Final

Removal Action Workplan

Richmond Bay Campus, Richmond, California

Research, Education, and Support Area and Groundwater within the Former Richmond Field Station Site

Prepared for

University of California, Berkeley

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ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per liter
$\mu g/m^3$	Micrograms per cubic meter
ARAR	Applicable or relevant and appropriate requirements
ATSDR	Agency of Toxic Substances and Disease Registry
BAP (EQ)	Benzo(a)pyrene equivalent
Bay Trail	East Bay Regional Park District Trail
bgs	Below ground surface
Bio-Rad	Bio-Rad Laboratories
BMP	Best Management Practices
Cal/EPA	California Environmental Protection Agency
CCC	California Cap Company
CCR	Current conditions report
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CIW	Commercial/industrial worker
COC	Chemical of concern
COPC	Chemical of potential concern
CSV	Cherokee Simeon Venture I, LLC
DCE	Dichloroethene
DO	Dissolved oxygen
DOT	Department of Transportation
DTSC	Department of Toxic Substances Control
EC	Engineering controls
EH&S	Office of Environment, Health and Safety
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
ESL	Environmental screening level
FSW	Field Sampling Workplan
GMW	Groundskeeper/maintenance worker
GRA	General response actions
HAZWOPER	Hazardous Waste Operations and Emergency Response
HHRA	Human health risk assessment
HI	Hazard index
HSC	Health and Safety Code
HSP	Health and Safety Plan

IC	Institutional controls
IDW	Investigation-derived waste
ISB	In situ bioremediation
LBNL	Lawrence Berkeley National Laboratory
LRDP	Long Range Development Plan
LUC	Land use control
MCL	Maximum Contaminant Level
MFA	Mercury Fulminate Area
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mil	Millimeter
MNA	Monitored natural attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOI	Notice of Intent
NOP	Notice of Preparation
NOS	Land use designation identified in the LRDP as Natural Open Space, which applies to areas that UC plans to protect from development and maintain in their natural condition
O&M	Operation and maintenance
OEHHA	Office of Environmental Health Hazard Assessment
ORP	Oxygen reduction potential
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethylene
PDR	Personal Data Rams
PPE	Personal protective equipment
PRB	Permeable reactive barrier
PVC	Polyvinyl chloride
RAO	Removal action objective
RAP	Remedial Action Plan
RAW	Removal Action Workplan
RBC	Richmond Bay Campus
RCRA	Resource Conservation and Recovery Act
REL	Reference exposure level
RES	Land use designation identified in the LRDP as Research, Education, and Support, which applies to areas that are either currently developed with

	facilities that would remain in their present form or be expanded, or that would be developed with new facilities
RFS	Richmond Field Station
RFS Site Investigation and Remediation Order	
	DTSC Site Investigation and Remediation Order. Docket No. IS/E-RAO 06/07-004 for the former RFS Site
RWQCB	California Regional Water Quality Control Board
SCR	Site Characterization Report
SMP	Soil Management Plan
SSE	Selective sequential extraction
SSG	Site-specific goals
STLC	Soluble Threshold Limit Concentration
SVOC	Semivolatile organic compounds
SW	Solid Waste
SWPPD	Storm Water Pollution Prevention Plan
TBC	To-be-considered
TCE	Trichloroethylene
TCLP	Toxicity Characteristic Leaching Procedure Leachate
TCRA	Time-Critical Removal Actions
TDS	Total dissolved solids
TEQ	Toxic equivalence quotient
Tetra Tech	Tetra Tech EM Inc. (1996-2012); currently Tetra Tech, Inc.
TPH	Total petroleum hydrocarbons
TSCA	Toxic Substance Control Act
TTLC	California Total Threshold Limit Concentration
UC	University of California
UCL	Upper Confidence Limit
URS	URS Corporation
VOC	Volatile organic compound
WET	Waste Extraction Test
Zeneca Order	DTSC Site Investigation and Remediation Order. Docket No. IS/E-RAO 06/07-005 for the former Zeneca Site
ZVI	Zero-valent iron

EXECUTIVE SUMMARY

On May 15, 2014, The Regents of the University of California (UC) approved establishment of a new major research campus on properties it owns in Richmond, California, composed of portions of the Former Richmond Field Station (RFS) and the Regatta Property located west of the RFS. The Richmond Bay Campus (RBC) will provide for the development of additional facilities for UC Berkeley and the Ernest Orlando Lawrence Berkeley National Laboratory (LBNL) for academic teaching, applied research, and collaborations with private industry focused on energy, environment, and health. The RBC Long Range Development Plan (LRDP) identifies two land use designations to form the pattern of development at the RBC: (1) Research, Education, and Support (RES) and (2) Natural Open Space (NOS). The RES land use applies to areas that are either currently developed with facilities that would remain in their present form or be expanded, or that would be developed with new facilities (UC 2014). The NOS land use applies to areas that UC plans to protect from development and maintain in their natural condition.

UC Berkeley has been conducting investigation and cleanup actions at the Former RFS under the oversight of the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC), in compliance with the Site Investigation and Remediation Order for the former RFS Site, Docket No. IS/E-RAO 06/07-004, dated September 15, 2006 (RFS Site Investigation and Remediation Order). The RFS Site Investigation and Remediation Order provides for the investigation and cleanup of 96 acres of upland and 13 acres of tidal marsh and transition habitat within the Former RFS. UC Berkeley has prepared this Removal Action Workplan (RAW) under Health and Safety Code (HSC) Section 25356.1(h)(1) and in compliance with the RFS Site Investigation and Remediation Order. For the purposes of this RAW, the property defined under the RFS Site Investigation and Remediation Order is referred to as the "Former RFS Site" or "Site." The Former RFS Site does not encompass the entire RFS; two outboard parcels are not included in the RFS Site Investigation and Remediation Order. The Regatta Property included in the RBC is not included in the RFS Site Investigation and Remediation Order or this RAW.

In HSC 25323.1, a RAW is defined as "a workplan prepared or approved by DTSC or a California Regional Water Quality Control Board which is developed to carry out a removal action, in an effective manner, that is protective of the public health and safety and the environment." A RAW is appropriate when the estimated capital cost of the removal action is less than $2,000,000. If the estimated capital cost of implementing the chosen action will exceed $2,000,000, a Remedial Action Plan should be prepared. The estimated capital cost of the selected remedies recommended in this RAW is estimated to be less than $2,000,000.

Based on the information developed during site characterization activities at the Former RFS Site, UC Berkeley determined that further action is required for the RES due to elevated concentrations of mercury, pyrite cinders-related metals (arsenic and lead), polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons, and dioxins detected in soil samples, as well as carbon tetrachloride and trichloroethylene (TCE) in groundwater samples. To address the chemicals of concern (COC), the RAW establishes removal action objectives (RAO) that are protective of human health, presents a screening of soil and groundwater cleanup technologies, and develops and evaluates soil and groundwater alternatives for the Mercury Fulminate Area (MFA), the Corporation Yard, the remainder of the RES, and the Carbon Tetrachloride Area. The remedy for contaminants in groundwater originating from the former Zeneca Site, including

TCE and its breakdown components, is subject to the DTSC Site Investigation and Remediation Order for the former Zeneca Site (IS/E-RAO 06/07-005) (Zeneca Order). Groundwater with contaminants originating from the former Zeneca Site is not subject to this RAW.

The following RAOs for the RES and Site-wide groundwater were developed to protect human health based on the COCs for each geographic soil area and Site-wide groundwater.

1. For future projects within the RES, (a) prevent exposure of commercial workers, maintenance workers, and construction workers via dermal contact with, and incidental ingestion and inhalation of, soil containing chemical concentrations greater than the receptor-appropriate remedial goals, and (b) prevent exposure of off-site receptors via inhalation of soil containing chemical concentrations greater than the remedial goal for off-site receptors. For each project, the exposure pathways for each receptor will be evaluated, and the applicable remedial goals for each potential receptor will be considered (Table ES-1). For instance, if it is known that soil within the project area will be excavated in preparation for a future building, the construction worker goal will be considered in addition to the commercial worker and off-site receptor goals. In this case, the lower of the three remedial goals will be selected, or appropriate mitigation measures will be used to protect the receptor with a remedial goal lower than that selected, such as requiring all construction workers to be 40-hour Hazardous Waste Operations and Emergency Response trained.

2. For the MFA and Corporation Yard, (a) prevent exposure of current maintenance and construction workers and future commercial workers, maintenance workers, and construction workers via dermal contact with, and incidental ingestion and inhalation of, soil containing mercury, arsenic, lead, benzo(a)pyrene equivalent (BAP [EQ]), and dioxin concentrations greater than the RAW remedial goals, and (b) prevent exposure of current and future off-site receptors via inhalation of soil containing mercury, arsenic, lead, BAP (EQ), and dioxin concentrations greater than the RAW remedial goals. Since there are no utility corridors proposed or imminent future construction activities, the construction worker or maintenance worker risk-based concentrations need not be considered for the remedial goals. Therefore, the lower of the commercial worker and off-site receptor inhalation risk-based concentration is the appropriate remedial goal for these areas, except where a background or ambient value is available (arsenic and BAP [EQ]). In the event of future maintenance activities or new projects identified at the MFA or Corporation Yard, then maintenance and construction worker remedial goals will be evaluated. Remedial goals for the MFA and Corporation Yard are included in Table ES-2.

3. For PCB Areas, prevent exposure of (a) current maintenance and construction workers and future commercial, maintenance, and construction workers via dermal contact with, and incidental ingestion and inhalation of, soil containing total PCB concentrations greater than the remedial goals; and (b) prevent exposure of off-site receptors via inhalation of soil containing chemical concentrations greater than the remedial goal. The Toxic Substances Control Act (TSCA) threshold for high occupancy areas without further conditions of 1 milligram per kilogram (mg/kg) is the appropriate remedial goal for PCBs for all receptors. Remedial goals for the PCB areas are included in Table ES-2.

4. Site-wide, prevent exposure of current maintenance workers, construction workers, and off-site receptors, and future commercial workers, maintenance workers, and construction workers, and off-site receptors via inhalation of unsafe vapors from groundwater containing carbon tetrachloride or TCE. Remedial goals for groundwater are included in Table ES-3.

The RAW alternatives analysis process evaluated five soil alternatives and four groundwater alternatives using three evaluation criteria: effectiveness, implementability, and cost. These three evaluation criteria encompass the nine evaluation criteria considered in feasibility studies and remedial action plans. The soil alternatives were evaluated separately for each of the geographic areas: MFA, Corporation Yard, and remainder of the RES. Each alternative was evaluated individually and then comparatively.

Alternative Number	Alternative Description
S-1	**No Action**
S-2	**Excavation to Unrestricted Use and Off-Site Disposal:** Excavate soils with chemical concentrations exceeding unrestricted risk-based concentrations; make assumptions about volume of soil exceeding unrestricted risk-based concentrations and volume of soil containing cinders. Off-site disposal at appropriate landfills.
S-3	**Excavation to Commercial Use, Off-Site Disposal, Land Use Controls (LUC), and Implementation of Soil Management Plan (SMP):** Excavate soils with COC concentrations exceeding commercial remedial goals. Off-site disposal at appropriate landfills. LUCs consisting of deed restrictions prohibiting residential reuse and requiring the implementation of a SMP for future soil disturbance.
S-4	**LUCs:** LUCs to consist of deed restrictions prohibiting residential reuse.
S-5	**Asphalt Cap, LUCs, and SMP (MFA Only):** Install 6-inch asphalt cap over MFA soils where mercury exceeds commercial remedial goals; LUCs consisting of deed restrictions prohibiting residential reuse and requiring implementation of SMP.
GW-1	**No Action**
GW-2	**Permeable Reactive Barrier (PRB), LUCs, and Monitoring:** Install a PRB downgradient of carbon tetrachloride plume (on eastern side of Buildings 280A and 280B) to treat carbon tetrachloride plume as it migrates through barrier; LUCs to prohibit use of groundwater; monitoring to assess effectiveness of PRB.
GW-3	**In Situ Bioremediation (ISB), LUCs, and Monitoring:** Develop network of wells to inject substrate to enhance biodegradation of carbon tetrachloride. LUCs to prohibit use of groundwater; monitoring to assess effectiveness of ISB.
GW-4	**Monitored Natural Attenuation and LUCs:** Allow natural biological processes to occur and monitor attenuation parameters and contaminant reduction over time. LUCs to prohibit use of groundwater.

Alternatives were not evaluated for PCB-impacted soil. PCB-impacted soil with total PCB concentrations greater than 1 mg/kg will be excavated and disposed of off-site. Alternatives were not evaluated for TCE-impacted groundwater. The remedy for groundwater contaminants originating from the former Zeneca Site, including TCE and its breakdown components, is subject to the former Zeneca Site Investigation and Remediation Order, and will meet the RAOs identified for groundwater. Alternatives were not evaluated for Site-wide groundwater. The Site-wide groundwater will continue to be monitored under the on-going groundwater monitoring program (Tetra Tech 2012) as a part of the proposed remedy.

Based on the individual and comparative analyses of alternatives for the MFA, Corporation Yard, remainder of the RES area, and Carbon Tetrachloride Area, one alternative was recommended for each area. The recommended alternatives are summarized below.

Soil Remedy

- Excavation of PCB-impacted soils at the Building 112 and Building 150 Transformer Areas and three areas within the Corporation Yard with total PCB concentrations exceeding the TSCA high occupancy without further conditions threshold remedial goal (1 mg/kg).
- Excavation of mercury-impacted soil at the MFA with concentrations exceeding the commercial worker remedial goal (275 mg/kg).
- Excavation of BAP (EQ)-impacted soil with concentrations exceeding background (0.4 mg/kg) and dioxin-impacted soil with concentrations greater than the commercial worker remedial goal (1.64E-05 mg/kg) at the Corporation Yard.
- Management of cinders encountered during soil excavations.
- Implementation of site-wide LUCs consisting of deed restrictions identifying the future use of the Site as commercial only, and mandating that future site soil disturbance or soil movement be conducted under the SMP.
- Implementation of the SMP which provides a framework for excavation and soil management, in conjunction with redevelopment or construction projects for chemicals in soil exceeding Category I or II screening level remedial goals within the RES.

