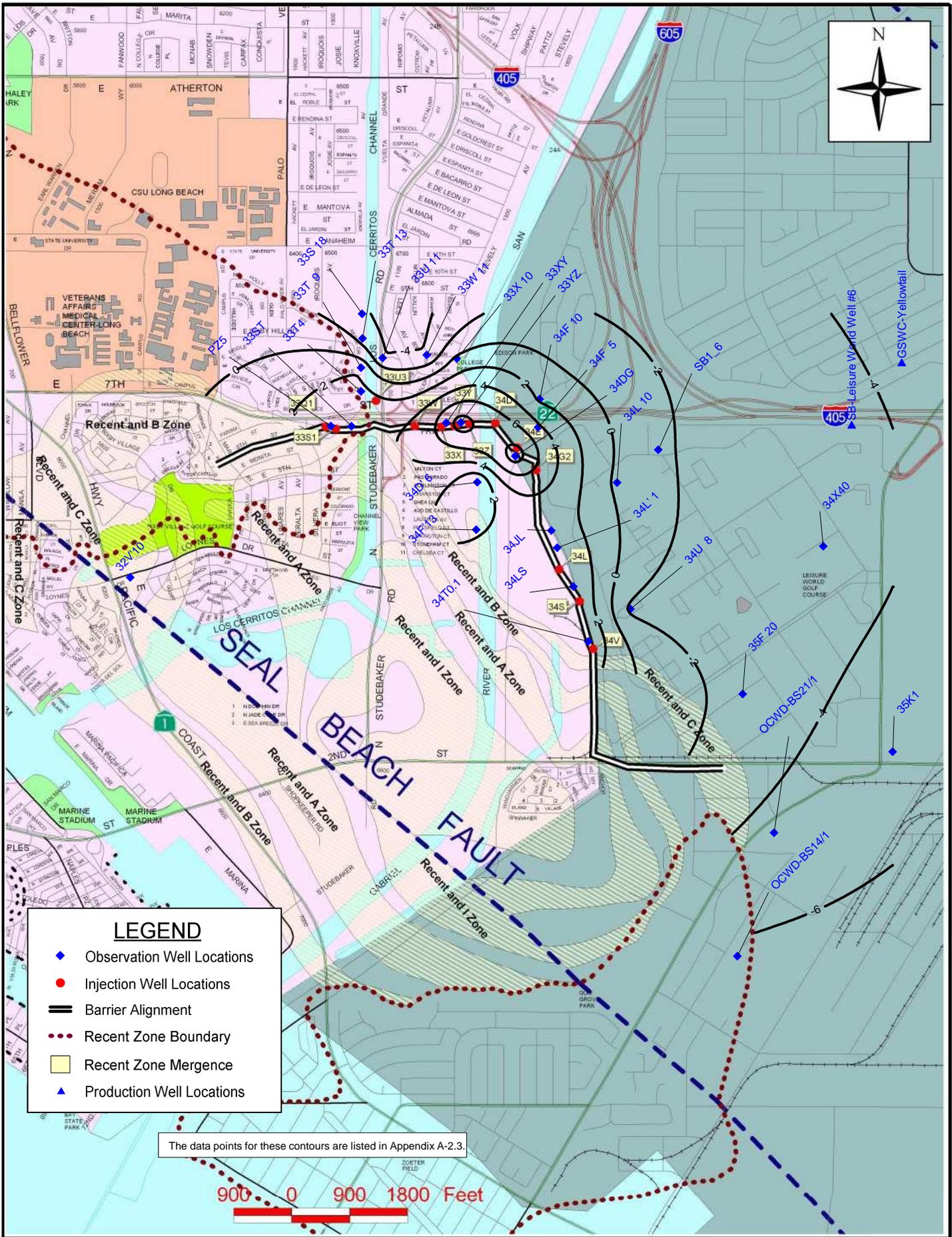
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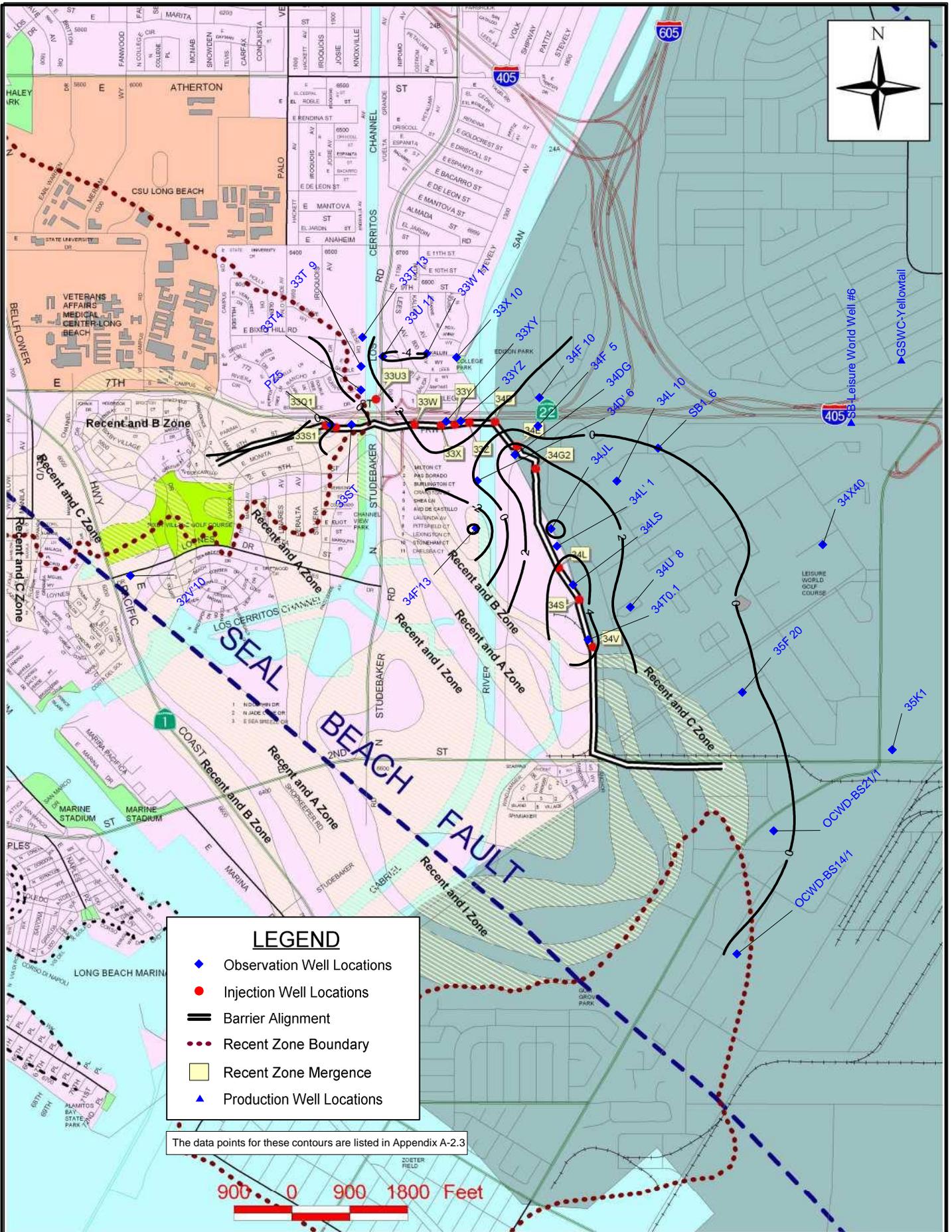
¹ P.E. represents the protective elevations calculated for intermodal wells.

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 2016



LEGEND

- ◆ Observation Well Locations
- Injection Well Locations
- == Barrier Alignment
- ... Recent Zone Boundary
- Recent Zone Mergence
- ▲ Production Well Locations

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



Alamitos Barrier Project
C Zone: Change in Elevation (ft), Spring 2015 to Spring 2016

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

POINT	PROJ	FCD	AQUIFER	DATE	FY 15-16 ELEV	P.E. ¹	Δ^2	FY 14-15 ELEV	CHANGE IN ELEV
1	32V'10	483H	C ZONE	20160303	-1.2			-1.1	-0.1
2	33S 18	492AG	C ZONE	20160309	-3.7				n/a
3	33ST	492BK	(C,B)	20160307	3.6	0.9	2.7	2.4	1.2
4	33T 9	492CU	C ZONE	20160324	1.7			2.5	-0.8
5	33T 13	492AC	C ZONE	20160328	-2.6			-1.9	-0.7
6	33T4	492CT	C ZONE	20160321	2.5			3.1	-0.6
7	33U 11	492AL	C ZONE	20160328	-3.8			0.4	-4.2
8	33W 11	502R	C ZONE	20160322	-3.7			0.3	-4.0
9	33X 10	502BB	C ZONE	20160303	0.4			4.1	-3.7
10	33XY	502BL	C ZONE	20160307	7.2	5.4	1.8	10.3	-3.1
11	33YZ	502AB	C ZONE	20160307	8.9	5.4	3.5	12.9	-4.0
12	34D' 6	502BF	C ZONE	20160314	0.0			-0.3	0.3
13	34DG	502X	C ZONE	20160321	9.1	5.4	3.7	5.2	3.9
14	34F 5	502BU	C ZONE	20160208	4.3			6.0	-1.7
15	34F 10	502AP	C ZONE	20160330	1.7			3.0	-1.3
16	34F'13	503R	C ZONE	20150908	1.8			6.2	-4.4
17	34JL	503AR	C ZONE	20160308	2.5	4.2	1.8	-1.9	4.4
18	34L' 1	503N	C ZONE	20160323	3.7	4.8	-1.7	0.0	3.7
19	34L 10	502AK	C ZONE	20160303	-0.4			-1.4	1.0
20	34LS	503BF	C ZONE	20160307	3.7	4.5	-0.8	-1.4	5.1
21	34T0.1	503AB	C ZONE	20160307	3.8	3.6	0.2	-1.0	4.8
22	34U 8	513D	C ZONE	20160330	-2.4			-2.5	0.1
23	34X40	513R	C ZONE	20160331	-3.0			-3.0	0.0
24	35F 20	513L	C ZONE	20160330	-2.5			-2.6	0.1
25	35K1	523D	C ZONE	20160308	-5.3	4.3	-9.6	-4.7	-0.6
26	PZ5	492CH	(C,B)	20150903	3.2			3.3	-0.1
27	SB1_6		C ZONE	20160316	-1.7			-1.7	0.0
28	OCWD- BS14/1		C ZONE	20160303	-6.3			-6.2	-0.1
29	OCWD- BS21/1		C ZONE	20160303	-4.6			-4.7	0.1

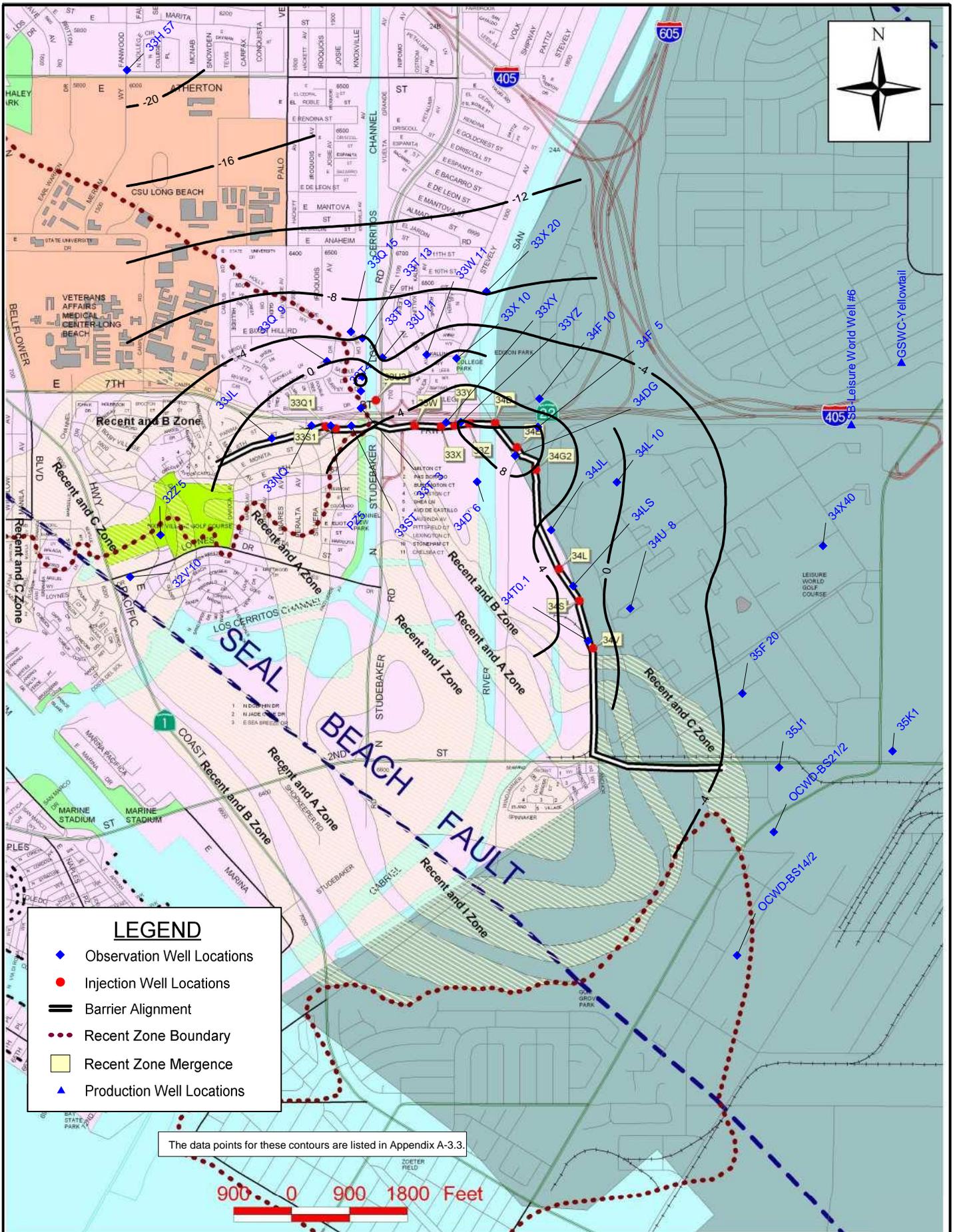
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AVG= 0.9

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

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

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



LEGEND

- ◆ Observation Well Locations
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- Recent Zone Mergence
- ▲ Production Well Locations

The data points for these contours are listed in Appendix A-3.3.



Alamitos Barrier Project
B Zone Groundwater Elevation (ft) Contours Spring 2016

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

POINT	PROJ	FCD	AQUIFER	DATE	FY 15-16 ELEV	P.E. ¹	Δ^2	FY 14-15 ELEV	CHANGE IN ELEV
1	32V'10	483G	B	20160303	-1.4			-1.1	-0.3
2	32Z'5	482W	B,A	20160301	-1.6			-0.8	-0.8
3	33H 57	481	B	20150924	-21.8			-16.2	-5.6
4	33JL	492BQ	B	20160317	2.0	0.9	1.1	2.2	-0.2
5	33NQ	492BN	B	20160317	3.2	0.7	2.5	4.1	-0.9
6	33Q 9	492CM	B	20160301	-0.3			2.8	-3.1
7	33Q 15	492AN	B	20150831	-5.9			-7.8	1.9
8	33S 18	492AF	B	20150831	0.1				n/a
9	33ST	492BK	C,B	20160307	3.6	0.9	2.7	2.4	1.2
10	33T 3	492CL	B	20160307	3.1			3.1	0.0
11	33T 9	492YY	B	20160321	3.5			5.0	-1.5
12	33T 13	492AB	B	20160324	4.9			6.4	-1.5
13	33T4	492CS	B	20160328	-3.5			-1.4	-2.1
14	33U 11	492AK	B	20150910	3.0			5.0	-2.0
15	33W 11	502S	B	20160322	-2.0			1.1	-3.1
16	33X 10	502BC	B	20160303	1.4			6.8	-5.4
17	33X 20	502K	B	20160328	-8.3			-3.7	-4.6
18	33XY	502BM	B	20160307	6.9	6.3	0.6	6.8	0.1
19	33YZ	502AC	B	20160307	8.2	7.1	1.1	11.5	-3.3
20	34D' 6	502BG	B	20160314	5.5			8.1	-2.6
21	34DG	502Y	B	20160307	10.1	6.6	3.5	7.7	2.4
22	34F 5	502BS	B	20160322	8.3			8.0	0.3
23	34F 10	502AQ	B	20160330	0.1			3.8	-3.7
24	34JL	503AQ	B	20160308	3.0	5.3	-2.3	-0.2	3.2
25	34L 10	502AL	B	20160303	0.4			-0.8	1.2
26	34LS	503BE	B	20160324	3.5	5.4	-1.9	-0.9	4.4
27	34T0.1	503AC	B	20160412	3.3	9.9	-6.6		n/a
28	34U 8	513E	B	20160330	-3.9			-3.0	-0.9
29	34X40	513Q	B	20160331	-5.0			-5.7	0.7
30	35F 20	513K	B	20160330	-4.7			-3.6	-1.1
31	35J1	514M	B	20160307	-4.6	5.8	-10.4	-4.2	-0.4
32	35K1	523A	B	20160328	-6.0	5.8	-11.8	-5.5	-0.5
33	PZ5	492CH	C,B	20150903	3.2			3.3	-0.1
34	OCWD- BS14/2		B	20160303	-6.6			-6.9	0.3
35	OCWD- BS21/2		B,A	20160303	-6.0			-6.6	0.6

