



TETRA TECH, INC.

March 24, 2017

Lynn Nakashima
Project Manager
Department of Toxic Substances Control
700 Heinz Avenue
Berkeley, CA 94710

**Subject: Proposed Continued Groundwater Monitoring Locations for 2017
Richmond Field Station Site
Berkeley Global Campus, Richmond, CA
Site Investigation and Remediation Order I/SE-RAO 07/07-004, Section 5.16**

Dear Ms. Nakashima:

Tetra Tech, Inc. was contracted by the University of California Berkeley to conduct groundwater sampling activities at the Richmond Field Station (RFS) Site, at the Berkeley Global Campus in Richmond, California. The scope of the sampling was outlined in the Phase I Groundwater Field Sampling Workplan, dated June 2, 2010. The results of the Phase I investigation (2010 – 2012) and of continued groundwater monitoring in 2013 are presented in the Phase I November 2010 through April 2012 Groundwater Sampling Results Technical Memorandum, dated December 12, 2012, the 2013 Groundwater Sampling Results Technical Memorandum, dated October 10, 2013, the 2014 Groundwater Sampling Results Technical Memorandum, dated November 24, 2014, the 2015 Groundwater Sampling Results Technical Memorandum, dated October 19, 2015, and the 2016 Groundwater Sampling Results Technical Memorandum, dated January 9, 2017.

The Phase I groundwater field effort was conducted to address data gaps through the installation and continued semi-annual monitoring of 51 piezometers throughout the RFS: 47 in the shallow groundwater zone and four in a deeper zone. Data collected from the developed piezometers included groundwater sample analyses, geological borehole logging, and depth to water measurements; all of which were used to develop a hydrogeologic model of the site, improve the understanding of overall site-wide groundwater quality, and to help confirm or deny the presence of contamination. UC Berkeley continued with a semi-annual groundwater sampling program at the 47 piezometers in the shallow groundwater zone and three existing shallow piezometers previously installed (PZ8, PZ9, and PZ11) for a total of 50 piezometers.

As a follow up to the Phase I groundwater investigation, UC Berkeley recommended annual groundwater monitoring in 2013 at a subset of the initial 50 shallow piezometers to evaluate ongoing conditions at RFS. Monitoring consisted of chemical analysis at 40 piezometers with sample results exceeding one-half of either the California or Federal maximum contaminant level (MCL) for drinking water standards during any of the previous four monitoring events; analytes were limited to those analytes that exceeded one-half the MCLs in each piezometer. Depth to water measurements were collected bi-annually, concurrent with the ongoing biannual sampling at the adjacent Campus Bay site, at all 50 shallow and 4 deep piezometers to continue the comprehensive assessment of seasonal groundwater flow. Groundwater sampling completed in 2014 and 2015 was consistent with the piezometers and analytes within the 2013 event.

In 2016, UC Berkeley completed a review of the four most recent consecutive groundwater sampling events conducted in April 2012, April 2013, April 2014, and April 2015. The review indicated that results from complete analytes at seven piezometers were below one-half of the California and Federal MCL for all four events. UC Berkeley recommended the elimination of these analytes from the April 2016 event, and as a result, seven piezometers were eliminated from the sampling program. Four new piezometers installed during FSP Phase IV field activities were added to the 2016 sampling program, bringing the total number of piezometers sampled in 2016 to 37 piezometers.

Consistent with the review conducted in 2016, UC Berkeley has compared the results from the four most recent events with the State and Federal water quality criteria and Berkeley Global Campus risk-based concentrations presented in Table 5, State and Federal Water Quality Criteria, 2016 Groundwater Sampling Results Technical Memorandum. In all chemicals, one-half the California or Federal MCL represents the most stringent screening criteria. Results indicate that two piezometers meet the criteria to eliminate sample analytes: B175W for volatile organic compounds (VOC) and B474 for metals. These were the only analytes being tested at these piezometers; therefore UC Berkeley recommends that both piezometers be eliminated from the sampling program.