Groundwater Remedy

- Monitoring natural attenuation of groundwater with carbon tetrachloride concentrations exceeding the vapor intrusion remedial goal (2.63 micrograms/liter) at the western edge of the upland meadows.
- Continuing groundwater monitoring at the Former RFS Site.
- Treatment and monitoring of contaminants in groundwater originating from the former Zeneca Site, including TCE and its breakdown components, under the Zeneca Order.
- Implementation of site-wide LUCs consisting of deed restrictions prohibiting groundwater extraction for purposes other than groundwater monitoring/treatment or construction dewatering.

A RAW is appropriate when the estimated cost of the removal action is less than $2,000,000. The estimated cost of the remedies recommended in this RAW is less than $2,000,000.

The RAW concludes with a description of the proposed implementation of each component of the recommended remedy.

Table ES-1: Remedial Goals for Soil

Chemical [3]	Remedial Goals						
	Risk-Based Concentrations [1,2]						
	Commercial Worker	Construction Worker	Maintenance Worker	Off-Site Receptor (Inhalation)	Other Criteria	Category I Criteria [4]	Category II On-Site Management Criteria [5]
Metals							
Aluminum	100000	**20300**	100000	6860000	--	20300	100000
Antimony	367	**109**	2720	--	--	109	1090
Arsenic	**0.224**	1.58	1.58	745	16 [6]	16 [6,7]	16 [6,7]
Barium	100000	**2110**	52600	686000	--	2110	100000
Beryllium	1760	**29.0**	128	1330	--	29.0	290
Boron	100000	**33600**	100000	27400000	--	33600	100000
Cadmium	1000	**68.1**	73.0	762	--	68.1	681
Chromium	**100000**	100000	100000	--	--	100000	100000
Cobalt	273	**19.9**	34.1	356	--	19.9	199
Copper	36700	**10900**	100000	--	--	10900	100000
Iron	**100000**	100000	100000	--	--	100000	100000
Lead [7,8]	**320**	320	320	--	320 [7,8]	320 [7,8]	800 [7,8]
Manganese	20500	**212**	5300	68600	--	212	2120
Mercury [9]	275	**77.0**	1920	412000	--	77.0	275
Molybdenum	4590	**1360**	34000	--	--	1360	13600
Nickel	14900	**60.6**	1180	12300	--	60.6	606
Selenium	4590	**1340**	33500	27400000	--	1340	13400
Silver	4590	**1360**	34000	--	--	1360	13600
Thallium	9.17	**2.72**	68.0	--	--	2.72	27.2
Vanadium	4590	**1360**	34000	--	--	1360	13600
Zinc	100000	**81600**	100000	--	--	81600	100000
VOCs							
1,2-Dichloropropane	4.41	71.0	83.7	**0.993**	--	0.993	9.93
Acetone	**100000**	100000	100000	475000	--	100000	100000
Benzene	1.44	27.9	27.9	**0.320**	--	0.320	3.20
Ethylbenzene	24	393	393	**5.94**	--	5.94	59.4
m,p-Xylene	2510	2350	58700	**614**	--	614	6140
o-Xylene	2950	2730	68100	**725**	--	725	7250
Toluene	5230	3830	95700	**1440**	--	1440	14400
Trichloroethylene	5.72	15.8	93.7	**1.03**	--	1.03	10.3

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	Risk-Based Concentrations [1,2]						
	Commercial Worker	Construction Worker	Maintenance Worker	Off-Site Receptor (Inhalation)	Other Criteria	Category I Criteria [4]	Category II On-Site Management Criteria [5]
SVOCs							
BAP (EQ) [10]	**0.145**	0.963	0.963	1150	0.4 [11]	0.4 [11]	1.45
1-Methylnaphthalene	**36.4**	243	243	--	--	36.4	364
2-Methylnaphthalene	1510	**403**	10100	--	--	403	4030
4-Methylphenol	47800	**13000**	100000	823000000	--	13000	100000
Acenaphthene	22600	**6050**	100000	--	--	6050	60500
Acenaphthylene	22600	**6050**	100000	--	--	6050	60500
Anthracene	100000	**30200**	100000	--	--	30200	100000
Benzo(a)anthracene	**0.880**	5.87	5.87	11500	--	0.880	8.80
Benzo(a)pyrene	**0.145**	0.963	0.963	1150	--	0.145	1.45
Benzo(b)fluoranthene	**0.88**	5.87	5.87	11500	--	0.880	8.80
Benzo(g,h,i)perylene	11300	**3020**	75600	--	--	3020	30200
Benzo(k)fluoranthene	**0.880**	5.87	5.87	11500	--	0.880	8.80
bis(2-Ethylhexyl)phthalat	**95.5**	647	647	1330000	--	95.5	955
Chrysene	**8.80**	58.7	58.7	115000	--	8.80	88.0
Dibenz(a,h)anthracene	**0.145**	0.963	0.963	2670	--	0.145	1.45
di-n-Butylphthalate	47800	**13000**	100000	--	--	13000	100000
Fluoranthene	15100	**4030**	100000	--	--	4030	40300
Fluorene	15100	**4030**	100000	--	--	4030	40300
Indeno(1,2,3-cd)pyrene	**0.880**	5.87	5.87	11500	--	0.880	8.80
Naphthalene	18.0	450	450	**3.57**	--	3.57	35.7
Phenanthrene	15100	**4030**	100000	--	--	4030	40300
Pyrene	11300	**3020**	75600	--	--	3020	30200
PCBs							
Aroclor-1242	**0.528**	3.50	3.50	5620	1 [12]	1 [12]	1 [12]
Aroclor-1248	**0.528**	3.50	3.50	5620	1 [12]	1 [12]	1 [12]
Aroclor-1254	**0.528**	2.02	3.50	5620	1 [12]	1 [12]	1 [12]
Aroclor-1260	**0.528**	3.50	3.50	5620	1 [12]	1 [12]	1 [12]
Total PCBs [13]	**1.58**	9.03	10.5	16900	1 [12]	1 [12]	1 [12]
Pesticides							
4,4'-DDD	**7.59**	52.8	52.8	46400	--	7.59	75.9
4,4'-DDE	**5.36**	37.3	37.3	33000	--	5.36	53.6
4,4'-DDT	**5.36**	37.3	37.3	33000	--	5.36	53.6

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Chemical [3]	Remedial Goals						
	Risk-Based Concentrations [1,2]						
	Commercial Worker	Construction Worker	Maintenance Worker	Off-Site Receptor (Inhalation)	Other Criteria	Category I Criteria [4]	Category II On-Site Management Criteria [5]
Pesticides (continued)							
Aldrin	**0.107**	0.745	0.745	654	--	0.107	1.07
alpha-BHC	**0.289**	2.01	2.01	1780	--	0.289	2.89
alpha-Chlordane	**1.40**	9.76	9.76	9420	--	1.40	14.0
beta-BHC	**1.01**	7.04	7.04	6040	--	1.01	10.1
Carbazole	**145**	934	934	291000	--	145	1450
Chlordane	**1.40**	9.76	9.76	9420	--	1.40	14.0
delta-BHC	**0.289**	2.01	2.01	1780	--	0.289	2.89
Dieldrin	**0.114**	0.792	0.792	696	--	0.114	1.14
Endosulfan I	3910	**1100**	27500	--	--	1100	11000
Endosulfan II	3910	**1100**	27500	--	--	1100	11000
Endosulfan sulfate	3910	**1100**	27500	--	--	1100	11000
Endrin	195	**54.9**	1370	--	--	54.9	549
Endrin aldehyde	195	**54.9**	1370	--	--	54.9	549
gamma-BHC (Lindane)	**1.66**	11.5	11.5	10300	--	1.66	16.6
gamma-Chlordane	**1.40**	9.76	9.76	9420	--	1.40	14.0
Heptachlor	**0.405**	2.82	2.82	2460	--	0.405	4.05
Heptachlor epoxide	**0.200**	1.39	1.39	1230	--	0.200	2.00
Mirex	**0.101**	0.704	0.704	628	--	0.101	1.01
Pentachlorophenol	**1.86**	12.2	12.2	628000	--	1.86	18.6
Dioxin							
Dioxin TEQ [14]	**0.0000164**	0.000116	0.000116	0.0843	--	0.0000164	0.000164
Explosives							
HMX	23900	**6500**	100000	--	--	6500	65000
TPH							
Diesel range organics	--	--	--	--	500 [15]	500 [15]	500 [15]
Gasoline range organics	--	--	--	--	500 [15]	500 [15]	500 [15]
Motor oil range organics	--	--	--	--	2500 [15]	2500 [15]	2500 [15]

Notes:
All values are in mg/kg.

Table ES-1: Remedial Goals for Soil

Notes (continued):

1	Risk-based concentrations are calculated in Appendix C of the Site Characterization Report (Tetra Tech 2013a). Risk-based concentrations are shown with 3 significant figures, except where the default value of 100,00 mg/kg applies (where calculated value exceeds 100,000 mg/kg). Risk-based concentrations shown are the minimum values between the cancer and noncancer multi-pathway risk-based concentrations. For the off-site receptor, the values shown are the minimum values between the cancer and noncancer inhalation pathway risk-based concentrations calculated for the unrestricted use scenario.
2	Bold values indicate the lowest of the risk-based concentrations for all potential future receptors.
3	All chemicals detected at the site are included in this table. If a chemical is detected in the future that is not included in the table, risk-based concentrations will be calculated for it, and DTSC will be consulted.
4	Category I criteria are based on the lowest of the calculated risk-based concentrations, unless background, ambient, or TSCA criterion are available, in which case the alternate values are selected and noted within this table. Category I criteria for TPH constituents are based on the RWQCB ESL.
5	Category II criteria are based on 10 times the Category I criteria, unless otherwise noted. In cases where 10 times the Category I criteria is greater than 100,000 mg/kg, the default value of 100,000 mg/kg is used.
6	The background level for arsenic (16 mg/kg) was established for the adjacent Campus Bay Site and approved by DTSC for the former RFS Site (Erler & Kalinowski, Inc. 2007; DTSC 2007). The arsenic remedial goal is a not to exceed value, except in cases where arsenic is associated with cinders in soil (see note 7).
7	If lead or arsenic is associated with cinders, manage on site per Section 5.2.3 of the SMP. If not associated with cinders, investigate further, determine if source is present, and dispose of off-site.
8	A risk-based concentration was not calculated for lead. Rather, the industrial CHHSL of 320 mg/kg (Cal/EPA OEHHA 2009) was used for the commercial, construction, and maintenance worker scenarios. The Category II lead value is based on industrial RSL from EPA (2012).
9	The toxicity criteria for mercuric chloride was used as a surrogate for mercury to calculate the risk-based concentration.
10	The toxicity criteria for benzo(a)pyrene was used as a surrogate for BAP (EQ) to calculate the risk-based concentration.
11	The ambient level for BAP (EQ) (0.4 mg/kg) is based on the 95 UCL concentration of the ambient dataset for BaP (EQ) in surface soils in Northern California (DTSC 2009; Environ Corporation and others 2002).
12	The other criterion is based on the TSCA High Occupancy, no further conditions threshold criterion for total PCBs from EPA (2005). The TSCA criterion is a not-to-exceed value.
13	PCB COCs include Aroclor-1248, Aroclor-1254, and Aroclor-1260. The receptor-specific risk-based concentration for total PCBs is the sum of the individual risk-based concentrations for the three COCs. The TSCA criteria for Aroclors of 1 mg/kg is applicable for total PCBs (the sum of all detected individual Aroclors in a particular sample).
14	The toxicity criteria for 2,3,7,8-TCDD was used as a surrogate for Dioxin TEQ to calculate the risk-based concentration.
15	Criteria for TPH constituents are based on the RWQCB ESL (RWQCB 2013).

--	Not applicable	DTSC	California Department of Toxic Substances Control
95 UCL	95th percentile Upper Confidence Limit of the arithmetic mean	EPA	U.S. Environmental Protection Agency
BAP (EQ)	Benzo(a)pyrene equivalent	ESL	Environmental Screening Level
BHC	Hexachlorocyclohexane	HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
Cal/EPA	California Environmental Protection Ageny	mg/kg	Milligrams per kilogram
CHHSL	California human health screening level	OEHHA	Office of Environmental Health Hazard Assessment
COC	Chemical of concern	PCB	Polychlorinated biphenyl
DDD	Dichlorodiphenyldichloroethane	RBC	Risk-based concentration
DDE	Dichlorodiphenyldichloroethylene	RSL	Regional Screeing Level
DDT	Dichlorodiphenyltrichloroethane	RWQCB	California Regional Water Quality Control Board

Table ES-1: Remedial Goals for Soil

Notes (continued):

SMP	Soil management plan	TPH	Total petroleum hydrocarbons
SVOC	Semivolatile organic compound	TSCA	Toxic Substances Control Act
TCDD	Tetrachlorodibenzo-p-dioxin	VOC	Volatile organic compound
TEQ	Toxic equivalency quotient		

References:

Cal/EPA OEHHA. 2009. "Revised California Human Health Screening Levels for Lead." Integrated Risk Assessment Branch, OEHHA, Cal/EPA. September.