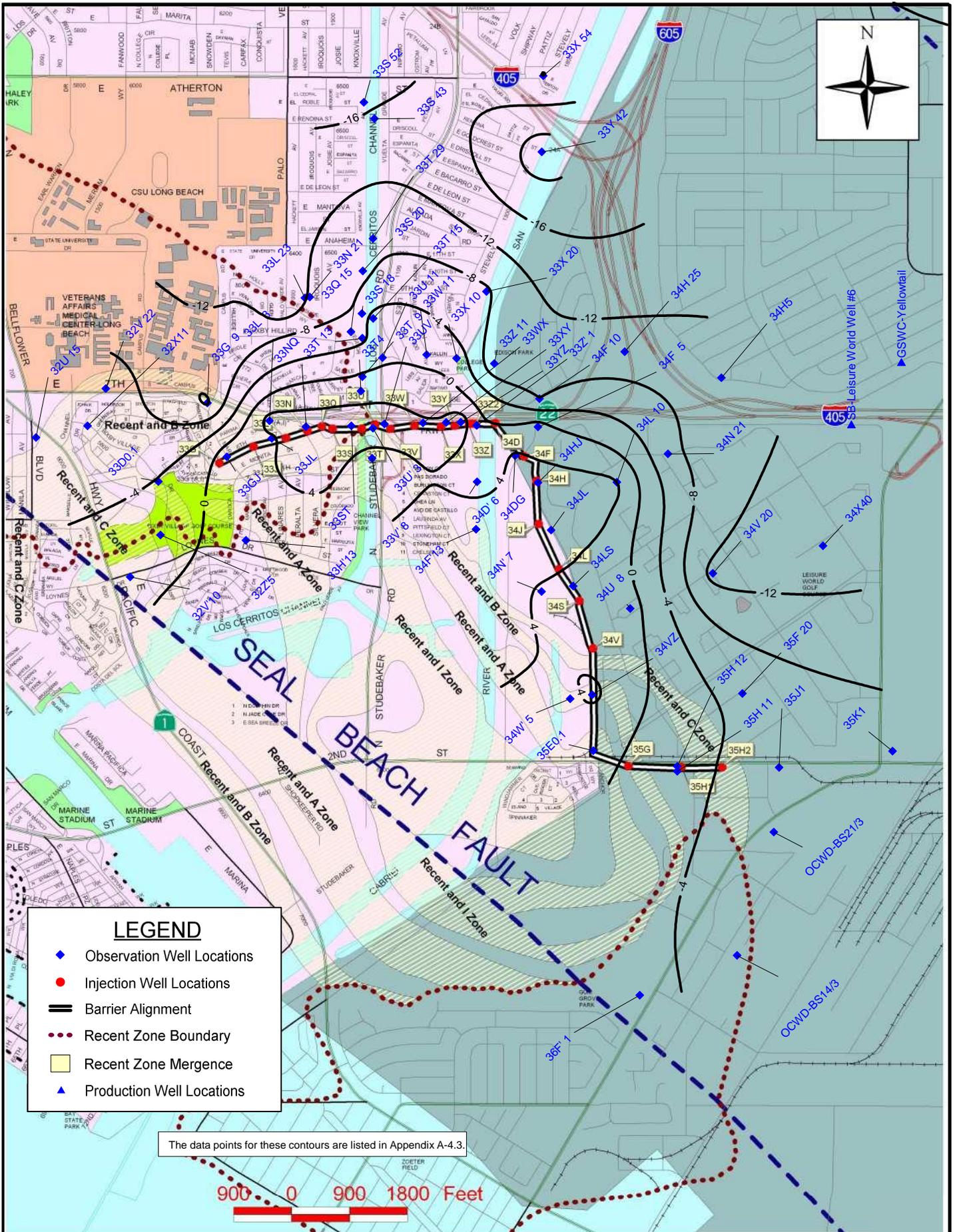
AVG= -0.1

AVG= 0.6

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

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

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



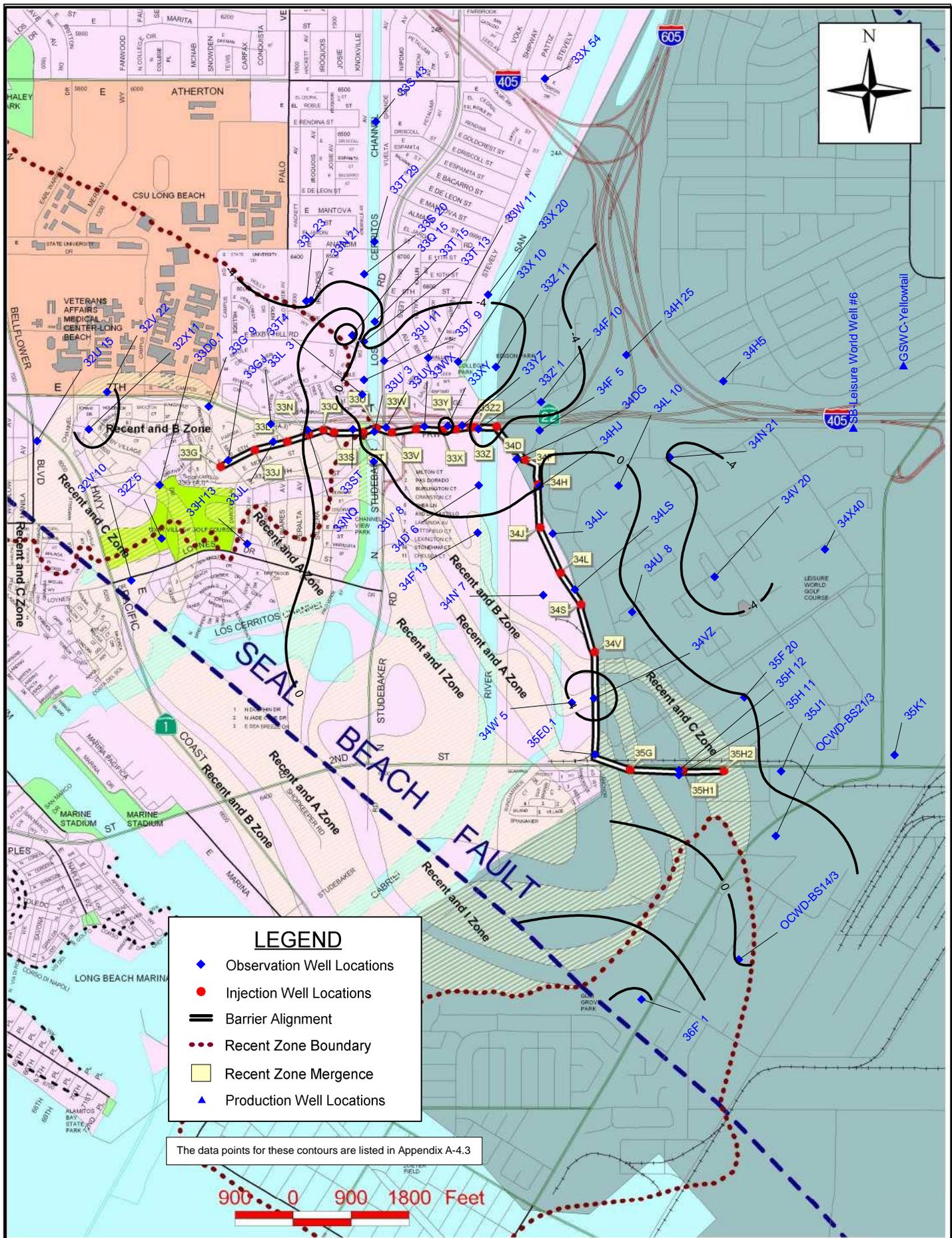
LEGEND

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

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



Alamitos Barrier Project
A Zone Groundwater Elevation (ft) Contours Spring 2016



Alamitos Barrier Project
 A Zone: Change in Elevation (ft), Spring 2015 to Spring 2016



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

POINT	PROJ	FCD	AQUIFER	DATE	FY 15-16 ELEV	P.E. ¹	Δ^2	FY 14-15 ELEV	CHANGE IN ELEV
1	32U 15	482M	A	20160229	-6.7			-5.6	-1.1
2	32V 22	482P	A	20160301	-5.3			-5.5	0.2
3	32V'10	483F	A	20160303	-0.8			-0.4	-0.4
4	32X11	482S	A	20160317	-7.8			-8.2	0.4
5	32Z'5	482W	B,A	20160301	-1.6			-0.8	-0.8
6	33D0.1	482U	A,I	20160317	-3.8			-2.4	-1.4
7	33G 9	482F	A	20160229	-12.4			-10.8	-1.6
8	33GJ	482X	A	20160321	2.1	1.4	0.7	5.4	-3.3
9	33H'13	493YY	R,A	20160308	1.2			2.4	-1.2
10	33JL	492BW	A,I	20160307	3.5	3.1	0.4	4.3	-0.8
11	33L 3	492	A	20160301	5.5			7.2	-1.7
12	33L 23	492RR	A	20160302	-12.2			-7.3	-4.9
13	33N 21	492BU	A	20160303	-10.7			-6.2	-4.5
14	33NQ	492BP	A,I	20160317	5.5	3.6	1.9	5.4	0.1
15	33Q 15	492AM	A	20160302	-6.1			-13.8	7.7
17	33S 20	492BR	A	20160301	-8.8			-3.5	-5.3
18	33S 43	491E	A	20160308	-13.8			-8.8	-5.0
19	33S 52	491H	A	20160309	-18.5				n/a
20	33ST	492BL	A	20160317	6.6	2.8	3.8	5.5	1.1
21	33T4	492CR	A	20160321	1.5			3.3	-1.8
22	33T 9	492TT	A	20160324	0.5			2.0	-1.5
23	33T 13	492ZZ	A	20150902	-4.7			0.1	-4.8
24	33T 15	492SS	A	20160310	-2.0			1.2	-3.2
25	33T 29	491C	A	20160308	-8.8			-4.6	-4.2
26	33U 11	492AJ	A	20160328	-0.7			2.4	-3.1
27	33U' 3	492WW	A	20160310	7.4			9.7	-2.3
28	33UV	492BH	A	20160307	5.9	4.0	1.9	6.9	-1.0
29	33V' 8	492BY	R,A	20160307	1.8			1.4	0.4
30	33W 11	502T	A	20160322	-1.5			0.3	-1.8
31	33WX	502AF	A	20160307	4.2	7.6	-3.4	6.3	-2.1
32	33X 10	502BD	A	20160303	-1.8			1.9	-3.7
33	33X 20	502J	A	20160328	-7.5			-3.4	-4.1
34	33X 54	501	A,I	20150924	-11.9			-6.4	-5.5
35	33XY	502BN	A	20160307	4.3	8.0	-3.7	2.9	1.4
37	33YZ	502AD	A	20160323	6.1	7.3	-1.2	8.5	-2.4
38	33Z' 1	502G	A	20160111	1.0			6.8	-5.8

ALAMITOS BARRIER PROJECT
A-Zone

Groundwater Elevation Data for Contours and Tables (Page 2 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 15-16 ELEV	P.E. ¹	Δ ²	FY 14-15 ELEV	CHANGE IN ELEV
39	33Z 11	502V	A	20160419	-10.7			-8.3	-2.4
40	34D' 6	502BH	A	20160314	2.6			5.9	-3.3
41	34DG	502Z	A	20160321	4.3	5.4	-1.1	5.0	-0.7
42	34F 5	502BR	A	20160322	1.7			2.3	-0.6
43	34F 10	502AR	A	20160330	-7.9			-0.7	-7.2
44	34F'13	503Q	A	20160208	6.4			4.8	1.6
45	34H 25	502AH	A	20160404	-10.0			-7.6	-2.4
46	34H5	512E	A	20160331	-9.6			-7.3	-2.3
47	34HJ	502BX	A	20160330	4.2	8.6	-4.4	4.3	-0.1
48	34JL	503AP	A	20160308	6.3	7.8	-1.5	3.7	2.6
49	34L 10	502AM	A	20160303	4.2			1.8	2.4
50	34LS	503BD	A	20160425	3.0	7.6	-4.6	2.3	0.7
51	34N 21	512B	A	20160303	-7.0			-2.7	-4.3
52	34N' 7	503AF	A	20160302	3.6			0.9	2.7
53	34U 8	513F	A	20160330	1.5			1.1	0.4
54	34V 20	513B	A	20160331	-13.1			-6.3	-6.8
55	34VZ	503BH	A	20160307	4.7	4.4	0.3	-0.7	5.4
56	34W' 5	503AJ	A	20160315	3.2			-0.8	4.0
57	34X40	513P	A	20160331	-13.7			-11.8	-1.9
58	35E0.1	503BK	A	20160307	1.6			-0.5	2.1
59	35F 20	513J	A	20160330	-4.7			-4.8	0.1
60	35H 11	514G	A	20160307	-3.1	3.8	-6.9	-4.3	1.2
61	35H 12	514D	A	20160307	-4.3	3.8	-8.1	-5.2	0.9
62	35J1	514L	A	20160307	-4.2			-3.8	-0.4
63	35K1	523B	A	20160308	-6.0			-5.0	-1.0
64	36F' 1	505D	A	20160316	-2.1			6.7	-8.8
65	OCWD- BS14/3		A	20160303	-6.9			-7.2	0.3
66	OCWD- BS21/3		A	20160303	-5.9			-6.6	0.7

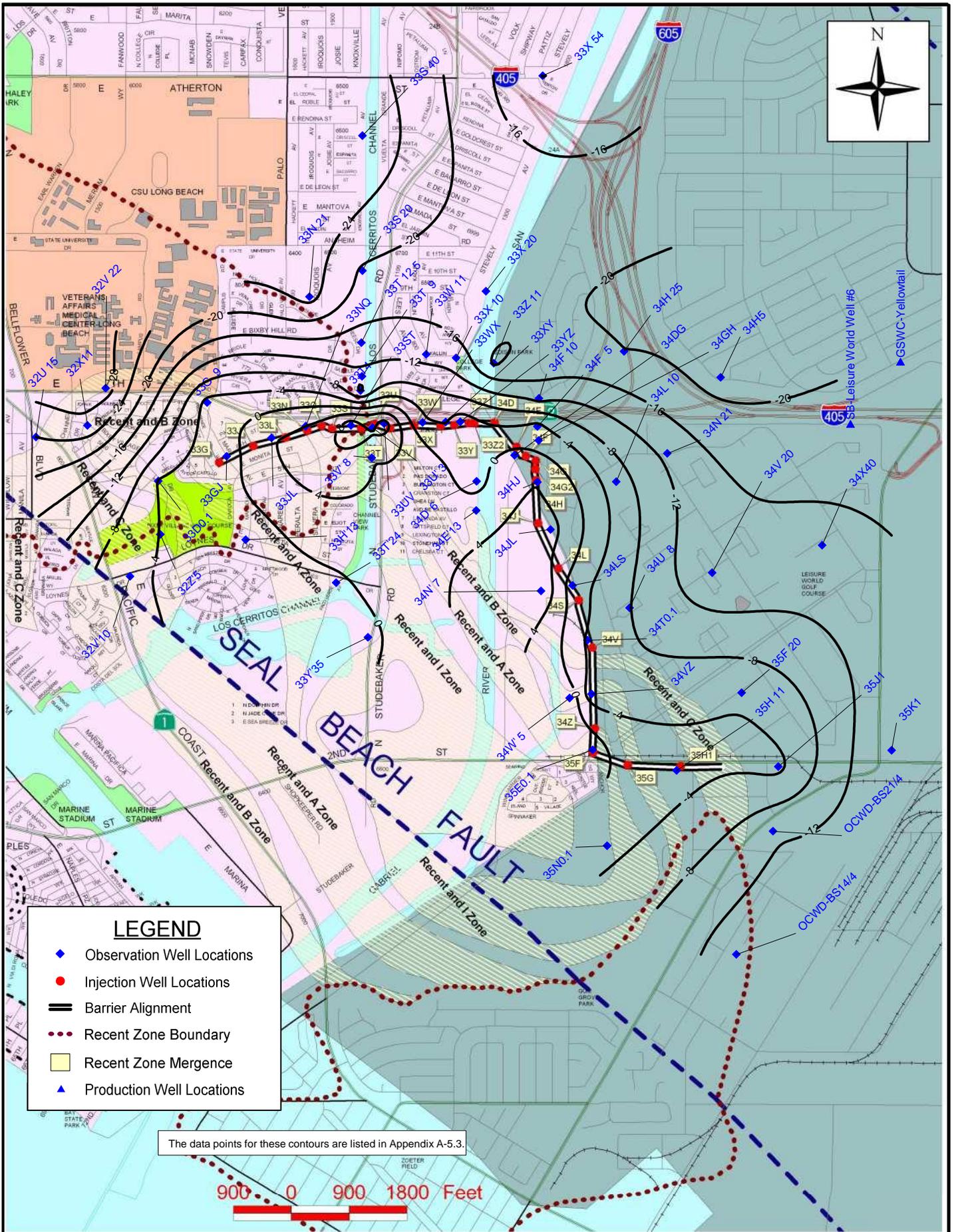
AVG= -2.4

AVG= -0.8

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

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

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



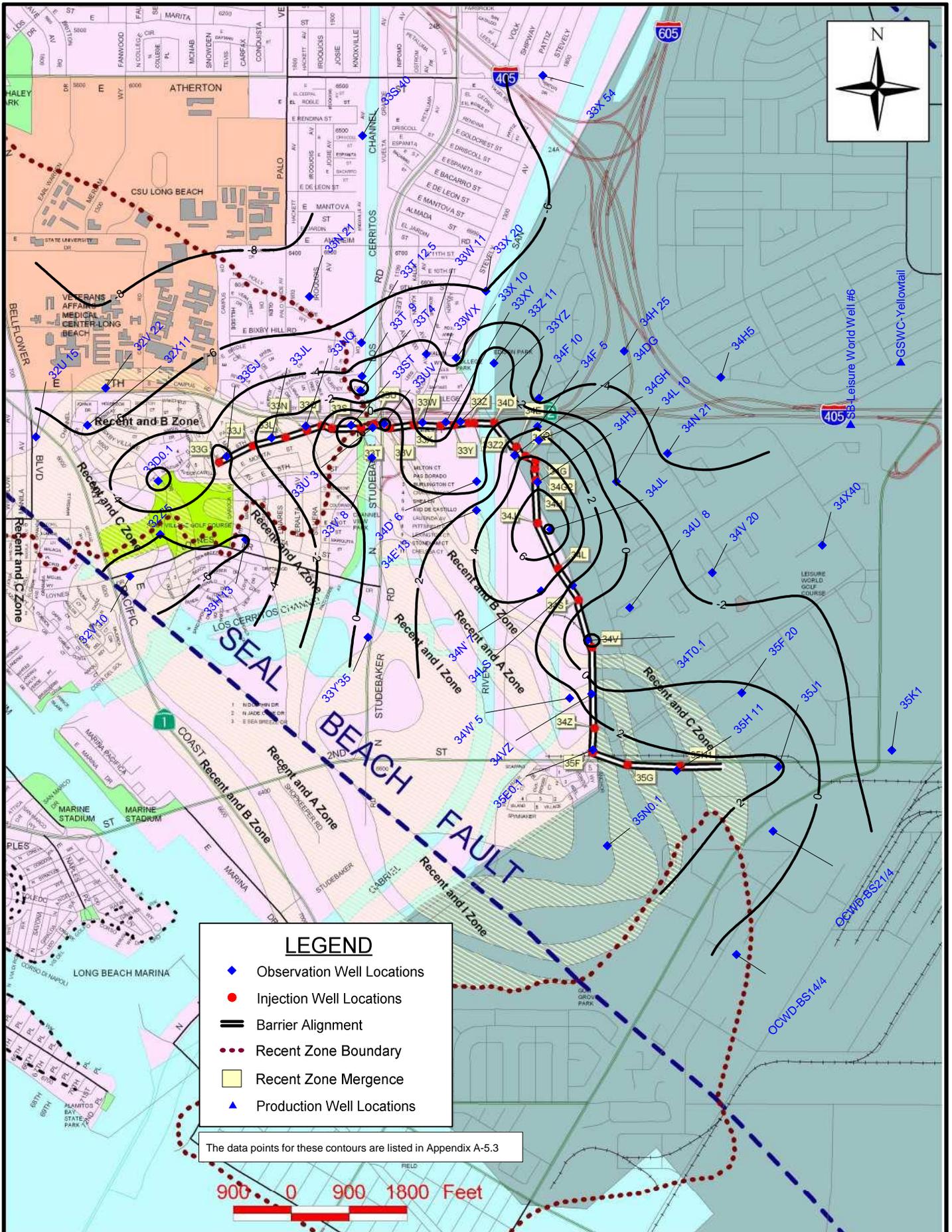
LEGEND

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

The data points for these contours are listed in Appendix A-5.3.