In addition, UC Berkeley reviewed all metals results to determine if any metals not considered to be chemicals of potential concern at the RFS site were the only metals detected above the screening levels discussed above. Results at four piezometers indicate that only antimony, selenium, or thallium have been detected above the screening levels during one or more of the four most recent sampling events. UC Berkeley recommends that metals analysis be discontinued at the piezometers. A summary of the detections and recommendations are presented below.

Piezometer	Metals Detections above ½ MCLs	Recommendation
B150	Selenium	Eliminate metals and exit sampling program
B450	Antimony	Eliminate metals, continue VOC analysis
CTP	Thallium	Eliminate metals, continue VOC analysis
FG	Antimony	Eliminate metals and exit sampling program

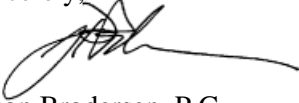
Modifying the sampling design in this way will eliminate all sampling at piezometers B150, B175W, B474, and FG. The revised number of piezometers proposed for sampling in 2017 is 33 piezometers.

Table 1 summarizes the piezometers and analytes recommended for sampling in 2017, and also identifies which piezometers sampled in 2016 are not recommended for further sampling in 2017. Tables 2 and 3 present the analytical data from the past four consecutive monitoring events for the seven piezometers discussed above. Figure 1 shows the piezometers proposed for continued monitoring in 2017, piezometers eliminated in 2013, 2016, and the current recommendations for piezometers to be eliminated from the April 2017 sampling event.

The groundwater samples will be collected consistent with the protocols outlined in the Field Sampling Workplan dated June 2, 2010 and will follow the quality control measures for both field work and data analysis as outlined in the accompanying Quality Assurance Project Plan. Samples will be analyzed for dissolved metals (field-filtered) and VOCs at locations described above. Bi-annual groundwater level collection at all 54 shallow and 4 deep piezometers will continue consistent with previous events.

If you have any questions or comments regarding this submittal, please call me at (510) 302-6283.

Sincerely,

A handwritten signature in black ink, appearing to read 'J. Brodersen', with a long horizontal flourish extending to the right.

Jason Brodersen, P.G.
Project Manager

cc: Greg Haet, UC Berkeley Office of Environment, Health and Safety
Bill Marsh, Edgcomb Law Group

Table 1. Piezometers Recommended for Sampling in 2017

Piezometer	VOC EPA Method 8260B	Field Filtered Metals EPA Method 6020A/7400 Series
B120	X	
B150*		O
B163	X	X
B175S	X	
B175W*	O	
B178	X	
B185	X	
B195	X	X
B197R	X	X
B277	X	
B278	X	
B280A	X	
B450	X	O
B473	X	
B474*		O
B480	X	
Bulb1	O	X
Bulb2	X	X
CCC2	X	X
CCCT	X	
CTP	X	O
DHR		X
EERC		X
ETA	X	X
ETA01	X	X
ETA02	X	X
ETA03	X	X
FG*		O
GEO	X	
MFA	X	
NRLF		X
PZ11	X	X
PZ9	X	
RWF	X	
TP1	X	X
TP2	X	
WSM01	X	X

Notes:

- X Sampling analyte recommended in 2017
- O Sampling analyte not recommended in 2017, but was evaluated in 2016
- * Sampling at this piezometer would be discontinued

Table 2. VOC Detected Results Summary
 2017 Groundwater Well Elimination Justification

Sample Location	Sample Date	CARBON TETRACHLORIDE	CHLOROFORM	CIS-1,2-DICHLOROETHENE	TETRACHLOROETHENE	TRICHLOROETHENE
California MCLs		0.5		6	5	5
Federal MCLs		5		70	5	5
1/2 MCL		0.25		3	2.5	2.5
B175W	4/2/2013	0.5 U	0.5 U	0.5 U	2	0.5 U
	4/1/2014	0.5 U	0.1 J	0.5 U	2.3	0.1 J
	4/15/2015	0.5 U	0.5 U	0.5 U	2.1	0.2 J
	4/7/2016	1 U	1 U	1 U	1.4	1 U