DTSC. 2007. Letter to Doug Mosteller from Barbara Cook Concurring on the Recommendation of 16 mg/kg Arsenic as a Good Estimator of the Upper Range of the Ambient Distribution of Arsenic at the Campus Bay Site. October 1.

DTSC. 2009. Use of the Northern and Southern California Polynuclear Aromatic Hydrocarbon (PAH) Studies in the Manufactured Gas Plant Site Cleanup Process. July.

Environ Corporation, Entrix, IRIS Environmental, and Env America. 2002. Background Levels of Polycylic Aromatic Hydrocarbons in Northern California Surface Soil. Prepared for: Pacific Gas and Electric Company and U.S. Navy. June 7.

EPA. 2005. PCB Site Revitalization Guidance Under the Toxic Substances Control Act. November. Available online at: http://www.epa.gov/osw/hazard/tsd/pcbs/pubs/pcb-guid3-06.pdf.

EPA. 2012. "Regional Screening Levels." Screening Levels for Chemical Contaminants. November.

Erler & Kalinowski, Inc. 2007. Technical Memorandum: Background Concentrations of Arsenic in Soil at Campus Bay, Campus Bay Site, Richmond, California. July 23.

RWQCB. 2013. “February 2013 Update to Environmental Screening Levels.” February. Available on-line at: http://www.waterboards.ca.gov/rwqcb2/water_issues/programs/esl.shtml.

Tetra Tech. 2013. Site Characterization Report, Research, Education, and Support Area and Groundwater within the Richmond Field Station Site. May 28.

Table ES-2: Selected Soil Remedial Goals for Mercury Fulminate Area, Corporation Yard, and Polychlorinated Biphenyl Areas

	Selected Remedial Goals			
Chemical	**MFA**	**Corporation Yard**	**PCB Areas**	**Rationale**
Arsenic [1]	--	NA	--	Background
Lead [1]	--	NA		CHHSL
Mercury	275	--	--	Commercial risk-based concentration
BAP (EQ) [2]	--	0.4	--	Ambient
Aroclor-1248 [3]	--	--	1	TSCA High Occupancy, No Cap
Aroclor-1254 [3]	--	--	1	TSCA High Occupancy, No Cap
Aroclor-1260 [3]	--	--	1	TSCA High Occupancy, No Cap
Total PCBs [3]	--	--	1	TSCA High Occupancy, No Cap
Dioxin TEQ [4]	--	0.0000164	--	Commercial risk-based concentration

Notes:

All values are in mg/kg.

1 Arsenic and lead in the Corporation Yard are associated with cinders, therefore there are not remedial goals for these COCs. Manage cinder-containing soil on site per Section 5.2.3 of the SMP.

2 The toxicity criteria for benzo(a)pyrene was used as a surrogate for BAP (EQ). Ambient levels for BAP (EQ) (0.4 mg/kg) are based on the 95 UCL concentration of the ambient dataset for BaP EQ in surface soils in Northern California (DTSC 2009; Environ Corporation and others 2002).

3 TSCA High Occupancy, no further conditions threshold criterion for total PCBs from EPA (2005). The TSCA criterion is a not to exceed value.

4 The toxicity criteria for 2,3,7,8-TCDD was used as a surrogate for Dioxin TEQ.

--	Not applicable
BAP (EQ)	Benzo(a)pyrene equivalent
Cal/EPA	California Environmental Protection Ageny
CHHSL	California human health screening level
COC	Chemical of concern
DTSC	California Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
mg/kg	Milligrams per kilogram
NA	Not applicable (see note 1)
OEHHA	Office of Environmental Health Hazard Assessment
PCB	Polychlorinated biphenyl
TCDD	Tetrachlorodibenzo-p-dioxin
TEQ	Toxic equivalency quotient
TSCA	Toxic Substances Control Act

References:

Cal/EPA OEHHA. 2009. "Revised California Human Health Screening Levels for Lead." Integrated Risk Assessment Branch, OEHHA, Cal/EPA. September.

DTSC. 2007. Letter to Doug Mosteller from Barbara Cook Concurring on the Recommendation of 16 mg/kg Arsenic as a Good Estimator of the Upper Range of the Ambient Distribution of Arsenic at the Campus Bay Site. October 1.

DTSC. 2009. Use of the Northern and Southern California Polynuclear Aromatic Hydrocarbon (PAH) Studies in the Manufactured Gas Plant Site Cleanup Process. July 1.

Environ Corporation, Entrix, IRIS Environmental, and Env America. 2002. Background Levels of Polycylic Aromatic Hydrocarbons in Northern California Surface Soil. Prepared for: Pacific Gas and Electric Company and U.S. Navy. June 7.

EPA. 2005. Polychlorinated Biphenyl (PCB) Site Revitalization Guidance Under the Toxic Substances Control Act. November. Available online at: http://www.epa.gov/osw/hazard/tsd/pcbs/pubs/pcb-guid3-06.pdf.

Erler & Kalinowski, Inc. 2007. Technical Memorandum: Background Concentrations of Arsenic in Soil at Campus Bay, Campus Bay Site, Richmond, California. July 23.

Tetra Tech. 2013. Site Characterization Report, Research, Education, and Support Area and Groundwater within the Richmond Field Station Site. May 28.

Table ES-3: Remedial Goals for Groundwater

	Remedial Goals		
	Risk-Based Concentrations		
Chemical	**Commercial Worker (Vapor Intrusion into Indoor Air)**	**Construction Worker (in a Construction Trench)**	**Maintenance Worker (in a Construction Trench)**
Carbon Tetrachloride [1]	2.63	2.68	2.68
Trichloroethylene [2]	270	890	890

Notes:

All values are in µg/L.

1 Risk-based concentrations for carbon tetrachloride are calculated in Appendix C of the Site Characterization Report (Tetra Tech 2013a). Risk-based concentrations are shown with 3 significant figures. Risk-based concentrations shown are the minimum values between the cancer and noncancer multi-pathway risk-based concentrations.

2 Risk-based concentrations for trichloroethylene are a site-specific goals established by DTSC for the Campus Bay site (Terraphase 2008, 2012a).

µg/L Micrograms per liter
DTSC California Department of Toxic Substances Control

References:

Terraphase. 2008. Revised Human Health Risk Assessment and Calculation of Site-Specific Goals for Lots 1, 2, and 3. Campus Bay Site, Richmond, California. April 30.

Terraphase. 2012a. Response to Department of Toxic Substances Control Comments Regarding the "Revised TCE Risk Evaluation." Campus Bay Site, Richmond, California. July 19.

Tetra Tech. 2013. Site Characterization Report, Research, Education, and Support Area and Groundwater within the Richmond Field Station Site. May 28.

1.0 INTRODUCTION AND PURPOSE

On May 15, 2014, The Regents of the University of California (UC) approved establishment of a new major research campus on properties it owns in Richmond, California, composed of portions of the Former Richmond Field Station (RFS) and the Regatta Property located west of the RFS. The Richmond Bay Campus (RBC) will provide for the development of additional facilities for both UC Berkeley and the Ernest Orlando Lawrence Berkeley National Laboratory (LBNL) for academic teaching, applied research, and collaborations with private industry focused on energy, environment, and health. The RBC Long Range Development Plan (LRDP) Environmental Impact Report (EIR) identifies two land use designations to form the pattern of development at the RBC: (1) Research, Education, and Support (RES) and (2) Natural Open Space (NOS). The RES land use applies to areas that are either currently developed with facilities that would remain in their present form or be expanded, or that would be developed with new facilities (UC 2014). The NOS land use applies to areas that UC plans to protect from development and maintain in their natural condition. The location of the RBC and areas identified as RES and NOS land uses are shown on Figure 1-1.

UC Berkeley has been conducting investigation and cleanup actions at the Former RFS under the oversight of the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC), in compliance with the Site Investigation and Remediation Order for the former RFS Site, Docket No. IS/E-RAO 06/07-004, dated September 15, 2006 (RFS Site Investigation and Remediation Order). The RFS Site Investigation and Remediation Order provides for the investigation and cleanup of 96 acres of upland and 13 acres of tidal marsh and transition habitat within the Former RFS Site. UC Berkeley has prepared this Removal Action Workplan (RAW) under Health and Safety Code (HSC) Section 25356.1(h)(1) and in compliance with the RFS Site Investigation and Remediation Order. For the purposes of this RAW, the property defined under the RFS Site Investigation and Remediation Order is referred to as the "Former RFS Site," "RFS Site," or "Site." The Former RFS Site does not encompass the entire RFS; two outboard parcels are not included in the RFS Site Investigation and Remediation Order. The Regatta Property, which is included in the RBC, is not included in the RFS Site Investigation and Remediation Order or this RAW. Figure 1-2 shows the Former RFS Site in relation to the RBC, Regatta Property, and outboard parcels.

The RAW establishes the final remedy including prescriptive requirements for the RES soils and groundwater at the portions of RBC within the Former RFS Site. The remainder of the Former RFS Site consisting of the NOS is not addressed by this RAW. Continued investigation within the NOS of the Former RFS Site will occur under the RFS Site Investigation and Remediation Order. The Former RFS Site including the related RES and NOS, is shown on Figure 1-3.

1.1 RAW PROCESS

The RAW process, including the regulatory background and the RAW objectives, is described in the following sections.

1.1.1 Regulatory Basis for the RAW

In HSC 25323.1, a RAW is defined as "a workplan prepared or approved by DTSC or a California Regional Water Quality Control Board (RWQCB) which is developed to carry out a removal action, in an effective manner, that is protective of the public health and safety and the environment." A RAW is appropriate when the estimated capital cost of the removal action is less than $2,000,000 (DTSC 1998, 2009a). If the estimated capital cost of implementing the chosen action will exceed $2,000,000, a Remedial Action Plan (RAP) should be prepared. The estimated capital cost of the selected remedies recommended in this RAW is estimated to be less than $2,000,000.

This RAW also satisfies the evaluation criteria requirements specified in DTSC guidance for the preparation of a RAP. Adherence to the DTSC RAP guidance affects this document by (1) including the "No Action" alternative (Section 3.2.1), and (2) evaluating the nine RAP criteria in addition to three RAW criteria (Section 3.2.5). Adherence to the RAP evaluation criteria does not affect the recommendations of this RAW.

In response to the RFS Site Investigation and Remediation Order, UC Berkeley previously prepared a current conditions report (CCR) (Tetra Tech 2008). The RFS Site Investigation and Remediation Order is presented as Attachment A. The CCR comprehensively summarized current conditions through 2008 for the Former RFS Site, including the 96 acres of upland and 13 acres of tidal marsh and transition habitat. The CCR identified data gaps that warranted additional characterization or evaluation at the Former RFS Site and a Field Sampling Workplan (FSW) identifying the methods and five-phase approach to completing site investigations at the former RFS Site was prepared to address those data gaps.

A Site Characterization Report (SCR) (Tetra Tech 2013) was prepared in support of the RAW. The SCR addressed data gaps identified in the CCR and summarized the results of investigations completed under the FSW Phases I, II, and III. Phase I involved a site-wide groundwater investigation; Phase II involved soil investigations within areas where historical activities may have adversely impacted soil conditions; and Phase III included additional soil investigations in areas where historical activities may have adversely impacted soil conditions and additional groundwater investigation in the vicinity of piezometer CTP. The SCR presented historical information, investigation details, an updated conceptual site model, and an evaluation of the nature and extent of contamination. The SCR also incorporated a human health risk assessment (HHRA) identifying contaminants of concern and risk results for potential future receptors and exposure pathways based on the most current and most probable future land uses in portions of the RES sufficiently characterized for a HHRA, including the Mercury Fulminate Area (MFA) and the Corporation Yard. The HHRA also presented site-wide risk-based concentrations used as screening criteria for the Site.

The U.S. Environmental Protection Agency (EPA) "Area of Contamination" policy provides guidance and conditions under which wastes may be moved within such areas without triggering solid waste or landfill disposal restrictions criteria (EPA 1996). The Area of Contamination concept is considered applicable to the management of any soil within the RFS Site boundaries as defined by the RFS Site Investigation and Remediation Order.

Both the CCR and SCR provide information supporting this RAW and should be referred to for historical information about the Former RFS Site. Section 2.0 of this RAW summarizes the history and previous investigations, nature and extent of contamination, HHRA, and SCR conclusions and recommendations.

1.1.2 Objectives of the RAW

The objectives of this RAW are to:

- Present existing conditions;
- Establish appropriate removal action objectives (RAO) for protection of human health and the environment; and
- Evaluate alternatives and identify a remedy that is protective of human health and the environment.

1.1.3 Elements of the RAW

To accomplish the RAW objectives and satisfy regulatory requirements, this RAW includes the following elements:

- A description of the nature and extent of the chemicals of concern (COC);
- The goals to be achieved by the remedy;
- An analysis of the alternatives considered and rejected, and the basis for the rejection, including a discussion of effectiveness, implementability, and cost of each alternative;
- A description of the recommended alternative and an implementation plan;
- A description of the public participation process; and
- Attachments, including:
    - Attachment A: RFS Site Investigation and Remediation Order
    - Attachment B: Administrative Record List
    - Attachment C: Soil Management Plan (SMP)
    - Attachment D: Air Monitoring Plan
    - Attachment E: RAW Responsiveness Summary

1.2 PURPOSE

Based on the information developed during the site characterization activities, UC Berkeley determined that further action is required for soils within the RES due to elevated concentrations of mercury, pyrite cinders-related metals (arsenic and lead), polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH), and dioxins, as well as carbon tetrachloride and trichloroethylene (TCE) in groundwater. To address these COCs, this RAW was prepared to establish RAOs that are protective of human health, present screening of soil and groundwater cleanup technologies, and develop and evaluate soil and groundwater alternatives for the MFA, the Corporation Yard, the remainder of the RES, and Site-wide groundwater. This RAW analyzes the remedial alternatives and presents a recommended alternative and implementation plan. The public draft RAW has been revised in response to the comments received during the public comment period; DTSC has approved this final RAW for implementation. When the remedy has been implemented, a removal action completion report will be submitted to DTSC for review and certification of completion. All remaining activities in the RES will be conducted pursuant to the land use controls (LUC) identified in this RAW. Additional information regarding approval of the RAW and associated LRDP EIR process is presented in Section 6.0.