Alamitos Barrier Project
I Zone Groundwater Elevation (ft) Contours Spring 2016



Alamitos Barrier Project
I Zone: Change in Elevation (ft), Spring 2015 to Spring 2016

ALAMITOS BARRIER PROJECT

I-Zone

Groundwater Elevation Data for Contours and Tables (Page 1 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 15-16 ELEV	P.E. ¹	Δ^2	FY 14-15 ELEV	CHANGE IN ELEV
1	32U 15	482L	I	20160229	-24.0			-19.1	-4.9
2	32V 22	482N	I	20160301	-29.8			-21.9	-7.9
3	32V'10	483E	I	20160303	-4.8			1.7	-6.5
4	32X11	482R	I	20160317	-26.6			-20.1	-6.5
5	32Z'5	482V	I	20160301	-3.9			2.1	-6.0
6	33D0.1	482U	A,I	20160317	-3.8			-2.7	-1.1
7	33G 9	482G	I	20160229	-2.8				n/a
8	33GJ	482Y	I	20160321	-1.8	2.6	-4.4	2.5	-4.3
9	33H'13	493XX	I	20160308	-2.7			3.5	-6.2
10	33JL	492BW	A,I	20160317	3.7	3.1	2.5	4.3	-0.6
11	33N 21	492BV	I	20160303	-25.3			-17.7	-7.6
12	33NQ	492BP	A,I	20160217	4.0	3.6	0.4	5.6	-1.6
13	33S 20	492BS	I	20150831	-19.4				n/a
14	33S 40	491F	I	20160309	-27.3			-19.6	-7.7
15	33ST	492BM	I	20160307	10.6	4.2	6.4	6.6	4.0
16	33T 9	492XX	I	20160324	-11.3			-8.0	-3.3
17	33T 12.5	492BT	I	20160310	-13.5			-8.6	-4.9
18	33T4	492CQ	I	20160321	-12.6			-7.4	-5.2
19	33T'24	493RR	I	20150908	-0.6				n/a
20	33U' 3	492QQ	I	20160310	7.6			7.3	0.3
21	33UV	492BJ	I	20160307	9.8	6.1	3.7	6.7	3.1
22	33V' 8	492BX	I	20160307	4.1			3.4	0.7
23	33W 11	502U	I	20160322	-13.5			-10.3	-3.2
24	33WX	502AG	I	20160307	-3.2	10.4	-13.6	0.1	-3.3
25	33X 10	502BE	I	20160303	-13.6			-8.9	-4.7
26	33X 20	502H	I	20160209	-17.5			-11.5	-6.0
27	33X 54	501	A,I	20150924	-11.9			-6.4	-5.5
28	33XY	502BP	I	20160307	-4.2	11.0	-15.2	-2.0	-2.2
29	33Y'35	493ZZ	I	20160307	-0.9			-1.5	0.6
30	33YZ	502AE	I	20160307	-1.8	11.1	-12.9	0.0	-1.8
31	33Z 11	502W	I	20160419	-20.5			-20.4	-0.1
32	34D' 6	502BI	I	20160314	-1.0			0.6	-1.6
33	34DG	502AA	I	20160321	0.9	6.5	-5.6	-2.8	3.7
34	34E'13	503AT	I	20160314	1.1			-1.8	2.9
35	34F 5	502BQ	I	20160322	-2.8			-4.7	1.9
36	34F 10	502AS	I	20160330	-13.1			-8.0	-5.1
37	34GH	502BV	I	20160425	-1.7	10.5	-12.2	-4.4	2.7
38	34H 25	502AJ	I	20160404	-19.9			-15.4	-4.5

ALAMITOS BARRIER PROJECT
I-Zone

Groundwater Elevation Data for Contours and Tables (Page 2 of 2)

POINT	PROJ	FCD	AQUIFER	DATE	FY 15-16 ELEV	P.E. ¹	Δ ²	FY 14-15 ELEV	CHANGE IN ELEV
39	34H5	512D	I	20160331	-21.6			-16.8	-4.8
40	34HJ	502BW	I	20160308	3.9	11.0	-7.1	-1.9	5.8
41	34JL	503AN	I	20160308	5.2	10.5	-5.3	-3.2	8.4
42	34L 10	502AN	I	20160303	-6.0			-3.9	-2.1
43	34LS	503BC	I	20160412	-2.0	9.9	-11.9	-3.7	1.7
44	34N 21	512C	I	20160303	-12.8			-8.6	-4.2
45	34N' 7	503AG	I	20160302	7.3			3.1	4.2
46	34T0.1	503AD	I	20160412	-4.5	8.4	-12.9	-2.1	-2.4
47	34U 8	513G	I	20160330	-7.9			-7.2	-0.7
48	34V 20	513C	I	20160331	-15.4			-12.6	-2.8
49	34VZ	503BG	I	20160412	-6.4	6.7	-13.1	-6.8	0.4
50	34W' 5	503AK	I	20160315	3.0			-0.1	3.1
51	34X40	513N	I	20160331	-13.9			-11.8	-2.1
52	35E0.1	503BJ	I	20160307	1.6	3.1	-1.5	-1.6	3.2
53	35F 20	513H	I	20160330	-4.7			-5.0	0.3
54	35H 11	514H	I	20160307	-2.8	5.5	-8.3	-5.2	2.4
55	35J1	513M	I	20160307	-3.1			-5.4	2.3
56	35K1	523C	I	20160308	-16.0			-12.0	-4.0
57	35N0.1	504N	I	20160316	-2.9			-6.5	3.6
58	OCWD- BS14/4		I	20160303	-14.1			-13.5	-0.6
59	OCWD- BS21/4		I	20160303	-11.3			-12.2	0.9

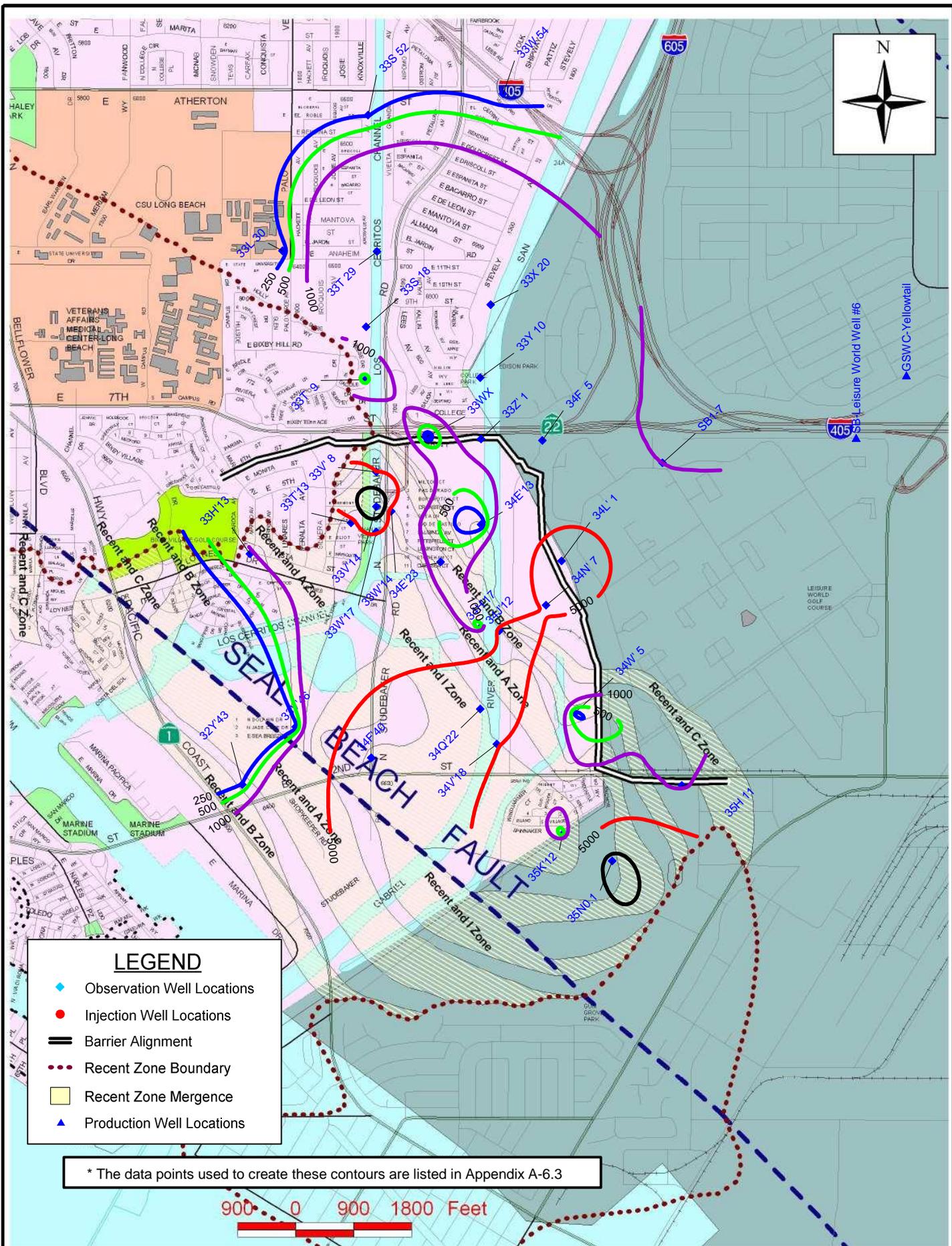
AVG= -7.1

AVG= -5.6

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

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

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



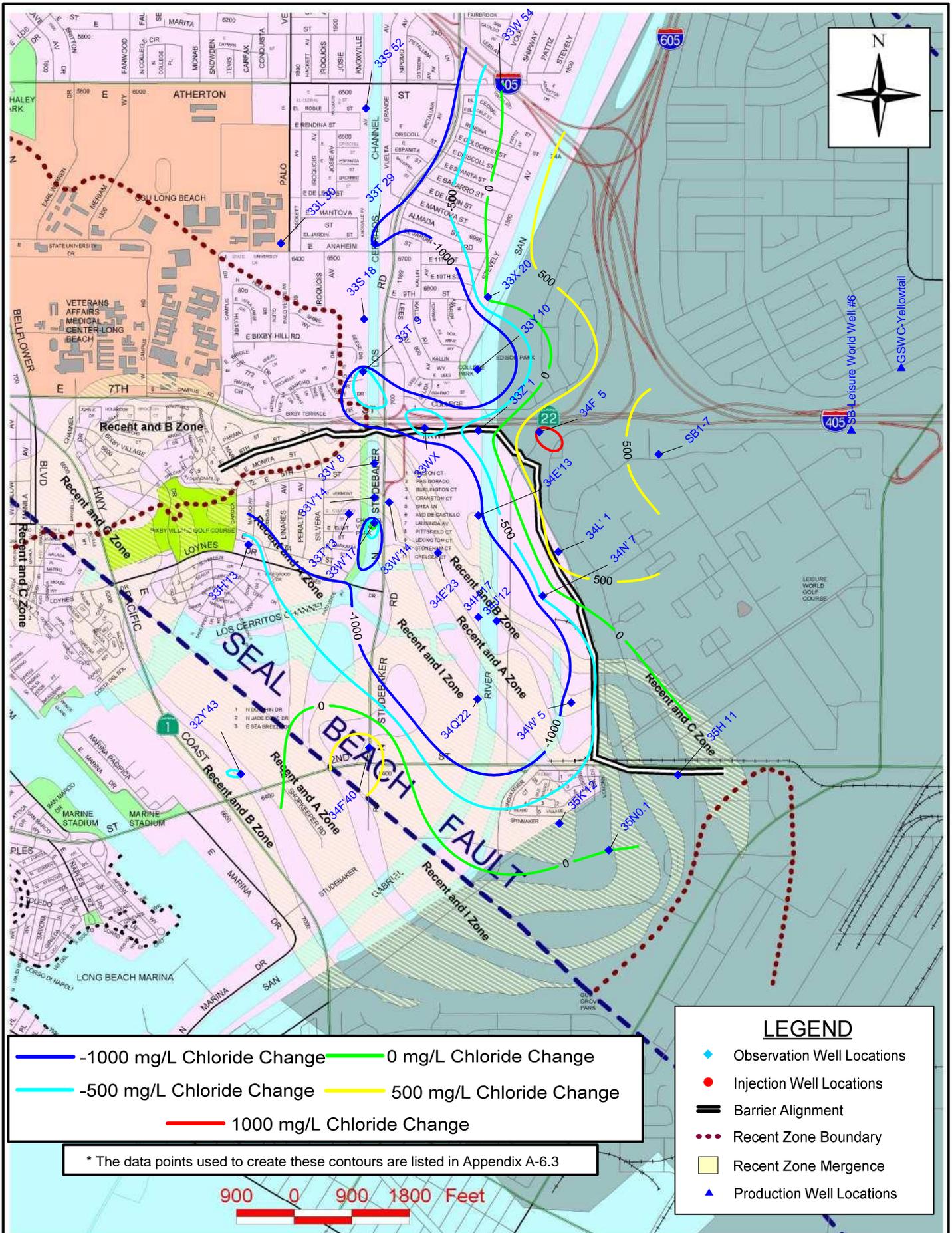
LEGEND

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

* The data points used to create these contours are listed in Appendix A-6.3



Alamitos Barrier Project
R Zone Chloride Concentration (mg/L) Contours: Spring 2016



— -1000 mg/L Chloride Change — 0 mg/L Chloride Change
— -500 mg/L Chloride Change — 500 mg/L Chloride Change
— 1000 mg/L Chloride Change

* The data points used to create these contours are listed in Appendix A-6.3



LEGEND

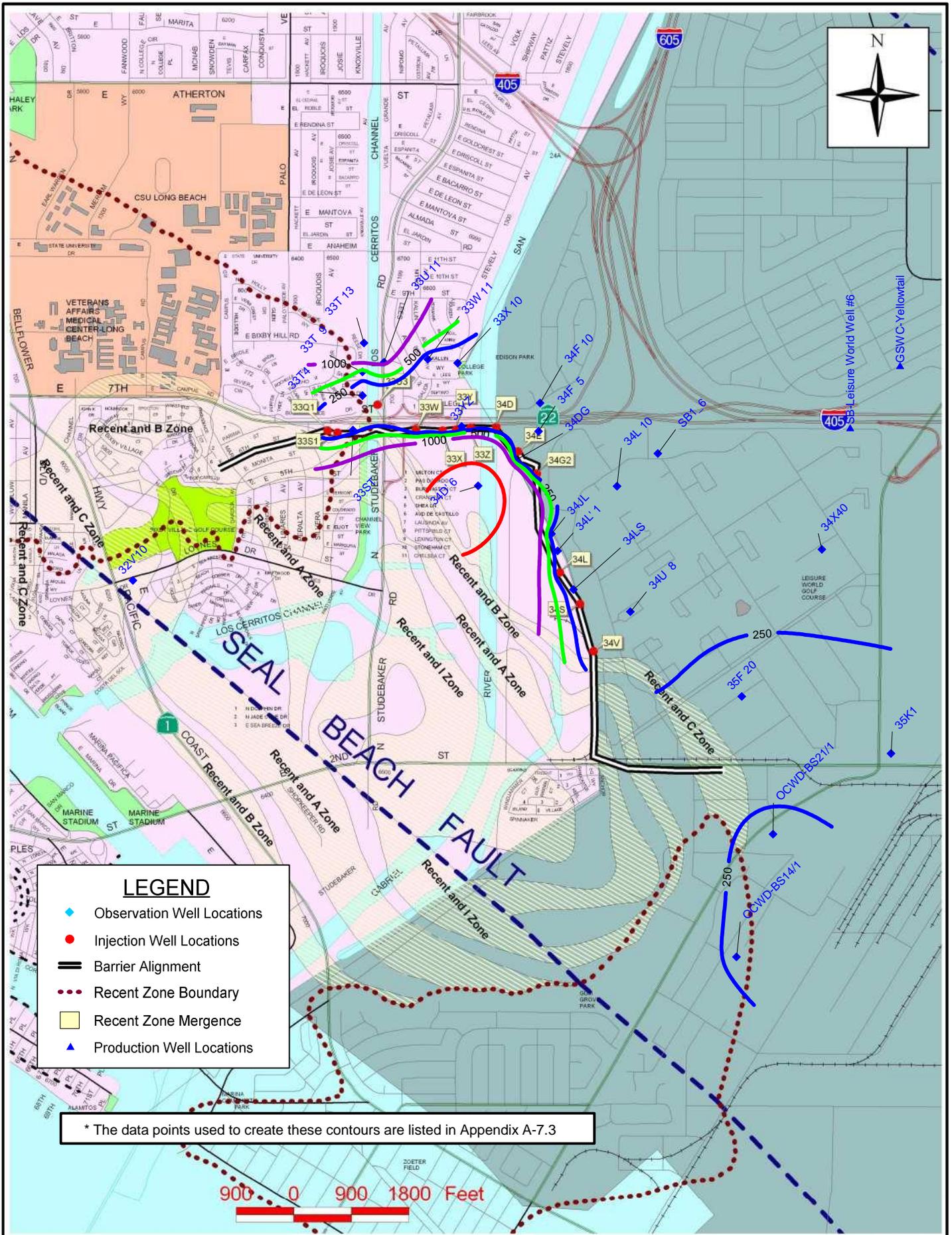
- ◆ Observation Well Locations
- Injection Well Locations
- Barrier Alignment
- ⋯ Recent Zone Boundary
- Recent Zone Mergence
- ▲ Production Well Locations



Alamitos Barrier Project
R Zone: Change in Chloride Concentration, Spring 2015 to Spring 2016