Notes:

All results are presented in µg/L.
 Non detected results not shown

µg/L Micrograms per liter
 ID Identification
 J Estimated value
 MCL Maximum contaminant level
 U Not detected
 VOC Volatile organic compound

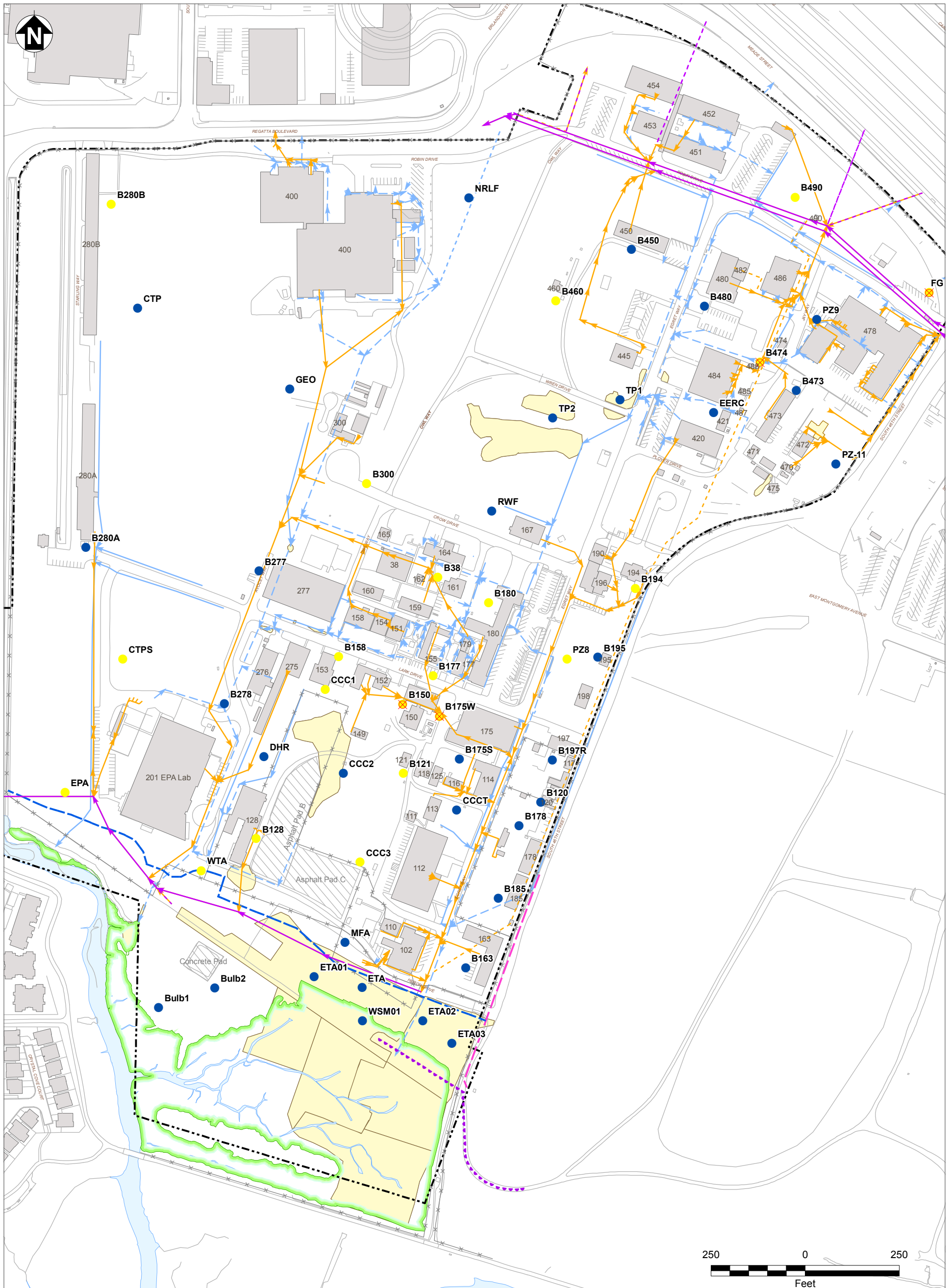
Table 3. Metals Detected Results Summary
2017 Groundwater Well Elimination Justification