2.0 SITE CHARACTERIZATION

Characterization activities have been conducted beginning in 1981 through 2012. A summary of the activities and results are discussed in the sections below.

2.1 SITE OWNER

The RBC is owned by the UC Regents. In October 1950, the UC Regents purchased the eastern portion of the property from the California Cap Company (CCC). From 1950 through 1963, UC acquired the adjacent undeveloped property between Avocet Way and Regatta Boulevard in the western portion of the property.

2.2 SITE DESCRIPTION

The Site is located at 1301 South 46th Street in Richmond, California, along the eastern shoreline of the Richmond Inner Harbor of the San Francisco Bay and northwest of Point Isabel (see Figure 1-1). The Site is bounded to the north by Meade Street and Hoffman Boulevard, east by South 46th Street, south by the East Bay Regional Park District Bay Trail (Bay Trail) and the San Francisco Bay, and west by Meeker Slough and Regatta Boulevard.

The Site consists of: Upland Areas developed for academic teaching and research activities, upland remnant coastal terrace prairie, a tidal salt marsh (Western Stege Marsh), and a transition zone between the academic teaching and research activity areas and the marsh (Figure 2-1). The 5.5-acre Transition Area consists entirely of artificial fill placed on historical mudflats. The 7.5-acre Western Stege Marsh includes a small isolated area of artificial fill, known as the "Island," that occupies 0.425 acre and is surrounded by tidal marsh (see Figure 2-2).

The Site property has been subject to numerous land alterations through its history of development, including ditching and culverting to channel storm drainage; placement of fill onto tidal mudflats, and to a lesser degree in the uplands; construction of buildings and utilities; and placement on tidal mudflats of structures such as a pier, breakwaters, and a railroad embankment.

This RAW focuses on the portions of the Site which the RBC LRDP designates as developable in the RES. The RES consists of 82.5 acres within the Site (Figure 1-3), including portions of the Upland Area and Transition Area. The LRDP also designates portions of the Upland Area to be preserved as natural open space (25 acres). The NOS includes the upland remnant coastal terrace prairie, portions of the Transition Area, and the Western Stege Marsh, and is not addressed as part of this RAW. The RAW also addresses groundwater at the Site.

2.2.1 Site Land Use (1950 to 2013)

The Site is an academic teaching and research facility for UC Berkeley, which has been used primarily for large-scale engineering research since 1950. Teaching facilities were available for bioengineering, civil engineering, mechanical engineering, transportation, fine arts, ergonomics, and occupational and environmental health. With over 500,000 assignable square feet of research space, the Site accommodated a range of space-intensive activities—including the UC Office of the President, Northern Regional Library Facility, the Asbestos Information Center, some of the world's largest earthquake shaking tables, the Geosciences Well Field, sophisticated test facilities for advanced transportation research, bioengineering tissue projects, and a robotics laboratory. The Site also provided a location for a variety of smaller-scale engineering research projects not conducted on the central UC Berkeley campus. The CCR (Tetra Tech 2008) provides greater detail about research performed at the Site and summarizes the Site utilities and facilities maintenance operations.

The UC Regents have also leased space to non-UC Berkeley tenants. Tenants include the EPA Region 9 Laboratory; Schlumberger, Inc.; The Watershed Project; Marine Advanced Research; and Stratacor, Inc.

In 1989, UC management estimated that 250 to 300 people worked at the Site (Ensco Environmental Services, Inc. 1989). In 2012, staffing estimates remained at approximately 300 people.

2.2.2 Future Site Uses

The UC has established a new major research campus on properties it owns in Richmond, California, composed of portions of the Former RFS Site and the Regatta Property located west of the Site. The RBC will provide for the development of additional facilities for both LBNL and UC Berkeley for academic teaching and research focused on energy, environment, and health. The RBC LRDP identifies the developable portion of the new campus as the RES and the remainder as NOS. An LRDP is defined by statute (Public Resources Code 21080.09) as a "physical development and land use plan to meet the academic and institutional objectives for a particular campus or medical center of public higher education." The RBC LRDP will guide growth and development of the campus through year 2050.

The types of facilities and activities that will potentially take place within the RES include:

- Laboratory, classroom, office, and administration buildings for researchers, faculty, postdocs, students, and non-University public and private entities. Classrooms would be for college-aged students or older, including undergraduate and graduate student research use and the possibility of job training classrooms for adults. Each student would be in a classroom space not more than 12 hours per week. Educational activities may also include programs that allow elementary and high school students to periodically visit the Site where they would be in classrooms or visiting laboratories.

- Product and process development space for private sector startups, small businesses, and industry counterparts that are synergistic with UC Berkeley and LBNL research areas.

- Support infrastructure and facilities for operations, transportation, utilities, renewable power generation, firefighting, security, safety, hazardous materials management, and corporation yard uses including vehicle and materials shops and storage. There is no current plan for constructing a fire station within the Former RFS Site portion of the RBC. Community outreach and education resources including exhibit, lecture and event spaces as well as conference facilities and meeting rooms focused on public education.

- Amenities such as dining, short-term accommodation facilities, retail, and recreation facilities. Short-term accommodation facilities would be being similar to the UC Berkeley Faculty Club or the Berkeley Lab Guest House. Individuals affiliated with the campus or laboratory can stay in these accommodations an average of 2 nights each and up to a maximum of 2 weeks while doing research or visiting the campus in some capacity.

- Transportation-related facilities including parking lots and structures, bus and shuttle stops, and roadways/circulation pathways. Developed open spaces that are usable by the campus population and visitors, ranging from courtyards, terraces, and quad-like spaces, to walkways, tree groves, and recreational fields.

- Transition zones to buffer development from the NOS, allowing for maintenance access and minimizing the transference of non-native species or noise or light intrusions.

The NOS would include natural areas such as the Western Stege Marsh and coastal grasslands. Human engagement and disruption to these spaces would be limited, with the intent to protect, restore, and maintain these resources in their natural condition.

A LUC in the form of a deed restriction is expected to be implemented as part of this RAW to prohibit residential use consisting of a residence, mobile home, or factory-built housing constructed or installed for use as residential human habitation. In addition, certain commercial uses defined as “sensitive uses” will also be prohibited. Sensitive uses consist of (a) a hospital for humans, (b) a public or private school for persons less than 18 years of age, (c) a day care center for children, or (d) any permanently occupied habitation other than those used for industrial purposes.

2.2.3 Historic Uses

Prior to settlement of the East Bay plain by the Spanish beginning in the 1772, Native Americans used the area for fishing and harvesting shellfish. In the late 1800s, portions of the property were sold, and chemical and explosives industries moved into the area. Between the 1880’s and 1948, several companies, including CCC, manufactured explosives at the Site (see Figure 2-3). The CCC plant hosted several operations, including manufacturing explosives (primarily mercury fulminate), shells, and blasting caps; testing explosives; and storing explosives (URS Corporation [URS] 1999).

Two small companies, the U.S. Briquette Company and the Pacific Cartridge Company, are presumed to have operated on a portion of the Site. Both companies are shown on the 1912 and 1916 Sanborn maps, although the U.S. Briquette Company was noted as “not in operation” as of January 1912. Neither company is listed on the 1930 Sanborn map. By 1920, the CCC was the only remaining explosives manufacturer in the RES.

The chief constituent of the explosive manufactured by the CCC was a nitrocellulose (guncotton) base called “tonite.” Manufacture of the explosive included production of mercury fulminate, a whitish-gray solid with the chemical formula $Hg(ONC)_2$, a key ingredient in blasting caps. The former mercury fulminate facility was in the southeastern portion of the Site (see Figure 2-4). Other former facilities associated with the CCC included the shell manufacturing areas in the southern portion of the Site; the blasting cap manufacturing area in the central portion of the Site;

an explosives test pit area in the northeast portion of the Site; and two explosive storage areas, both southwest of the former explosives test pit area (URS 1999).

According to an article published in the July 1922 edition of the CCC newspaper, *The Detonator*, the manufacturing plant consisted of approximately 150 buildings, including administration buildings, a shell and metal drawing unit, a wire drawing unit, the blasting cap line unit, an electric blasting cap unit, and fulminate nitrating and recovery units. A tram line, evident on Sanborn maps and historical photographs, was present between these buildings (see Figure 2-5). It appears from the photographs that the tram line was a rail system with a horse-drawn cart that moved supplies and other goods around the property. The entire CCC facility covered approximately 30 acres, with an additional 30 acres of trees surrounding the facility.

In October 1950, the CCC property was purchased by UC. Historical academic research and teaching at the Site has occurred in indoor and outdoor laboratories, varying from small bench-top operations to large sewage treatment ponds. In addition, the Site has been the location of ecological research on salt marsh and upland wildlife, as well as research on contamination of the Stege Marsh.

2.2.4 Adjacent Properties

Richmond Inner Harbor, Stege Marsh, and the central San Francisco Bay border the Site to the south. The Bay Trail on the former Southern Pacific Railroad right-of-way is near the property to the south. Tidal mudflats fronting the Richmond Inner Harbor are farther south of the Site.

Several large former and existing chemical and industrial sites border the Site property to the north, east, and west (Figure 2-3). A former Pacific Gas and Electric Company facility was north of the Site. The former Kaiser Shipyard and the Butler Steel Products facilities were southwest of the Site in the current location of the Marina Bay mixed-use residential and commercial development. Bio-Rad Laboratories (Bio-Rad) is presently west of the Site. The adjacent property east of the Site (now known as Campus Bay) is the location of former chemical production operations previously owned by several entities, including Stauffer and Zeneca. This report refers to this adjacent site, formerly owned by Stauffer, Zeneca, and others (and currently owned by Cherokee Simeon Venture I, LLC [CSV]), as the former Zeneca site. The former Liquid Gold Corporation site is east of the former Zeneca site. Hoffman Marsh and Point Isabel are also slightly farther to the east, approximately 1.5 miles from the Site.

Marina Bay Site

The Marina Bay housing development borders Western Stege Marsh to the west (see Figure 2-3) and was the location of the former Kaiser Shipyard No. 2 for construction of ships in the early 1940s during World War II (DTSC 2007a). During shipbuilding activities, the area was used for storage of shipyard supplies and disposal of debris (URS 2000). Between 1941 and 1943, this area was filled with dredge spoils and off-site fills. Additional fill was imported in the late 1970s. Prior to this time, the eastern part of this area along Meeker Slough consisted of mudflats and marsh.

After the war, the Marina Bay site was used by several industrial firms (DTSC 2007a). From the 1940s to 1971, Butler Steel Products used the eastern portion of the Marina Bay site. In 1982, during excavations to form a lagoon at the southeastern corner, a large amount of solidified paint material was discovered, prompting site remediation activities from 1982 to the early 1990s. Since then, the Marina Bay site has been developed into a residential area, including parks and a marina for the City of Richmond (URS 2000).

BioRad Site

The 5-acre Bio-Rad site, at 3110 Regatta Boulevard, is immediately west of the Site and north of the Marina Bay housing development (Figure 2-3). Bio-Rad's Richmond manufacturing facility has been operating since 1957. Bio-Rad manufactures products for the life sciences and medical diagnostic testing markets. Chemicals associated with manufacture of these products have been detected in soil and groundwater at the Bio-Rad site (DTSC 2006).

Former Zeneca Site

The former Zeneca site, an 86-acre property, is located at 1415 South 47th Street (see Figure 2-6). From approximately 1897 through 1997, the former Zeneca site was used for manufacture of sulfuric acid and other chemicals by various entities, including Stauffer. The last production line was closed in 1997.

Stauffer generated pyrite cinders as a byproduct of its sulfuric acid manufacturing operations from approximately 1919 through approximately 1970. The pyrite cinders, which contain metals, were placed in an area at the southwestern corner of the former Zeneca site, and in the eastern portion of the Transition Area and Western Stege Marsh on the Site. The former cinder area at the former Zeneca site was remediated by Zeneca and CSV's remediation contractor in 2002 and 2003. The cinders in the eastern portions of the Transition Area and Western Stege Marsh on the Site were removed by UC Berkeley's remediation contractors in 2002 and 2003. In addition, certain surface spills originating from the former Stauffer operations reportedly migrated onto the Site, as discussed in the SCR (Tetra Tech 2013).

Liquid Gold Site

The 17-acre Liquid Gold property is located southeast of Bayview Avenue in Richmond, California, approximately 0.5 mile east of the Site and adjacent to the former Zeneca site (Figure 2-3). The property was leased from 1947 to 1974 to San Pablo Oil for an asphalt manufacturing plant. The property was later leased to Liquid Gold, which used the property as an oil storage and transfer facility until 1982 (URS 2000). Oils, solvents, and tank bottoms were stored on site (URS 2000).

Previous activities at the Liquid Gold property are a possible source of contaminants in Western Stege Marsh through discharges to Baxter Creek, which was hydrologically connected to Western Stege Marsh until sometime in the 1960s when Stauffer constructed a landfill that hydrologically separated Eastern and Western Stege marshes (based on aerial photographs).

2.3 PREVIOUS INVESTIGATIONS

This section summarizes previous investigations and remediation activities within the RES and groundwater at the Site. Section 2.3.1 summarizes investigations prior to the FSW through 2008 in the Upland Area and Transition Area. Investigations conducted in the Western Stege Marsh are not discussed in this RAW, as they are not part of the RES. Section 2.3.2 summarizes FSW

Phases I, II, and III investigation activities and sampling results from 2010 through 2012. Section 2.3.3 summarizes previous cleanup actions Phases 1 through 3 as well as two Time-Critical Removal Actions (TCRA).