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. 15-16	14-15	(FY15-16 - FY14-15)
1	32Y43	493WW	20160301	R	-43	270					270	781	-511
2	33H13	493YY	20160308	(R,A)	-18	484	-38	929	-58	878	929	1,200	-271
3	33L 30	491G	20160309	R	-50	130					130	4,000	-3,870
4	33S 18	492AH	20160309	R	-67	1,360					1,360	12,000	-10,640
5	33S 52	491J	20160309	R	-54	235					235	3,800	-3,565
6	33T 9	492CV	20160324	R	-21	404					404	409	-5
7	33T 29	491D	20160308	R	-56	3,890					3,890	4,700	-810
8	33T13	492AU	20160309	R	-41	1,420	-51	3,300			3,300	7,600	-4,300
9	33V 8	492BY	20160307	(R,A)	-24	5,040	-48	4,300			5,040	7,500	-2,460
10	33V14	492JJ	20160310	R	-67	17,900					17,900	21,000	-3,100
11	33V46	493UU	20160301	R	-61	146					146		n/a
12	33W 54	501C	20160315	R	-33	97	-53	101			101	100	1
13	33W14	492AT	20160316	R	-46	1,720	-66	2,810			2,810	13,000	-10,190
14	33W17	493PP	20160316	R	-41	4,510	-51	5,310			5,310	4,800	510
15	33WX	502AZ	20160322	R	-45	66					66	62	4
16	33X 20	502L	20160328	R	-68	1,850					1,850	1,710	140
17	33Y 10	502BA	20160303	R	-58	3,240	-83	4,300			4,300	7,400	-3,100
18	33Z' 1	502AU	20160329	R	-46	1,010	-56	1,620			1,620	1,800	-180
19	34E13	503AU	20160314	R	-19	69	-52	72			72	1,200	-1,128
20	34E23	503X	20160321	R	-43	826					826	2,250	-1,424
21	34F 5	502BT	20160322	R	-136	84	-146	86	-156	1,180	1,180	81	1,099
22	34F40	483J	20160315	R	-40	9,060					9,060	8,190	870
23	34H17	503Y	20160314	R	-46	218					218	5,100	-4,882
24	34J12	503U	20160316	R	-28	5,540	-36	5,660			5,660	10,000	-4,340
25	34L* 1	503P	20160323	R	-57	7,600					7,600	6,820	780
26	34N* 7	503AE	20160302	R	-51	4,220	-61	4,470	-70	5,030	5,030	5,400	-370
27	34Q22	503T	20160315	R	-42	9,830	-57	8,650			9,830	13,000	-3,170
28	34V18	503V	20160316	R	-48	5,220					5,220		n/a
27	34W* 5	503AH	20160315	R	-51	202					202	938	-736
28	35H 11	514F	20160329	R	-42	285	-65	904			904	1,090	-186
29	35K12	504R	20160316	R	-44	229	-54	278			278	457	-179
30	35N0.1	504M	20160316	R	-38	11,200	-62	11,400			11,400	11,400	0
31	SB1-7		20160316	R		1,000					1,000	900	100



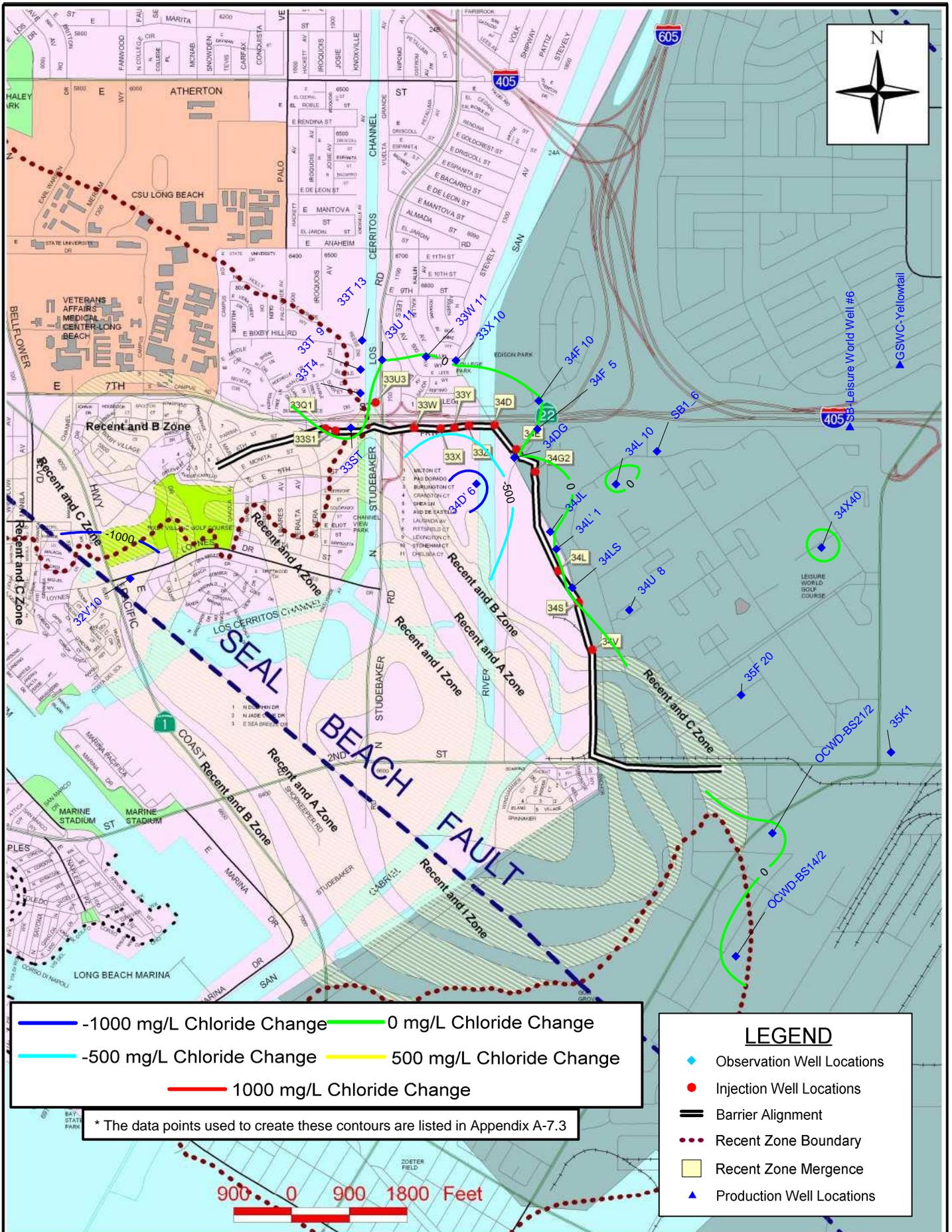
LEGEND

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

* The data points used to create these contours are listed in Appendix A-7.3



Alamitos Barrier Project
C Zone Chloride Concentration (mg/L) Contours: Spring 2016



— -1000 mg/L Chloride Change — 0 mg/L Chloride Change
— -500 mg/L Chloride Change — 500 mg/L Chloride Change
— 1000 mg/L Chloride Change

* The data points used to create these contours are listed in Appendix A-7.3

LEGEND

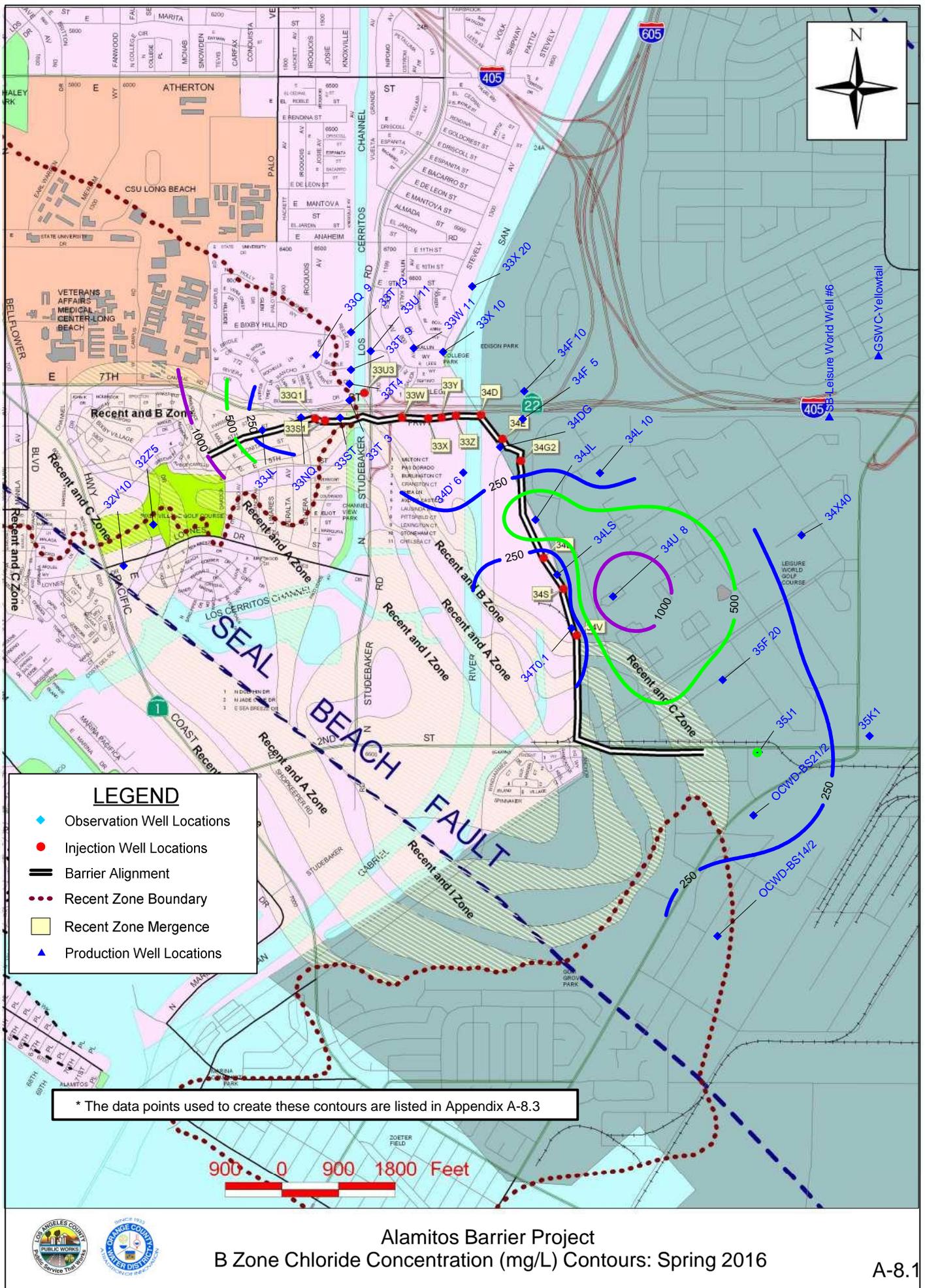
- ◆ Observation Well Locations
- Injection Well Locations
- Barrier Alignment
- Recent Zone Boundary
- Recent Zone Mergence
- ▲ Production Well Locations

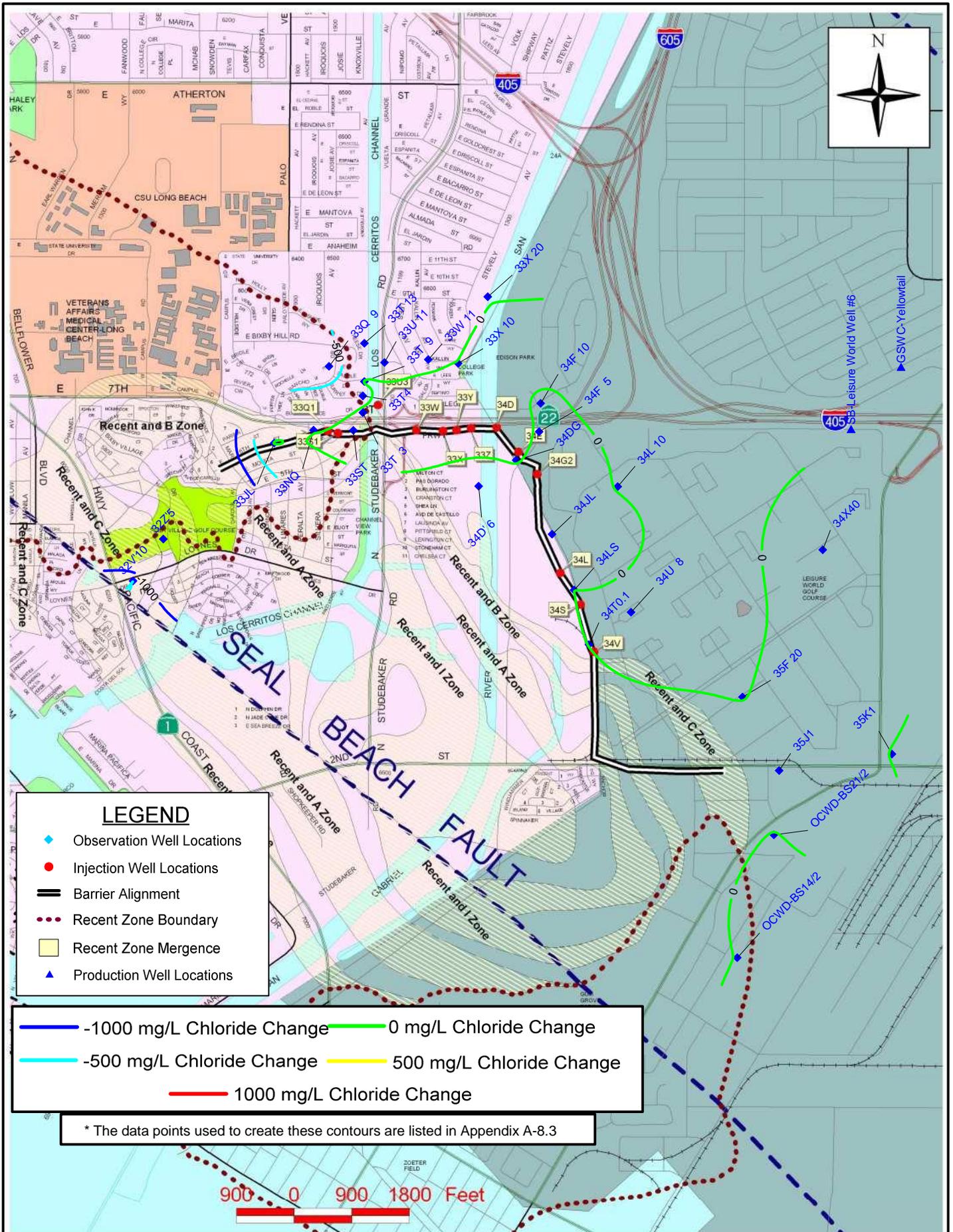


**ALAMITOS BARRIER PROJECT
C-ZONE CHLORIDE CONCENTRATIONS
Chloride Data Used for Contours and Cross-Section**

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE	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. 15-16	14-15	(FY14-15 - FY15-16)
1	32V10	483H	20160303	C	-37	1,520					1,520	2,700	-1,180
2	33ST	492BK	20160317	C,B	-25	183					183	81	102
3	33T 9	492CU	20160324	C	-129	169	-144	357			357	272	85
4	33T 13	492AC	20160328	C	-199	2,330					2,330	1,980	350
5	33T4	492CT	20160321	C	-56	117					117	74	43
6	33U 11	492AL	20160328	C	-188	1,100					1,100	1,100	0
7	33W 11	502R	20160322	C	-183	70	-216	78			78	92	-14
8	33YZ	502AB	20150917	C	-195	91	-210	99			99		n/a
9	33X 10	502BB	20160303	C	-190	70	-215	101			101	74	27
10	34D 6	502BF	20160314	C	-125	9,730					9,730	11,000	-1,270
11	34DG	502X	20160321	C	-190	89	-205	89			89	99	-9
12	34F 5	502BU	20160322	C	-191	86	-201	86	-211	90	90	88	2
13	34F 10	502AP	20160330	C	-211	68					68	75	-7
14	34JL	503AR	20160328	C	-161	131					131	149	-18
15	34L 1	503N	20160323	C	-162	115					115	103	12
16	34L 10	502AK	20160303	C	-166	73					73	85	-12
17	34LS	503BF	20160324	C	-133	113	-151	94	-163	96	113	87	26
18	34U 8	513D	20160330	C	-150	103	-165	119			119	68	51
19	34X40	513R	20160331	C	-85	42	-101	54			54	65	-11
20	35F 20	513L	20160330	C	-70	356	-78	393	-85	478	478	356	122
21	35K1	523D	20160404	C	-88	381	-98	394			394	366	28
22	SB1_6		20160316	C		82					82	82	0
23	OCWD-BS14/2		20160420	C		217					217	195	22
24	OCWD-BS21/2		20160420	C		181					181	189	-8
25	33Q1							DP1			50	50	n/a
26	33S1							DP2			50	50	n/a
27	33U3							DP3			50	50	n/a
28	33W							DP4			50	50	n/a
29	33X							DP5			50	50	n/a
30	33Y							DP6			50	50	n/a
31	33Z							DP7			50	50	n/a
32	34D							DP8			50	50	n/a
33	34E							DP9			50	50	n/a
34	34G2							DP10			50	50	n/a
35	34L							DP11			50	50	n/a
36	34S							DP12			50	50	n/a
37	34V							DP13			50	50	n/a

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



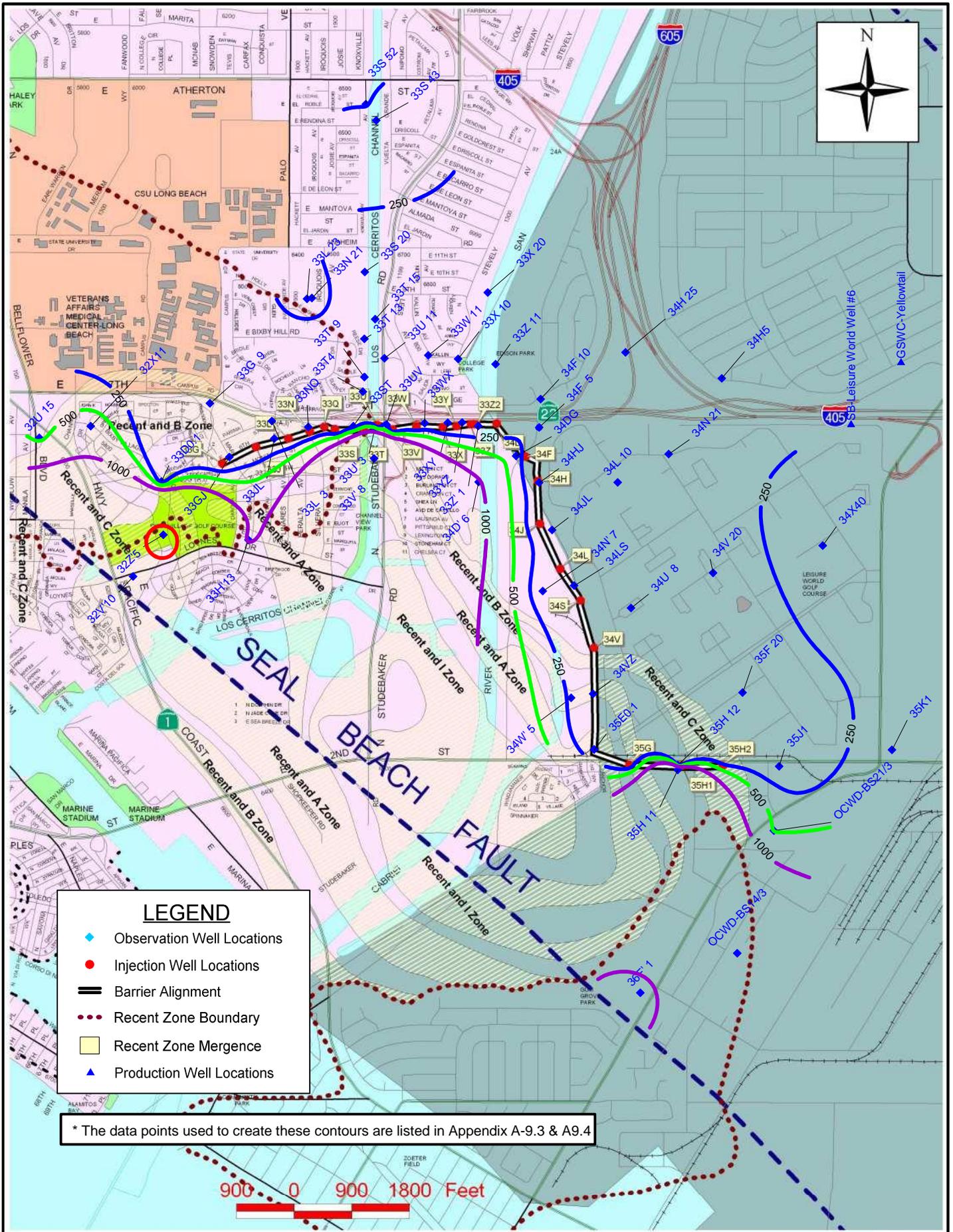


Alamitos Barrier Project
 B Zone: Change in Chloride Concentration, Spring 2015 to Spring 2016