Sample Location	Sample	Date	ALUMINIUM	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CALCIUM	CHROMIUM	COBALT	COPPER	IRON	LEAD	MAGNESIUM	MANGANESE	MERCURY	MOLYBDENUM	NICKEL	POTASSIUM	SELENIUM	SILVER	SODIUM	THALLIUM	VANADIUM	ZINC
California MCLs			1,000	6	10	1,000	4	5	50			1,300	15				2		100		50			2		
Federal MCLs			6	10	2,000	4	5		100			1,300	15				2			50			2			
1/2 MCL			500	3	5	500	2	2.5				650	7.5				1		50		25		1			
B150	4/2/2013		50 U	1 U	1 U	44	1 U	1 U	18000	1.6	1 U	9.8	50 U	0.17 J	14000	0.76 UJ	0.2 U	1 U	3.4	50 U	29	1 U	26000	1 U	1.2	17 J
	4/1/2014		50 U	1	0.52 J	39	4.3 U	1.3 U	15000	1.6	1 U	1 U	71 U	1 U	12000	4.6	0.2 U	3.2 U	3.7	250	82	1 U	26000	1 U	0.6 J	5.6 J
	4/15/2015		13 UJ	0.74 J	0.7 J	49	1 U	1 U	18000	4.7	1 U	0.46 UJ	42 J	1 U	14000	0.16 UJ	0.2 U	0.56 UJ	3.9	170	36	1 U	31000	1 U	3 UJ	12 U
	4/7/2016		NA	10 U	5 U	39	2 U	5 U	NA	1.1 J	5 U	2.1 UJ	NA	5 U	NA	NA	0.2 U	1 J	1.9 J	NA	38	1.7 J	NA	1 U	1.1 J	20 U
B450	4/3/2013		50 U	0.23 UJ	1.3	50	1 U	1 U	46000	0.51 J	1 U	2.3 U	50 U	0.17 J	40000	5.8	0.2 U	0.27 UJ	1 U	1400	1 U	1 U	47000	1 U	2.5	39
	4/3/2014		50 U	0.19 J	1.5	120	1 U	1 U	80000	0.74 J	1 U	1 U	63 U	1 U	66000	0.48 J	0.2 U	3.2 U	2.3 J	2800	0.27 J	1 U	72000	1 U	2.4	3.1 J
	4/14/2015		9.8 J	0.18 J	1.6	91	0.14 J	1 U	64000	1	1 U	0.53 UJ	50 U	1 U	52000	1.4	0.2 U	1.3 UJ	1.6	1800	0.46 J	1 U	55000	1 U	3.9	12 U
	4/7/2016		NA	4.2 J	5 U	56	2 U	5 U	NA	5 U	5 U	1.8 UJ	NA	5 U	NA	NA	0.2 U	1.5 J	5 U	NA	10 U	1.9 J	NA	1 U	3 J	20 U
B474	4/3/2013		40 J	2.8	3.4	52	1 U	1 U	21000	1 U	0.59 J	4.4	92	0.16 J	12000	82	0.027 J	7.8	5.3	1600	1 U	1 U	14000	1 U	2.5	8.4 J
	4/3/2014		15 J	1.2	2.2	74	1 U	1 U	34000	1.5	0.56 J	22	40 J	2.2	14000	37	0.106 J	43	7.5	3000	1 U	0.12 J	9600	1 U	2.8	12
	4/16/2015		16 J	0.41 J	3.8	52	1 U	1 U	25000	1.5	0.55 J	0.9 UJ	220	0.14 UJ	13000	43	0.022 J	14	5.2	2100	1 U	1 U	20000	1 U	2.9	12 U
	4/11/2016		NA	10 U	5 U	55	2 U	5 U	NA	5 U	5 U	18	NA	5 U	NA	NA	0.2 U	15	5 U	NA	4 J	4.6 J	NA	10 U	5.8 UJ	20 U