2.3.1 Pre-FSW Investigations

Investigations at the Site between 1981 and 2008 involved collection of soil, sediment, groundwater, and ecological samples in the Upland Area and Transition Area. Table 2-1 summarizes the investigation, reports and conclusions or recommendations from 1981 to 2008 at the Site prior to the FSW investigations that began in 2010. The investigations prior to 2010 focused on potential source areas (see Figure 2-3), and identified areas requiring further investigation.

2.3.2 FSW Investigations

In 2010, UC completed the FSW identifying the methods and five-phase approach to completing site investigations to address data gaps identified in the CCR that warranted additional characterization or evaluation at the Site (Table 2-2). Between 2010 and 2012, UC Berkeley completed FSW Phases I, II, and III investigations, which addressed soil data gaps in the RES, and groundwater throughout the Site, excluding groundwater beneath Western Stege Marsh. In addition, soil samples were collected outside of the RES as part of the Phase II transformer investigation and the Phase III EPA Building 201 soil mounds investigation; these are described in Appendix H of the SCR (Tetra Tech 2013), and will also be documented in future reports for the NOS.

The purpose of the FSW investigation was to close previously-identified data gaps, and to identify any immediate or potential risks to public health and the environment. Sampling results addressed data gaps identified in the CCR and contributed to the SCR. The SCR serves as the necessary investigation and risk assessment document to support a remedial or removal action decision regarding RES soils and groundwater.

All major significant data gaps within the RES identified in the CCR have been characterized, including RFS-wide groundwater. Remaining areas which have not been sampled to date will either be sampled in the future prior to any new projects within the RES, per the sampling protocols identified in the SMP.

Any areas which require sampling within the NOS will be conducted under Phases IV and V of sampling, per the FSW. Future investigations and recommended cleanups of soil, sediment, or surface waters within the NOS, including the marsh will continue as a part of the FSW activities pursuant to the existing RFS Site Investigation and Remediation Order. Following receipt and analysis of investigation results, any future cleanup activities within the NOS soil, sediment, or surface water, including Western Stege Marsh, would be subject to public review documents such as a RAW or RAP. Cleanup of the NOS continues under the oversight of DTSC in connection with current ongoing investigations.

2.3.3 Previous Cleanup Actions

Remediation activities at the Site occurred in three phases beginning in 2002. Remediation Phases 1 through 3 were completed in 2002, 2003, and 2004, respectively, under oversight of the

RWQCB. A TCRA occurred near the Former Forest Product Laboratory Wood Treatment Laboratory in fall 2007. A second TCRA was conducted at two subareas in the Western Transition Area in fall 2008. The TCRAs were completed under DTSC oversight. Figure 2-7 shows locations of the previously remediated areas. Table 2-3 briefly summarizes these remediation activities.

2.4 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination evaluation focuses on the areas investigated in the FSW investigations in the RES (FSW Phase I through III investigations) as well as a discussion of fate and transport of detected chemicals of potential concern (COPC) known to occur in the primary source areas at the Site. This section of the RAW summarizes detailed information provided in Sections 6.0 and 7.0 of the SCR (Tetra Tech 2013).

Analytical results for the FSW were evaluated using human health screening criteria developed in the SCR (see SCR Tables 6-1 and 6-2) based on the assessment of existing and future uses identified in the LRDP and potential beneficial uses of groundwater (Tetra Tech 2013). The Site is within the East Bay Plain Subbasin, which is identified as having the potential beneficial uses of municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply (RWQCB 2007).

Drinking water is currently provided by East Bay Municipal Utility District, whose principal water source is the Mokelumne River Basin in the Sierra Nevada range. Future use of groundwater at the Site as a drinking water source is not anticipated for two primary reasons: the potential for salt water intrusion and elevated total dissolved solids (TDS) values in various areas of the Site. Because of the adjacency to the San Francisco Bay, there is high potential for salt water intrusion in the event of groundwater extraction, making it unsuitable for many beneficial uses (Department of Water Resources 2004). Analytical results for TDS from the Phase I FSW investigation (Tetra Tech 2012) indicate that levels in groundwater in the northeast of the Site (piezometer EERC), the southern central portion of the Site (piezometer DH), and the far southern area near the marsh (piezometer Bulb1) exceed the State Water Board Resolutions No. 88-63 and No. 89-39 criterion of 3,000 milligrams per liter (mg/L) TDS. Although TDS concentrations from other areas of the site do not exceed the 3,000 mg/L criterion, the areas with high TDS concentrations are distributed across the Site, and are not confined to one geographic portion of the Site. Based on the potential for salt water intrusion and the high TDS levels in various areas of the Site, groundwater is not expected to be appropriate for beneficial uses identified in the 2007 Basin Plan.

Additionally, Resolution No. 88-63 identifies aquifers that do not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day as not to be considered suitable or potentially suitable for municipal or domestic water supply. While site-specific pump tests have not been conducted, groundwater recharge rates observed during well development and sampling activities do not support that a well would produce at least 200 gallons per day.

2.4.1 Soil Sample Results

Soil sample results are presented by location. Only locations with COPC concentrations exceeding the human health screening criteria are discussed in the following sections. Human health screening criteria are based on calculated commercial risk-based concentrations, Toxic

Substance Control Act (TSCA) criterion for PCBs, and background values for arsenic and benzo(a)pyrene equivalent (BAP [EQ]). Sections 6.2 and 6.3 of the SCR (Tetra Tech 2013) have a complete discussion of human health screening criteria and FSW results.

Mercury Fulminate Area

Investigation in the MFA occurred to further delineate vertical and lateral extents of mercury present in soil at the vicinity of the former CCC's mercury fulminate production area. Samples collected in the MFA were analyzed for mercury only as total mercury, and a subset of samples was analyzed for methylmercury and elemental mercury.

Generally, the concentrations are widely variable at short distances both vertically and laterally within the area of higher concentrations (source area) of the MFA, but are relatively homogeneous outside of this area. In most areas of the MFA, the deepest sample exceeding the human health commercial worker risk-based concentration of 275 milligrams per kilogram (mg/kg) is 4 to 4.5 feet below original ground surface, and the highest concentrations are bounded by deeper samples with concentrations less than the commercial worker risk-based concentration. Within the immediate area of the former mercury fulminate production area concentrations of mercury exceeding the commercial worker risk-based concentration extend to at least 8.5 feet below native ground surface (up to 11.3 to 11.8 feet below current ground surface which includes the elevated asphalt pad), with concentrations ranging from 550 to 1,200 mg/kg. Concentrations less than the commercial worker risk-based concentration bound the elevated concentrations at 10 to 10.5 feet below original ground surface (13.3 to 13.8 feet below current ground surface).

The maximum concentration of mercury (8,800 mg/kg) was reported in the sample collected from 2 to 2.5 feet below ground surface (bgs) at location MFA12. This value is 32 times the commercial worker risk-based concentration and is approximately eight times higher than the next highest concentration (1,200 mg/kg at MFA 24, 6 to 6.5 feet bgs) found in MFA soils. Elemental mercury, in the form of shiny flecks that formed into a small silver ball at the bottom of the stainless steel bowl used to contain the soil sample, was identified in the sample with the maximum mercury concentration. The anomalously high mercury result associated with the free-phase mercury observation indicates that the soil sample likely represents a localized spill of the mercury source used in manufacturing.

Selected samples were also analyzed for methylmercury. Methylmercury concentrations in the MFA are approximately between three to five orders of magnitude less than the commercial risk-based concentration of 47.8 mg/kg. Analysis of the results of the methylmercury speciation indicate that only a small fraction of the mercury detected in soil is present as methylmercury and at levels significantly less than the commercial risk-based concentration.

A mercury speciation study was conducted to determine whether mercury was present in the MFA as elemental mercury and is summarized in Section 6.3.1.7 of the SCR (Tetra Tech 2013). A five-step selective sequential extraction (SSE) was used to assess mercury fractionation and mobility in seven soil samples collected from four locations in the MFA. The SSE procedure demonstrates mobility of the mercury in each sample. The primary mercury species found in four of the seven samples is mineral-bound mercury, one of the most biounavailable and immobile species. In two samples, the SSE recovered mercury was primarily associated with the organo-complexed forms of mercury. In sample MFA12 (2 to 2.5 feet bgs) in which free-phase mercury was visually observed, the SSE recovered mercury primarily associated with strong complexed forms of mercury (elemental mercury or mercuric ion complexes). This soil sample was the only sample collected in the FSW investigation in which free-phase mercury was visually observed, and thus the result likely indicates that elemental mercury is present in this sample. For the other samples analyzed, mercury may be elemental mercury or mercuric ion complexes or both.

Corporation Yard

Soil samples collected in the Corporation Yard during the FSW Phase II investigation were analyzed for metals, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), PCBs, pesticides, and total petroleum hydrocarbons (TPH). Selected step-out samples were collected during the FSW Phase III investigation from locations where the Phase II results exceeded human health screening criteria; these samples were analyzed for arsenic, lead, PAHs, or PCBs, depending on which chemical results exceeded criteria during the Phase II investigation. Additionally, 10 samples collected from 0 to 0.5 and 2 to 2.5 feet bgs at the center of the Corporation Yard during the FSW Phase III investigation were analyzed for dioxins.

Arsenic and lead, likely associated with observed cinders, were the only metals detected at concentrations exceeding commercial worker risk-based concentrations. Arsenic was reported at concentrations greater than the commercial worker risk-based concentrations in all samples analyzed for metals, and exceeded the background level of 16 mg/kg in five of the 49 samples. Lead exceeded the commercial worker risk-based concentration in two of the 71 samples.

VOCs were detected infrequently in the Corporation Yard soil samples. None of the VOCs was detected at concentrations exceeding commercial worker risk-based concentrations.

Except for 4-methylphenol and carbazole, PAHs were the only SVOCs detected in soil samples collected in the Corporation Yard. A BAP (EQ) value was calculated for the 40 samples with detections of carcinogenic PAHs. All individual carcinogenic PAHs included in the calculation of the BAP (EQ) were detected at concentrations exceeding their respective commercial risk-based concentrations. BAP (EQ) is widespread at relatively low concentrations around the Corporation Yard, indicating that BAP (EQ) levels can be attributed to anthropogenic sources including vehicle emissions, refineries, or other off-site sources. The elevated concentrations of BAP (EQ) in this area may be attributable to the incinerator formerly present in Building 120, incinerator ash disposal in the vicinity, or other nearby or adjacent industrial activities.

Total PCB concentrations exceeding the TSCA high occupancy without further conditions threshold criterion of 1 mg/kg (40 Code of Federal Regulations [CFR] 761.61(a)(4)(i)(A)) in the Corporation Yard are delineated vertically, except in the area around CY26, but are not delineated laterally at multiple locations. Soil samples with detected concentrations of PCBs contained either Aroclor-1254 or Aroclor-1260, but not both.

Of the 12 pesticides detected in the Corporation Yard, no pesticide soil concentrations exceeded commercial risk-based concentrations.

Three TPH compounds, diesel-, gasoline-, and motor oil-range, were detected in samples collected in the Corporation Yard. Two results for diesel range organics exceeded the RWQCB environmental screening level (ESL) of 500 mg/kg (RWQCB 2013). Samples exceeding the ESL were collected from the 0 to 0.5 feet bgs interval and are bound vertically by samples with concentrations less than the ESL collected at 2 to 2.5 feet bgs; however, none of the samples are bound laterally by samples with TPH concentrations less than the ESL. None of the results for gasoline range organics or motor oil range organics exceed the ESL.

Dioxin toxic equivalence quotient (TEQ) concentrations in the Corporation Yard exceed the commercial worker risk-based concentration of 1.64E-05 mg/kg in two soil samples collected at two adjacent shallow sample locations. All sample concentrations exceeding the commercial worker risk-based concentration are bounded vertically by samples collected at 2 to 2.5 feet bgs, and the elevated concentrations at CY06 are bounded laterally to the north, west, and east by samples that do not exceed the commercial worker risk-based concentration. The highest dioxin concentration was reported at location CY26 at 11.4 feet bgs. This exceedance is bounded laterally only to the north. Soil concentrations exceeding the commercial worker risk-based concentration for dioxin TEQ in the Corporation Yard are likely localized within an area of contamination limited to surface soil; however, the dioxin TEQ is not bounded laterally to the south in soil.

PCB Areas

PCBs were detected at concentrations exceeding the commercial worker risk-based concentration (0.528 mg/kg) at Building 112, Building 150, and Building 474 transformer areas. Concentrations of total PCBs exceed the TSCA criterion of 1 mg/kg for high occupancy areas with no further conditions at both the Building 112 and 150 transformer areas, but not at the Building 474 transformer area.

Remainder of the RES

Sampling density in the remainder of the RES is limited and a comprehensive evaluation of the nature and extent of possible contaminants has not been completed. Based on existing sample data and knowledge of historical operations, contaminants may be encountered at concentrations greater than background levels and commercial worker risk-based concentrations in the remainder of the RES. The list of contaminants likely to be encountered is anticipated to be consistent with those contaminants found in the MFA, Corporation Yard, and PCB areas, including mercury; cinders-related metals (arsenic and lead); PAHs, specifically carcinogenic PAHs; PCBs; dioxins; and TPH. Elevated levels of lead in soil may also be encountered due to the potential historical use of lead-based paint. No other contaminants than those already identified are anticipated to be found at the remainder of the RES.

2.4.2 Groundwater Results

This section discusses detections of inorganic and organic compounds in groundwater samples collected from piezometers during the four rounds of FSW Phase I groundwater monitoring and from Phase III groundwater grab samples.