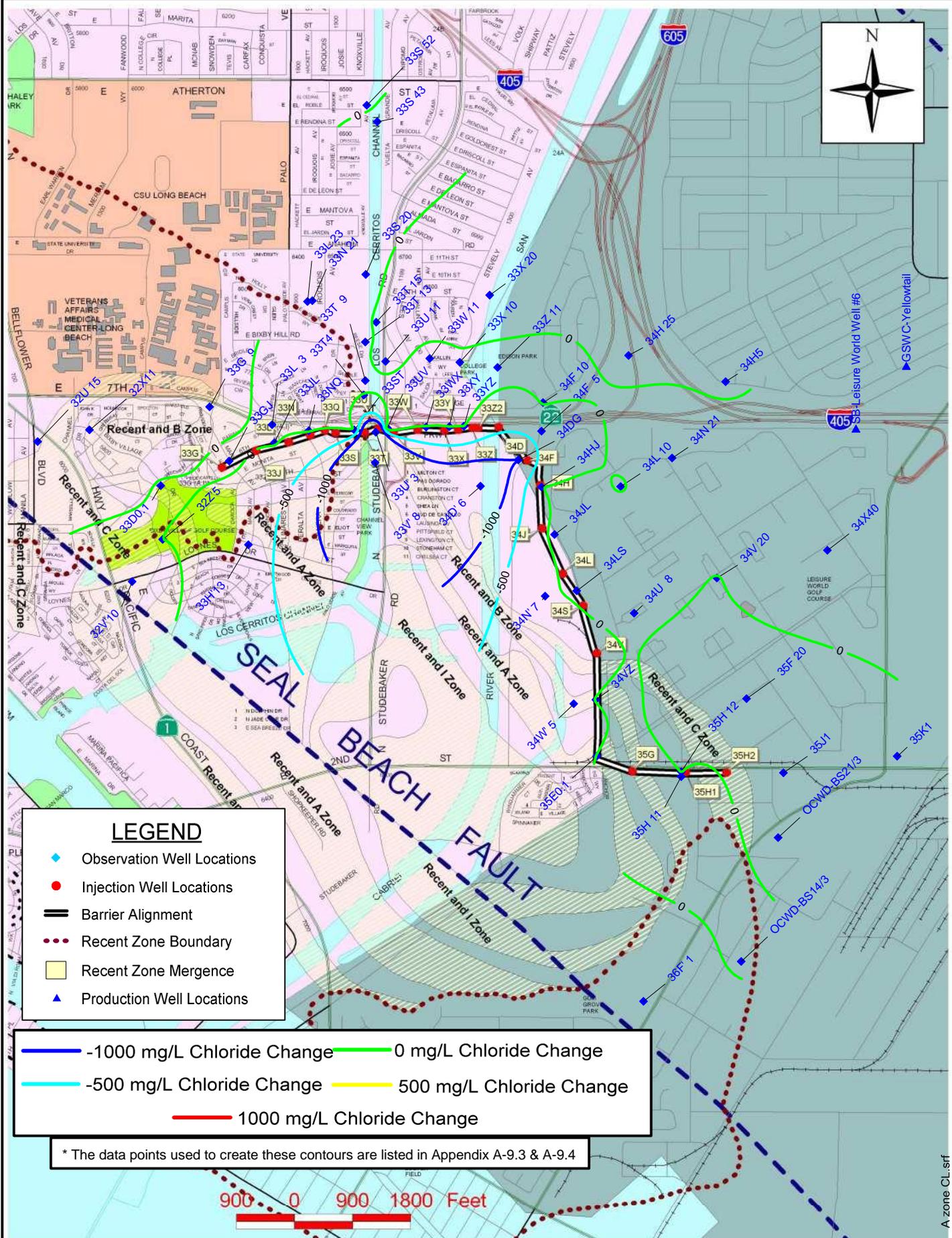
ALAMITOS BARRIER PROJECT
B-ZONE CHLORIDE CONCENTRATIONS
 Chloride Data Used for Contours and Cross-Section

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. 15-16	14-15	(FY15-16 - FY14-15)
1	32V10	483G	20160303	B	-62	4,400					4,400	4,900	-500
2	32Z5	482W	20160301	B,A	-20	897	-30	1,580	-40	2,330	2,330	6,100	-3,770
3	33JL	492BQ	20160317	B	3		-7	79			79	63	16
4	33NQ	492BN	20160317	B	-3	76	-14	76			76	86	-11
5	33Q 9	492CM	20160301	C,B	-85	90	-95	81	-105	80	90	920	-830
6	33ST	492BK	20160317	B	-25	183					183	81	102
7	33T 3	492CL	20160307	B	-40	214	-57	166	-75	138	214	170	44
8	33T 9	492YY	20160324	B	-163	113					113	101	12
9	33T 13	492AB	20160328	B	-254	195					195	189	6
10	33T4	492CS	20160321	B	-91	18					18	92	-74
11	33U 11	492AK	20160328	B	-260	59					59	146	-87
12	33W 11	502S	20160322	B	-241	133	-269	139			139	158	-19
13	33X 10	502BC	20160303	B	-275	64					64	63	1
14	33X 20	502K	20160328	B	-266	67					67	71	-4
15	34D' 6	502BG	20160314	B	-180	82	-194	84			84	150	-66
16	34DG	502Y	20160321	B	-232	79	-257	100			100	88	12
17	34F 5	502BS	20160322	B	-231	94	-260	95			95	100	-5
18	34F 10	502AQ	20160330	B	-269	71					71	79	-9
19	34JL	503AQ	20160328	B	-196	954	-211	917			954	1,300	-346
20	34L 10	502AL	20160303	B	-224	68	-249	79			79	66	12
21	34LS	503BE	20160324	B	-188	77					77	76	1
22	34T0.1	503AC	20150922	B	-174	71	-207	68	-239	79	79	77	2
23	34U 8	513E	20160330	B	-225	1,660					1,660	1,620	40
24	34X40	513Q	20160331	B	-137	24					24	67	-43
25	35F 20	513K	20160330	B	-115	366					366	347	19
26	35J1	514M	20160418	B	-128	384	-143	405	-148	507	507	997	-490
27	35K1	523A	20160328	B	-127	112	-142	139	-157	136	139	129	10
28	OCWD-BS14/2		20160303	B		35					35	34	1
29	OCWD-BS21/2		20160303	B		376					376	355	21
32	33Q1							DP1			50	50	n/a
26	33S1							DP2			50	50	n/a
33	33U3							DP2			50	50	n/a
34	33W							DP3			50	50	n/a
35	33X							DP4			50	50	n/a
36	33Y							DP5			50	50	n/a
37	33Z							DP6			50	50	n/a
38	34D							DP7			50	50	n/a
39	34E							DP8			50	50	n/a
40	34G2							DP9			50	50	n/a
41	34L							DP10			50	50	n/a
42	34S							DP11			50	50	n/a
43	34V							DP12			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 2016



LEGEND

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

- -1000 mg/L Chloride Change
- -500 mg/L Chloride Change
- 1000 mg/L Chloride Change
- 0 mg/L Chloride Change
- 500 mg/L Chloride Change

* The data points used to create these contours are listed in Appendix A-9.3 & A-9.4



Alamitos Barrier Project
A Zone: Change in Chloride Concentration, Spring 2015 to Spring 2016

A zone CL.srf

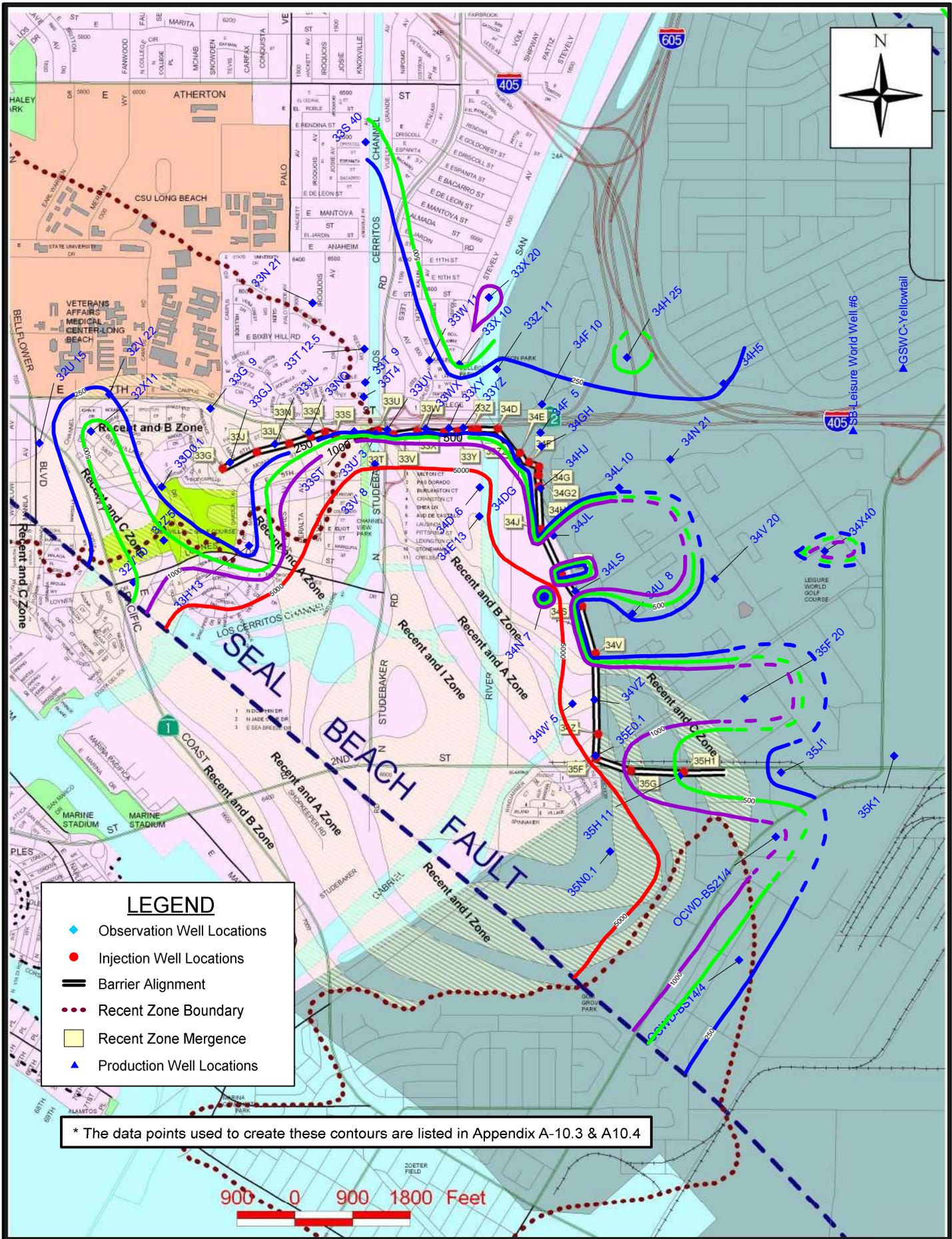
ALAMITOS BARRIER PROJECT
A-ZONE CHLORIDE CONCENTRATIONS
 Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE	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. 15-16	14-15	(FY15-16 - FY14-15)
1	32U 15	482M	20160229	A	-17	438					438	700	-262
2	32V'10	483F	20160303	A	-90	3,720	-105	3,470			3,720	3,500	220
3	32X11	482S	20160317	A	-9	147	-24	710			710	1,120	-410
4	32Z'5	482W	20160301	A	-20	1,000	-30	4,500	-40	6,100	6,100	6,100	0
5	33D0.1	482U	20160317	A,I	-24	118	-49	112	-74	131	131	110	21
6	33G 9	482F	20160229	A	-3		-23	108			108	270	-162
7	33GJ	482X	20160321	A	-35	102					102	50	52
8	33H'13	493YY	20160308	R,A	-18	484	-38	929	-58	878	929	1,200	-271
9	33JL	492BW	20160317	A,I	-41	107	-79	93	-116	95	107	87	20
10	33L 3	492	20160301	A	-60	62					62	50	13
11	33L 23	492RR	20160302	A	-344	363					363	360	3
12	33N 21	492BU	20160303	A	-305	224	-330	329	-346		329	230	99
13	33NQ	492BP	20160317	A,I	-48	106	-92	99	-136	102	106	94	12
14	33S 20	492BR	20160301	A	-317	99	-336	98	-355	117	117	97	20
15	33S 43	491E	20160308	A	-333	453	-344	335			453	370	83
16	33S 52	491H	20160309	A	-284	214	-289	227			227	260	-33
17	33ST	492BL	20160317	A	-65	95	-86	92	-100	83	95	89	6
18	33T 9	492TT	20160324	A	-262	256					256	148	108
19	33T 13	492ZZ	20160328	A	-128	172					172	130	42
20	33T 15	492SS	20160310	A	-334	105					105	120	-15
21	33T4	492CR	20160321	A	-146	117	-166	109	-186	102	117	139	-22
22	33U 11	492AJ	20160328	A	-348	242					242	368	-126
23	33U' 3	492WW	20160310	A	-89	666					666	3,700	-3,034
24	33UV	492BH	20160317	A	-106	337	-131	241	-155	239	337	83	254
25	33V' 8	492BY	20160307	R,A	-24	5,040	-48	4,300			5,040	7,500	-2,460
26	33W 11	502T	20160322	A	-321	88	-349	101	-376	133	133	81	52
27	33WX	502AF	20160322	A	-258	76	-281	80	-297	96	96	114	-18
28	33X 10	502BD	20160303	A	-320	107	-340	94	-356	100	107	92	15
29	33X 20	502J	20160328	A	-353	120					120	248	-128
30	33XY	502BN	20160323	A	-279	94	-296	88	-311	88	94	92	2
31	33YZ	502AD	20160323	A	-296	86	-327	95			95	93	2
32	33Z' 1	502G	20150922	A	-320	64					64		n/a
33	33Z' 11	502V	20160419	A	-321	139	-346	117			139	80	59
34	34D' 6	502BH	20160314	A	-270	893	-303	888	-335	1,050	1,050	2,600	-1,550
35	34DG	502Z	20160321	A	-292	205	-324	433			433	1,440	-1,007
36	34F 5	502BR	20160322	A	-297	92	-322	259	-347	262	262	588	-326
37	34F 10	502AR	20160330	A	-311	96	-326	100			100	81	18
38	34H 25	502AH	20160404	A	-297	56	-312	58	-331	59	59	101	-42
39	34H5	512E	20160331	A	-298	74	-313	76	-328	75	76	118	-42
40	34HJ	502BX	20160330	A	-310	78	-321	81	-331	80	81	90	-9