CTP	4/4/2013		50 U	1 U	0.81 J	66	1 U	1	57000	0.34 J	0.22 J	2.3 U	19 UJ	0.12 UJ	33000	37	0.2 U	0.78 UJ	2.3	760	0.23 UJ	1 U	67000	1 U	2.5	59
	4/3/2014		50 U	0.12 J	0.92 J	85	1 U	2	62000	1.4	0.2 J	3.4 U	25 J	1 U	34000	66	0.2 U	0.84 J	4.2 U	600	1 U	1 U	71000	1 U	2.8	42
	4/17/2015		50 U	1 U	1.2	80	1 U	2.6	58000	1.4	0.32 J	1 U	28 J	0.088 UJ	31000	100	0.2 U	0.6 UJ	1.4 UJ	690	0.26 J	1 U	73000	1 U	4	44
	4/11/2016		NA	10 U	5 U	77	2 U	1.5 J	NA	1 J	5 U	5 U	NA	5 U	NA	NA	0.2 U	2.6 J	2.6 J	NA	5.3 J	5 U	NA	5.9 J	3.3 J	34
FG	4/3/2013		77	6.4	1.1	24	1 U	1 U	28000	1 U	1 U	2.3 U	22 J	1 U	33000	4.8	0.2 U	2.4	2.8	1100	0.73 UJ	1 U	83000	1 U	1.7	13 J
	4/9/2014		50 U	2.7	1.3	19	1 U	1 U	18000	0.37 J	0.15 J	2.3 U	58 UJ	1 U	21000	6.9	0.2 U	0.72 UJ	2 J	330	0.48 J	1 U	75000	0.044 J	2.2	16 U
	4/16/2015		45 J	0.16 J	1.7	31	1 U	1 U	26000	0.41 J	1 U	0.36 UJ	50 J	0.11 UJ	28000	3.1	0.2 U	0.45 UJ	2.3	520	1 U	1 U	90000	1 U	3.8	12 U
	4/7/2016		NA	10 U	5 U	25	2 U	5 U	NA	5 U	5 U	1.3 UJ	NA	5 U	NA	NA	0.2 U	5 U	5 U	NA	3.4 J	1.5 J	NA	1 U	1.9 J	20 U

Notes:

All results are presented in µg/L.

µg/L Micrograms per liter
 ID Identification
 J Estimated value
 MCL Maximum Contaminant Level
 U Not detected



- Existing Buildings
- Asphalt/Concrete Pads
- Remediated Areas
- Surface Water
- Marsh Boundary
- Richmond Field Station Site Boundary
- Roads and Other Landscape Features
- Fenceline
- Former Seawall
- Biologically Active Permeable Barrier Wall
- Slurry Wall

- Storm Drain Lines:**
- Open Swale
 - Underground Culvert
 - Gutters
 - Underground Culvert, Abandoned (Grouted at Manholes)
- Sanitary Sewer Lines:**
- Existing City of Richmond Sewer
 - Abandoned City of Richmond Sewer
 - Existing RFS Sewer
 - Abandoned RFS Sewer

- Proposed piezometer for sampling in April 2017
- Piezometer not sampled in April 2016
- Piezometer sampled in April 2016; proposed to be eliminated from sampling in 2017

**Richmond Field Station Site
University of California, Berkeley**

**FIGURE 1
PROPOSED GROUNDWATER
SAMPLING LOCATIONS**

2017 Groundwater Sampling Event