The initial round of samples (November 2010) were analyzed for metals, VOCs, SVOCs, TPH, PCBs, pesticides, perchlorates, and TDS. Because PCBs and perchlorates were detected at a very low frequency (in 1 of 49 and 3 of 52 samples, respectively) and at low concentrations, and pesticides were not detected in the initial round of sampling, these analytes were not included in the next three rounds of sampling. The subsequent three rounds of samples collected in

April 2011, October 2011, and April 2012 were analyzed for metals, VOCs, SVOCs, TPH, and TDS. Results were compared to California Maximum Contaminant Levels (MCL) and federal MCLs; VOC results were compared to human health commercial vapor intrusion risk-based concentrations.

Of the 24 metals sampled, seven were detected at concentrations exceeding their respective MCLs, including: aluminum (California MCL only), arsenic, cadmium, chromium (unfiltered only), copper (unfiltered only), lead (unfiltered only), mercury, nickel, and selenium (filtered only). Metals are naturally occurring in groundwater, and the concentrations detected do not indicate a contaminant release or plumes at the Site (Tetra Tech 2012).

VOCs were detected at many sampling locations. Seven compounds exceeded their respective California MCLs or federal MCLs, including benzene (California MCL only), carbon tetrachloride, and TCE and other chlorinated solvents (1,2-dichloroethane, *cis*-1,2-dichloroethene (DCE), tetrachloroethylene (PCE), and vinyl chloride [California MCL only]). Only carbon tetrachloride and TCE exceeded their commercial risk-based concentrations for vapor intrusion.

Carbon tetrachloride was detected at piezometer CTP at concentrations exceeding the California MCL of 0.5 micrograms per liter (µg/L), the federal MCL of 5 µg/L, and the commercial risk-based concentration for vapor intrusion of 2.63 µg/L during all four rounds of sampling. Carbon tetrachloride was also present at concentrations exceeding the California MCL in downgradient piezometers. As part of Phase III sampling activities, grab groundwater samples were collected from 20 borings advanced to depths of 17 or 20 feet bgs (depending on the location), and from piezometer CTP in the area near Building 280B. Because grab groundwater sampling results are not considered high-quality data, the concentrations detected were not compared to human health screening criteria. The objective of the investigation was to confirm or refute the presence of an upgradient source of carbon tetrachloride. The investigation results do not indicate the presence of an upgradient off-site source of contamination, and the source may be from historical activities near Building 280B. The presence of carbon tetrachloride in the vicinity of piezometer CTP appears to represent a release and will be addressed further in this RAW; carbon tetrachloride in soil gas will also be investigated as part of Phase IV of the FSW.

TCE also exceeded its commercial vapor intrusion risk-based concentration of 270 µg/L near Building 478 (piezometer PZ11) in the northeast portion of the Site, and in the vicinity of the Corporation Yard (piezometer B178) in the southeast portion of the Site, although TCE was detected across much of the Site at low levels. TCE near Building 478 is currently being monitored by DTSC under a pilot treatment study conducted by Zeneca's contractors. TCE along the southeastern Site property boundary in the Corporation Yard was further investigated by Zeneca's contractors in October 2011: soil gas samples were collected at five locations in the vicinity of the Corporation Yard to evaluate if TCE or other compounds were migrating from groundwater to subsurface soils (Terraphase 2012b). The results of the soil gas samples were compared to the site-specific goals (SSG) calculated by Zeneca for the commercial/industrial worker (CIW) and groundskeeper/maintenance worker (GMW). The concentrations detected in the soil gas samples in the Corporation Yard including near piezometer B178 were all less than the CIW and GMW SSGs. TCE concentrations in groundwater samples collected in piezometer B178 in five subsequent sampling events have been substantially lower than the commercial vapor intrusion risk-based concentration. UC Berkeley concludes that TCE in groundwater originated from legacy industrial activities at the former Zeneca site, based on (1) the measured groundwater gradient from the former Zeneca site to the Site, (2) known historical TCE sources and groundwater contamination at the upgradient former Zeneca site, and (3) lack of measured or identified TCE sources within the Site. TCE concentrations in groundwater will continue to be monitored under the on-going groundwater monitoring program at the former RFS and UC will consult with DTSC in the event future TCE concentrations in groundwater increase and exceed these values, or if any other specific actions must be conducted to be within compliance with the FS/RAP prepared under the Zeneca Order, when finalized by DTSC.

SVOCs were detected infrequently and sporadically in groundwater across the Site, and will continue to be sampled during the continued groundwater monitoring program.

2.4.3 Fate and Transport

This subsection describes possible fate and transport mechanisms for detected COPCs, including descriptions of the persistence and mobility of specific contaminants known to occur in the primary source areas (for example, pyrite cinders fill areas, the former MFA, and PCB areas). Behaviors of key contaminants in the environment provide a basis for understanding the transport pathways from the former source areas and potential for migration from the locations where contaminants have been detected.

The primary contaminants present in RES soils are PCBs and metals, specifically mercury. PCBs have relatively low mobility because of their high adsorption to soil particles. PCBs have been detected in soils across the Site, but were only detected at concentrations exceeding commercial worker risk-based concentrations (0.53 mg/kg) in a few discrete locations where transformers were either located or stored in the past. PCBs typically have a slow rate of adsorption and desorption between sedimentary particles and surrounding water. They tend to migrate very little from their initial release point and are not likely to leach from surface soils to subsurface soils and groundwater (Agency of Toxic Substances and Disease Registry [ATSDR] 2000).

Behaviors of metals in soils are influenced by the geochemical environment. In addition, physical processes, such as the amount of precipitation infiltration (leaching), can also influence the fate of metals. The geochemical environment in RES soils is conducive to sorption of metals (Tetra Tech 2013).

Mercury is an especially complex metal because it has elemental and inorganic forms, in addition to the organic species methylmercury and di methylmercury. The primary route of exposure to mercury for humans and wildlife is consumption of fish and aquatic biota. During the FSW Phase III investigation, 14 samples were collected for methylmercury analysis, and all results were below 0.01 mg/kg or non-detect, indicating that methylmercury is not a concern at the MFA.

The former CCC historically used elemental or liquid mercury in the MFA. This form of mercury can volatilize into the atmosphere from soil, sediment, or water (ATSDR 1999). Elemental mercury was observed in only one sample and is thought to represent an isolated spill (Tetra Tech 2013).

Mercury fulminate is a compound produced by dissolving mercury in nitric acid and then adding a solution of 95 percent ethanol (Jonas & Associates, Inc. 1990). The reaction results in formation of small brown to gray pyramid-shaped crystals ($Hg[ONC]_2$) that contain colloidal mercury. The crystals are relatively insoluble in water. However, when dry, they are easily detonated by shock, impact, friction, sparks, or flame. Elevated concentrations of mercury have been found in soils in the former CCC MFA; however no crystals have been encountered (Tetra Tech 2013).

Groundwater samples collected across the Site as part of the FSW Phase I investigation were analyzed for filtered and unfiltered metals concentrations. A review of the groundwater sampling results during the four rounds of quarterly monitoring showed infrequent exceedances of MCLs, indicating that metals concentrations detected in soil are not leaching to groundwater.

The primary contaminants present in Site groundwater are TCE and carbon tetrachloride. The following solvents have been identified in the shallow groundwater near the Site and former Zeneca site property line at concentrations exceeding the respective California and federal MCLs: PCE, TCE, and *cis*-1,2-DCE. Carbon tetrachloride has been identified in the shallow groundwater near Building 280B at concentrations exceeding the California and federal MCL and the commercial vapor intrusion risk-based concentration. Because these solvents are soluble in groundwater, they are more mobile than metals and can volatilize and be degraded by soil microorganisms under natural or enhanced biodegradation conditions.

2.5 HUMAN HEALTH RISK ASSESSMENT

The purpose of the HHRA is to conservatively estimate potential risks to human receptors from exposure to specific chemicals present in RES soil and in groundwater at the Site. A two-step HHRA was conducted for the Site, identifying site contaminants, exposure pathways based on most probable future land uses, and risks posed to potential receptors.

Because not all portions of the RES have been investigated to the same level of sampling, the HHRA was conducted in two steps: (1) Step 1 of the HHRA evaluated chemical concentrations in RES soil and site-wide groundwater against human health screening criteria, and (2) Step 2 of the HHRA was a quantitative, focused HHRA of only those areas in the RES for which available soil data are sufficient to conduct a risk assessment.

2.5.1 Identification of Datasets and Chemicals of Potential Concern

The process of identifying COPCs for Steps 1 and 2 of the HHRA included determinations of: (1) occurrence and distribution of chemicals in the environmental media, and (2) chemical toxicities.

Step 1 of the HHRA evaluated concentrations of chemicals (obtained via sampling) from the entire Site dataset within the RES. Results of historical sampling, in addition to those from samples collected during the more recent FSW Phases I, II, and III investigations, were included in Step 1 to update the evaluation of site data in the CCR with an evaluation based on the new screening criteria (commercial risk-based concentrations) developed in the SCR.

Soil data used in the HHRA were limited to data collected under either the RWQCB or DTSC oversight, as the quality of these data is known. Soil sample collection dates range from June 2, 1990, through October 19, 2012. Data points that represent soils that were previously excavated were not used, as the soil was removed from the Site. Confirmation sampling data and field duplicate samples were included, but waste characterization, composite sample data, ISM sample data, and data associated with removed USTs were excluded.

Groundwater data used in the HHRA were limited to data collected since September 2010 from the 50 shallow and 4 deep piezometers installed under DTSC oversight within the FSW Investigation, as well as grab groundwater data obtained as part of the FSW; historical grab groundwater data were excluded from the assessment. The FSW groundwater data provide a more comprehensive understanding of the groundwater at the Site, spatially and temporally. Field duplicate samples were also excluded. Groundwater was originally collected from the FSW piezometers at two different times of the year, but as it was determined that a seasonal variation in contaminant concentrations was not occurring, annual groundwater monitoring is now being conducted.

All chemicals detected in soil and groundwater were considered as COPCs in Step 1 of the HHRA.

All soil data evaluated under Step 1 were considered for inclusion in Step 2 of the HHRA. Groundwater data were not evaluated in Step 2 of the HHRA because it was addressed in a piezometer-by-piezometer evaluation under Step 1. After a review of RES soil data, two areas qualified for inclusion into Step 2 of the HHRA as a result of their comprehensive characterization data: (1) the MFA (inclusive of Building 128 and nearby sample locations), and (2) the Corporation Yard. All chemicals detected in soil were considered as COPCs in Step 2 of the HHRA.

The following chemicals exceeded the commercial risk-based concentration, background level (arsenic or BAP [EQ] only), or TSCA high occupancy without further conditions criterion (PCBs only) in soil based on the screening in HHRA Step 1:

- Metals: Arsenic, lead, mercury (total), and thallium (one sample)
- SVOCs: BAP (EQ)
- Pesticides: Chlordane (one sample)
- Dioxins: Dioxin TEQ
- PCBs: Aroclor-1248, -1254, and -1260

Concentrations of arsenic, BAP (EQ), and Aroclor-1254 exceeded the commercial risk-based concentrations or background levels by more than two orders of magnitude (regarded as significant exceedances).

Concentrations of carbon tetrachloride and TCE exceeded the commercial vapor-intrusion risk-based concentration in groundwater at the Site based on the HHRA Step 1 screening in multiple samples at multiple locations.

2.5.2 Exposure Assessment

An exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposure to a chemical in the environment. An exposure assessment consists of: (1) characterization of the exposure setting, (2) identification of exposure pathways, and (3) quantification of pathway-specific exposures.

The anticipated future use of the RES assumes development or redevelopment of significant portions for commercial activities. A LUC prohibiting use of the site for residential development and sensitive uses (day care, hospital, or K-12 school) is expected to be implemented as part of the RAW, thus eliminating the potential for long-term exposure to residents and children. Future potential receptors, expected to be limited, include (1) future commercial workers, (2) future construction workers, (3) future maintenance workers, and (4) on-site visitors and off-site receptors (via the inhalation pathway only).

The potential exposure pathways quantitatively or qualitatively evaluated for soil include: (1) incidental ingestion of soil, (2) dermal contact with soil, and (3) inhalation of chemicals released to outdoor air from wind erosion and volatilization. Three potentially complete exposure pathways for groundwater were identified: (1) inhalation of volatile chemicals that may have migrated from groundwater into indoor air, if the groundwater contamination plume is within 100 feet of a current or future occupied building, (2) inhalation of volatile chemicals migrating from groundwater into air in a construction trench, and (3) dermal contact with groundwater in a construction trench. For each medium and pathway cited above, risk-based concentrations were developed.

In Step 1 of the HHRA, all chemicals in each sample within the RES were compared with:

- Soil commercial risk-based concentrations;
- Groundwater commercial (vapor intrusion) risk-based concentrations;
- TSCA criterion for high occupancy areas without cap and with cap (PCBs only) (EPA 2005);
- Background levels for arsenic (Erler & Kalinowski, Inc. 2007; DTSC 2007b), and
- Ambient levels for BAP (EQ) (DTSC 2009b; Environ Corporation and others 2002).

The Step 1 point-by-point evaluation also identifies significant exceedances of the human health screening criteria (significant exceedances were defined as an exceedance 100 times greater than the criterion). Step 1 terminates at this step.

In Step 2 of the HHRA, two sets of exposure point concentrations (EPC) were calculated to evaluate exposures to soils at the MFA and the Corporation Yard. The EPCs were calculated as the 95th percentile Upper Confidence Limit (UCL) of the arithmetic mean using EPA's ProUCL Version 4.1.00 statistical software package (EPA 2010). A 95th percentile UCL was not developed for constituents with less than six detected results and the maximum detected concentration was used as the EPC. If the 95th percentile UCL was found to be higher than the maximum detected concentration, the maximum value was used at the EPC.