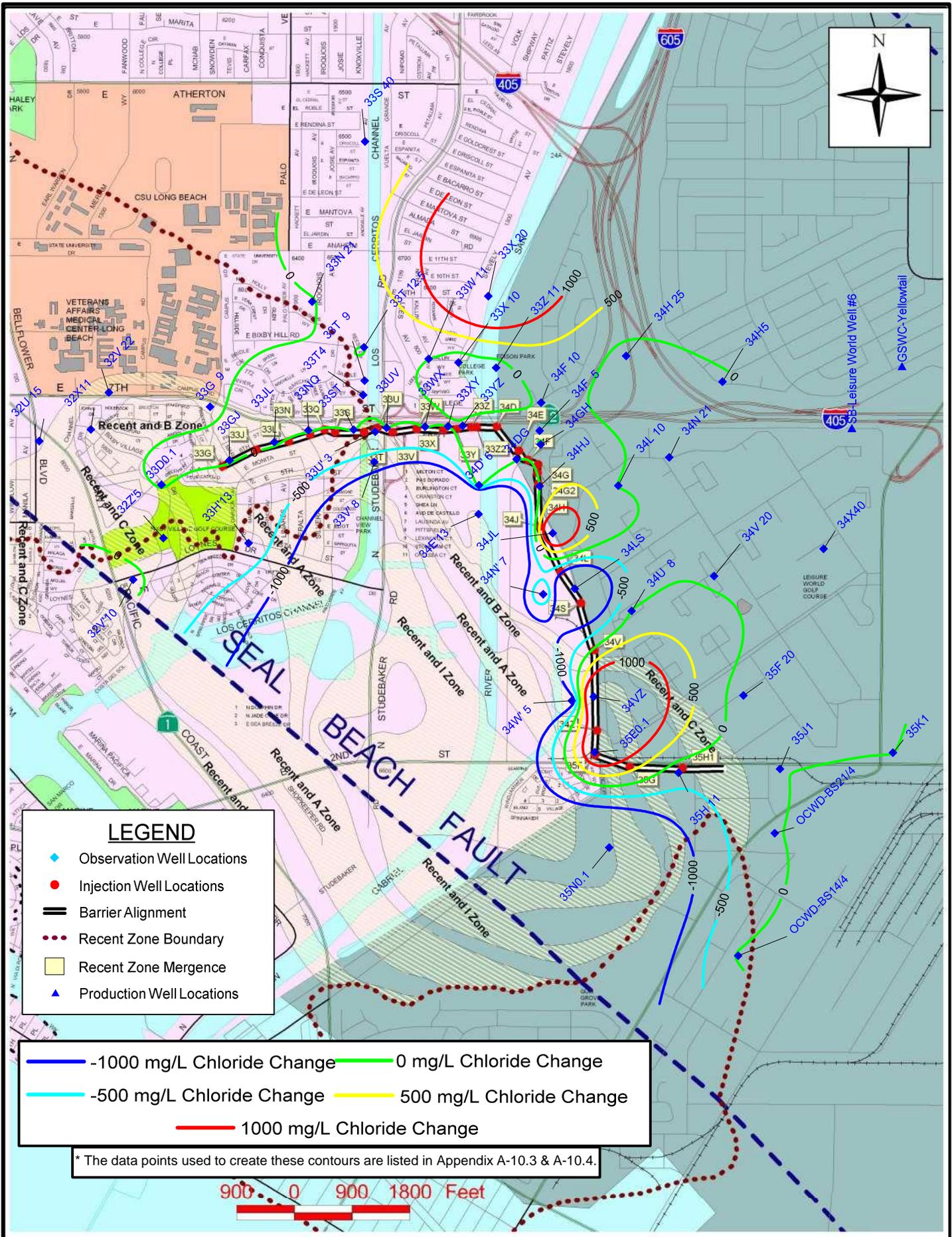
ALAMITOS BARRIER PROJECT
A-ZONE CHLORIDE CONCENTRATIONS
 Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE	Change in Chloride
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 15-16	14-15	(FY15-16 - FY14-15)
42	34JL	503AP	20160328	A	-263	66	-288	92	-308	175	175	86	89
43	34L 10	502AM	20160303	A	-310	80	-330	80	-354	82	82	100	-18
44	34LS	503BD	20150922	A	-238	89	-283	86			89	75	14
45	34N 21	512B	20160303	A	-328	211	-354	220			220	62	158
46	34N 7	503AF	20160302	A	-106	82	-144	80	-176	82	82	120	-38
47	34U 8	513F	20160330	A	-280	89	-310	91			91	81	10
48	34V 20	513B	20160331	A	-234	76	-265	36	-292	76	76	81	-5
49	34VZ	503BH	20160329	A	-146	90	-156	97			97	88	9
50	34W 5	503AJ	20160315	A	-81	220	-101	202	-119	143	220	391	-171
51	34X40	513P	20160331	A	-202	430	-232	88			430	235	195
52	35E0.1	503BK	20160329	A	-74	98					98	95	4
53	35F 20	513J	20160330	A	-129	185	-158	168			185	284	-99
54	35H 11	514G	20160329	A	-123	2,870	-146	3,720			3,720	3,340	380
55	35H 12	514D	20160418	A	-137	134					134	173	-39
56	35J1	514L	20160418	A	-193	84	-208	83	-228	86	86	430	-344
57	35K1	523B	20160404	A	-197	15	-212	249	-227	379	379	428	-49
58	36F 1	505D	20160316	A	-99	779					779	1,130	-351
59	OCWD-BS14/3		20160420	A		2,190					2,190	2,140	50
60	OCWD-BS21/3		20160420	A		484					484	580	-96
60	33G						DP1				50	50	n/a
61	33J						DP2				50	50	n/a
62	33L						DP3				50	50	n/a
63	33N						DP4				50	50	n/a
64	33Q						DP5				50	50	n/a
65	33S						DP6				50	50	n/a
66	33T						DP7				50	50	n/a
67	33U						DP8				50	50	n/a
68	33V						DP9				50	50	n/a
69	33W						DP10				50	50	n/a
70	33X						DP11				50	50	n/a
71	33Y						DP12				50	50	n/a
72	33Z						DP13				50	50	n/a
73	33Z2						DP14				50	50	n/a
74	34D						DP15				50	50	n/a
75	34F						DP16				50	50	n/a
76	34H						DP17				50	50	n/a
77	34J						DP18				50	50	n/a
78	34L						DP19				50	50	n/a
79	34S						DP20				50	50	n/a
80	34V						DP21				50	50	n/a
81	35G						DP22				50	50	n/a
82	35H1						DP23				50	50	n/a
83	35H2						DP24				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 2016



LEGEND

- ◆ Observation Well Locations
- Injection Well Locations
- ==** Barrier Alignment
- ⋯ Recent Zone Boundary
- Recent Zone Mergence
- ▲ Production Well Locations

— -1000 mg/L Chloride Change — 0 mg/L Chloride Change
— -500 mg/L Chloride Change — 500 mg/L Chloride Change
— 1000 mg/L Chloride Change

* The data points used to create these contours are listed in Appendix A-10.3 & A-10.4.



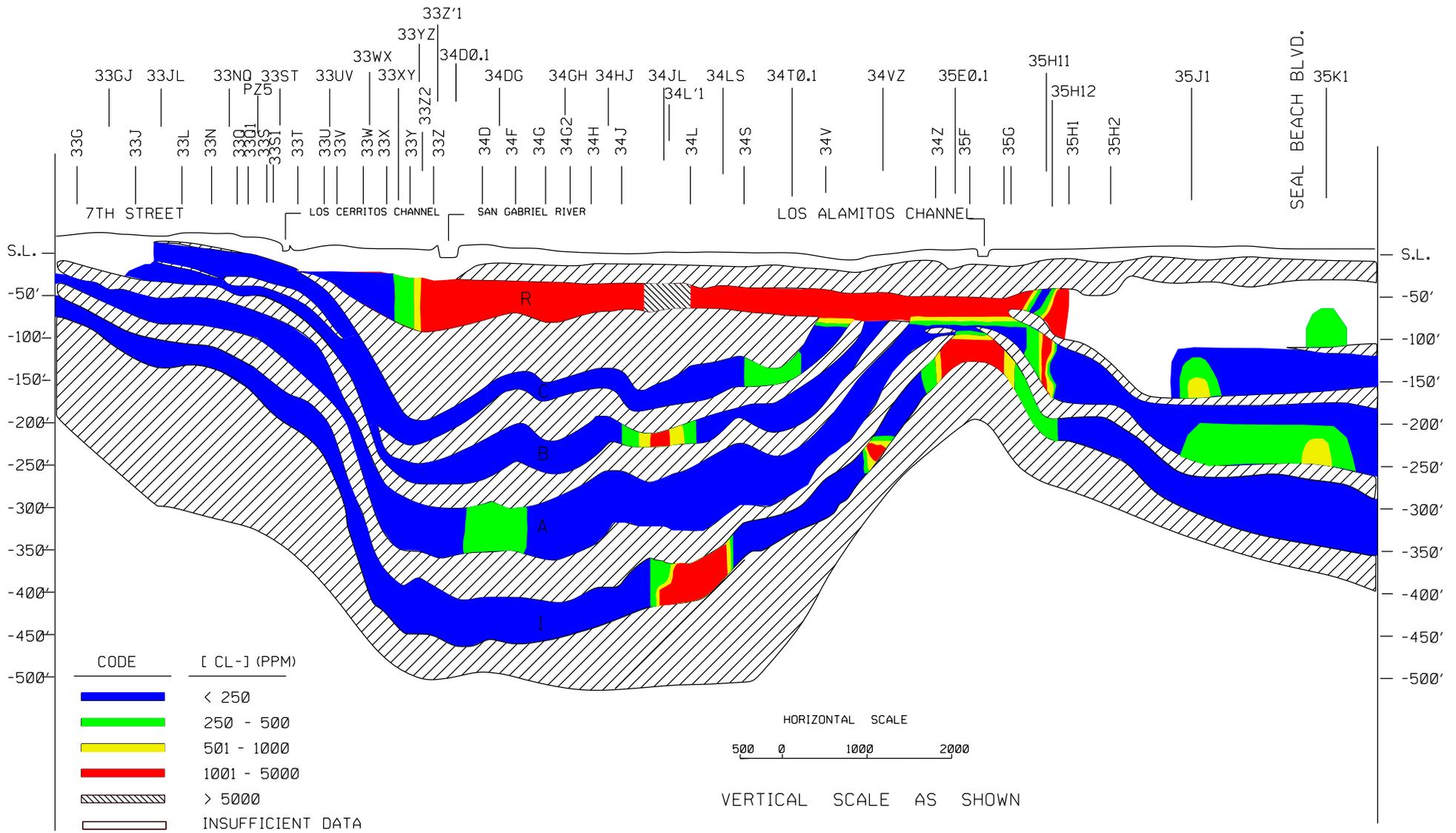
ALAMITOS BARRIER PROJECT
I-ZONE CHLORIDE CONCENTRATIONS
 Chloride Data Used for Contours and Cross-Section

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE	Change in Chloride
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 14-15	13-14	(FY14-15 - FY13-14)
1	32U 15	482L	20160229	I ZONE	-74	81					81	170	-89
2	32V 22	482N	20160301	I ZONE	-51	138					138	250	-112
3	32V'10	483E	20160303	I ZONE	-140	374	-152	401	-165		401	270	131
4	32X11	482R	20160317	I ZONE	-51	480	-61	614			614	690	-76
5	32Z'5	482V	20160301	I ZONE	-68	432	-83	442	-98	546	546	1,000	-454
6	33D0.1	482U	20160317	(A,I)	-24	118	-49	112	-74	131	131	110	21
7	33G 9	482G	20160229	I ZONE	-34	66	-68	68	-78	72	72	99	-27
8	33GJ	482Y	20160321	I ZONE	-75	80	-95	93			93	89	5
9	33H'13	493XX	20160308	I ZONE	-89	227					227	350	-123
10	33JL	492BW	20160317	(A,I)	-41	107	-79	93	-116	95	107	87	20
11	33N 21	492BV	20160303	I ZONE	-457	68	-468				68	82	-14
12	33NQ	492BP	20160317	(A,I)	-48	106	-92	99	-136	102	106	94	12
13	33S 40	491F	20160309	I ZONE	-470	389					389	370	19
14	33ST	492BM	20160317	I ZONE	-130	98	-148	108	-163	104	108	90	19
15	33T 9	492XX	20160324	I ZONE	-364	161					161	130	31
16	33T 12.5	492BT	20160310	I ZONE	-423	105	-438	103	-443	124	124	130	-6
17	33T4	492CQ	20160321	I ZONE	-277	121	-292	116			121	99	22
18	33U' 3	492QQ	20160310	I ZONE	-147	102					102	290	-188
19	33UV	492BJ	20150824	I ZONE	-209	93	-228	93	-246	92	93	83	10
20	33V' 8	492BX	20160307	I ZONE	-109	4,460	-130	4,910			4,910	5,600	-690
21	33W 11	502U	20160322	I ZONE	-423	76	-446	82	-468	82	82	81	1
22	33WX	502AG	20160322	I ZONE	-374	77	-391	85	-405	86	86	69	27
23	33X 10	502BE	20160303	I ZONE	-420	522	-440		-460		522	790	-268
24	33X 20	502H	20160328	I ZONE	-442	2,300					2,300	79	2,221
25	33XY	502BP	20160323	I ZONE	-404	83	-417	89	-431	88	89	83	6
26	33YZ	502AE	20160323	I ZONE	-402	75	-433	100			100	89	11
27	33Z 11	502W	20160419	I ZONE	-417	230	-437	232	-457	238	238	460	-222
28	34D 6	502BI	20160314	I ZONE	-400	559	-410	5,460	-418	5,460	5,460	5,200	260
29	34DG	502AA	20160321	I ZONE	-402	87	-432	84			87	79	8
30	34E'13	503AT	20160314	I ZONE	-289	1,010	-308	6,460			6,460	15,000	-8,540
31	34F 5	502BQ	20160322	I ZONE	-411	67	-426	72	-441	70	72	66	6
32	34F 10	502AS	20160330	I ZONE	-416	77	-442	90			90	80	10
33	34GH	502BV	20160407	I ZONE	-412	77	-427	78	-437		78	86	-8
34	34H 25	502AJ	20160404	I ZONE	-407	498	-427	528	-446		528	696	-168
35	34H5	512D	20160331	I ZONE	-408	150	-423	150	-443	253	253	280	-27
36	34HJ	502BW	20160330	I ZONE	-407	88	-417	91	-427	90	91	85	6
37	34JL	503AN	20160328	I ZONE	-383	92	-403	4,500			4,500	2,390	2,110

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

No.	PROJ	FCD	DATE	AQUIFER	For Cross-Section (Internodal Wells in Bold)						For Contours	MAX CHLORIDE	Change in Chloride
					ELEV 1 (ft)	CHL 1 (mg/L)	ELEV 2 (ft)	CHL 2 (mg/L)	ELEV 3 (ft)	CHL 3 (mg/L)	MAX CHL. 15-16	14-15	(FY15-16 - FY14-15)
38	34L 10	502AN	20160303	I ZONE	-404	69	-426	74			74	90	-17
39	34LS	503BC	20160324	I ZONE	-338	2,200	-368	2,580			2,580	5,650	-3,070
40	34N 21	512C	20160303	I ZONE	-423	63	-448	71			71	74	-3
41	34N 7	503AG	20160302	I ZONE	-221	209	-254	211	-274	199	211	160	51
42	34U 8	513G	20160330	I ZONE	-360	157	-375	355			355	314	41
43	34V 20	513C	20160331	I ZONE	-386	31					31	95	-64
44	34VZ	503BG	20160329	I ZONE	-214	85	-224	2,560			2,560	88	2,472
45	34W 5	503AK	20160315	I ZONE	-156	4,090					4,090	5,490	-1,400
46	34X40	513N	20160331	I ZONE	-331	836	-346	1,780			1,780	1,830	-50
47	35E0.1	503BJ	20160329	I ZONE	-114	4,240					4,240	2,550	1,690
48	35F 20	513H	20160330	I ZONE	-235	1,580	-245	3,150	-255	3,300	3,300	3,540	-240
49	35H 11	514H	20160329	I ZONE	-203	460					460	774	-314
51	35J1	513M	20160418	I ZONE	-261	141	-271	219	-281	209	219	227	-8
52	35K1	523C	20160404	I ZONE	-363	26	-373				26	28	-3
53	35N0.1	504N	20160316	I ZONE	-71	7,220					7,220	10,000	-2,780
54	OCWD-BS14/4		20160420	I ZONE		273					273	231	42
55	OCWD-BS21/4		20160420	I ZONE		1,250					1,250	1,280	-30
58	33G						DP1				50	50	n/a
59	33J						DP2				50	50	n/a
60	33L						DP3				50	50	n/a
61	33N						DP4				50	50	n/a
62	33Q						DP5				50	50	n/a
63	33U						DP6				50	50	n/a
64	33V						DP7				50	50	n/a
65	33W						DP8				50	50	n/a
66	33X						DP9				50	50	n/a
67	33Y						DP10				50	50	n/a
68	33Z						DP11				50	50	n/a
69	33Z2						DP12				50	50	n/a
70	34D						DP13				50	50	n/a
71	34E						DP14				50	50	n/a
72	34F						DP15				50	50	n/a
73	34G2						DP16				50	50	n/a
74	34H						DP17				50	50	n/a
75	34J						DP18				50	50	n/a
76	34L						DP19				50	50	n/a
77	34S						DP20				50	50	n/a
78	34V						DP21				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.



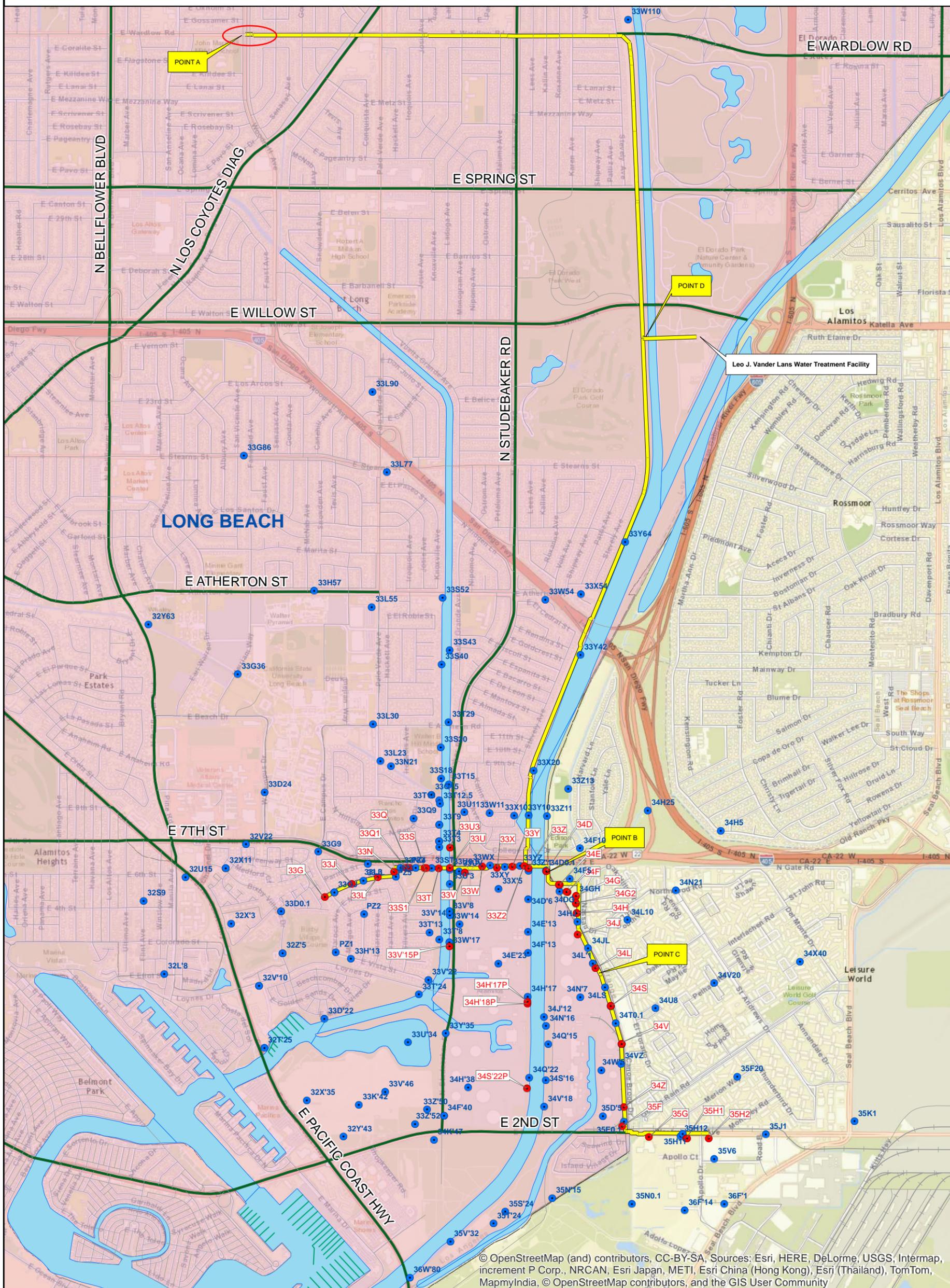
CHLORIDE SECTION ALONG THE BARRIER

Spring 2016

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



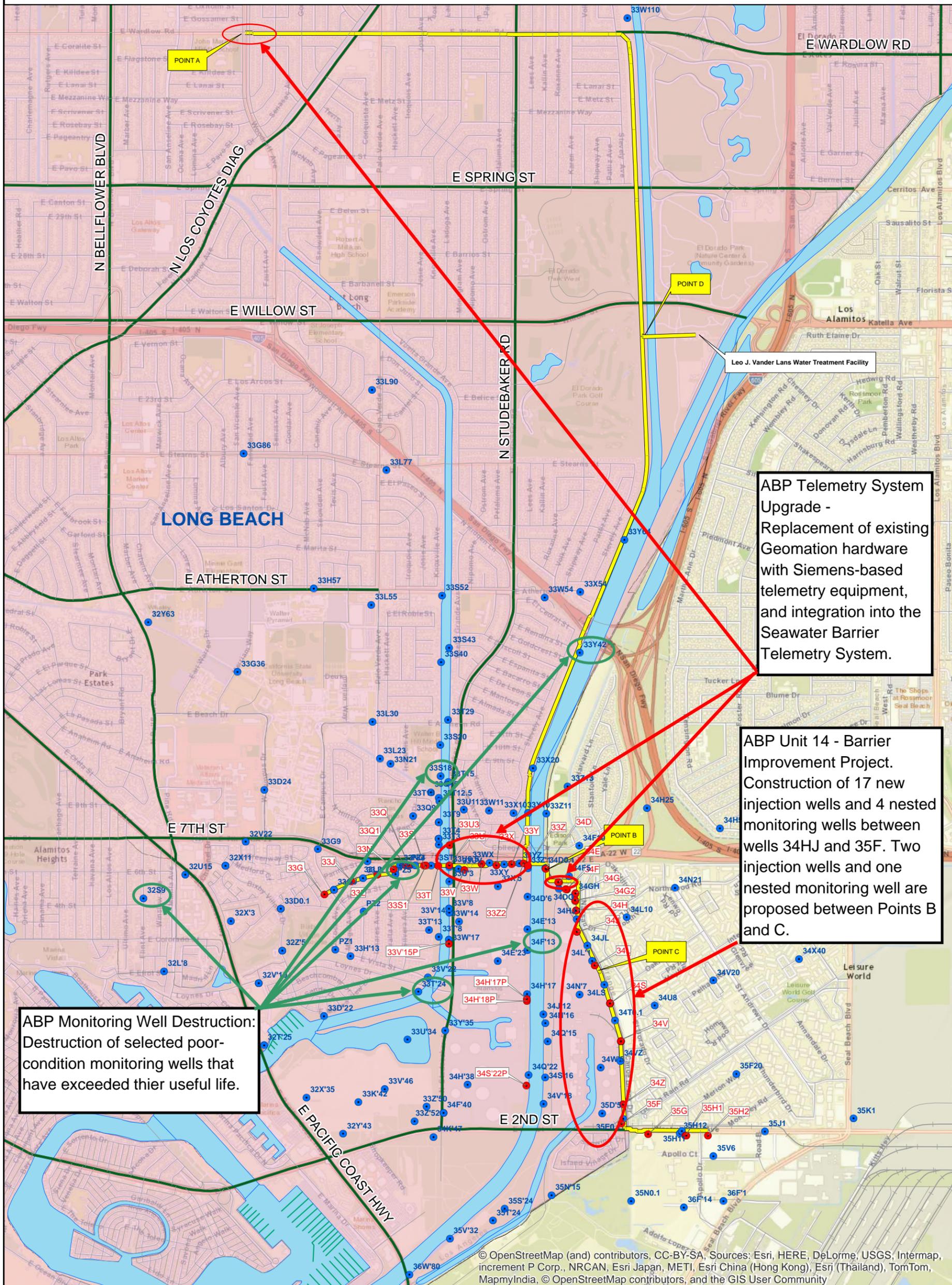
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Legend	
●	Alamos Injection Well
●	Observation Well
—	ABP Water Supply Line



ALAMITOS BARRIER PROJECT Project Location Map



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

ABP Unit 14 - Barrier Improvement Project.
Construction of 17 new injection wells and 4 nested monitoring wells between wells 34HJ and 35F. Two injection wells and one nested monitoring well are proposed between Points B and C.

ABP Monitoring Well Destruction:
Destruction of selected poor-condition monitoring wells that have exceeded their useful life.

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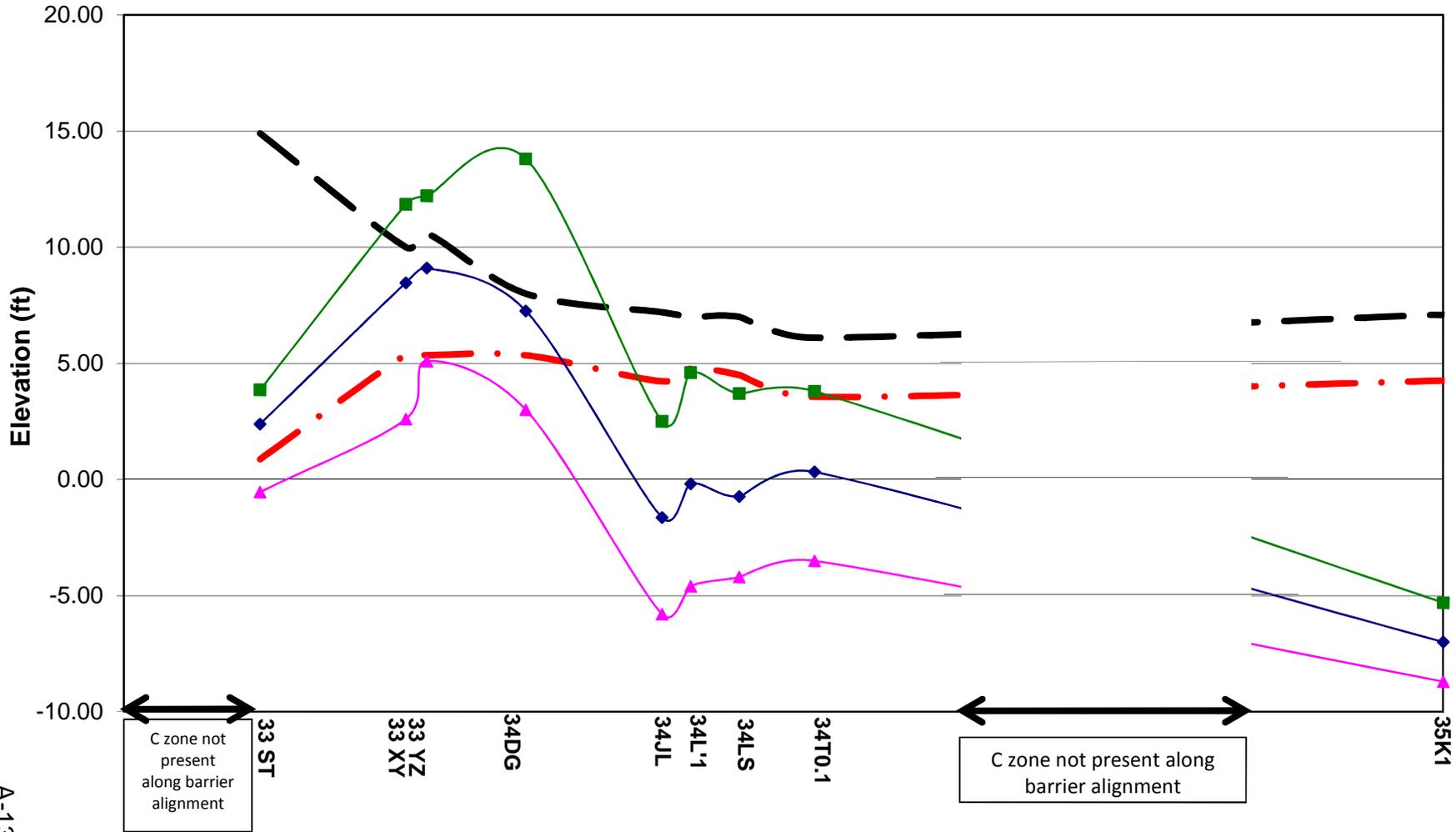


Legend

- Alamos Injection Well
- Observation Well
- ABP Water Supply Line

C Zone - Groundwater Elevation (GWE) Along the ABP FY 2015-16

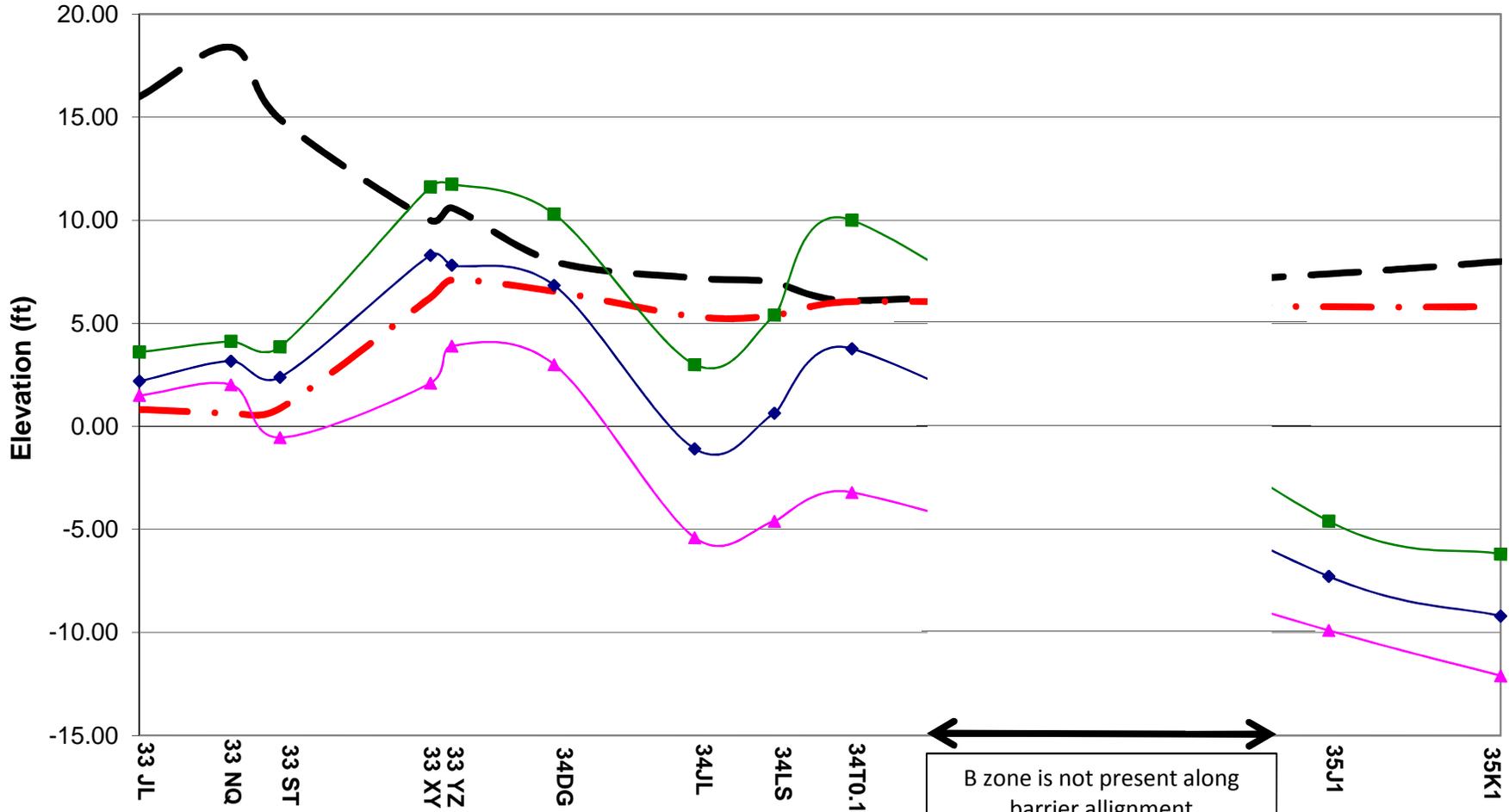
—◆— Ground Surface
 —◆— Protective Elevation
 —◆— GWE Avg
 —■— GWE Max
 —▲— GWE Min



A-13

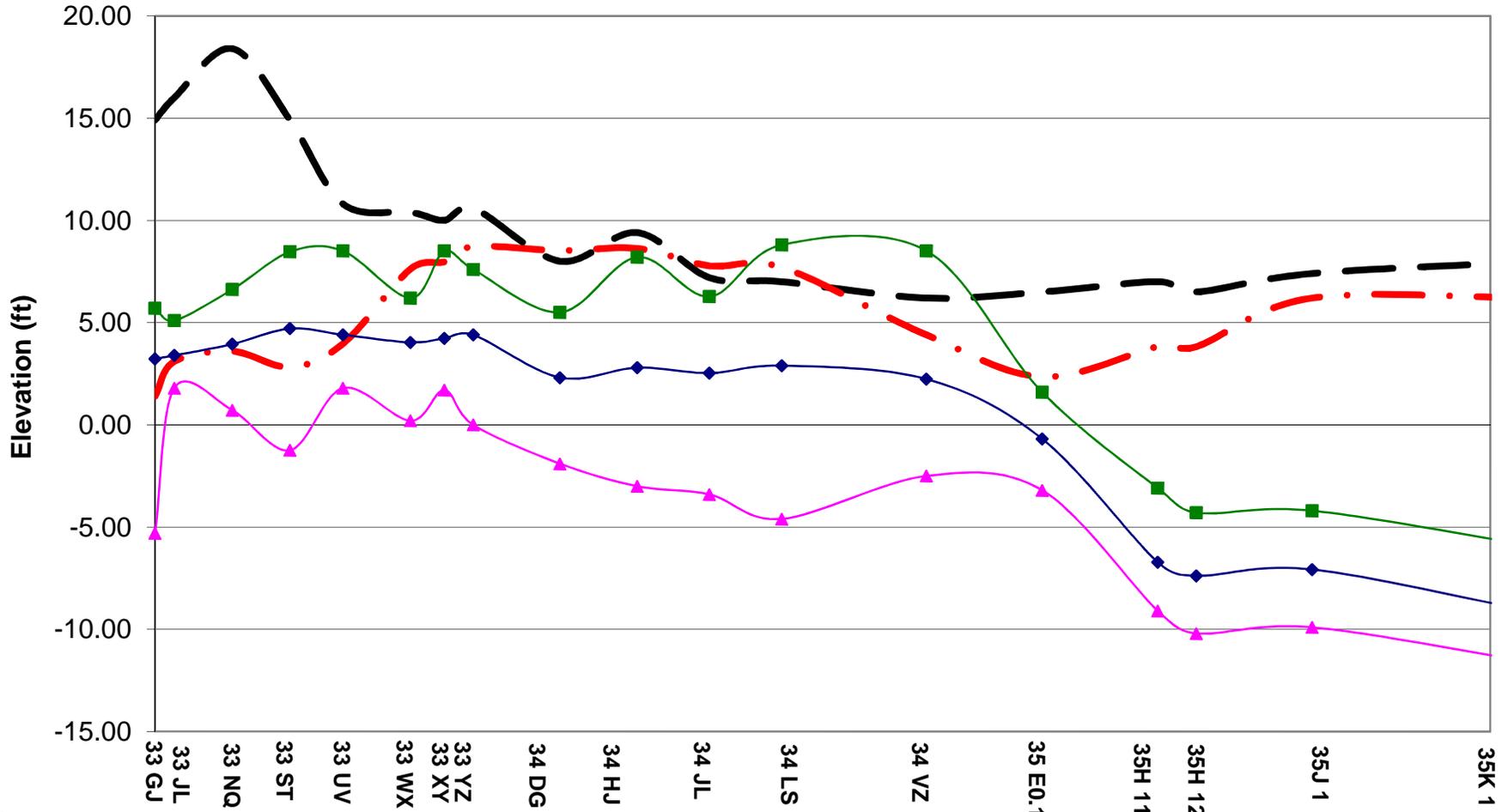
B Zone - Groundwater Elevation (GWE) Along the ABP FY 2015-16

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



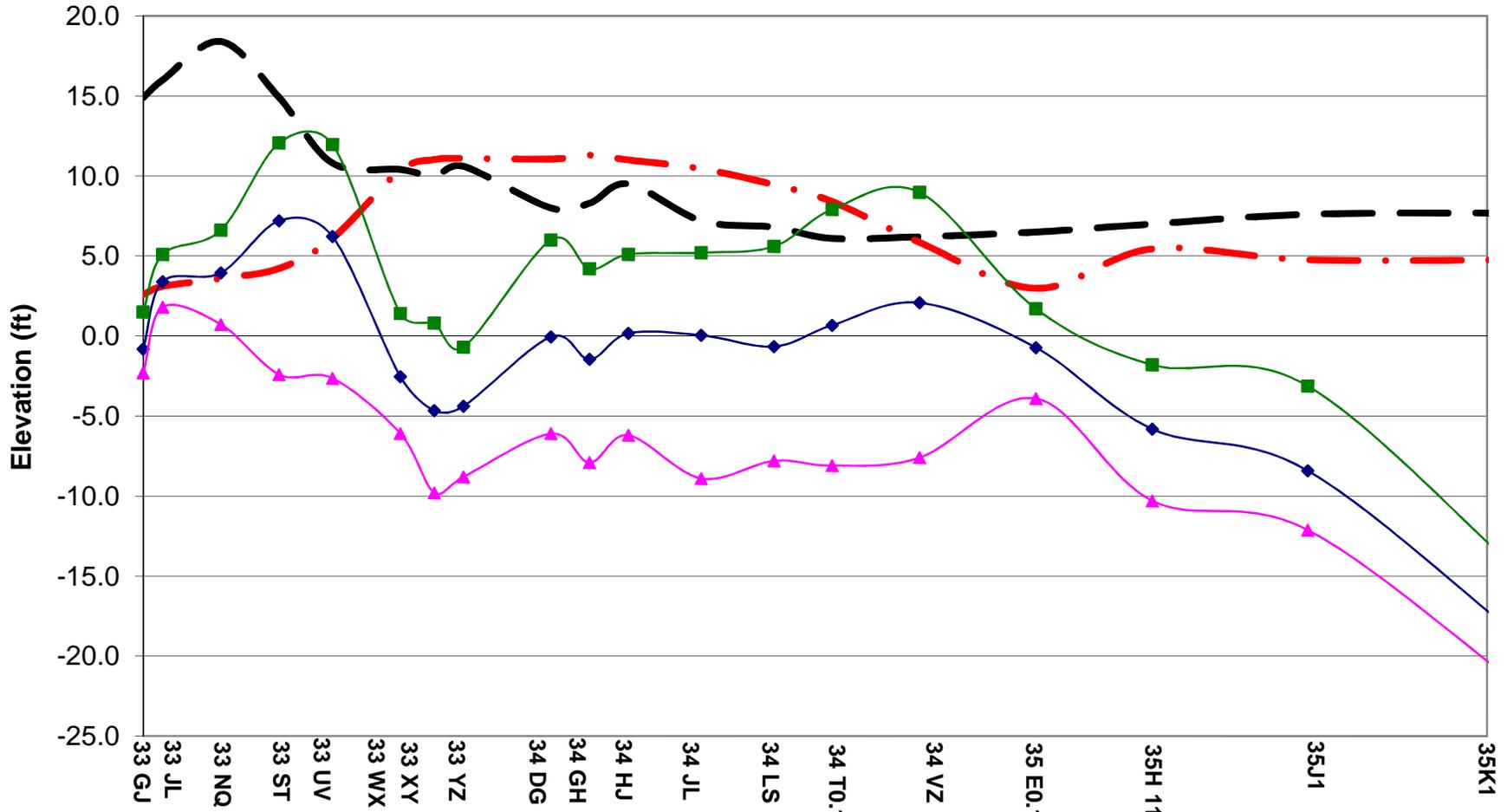
A Zone - Groundwater Elevation (GWE) Along the ABP FY 2015-16

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



I Zone - Groundwater Elevation (GWE) Along the ABP FY 2015-16

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



Current Capital Improvement Projects and Contracts (July 2015 through June 2016)

Board Award Date	Project Title	Description	Contractor	Final Contract Amount	Field Acceptance
Jun-16	ABP Telemetry Upgrade	Replace existing Geomation system with Siemens based system, also incorporate signal from well 33U3	Leed Electric, Inc.	\$388,308 Awarded	Spring 2017 [Estimated]
Oct-15	ABP Unit 14 - Phase 1 Drilling of injection and observation wells	Construction of 17 new clustered injection wells (8 locations), 4 nested observation wells, and 2 shallow piezometers	Jensen Drilling Co.	\$9,984,335 Awarded	Fall 2017 [Estimated]
Anticipated Early 2017	ABP Unit 14 - Phase 2 Wellhead improvement	Installation of injection well vaults, piping, and telemetry equipment	Jensen Drilling Co.	\$5,000,000 [Estimated]	Fall 2018 [Estimated]

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

Summary of the Alamitos Barrier Project Shutdowns (July 2015 through June 2016)

Shutdown	Startup	Duration (days)	Impacted Portion of ABP	Reason	Addressed By	Means of Repair/Remediation
02/15/2013	09/01/2015	928	Well 34G	Return of Surface Leakage	LACDPW	Packer was installed immediately above perforations to eliminate surface leakage.
10/13/2013	06/14/2016	975	Well 33W	Surface leakage	LACDPW	Packer was installed immediately above perforations to eliminate surface leakage.
05/15/2014	N/A	N/A	Well 34H(A)	Overpressure, will not take water.	LACDPW	Well is filled with sediment due to hole near top of perforations. Well to be abandoned

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.