2.5.3 Toxicity Assessment

The toxicity assessment describes the relationship between a dose of a chemical and the potential likelihood of an adverse health effect. It identifies toxicity criteria used to evaluate risk to receptors. Sources used to obtain toxicity criteria follow the hierarchy outlined in EPA (EPA 2003), except that State of California toxicity criteria, when available, were used preferentially over federal criteria if the State of California criteria were determined more conservative.

Chemical surrogates were used in the HHRA because toxicity criteria and subsequent risk-based concentrations were not available for some COPCs. Chemical surrogates were selected based on structural similarity, chemical activity, and mechanisms of toxicity. Risks from exposure to lead were characterized by comparing the EPC with the Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA) industrial and residential California human health screening levels (80 and 320 mg/kg, respectively) (Cal/EPA OEHHA 2009).

2.5.4 Risk Characterization

The risk characterization component of the HHRA involves comparing EPCs with risk-based concentrations (which include assumptions regarding daily intakes and chemical-specific toxicity criteria) to assess potential for health risks associated with exposure to COPCs. The risk characterization step was conducted to quantify risk estimates in Step 2 of the HHRA.

Quantitative assessments of risk regarding soil at the MFA and the Corporation Yard were conducted in Step 2 of the HHRA. The total cancer risk estimates for both the MFA and the Corporation Yard were greater than 1E-06 for all future receptors. The total noncancer hazard indices (HI) were greater than 1 for all receptors except the future maintenance worker, which had an HI less than 1. COCs for one or more receptors at the MFA or the Corporation Yard included the following: arsenic, lead, mercury, Aroclor-1248, Aroclor-1254, Aroclor-1260, BAP (EQ), chlordane, and Dioxin TEQ.

2.6 Ecological Evaluation

The RES is primarily covered by buildings, parking lots, landscaped vegetation, or open spaces covered with non-native grasses that do not currently provide quality habitat for ecological receptors. However, the RES includes an old grove of eucalyptus trees planted by the CCC that provides roosting and breeding habitat for tree-nesting raptor species and monarch butterflies. Buildings may also provide roosting habitat for bats. In addition, west of Building 280B, the RES includes a meadow containing a high density of native grasses and seasonal wet meadows that serves as native habitat for ecological receptors. Proposed future commercial land use for the RES is not likely to provide ecological habitat. Within the RES, pathways to upland ecological receptors are generally limited (Tetra Tech 2013).

The LRDP EIR addresses mitigation measures for protected ecological resources during future demolition or construction projects. Any activities conducted under the RAW are subject to mitigation measures to be approved in the Final EIR, as discussed in Section 6.0.

The majority of the coastal terrace prairie and the entirety of the salt marsh at the Site are within what the RBC LRDP identifies as the NOS of the RBC and is not included in the RES (Figure 1-3). The existing requirements of the RFS Site Investigation and Remediation Order provide for an ecological assessment of the NOS, inclusive of all media: soil, sediment, surface water, and groundwater, following which action necessary to address levels of any contaminants that might be found not to be protective of ecological receptors will be conducted.

Any area within the RES currently serving as habitat (Figure 1-3) remains subject to consideration for an ecological risk assessment unless and until a development schedule is defined for that area, at which point it will become subject to the RES requirements.

2.7 SCR Conclusions and Transition to RAW

The SCR concluded that an evaluation of final remedy in the RAW for the RES should incorporate the following recommendations:

- **Soil Recommendation No. 1.** The MFA, Corporation Yard, Building 112 transformer area, and Building 150 transformer area should be evaluated for final remedy.
  - The nature and extent and risk evaluations for the MFA indicate that soils with elevated concentrations of arsenic, mercury, and PCBs are present, which may pose unacceptable risk to future commercial receptors under very specific conservative exposure scenarios.
  - The nature and extent and risk evaluations for the Corporation Yard indicate that soils with elevated concentrations of arsenic, PCBs, BAP (EQ), and dioxin are present, which may pose unacceptable risk to future commercial receptors under very specific conservative exposure scenarios.
  - Comparison of concentrations of PCBs in soil with TSCA criteria indicates that soils with elevated concentrations of PCBs are present at Building 112 and Building 150 transformer areas.

  These areas should be evaluated for removal action alternatives, such as removal, treatment, capping, or management alternatives, to reduce or eliminate risks to possible future exposures. Elevated arsenic concentrations are likely associated with cinders, which are recommended to be managed under a cinders management plan.

- **Soil Recommendation No. 2.** In the remainder of the RES, the nature and extent and risk evaluations indicate that elevated concentrations of arsenic, lead, BAP (EQ), and PCBs are present sporadically across the RES, and that these areas do not pose significant risk to future receptors. Elevated arsenic and lead concentrations are likely associated with cinders, which are recommended to be managed in place under a SMP, consistent with the current interim cinders management plan.

- **Groundwater Recommendation No. 1.** Carbon tetrachloride detections in groundwater near Building 280B should be evaluated for final remedy.

- **Groundwater Recommendation No. 2.** TCE-impacted groundwater at the Site originating from the former Zeneca site should be subject to the Zeneca Order, and investigation, remediation, and monitoring activities should be addressed under that Order.

- **Groundwater Recommendation No. 3.** The remainder of groundwater at the Site will continue to be monitored under the on-going groundwater monitoring program (Tetra Tech 2012).

2.7.1 RAW Evaluation of SCR Soil Recommendations

The RAW evaluated the conclusions of the SCR to develop remedial goals and to define COCs and geographic areas requiring remedial action. In order to identify contaminated areas and develop cleanup technologies for soil, Figure 2-8 was developed using the same dataset as was evaluated in the HHRA, which identifies the soil sampling locations with chemical exceedances of commercial worker risk-based concentrations or background, and total PCB concentrations greater than the TSCA high occupancy without further conditions threshold criterion (1 mg/kg). Figure 2-8 shows concentrated areas of exceedances in the PCB areas, the MFA, the Corporation Yard, and sporadic exceedances in the remainder of the RES. Because each of these geographic areas is distinct, they will be evaluated separately, including identification of COCs and alternative analysis, with the exception of the PCB areas, which will be evaluated together. The remainder of the RES constitutes a fourth geographic area to be evaluated separately.

COCs for soil requiring evaluation in this RAW for each of the four geographic soil areas are presented below:

1. PCB Areas and Known PCB Areas:
    a. COC: PCBs
    b. Rationale: Potential future exposure to PBCs at total PCB concentrations greater than the TSCA high occupancy without further conditions threshold of 1 mg/kg (without cap)
    c. Based on limited alternative options for PCB remediation, total PCB concentrations greater than 1 mg/kg in soil will be excavated and disposed of at an off-site disposal facility. Excavation will be recommended and no additional alternatives evaluation will be conducted for PCBs.
2. MFA
    a. Commercial COCs: mercury, cinders-related metals (arsenic and lead), and PCBs (in transformer area only)
    b. Rationale: Source removal of mercury and potential future exposure to cinders (PCBs are addressed as part of remediation in the Building 112 transformer area)
3. Corporation Yard
    a. Commercial COCs: cinders-related metals (arsenic and lead), PCBs, BAP (EQ), and dioxin
    b. Rationale: Potential future exposure to COCs (PCBs are addressed as part of PCB remediation in the Corporation Yard)
4. Remainder of the RES
    a. Commercial COCs: mercury, cinders-related metals (arsenic and lead), PCBs, BAP (EQ), and dioxin
    b. Rationale: Potential future exposure to known and not previously identified COCs

2.7.2 RAW Evaluation of SCR Groundwater Recommendations

In order to identify contaminated areas and develop cleanup technologies for groundwater, Figure 2-9 identifies groundwater sampling locations with chemical exceedances of the commercial risk-based concentrations for vapor intrusion, which has been identified as the primary pathway of concern. Figure 2-9 shows areas of elevated carbon tetrachloride and TCE concentrations in groundwater. These two groundwater contaminants are addressed separately. The remainder of groundwater at the Site will continue to be monitored under the existing groundwater monitoring program (Tetra Tech 2012) and does not require a remedy evaluation.

COCs requiring remediation and the rationale for remediation for the two geographic groundwater areas are presented below:

1. Carbon Tetrachloride Area:
   a. COC: Carbon tetrachloride
   b. Rationale: Source identification and control or monitoring of carbon tetrachloride and reduction of potential future vapor intrusion exposure. The identification of a contaminant soil source for the impacted groundwater will be addressed in the NOS investigations. Based on groundwater flow direction being from the northeast to southwest, a soil source is likely in the vicinity or northeast of piezometer CTP, located in the NOS.
2. TCE Areas:
   a. COC: TCE
   b. Rationale: Contaminants in groundwater originating from the former Zeneca Site, including TCE and its breakdown components, are subject to the Zeneca Order. The remediation of TCE-impacted groundwater must meet the groundwater RAOs developed in this RAW.

3.0 REMOVAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS, AND APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Following DTSC RAW guidance (DTSC 1998), this section identifies RAOs for contaminated soil within the RES and groundwater, presents a range of general response actions (GRA) and technologies that will satisfy the goal of protecting human health, develops alternatives for the RES and groundwater in the Carbon Tetrachloride Area, and identifies applicable or relevant and appropriate requirements (ARAR). Contaminants in groundwater originating from the former Zeneca Site, including TCE and its breakdown components, are subject to the Zeneca Order. Alternatives will not be evaluated for PCB-impacted soil. PCB-impacted soil with total PCB concentrations greater than 1 mg/kg will be excavated and disposed of offsite.

3.1 REMOVAL ACTION OBJECTIVES AND REMEDIAL GOALS

RAOs are medium-specific goals for protecting human health and the environment. An RAO should specify (1) the COCs, (2) the exposure route and receptors, and (3) an acceptable chemical concentration or range of concentrations for each exposure route, also known as a remedial goal. RAOs include both an exposure pathway and a chemical concentration in a given medium because protectiveness may be achieved in two ways: limiting or eliminating the exposure pathway, or reducing chemical concentrations.

The 2006 RFS Site Investigation and Remediation Order identified the following remedial action objective for the Site:

> “The reasonably foreseeable future land use of the Site is commercial/educational and open space. Therefore, remedial action objectives for contaminated media shall be developed that are protective of adults and children in a commercial/education scenario and as recreational users of open space.”

The development plan for the RES in the LRDP indicates that potential future users are primarily future commercial workers, construction workers, and maintenance workers. Future receptors may also include recreational users and children visiting the site during field trips, as well as off-site receptors, who may be exposed to COCs via inhalation and wind dispersion. The commercial worker exposure pathway evaluated in the HHRA is overly protective of occasional visitors to the site, including recreational users and children visiting the facility during supervised field trips. Therefore, recreational users and children are included as potential future users under the commercial worker exposure pathway. Exposure to commercial workers, construction workers, maintenance workers, and off-site receptors will be explicitly considered when selecting a remedial goal.

3.1.1 Remedial Action Objectives

The following RAOs for the RES and Site-wide groundwater were developed to protect human health based on the COCs and future receptors for each geographic soil and groundwater area.

1. For future projects within the RES, (a) prevent exposure of commercial workers, maintenance workers, and construction workers via dermal contact with, and incidental ingestion and inhalation of, soil containing chemical concentrations greater than the receptor-appropriate remedial goals, and (b) prevent exposure of off-site receptors via inhalation of soil containing chemical concentrations greater than the remedial goal for off-site receptors. For each project, the exposure pathways for each receptor will be evaluated, and the applicable remedial goals for each potential receptor will be considered (Table 3-1). For instance, if it is known that soil within the project area will be excavated in preparation for a future building, the construction worker goal will be considered in addition to the commercial worker and off-site receptor goals. In this case, the lower of the three remedial goals will be selected, or appropriate mitigation measures will be used to protect the receptor with a remedial goal lower than that selected, such as requiring all construction workers to be 40-hour HAZWOPER trained.

2. For the MFA and Corporation Yard, (a) prevent exposure of current maintenance and construction workers and future commercial workers, maintenance workers, and construction workers via dermal contact with, and incidental ingestion and inhalation of, soil containing mercury, arsenic, lead, BAP (EQ), and dioxin concentrations greater than the RAW remedial goals, and (b) prevent exposure of current and future off-site receptors via inhalation of soil containing mercury, arsenic, lead, BAP (EQ), and dioxin concentrations greater than the RAW remedial goals. Since there are no utility corridors proposed or imminent future construction activities, the construction worker or maintenance worker risk-based concentrations need not be considered for the remedial goals. Therefore, the lower of the commercial worker and off-site receptor inhalation risk-based concentration is the appropriate remedial goal for these areas, except where a background or ambient value is available (arsenic and BAP [EQ]). In the event of future maintenance activities or new projects identified at the MFA or Corporation Yard, then maintenance and construction worker remedial goals will be evaluated.

3. For PCB Areas, prevent exposure of (a) current maintenance and construction workers and future commercial, maintenance, and construction workers via dermal contact with, and incidental ingestion and inhalation of, soil containing total PCB concentrations greater than the remedial goals; and (b) prevent exposure of off-site receptors via inhalation of soil containing chemical concentrations greater than the remedial goal. The TSCA threshold for high occupancy areas without further conditions of 1 mg/kg is the appropriate remedial goal for PCBs for all receptors.

4. Site-wide, prevent exposure of current maintenance workers, construction workers, and off-site receptors, and future commercial workers, maintenance workers, and construction workers, and off-site receptors via inhalation of unsafe vapors from groundwater containing carbon tetrachloride or TCE.