ITEM NO.	DESCRIPTION	JOB NO.	DESCRIPTION	SERVICES AND SUPPLIES	FY 2015-16 BUDGET	% BUDGET FY 15-16	OCWD SHARE1 35%	OCWD BUDGET FY 15-16	% OCWD BUDGET FY 15-16	LADPW SHARE	LADPW BUDGET FY 15-16	% LADPW BUDGET FY 15-16	
1.	Analysis and direction of injection operation	H0321551 H0321550	ABP ANALY&DIR OF INJECTION O BARRIER PROJECT OPERATION-GEN	33,875.52 80,970.31									
			Subtotal #1	114,645.83	75,000	152.9%	40,355.33	26,250	153.7%	74,290.50	48,750	152.4%	
2.	Maintenance and repair of injection wells	F6004011 F5064011 H0321911 F6980080F HF0151000 HF01514000	MAINT INJECTION WELLS - ABP INJECT. WELLS-MAINTAIN(AMALITO Alamitos Barrier Proj;Telemetry M MAINT ENGR - BARRIER PROJ DGBP Automated System (Telemetry Alamitos Barrier Project Injectio	195,446.54 61,589.65 111,988.56 2,114.98 75,071.33 1,741.01									
			Subtotal #2	447,952.07	400,000	112.0%	157,679.13	140,000	112.6%	290,272.94	260,000	111.6%	
3.	Operation of injection	F6004000	RECHARGE OPER U/S - ABP	53,892.11									
			Subtotal #3	53,892.11	30,000	179.6%	18,970.02	10,500	180.7%	34,922.09	19,500	179.1%	
4.	Analysis and direction of extraction operations (No cost to OCWD) ¹	H0321555	ABP ANALY&DIR OF EXTRACT OPE	631.77									
			Subtotal #4	631.77	0	N/A	0.00	0	0.0	631.77	-	-	
5.	Maintenance and repair of extraction wells (No cost to OCWD) ²	HF01514001 F55455983	ABP Extraction Well Condition Ass REPAIR WELL / PUMPING WELLS 33V	1,354.92 2,327.58									
			Subtotal #5	3,682.50	15,000	24.6%	0.00	0	0.0	3,682.50	15,000	24.6%	
6.	Operation of extraction wells (No cost to OCWD) ²	F6000090	NON-LABOR EXP BARRIER (ALMT)	2,647.02									
			Subtotal #6	2,647.02	6,000	44.1%	0.00	0	0.0	2,647.02	6,000	44.1%	
7.	Maintenance and repair of distribution system	H0321569 F6004010 F6004012 F6004014F F6004022 H0321016 H0321613 F6001907 F6009924	ALAMITOS BARRIER PROJECT MAINT AIR/VAC-BLWVFF U/S - ABP MAINT PRS - ABP ABP Locate & Mark Barrier Proj. U WATER SAMPLING Seawater Barriers Administrative ABP HYDRO ELECT-EMD M&R INSPECT CRANE PRES REDUCE - ABP FENCE REPAIR - ABP	141,735.41 3,871.38 50,130.69 30,778.95 104.59 36,761.30 1,333.74 1,167.56 695.64									
			Subtotal #7	266,782.27	300,000	88.9%	93,907.36	105,000	89.4%	172,874.91	195,000	88.7%	
8.	Maintenance of observation wells	F6005205 F6005271	POST EMERGENT WEED CONTROL PRE EMERGENT WEED CONTROL	170.43 4,559.55									
			Subtotal #8	4,729.97	300,000	1.6%	1,664.95	105,000	1.6%	3,065.02	195,000	1.6%	
9.	Collection of groundwater data	H0321552	ABP COLL OF GR WTR DATA FOR City of Seal Beach Permit #DPW02 City of Seal Beach Permit #DPW02 OCPW Permit #2015-0953	159,621.11 0.00 201.38 427.45									
			Subtotal #9	160,249.94	170,000	94.3%	56,407.98	59,500	94.8%	103,841.96	110,500	94.0%	
10.	Yard Maintenance (Flat Fee from OCWD)	FFM34107 F6001904 F6001920 F6003123 F6003124 F6007022 F6060580	Facility Maintenance Alamitos Yd CONDUCT QUARTERLY INSPECTION CONDUCT QUARTERLY INSPECTION BUILDING MAINTENANCE NONRESI BUILDING MAINTENANCE-NONRESI LANDSCAPE MAINTENANCE Alamitos Yard Remodel	54,715.59 205.80 263.81 3,258.84 3,237.62 128.95 7,294.54									
			Subtotal #10	69,105.15	80,000	86.4%	8,027.25	4,620	173.8%	61,077.90	75,380	81.0%	
11.	Well redevelopment	F5064022 F55352824 F55361087 F55361093 F55387790 F55387792 F55387795 F55415812 F55415814 F55430538 F55430539 F55475786 F55475787 F55635560 F55635561 F55653836 F55653838 F55662233 F55662234 H0321565 H0321554 F5009760F F6009118	Redevelop injections wells - ABP REDEVELOP INJECTION WELL 34L - A REDEVELOP INJECTION WELL 34J - A REDEVELOP INJECTION WELL 34G - A REDEVELOP INJECTION WELL 34D - A REDEVELOP INJECTION WELL 35H1 (A REDEVELOP INJECTION WELL 35H1 (I REDEVELOP INJECTION WELL 35H2 - A REDEVELOP INJECTION WELL 33Y - A REDEVELOP INJECTION WELL 33Z2 - A REDEVELOP INJECTION WELL 33Z - A REDEVELOP INJECTION WELL 33X - A REDEVELOP INJECTION WELL 33W - A REDEVELOP INJECTION WELL 33V - A REDEVELOP INJECTION WELL 33U - A REDEVELOP INJECTION WELL 33U3 - A REDEVELOP INJECTION WELL 33P - A REDEVELOP INJECTION WELL 33S - A REDEVELOP INJECTION WELL 34S1 - A ABP NPDES MOMI & REPORT INJ WE ABP WELL REDEVELOPMENT PROGRAM DRILL EQPT-MAINT&TEST - Eaton Yar Disassemble/Reassemble of Wells A OCPW permit #2015-00954 City of Seal Beach Permit #DPW02	84,136.14 16,156.62 30,210.08 27,200.89 65,781.55 20,962.15 19,536.94 21,004.99 45,798.40 73,590.77 48,862.11 44,009.92 58,974.34 27,389.05 30,179.54 17,854.52 47,246.15 6,207.82 4,750.09 45,820.15 128,825.77 77,191.02 15,724.74 1,611.95 140.50									
			Subtotal #11	959,266.21	800,000	119.9%	337,661.71	280,000	120.6%	621,604.51	520,000	119.5%	
12.	Processing of data and preparation of reports	H0321553	ABP DATA PRO & PRE OF REPORT	47,601.96									
			Subtotal #12	47,601.96	70,000	68.0%	16,755.89	24,500	68.4%	30,846.07	45,500	67.8%	
13.	Special Programs (No cost to OCWD unless pre-arranged)	HF01515000 H0321591	ALAMITOS BARRIER MONITORING WELL ALAMITOS BARRIER PROJ-PLANNING	379,597.71 2,487.74									
			Subtotal #13	382,085.45	350,000	109.2%	0.00	0	0.0	382,085.45	350,000.00	109.2%	
14.	Reclaim Water Program	H0321556	ABP RECLAIMED WATER SUPPLY	36,212.89									
			Subtotal #14	36,212.89	15,000	241.4%	12,746.94	5,250	242.8%	23,465.95	9,750	240.7%	
15.	Projects & Studies (Reimbursable amounts include labor expenses, plus approved contract expenses that are not addressed under...)	HF01515001	ALAMITOS BARRIER PROJECT TELEMETRY	77,198.66									
			Subtotal #15	77,198.66	70,000	110.3%	27,173.93	24,500	110.9%	50,024.73	45,500	109.9%	
16.	ABP Liability Insurance Premiums paid separately by OCWD	N/A	ABP General Liability Coverage ABP Excess Liability Coverage	58,145.98 17,442.86									
			Subtotal #16	75,588.84	75,000	100.8%	37,794.42	37,500	100.8%	37,794.42	37,500	100.8%	
			TOTAL	2,702,272.65	2,756,000.00	98.1%	809,144.31	822,620.00	93.0	1,893,127.74	2,376,500	79.7%	

NOTES:

- 1 OCWD share represents 35.2% of the total costs in all Items except for 4, 5, 6, 10, 13, and 16. The percentage is based on amount of overall barrier injection water provided to Orange County portion of the ABP during this fiscal year.
- 2 Per Agreement No. 8458 between the LACPCD and the OCWD, all costs included in Items 4, 5, 6 and 13 are not reimbursable with respect to OCWD.
- 3 Cost of City of Seal Beach Permit #DPW02862 (\$260.50) was mistakenly credited to OCWD in FY2014-15.
- 4 Per Agreement No. 8458 between the LACPCD and the OCWD, the cost of liability insurance shall be split equally among the Parties.

TOTAL OPERATION AND MAINTENANCE COST 2,626,683.81
(not including insurance premium)
ORANGE COUNTY'S SHARE OF THE OPERATION AND MAINTENANCE COST 771,350.49
(not including insurance premium)
Less: Los Angeles County's Share of the FY15-16 Liability Insurance 37,794.42
Less: Permit fees paid by OCWD 2,381.28
Less: Advance Deposit Paid by OCWD (50% of the OCWD FY15-16 budget) 392,560.00
BALANCE DUE FROM ORANGE COUNTY WATER DISTRICT 338,614.79

* AS OF FY09-10, SHOWING CAPITAL IMPROVEMENT PROJECTS AS THEIR OWN CATEGORY AND ALSO SPLITTING UP LABOR EXPENSES FROM CONTRACT EXPENSES FOR APPLICABLE PROJECTS (WHERE SEPARATE COST-SHARING AGREEMENTS ARE IN PLACE FOR CONTRACT AMOUNTS)

ABP FY17-18 Budget

JMC No.	Fiscal Year	LACFCD		OCWD		WRD		TOTAL	
		Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
1.		Analysis and direction of injection operation (\$)							
	2013-14	52,000	43,588	28,000	24,472			80,000	68,060
	2014-15	48,750	62,054	26,250	28,453			75,000	90,507
	2015-16	48,750	74,291	26,250	40,355			75,000	114,646
	2016-17	55,250		29,750				85,000	
	2017-18	65,000		35,000				100,000	
2.		Maintenance and repair of injection wells (\$)							
	2013-14	195,000	163,057	105,000	91,546			300,000	254,603
	2014-15	260,000	304,809	140,000	139,764			400,000	444,573
	2015-16	260,000	290,273	140,000	157,679			400,000	447,952
	2016-17	292,500		157,500				450,000	
	2017-18	292,500		157,500				450,000	
3.		Operations of Injection Well Facilities (\$)							
	2013-14	26,000	14,919	14,000	8,376			40,000	23,295
	2014-15	22,750	24,537	12,250	11,251			35,000	35,787
	2015-16	19,500	34,922	10,500	16,970			30,000	53,892
	2016-17	26,000		14,000				40,000	
	2017-18	32,500		17,500				50,000	
4.		Analysis and direction of extraction operation (\$)							
	2013-14	0	728					0	728
	2014-15	0	693					0	693
	2015-16	0	632	0	0			0	632
	2016-17	0		0				0	
	2017-18	0		0				0	
5.		Redevelopment, maintenance, and repair of extraction wells (\$)							
	2013-14	5,000	0					5,000	0
	2014-15	200,000	8,764					200,000	8,764
	2015-16	15,000	632	0	0			15,000	3,683
	2016-17	10,000		0				10,000	
	2017-18	10,000		0				10,000	
6.		Operations of Extraction Wells (\$)							
	2013-14	5,200	5,584					5,200	5,584
	2014-15	5,200	4,257					5,200	4,257
	2015-16	6,000	2,647	0	0			6,000	2,647
	2016-17	6,000		0				6,000	
	2017-18	5,000		0				5,000	
7.		Maintenance and repair of ABP (\$)							
	2013-14	162,500	179,881	87,500	100,991			250,000	280,872
	2014-15	195,000	226,415	105,000	103,818			300,000	330,232
	2015-16	195,000	172,875	105,000	93,907			300,000	266,782
	2016-17	227,500		122,500				350,000	
	2017-18	227,500		122,500				350,000	
8.		Maintenance of Observation Wells (\$)							
	2013-14	97,500	215,433	52,500	120,951			150,000	336,385
	2014-15	32,500	49,901	17,500	22,881			50,000	72,783
	2015-16	195,000	3,065	105,000	1,665			300,000	4,730
	2016-17	45,500		24,500				70,000	
	2017-18	130,000		70,000				200,000	
9.		Collection of groundwater data (\$)							
	2013-14	65,000	94,945	35,000	53,305			100,000	148,250
	2014-15	97,500	134,811	52,500	61,815			150,000	196,625
	2015-16	110,500	103,842	59,500	56,408			170,000	160,250
	2016-17	130,000		70,000				200,000	
	2017-18	130,000		70,000				200,000	
10.		Yard Maintenance (\$)							
	2013-14	44,625	93,239	375	375			45,000	93,614
	2014-15	53,500	54,199	6,500	375			60,000	54,574
	2015-16	75,380	61,078	4,620	8,027			80,000	69,105
	2016-17	75,380		4,620				80,000	
	2017-18	70,760		9,240				80,000	
11.		Injection Well Redevelopment (\$)							
	2013-14	325,000	518,753	175,000	291,245			500,000	809,998
	2014-15	325,000	243,344	175,000	111,580			500,000	354,925
	2015-16	520,000	621,605	280,000	337,662			800,000	959,266
	2016-17	260,000		140,000				400,000	
	2017-18	650,000		350,000				1,000,000	
12.		Processing of data and preparation of reports (\$)							
	2013-14	45,500	25,200	24,500	14,148			70,000	39,348
	2014-15	45,500	36,360	24,500	16,672			70,000	53,033
	2015-16	45,500	30,846	24,500	16,756			70,000	47,602
	2016-17	39,000		21,000				60,000	
	2017-18	39,000		21,000				60,000	
13.		Special Programs (\$)							
	2013-14	50,000	1,227,246	0	0	300,000	300,000	50,000	1,227,246
	2014-15	1,000,000	50,022	0	0			1,000,000	50,022
	2015-16	350,000	382,085	0	0			350,000	382,085
	2016-17	50,000		0				50,000	
	2017-18	50,000		0				50,000	
14.		Oversight of Reclaim Water Program (\$)							
	2013-14	7,800	5,744	4,200	3,225			12,000	8,968
	2014-15	7,800	24,057	4,200	11,031			12,000	35,088
	2015-16	9,750	23,466	5,250	12,747			15,000	36,213
	2016-17	19,500		10,500				30,000	
	2017-18	29,250		15,750				45,000	
15.		Projects and Studies (\$)							
	2013-14	46,800	0	25,200	0			72,000	0
	2014-15	45,500	6,854	24,500	3,143			70,000	9,996
	2015-16	45,500	50,025	24,500	27,174			70,000	77,199
	2016-17	6,500		3,500				10,000	
	2017-18	6,500		3,500				10,000	
16.		ABP Liability Insurance (\$)							
	2013-14	0	17,834	0	17,834			0	35,668
	2014-15	37,500	35,955	37,500	35,955			75,000	71,910
	2015-16	37,500	37,794	37,500	37,794			75,000	75,589
	2016-17	37,500		37,500				75,000	
	2017-18	38,000		38,000				76,000	
17.		Joint Pipeline ROW (\$)							
	2013-14	0	266,640	0	74,067			0	340,706
	2014-15	0	0	0	0			0	0
	2015-16	0	0	0	0			0	0
	2016-17	0		0				0	
	2017-18	0		0				0	
18.		Total ABP Expenditure (\$)							
	2013-14	1,127,925	2,872,790	551,275	800,534	300,000		1,679,200	3,673,324
	2014-15	2,376,500	1,267,032	625,700	546,738			3,002,200	1,813,770
	2015-16	1,933,380	1,890,077	822,620	809,145			2,756,000	2,699,222
	2016-17	1,280,630		635,370				1,916,000	
		2017-18	1,776,010		909,990				2,686,000
TOTALS		Total ABP Operations and Maintenance (\$)(Item 18-Item 15)							
	2013-14	1,077,925	1,645,644	551,275	800,534	0		1,629,200	2,446,078
	2014-15	1,376,500	1,181,055	588,200	510,783			2,002,200	1,691,838
	2015-16	1,545,880	1,470,197	785,120	771,350			2,331,000	2,241,548
	2016-17	1,193,130		597,870				1,791,000	
	2017-18	1,688,010		871,990				2,560,000	
		Volume of Water (ac-ft)							
	2013-14			2,100	2,406	3,900	4,286	6,000	6,692
	2014-15			2,275	2,236	4,225	4,877	6,500	7,113
	2015-16			2,275		4,225		6,500	
	2016-17			2,450		4,550		7,000	
	2017-18			2,450		4,550		7,000	