Based on the above RAOs and the COCs identified in the HHRA, the RAW remedial goals for COCs in the MFA, PCB Areas, and Corporation Yard are presented in Table 3-2.

3.1.2 Remedial Goals for Soil

Remedial goals for soil will be selected for each project in order to incorporate project design, data evaluation, and other site-specific information, following collection of soil data. Cleanup and management to meet remedial goals will ensure compliance with RAOs. Remedial goals will be selected from a list of criteria, consisting of risk-based concentrations for commercial workers, construction workers, maintenance workers, and off-site receptors, background and ambient levels, and regulatory criteria. Table 3-1 presents the remedial goals developed for Site soils.

Regardless of the remedial goal selected, all potential receptors will be protected against unacceptable exposures. Risk-based criteria are receptor-specific; therefore, if the remedial goal selected does not protect a specific receptor, then other management or mitigation measures will be required (such as requiring all workers to be 40-hr Hazardous Waste Operations and Emergency Response [HAZWOPER] trained).

Remedial goals may be selected for specific exposures or soil depths. For example, a less stringent remedial goal may be selected for soils present below 2 feet of soil or other hardscaped area, where exposure pathways for all receptors are incomplete.

Category I and II Criteria

For future remedial actions in the RES, implemented using the SMP (Attachment C of this RAW), Category I and II criteria have been established for all chemicals detected at the Site to ensure protection of future receptors to surface and subsurface soils (Table 3-1); these criteria may be selected as remedial goals. Soil with concentrations less than Category I criteria do not pose unacceptable risk to any potential future human receptors. Soil with concentrations greater than Category I but less than Category II criteria indicate that direct exposure to future human receptors may pose unacceptable risk, and therefore the soil must not be accessible by future human receptors.

Category I criteria represent the most protective risk-based concentration (or background, ambient, or regulatory criteria, if available) for potential future human receptors at RBC. If all soil concentrations for a given project are below Category I criteria, then no further action is required and the identification of remedial goals for a project is not necessary. If a Category I criterion is selected as the remedial goal for a cleanup action, and soil concentrations following cleanup actions meet all Category I remedial goals, then no further action is required. Category I criteria are presented in Table 3-1.

Category II criteria represent acceptable soil concentrations which may remain in place, or be managed at depth or below hardscape (Table 3-1). Category II criteria values are based on 10 times the Category I criteria, with some exceptions, as presented in Table 3-1. Category II criteria may be selected as remedial goals as long as the soils are managed at depth or beneath hardscape features. If a Category II criterion is selected as the remedial goal, then specific soil management measures and protocols ensuring no future unacceptable exposures to chemicals will be implemented, such as a restriction to prevent breeching the hardscape surface. Soil containing concentrations of chemicals higher than Category II criteria may not remain in place, including at depth, and will be disposed of off-site. Category II criteria are presented in Table 3-1.

The selection of remedial goals and deviations from the selection process described above must be approved by DTSC.

3.1.3 Remedial Goals for Site-wide Groundwater

Remedial goals for groundwater will act as screening criteria to determine if further evaluation is necessary; remedial goals are equal to the risk-based concentrations for commercial workers exposed to groundwater via vapor intrusion to indoor air. Remedial goals were developed for carbon tetrachloride and TCE only. If remedial goals for carbon tetrachloride and TCE are exceeded, UC will conduct a soil gas investigation in the vicinity of the piezometer where the goal was exceeded to evaluate risk to potential receptors. Soil gas results will be evaluated according to DTSC and EPA guidance documents (DTSC 1994, 2011, 2013; EPA 2014). Soil gas screening criteria to be presented in the proposed remedy for the adjacent former Zeneca site will also be considered when evaluating contaminants originating from the former Zeneca site. DTSC will be consulted during the evaluation and UC will proceed with appropriate actions to protect all potential receptors. Groundwater remedial goals for carbon tetrachloride and TCE are presented in Table 3-3.

3.2 General Response Actions

Following DTSC RAW guidance (DTSC 1998), this section presents an initial screening of cleanup technologies, based on effectiveness, implementability, and cost, that identifies potentially applicable remedial technology types and specific process options by environmental medium. The remedial technology types and specific process options that pass this initial screening are assembled into medium-specific alternatives for detailed and comparative analyses. The following subsections describe the GRAs and the evaluation criteria.

3.2.1 No Action

Under the no-action GRA, no remedial measures will be taken. As discussed in Section 1.1.1, this RAW also meets the required elements of a RAP, including that the no-action GRA be carried through the detailed comparative analysis of the alternatives. No remedial action would take place under the no-action GRA; therefore, no institutional controls (IC), engineering controls (EC), containment, removal, treatment, or any other mitigating actions would be implemented.

3.2.2 Land Use Controls

LUCs are tools and mechanisms applied to implement restrictions at a site. LUCs encompass both institutional and engineering controls, as discussed below.

Institutional Controls (IC) are legal or administrative measures that influence human behavior through land use zoning, regulatory reports and agreements, permits, warnings, and advisories.

ICs manage risk associated with contaminated media exposure by limiting the potential for direct contact with the medium. ICs do not reduce the toxicity, mobility, or volume of hazardous substances in soil or groundwater, but they provide a means by which risk is reduced or eliminated by “breaking” the exposure pathway, which is acceptable.

ICs are legal and administrative mechanisms used to implement land use and access restrictions to limit the exposure of potential receptors to hazardous substances and to maintain the integrity of the remedial action until remediation is complete and remedial goals have been achieved. Monitoring and inspections are conducted to ensure the land use restrictions are being followed. Legal mechanisms include negative easements, restrictive covenants, equitable servitudes, and deed restrictions. Administrative mechanisms include deed notices, adopted local land use plans and ordinances, construction permitting, or other existing land use management systems that may be used to ensure compliance with use restrictions. Often ICs are more effective if they are layered or implemented in series. Layering means using different categories of ICs concurrently to enhance the protectiveness of the remedy. Implementation of ICs in series may be applied to ensure both the short- and long-term effectiveness of the remedy. As a single remedy, ICs are typically implemented as a long-term approach.

Engineering Controls (EC) are tangible measures that prevent exposure by physically preventing humans, wildlife, or media from coming into contact with contaminated media left on site. Common examples of engineering controls include designed soil caps, geotextile barriers, fencing and signage, personal protective equipment (PPE), surface water and soil vapor monitoring, and existing buildings or asphalt cover.

Typically, ECs are used in conjunction with some form of ICs to ensure proper monitoring and maintenance of the EC. The purpose of an exposure prevention barrier is to break a complete exposure pathway to a human receptor. Exposure prevention barriers can be applied at a site where the nature and extent of the contamination are such that a fully engineered and maintained containment system—such as that required at landfills—is not warranted. The components of exposure prevention barriers include existing or new building foundations and floors, parking lots, sidewalks, other paved areas, vapor barriers, subsurface vapor control systems, and landscaped areas. ICs would be required to maintain exposure prevention control and to allow for appropriate precautions to be taken should the need to penetrate the exposure prevention barrier be required (such as utility repair).

Health and safety protocols, such as the availability and use of proper PPE to prevent dermal and inhalation exposure to contaminants that might be encountered during construction activities, can also be a component of ECs.

3.2.3 Active Remediation

Active remediation consists of engineering processes that minimize or eliminate the potential exposures of receptors to contamination by removing or containing contaminated media, or reducing toxicity, volume, or mobility through natural attenuation or treatment. Active remediation technologies can be categorized into three groups: (1) removal, (2) containment, or (3) treatment. Treatment technologies are further categorized based on where the treatment occurs: (1) in-situ technologies, where the waste is treated on site where it is located (such as in the ground); (2) ex-situ technologies, where the waste is treated on site but at a location other than where the waste was originally located; and (3) off-site, at a permitted facility.

3.2.4 Monitoring

Monitoring is the collection and analysis of data (chemical, physical, or biological) over a sufficient period of time and frequency to determine the status and/or trend in one or more environmental parameters or characteristics (EPA 2004). Many types of monitoring may be conducted at a site, such as detection monitoring, compliance monitoring, and remedial monitoring.

The effectiveness of groundwater treatment technologies is often evaluated based on the results of groundwater monitoring samples. Groundwater monitoring plans typically recommend that several rounds of sampling be conducted over a period of at least one year to evaluate treatment effectiveness and document that no contaminant rebound has occurred. Results obtained during performance monitoring are valuable confirmation of the success of treatment technologies.

3.2.5 Screening of Technologies

Per DTSC RAW Guidance (DTSC 1998), the soil and groundwater technologies are evaluated against three criteria: effectiveness, implementability, and cost. This RAW also satisfies the evaluation criteria requirements specified in DTSC guidance for the preparation of a RAP, including California HSC section 25356.1(d) which requires that RAPs be based on the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The NCP identifies nine criteria, or standards, to evaluate alternatives for cleaning up a hazardous substance release site. The RAW evaluation criteria are described below and listed in Table 3-4 with a comparison to the nine evaluation criteria used in a feasibility study or RAP.

Effectiveness: Effectiveness is the ability of a remedial technology or alternative to achieve the RAO within a reasonable timeframe. The key aspects of the effectiveness criterion include:

- The overall protection of human health and the environment.
- The degree to which the response action complies with ARARs established for the Site.
- The short-term effects of the response action alternative on human health and the environment during implementation. This would include the impacts to nearby communities, site workers, and the surrounding environment. This would also include the time required until the alternatives are implemented.
- The long-term effectiveness of managing the residual risk remaining from any remaining contamination and the adequacy and reliability of controls used to manage the treated residuals or untreated contaminated media.
- The degree to which the response action reduces the toxicity, mobility, and/or volume of the hazardous substance or contaminated media.

Implementability: The evaluation of implementability encompasses both the technical and the administrative feasibility of implementing a remedial technology or alternative. Technical feasibility includes compatibility with site-specific conditions; the availability of equipment; the ease of constructing the remediation system; the labor intensiveness required by the system; and the availability of vendors that have the capability to design, construct, and maintain the system. Administrative feasibility includes the ease of obtaining approvals from other offices and agencies, the requirements for specific equipment and technical specialists, and the degree of community acceptance.

Cost: The evaluation of cost addresses direct and indirect capital costs and annual operation and maintenance (O&M) costs. The relative cost for each technology or alternative is described qualitatively as low, moderate, or high. The cost ranges are based on a review of the literature, vendor quotations, professional or engineering judgment, or data prepared for other studies. The costs associated with each of the alternatives does not take into account economies of scale that may be realized when implementation of activities may occur consecutively, but are calculated in a manner such that the alternatives could be compared to each other.

The GRA screening for soil and groundwater are presented in Tables 3-5 and 3-6, respectively.

3.3 REMOVAL ACTION ALTERNATIVES

Based on the technology evaluation presented in Table 3-5, LUC, containment, and removal GRAs were retained for development of soil alternatives. Treatment GRAs for soil were not considered for further evaluation because they have limited effectiveness and were deemed time and cost prohibitive. From the retained GRAs, soil alternatives identified ranged from no action (least protective) to an unrestricted use scenario. These alternatives were selected based on: (1) the lack of hazard or risk to current workers or other receptors at the Site; (2) the proposed commercial use presented in the LRDP; and (3) the evaluation of GRAs. The technology evaluation presented in Table 3-6 limited the GRAs retained for development of groundwater alternatives to LUCs, monitoring, and three treatment GRAs because they were deemed most effective for source reduction. The alternatives proposed for soil and groundwater are summarized in Table 3-7 and presented in detail below. A range of alternatives is not required for the PCB contamination because this soil is proposed for excavation and off-site disposal, as discussed in Section 2.7.3.

3.3.1 Soil Alternatives

Five soil alternatives were identified as a result of the technology screening, including the no-action alternative. Three excavation and disposal alternatives were developed for the MFA, Corporation Yard, and remainder of the RES. One additional capping alternative is included for evaluation at the MFA only. The alternatives are described in detail below.

Alternative S-1, No Action: DTSC guidance requires that the no-action alternative be carried through the detailed analysis of alternatives. Under the no-action alternative, no response actions are taken at the site. Soil would be left in place without implementing any LUCs, containment, removal, treatment, or any other mitigating actions. This alternative provides the least environmental protections.

Alternative S-2, Excavation to Unrestricted Reuse and Off-site Disposal: Alternative S-2 involves the excavation of all pyrite cinders and soil in the RES containing chemicals at concentrations greater than unrestricted risk-based concentrations and disposal at an off-site permitted disposal facility. Excavation would be achieved using conventional excavation equipment such as backhoes and front-end loaders. Site preparation activities, such as clearing utilities, and vegetation clearing and grubbing, would be conducted. Excavation depths would not exceed the depth of the top of groundwater. Decontamination facilities for equipment and personnel would be located at a centralized decontamination area. Off-site disposal of soil includes transportation and disposal of contaminated soil at an appropriately permitted landfill facility based on waste characterization sampling results. DTSC-approved clean soil currently stockpiled in the RES would be placed and compacted as backfill in each excavation. If additional backfill is required, imported clean soil with concentrations less than the Category I criteria and meeting DTSC Information Advisory, Clean Imported Fill Material requirements (DTSC 2001) will be used. Important considerations with excavation and disposal include excavation volume, fugitive emissions, hauling distance, and the type of treatment and disposal facility available for final disposition. This alternative provides for the most conservative environmental protections in the event of the property being considered for unrestricted use.

Alternative S-3, Excavation to Commercial Reuse, Off-site Disposal, LUCs, and SMP: Alternative S-3 involves the excavation of soil containing COCs at concentrations greater than remedial goals and disposal at an off-site permitted disposal facility. The excavation to commercial reuse alternative also incorporates Category I and II criteria as remedial goals for the management of soil not accessible under the commercial worker exposure scenario. Cinders encountered within excavation boundaries would be excavated and disposed of offsite. Cinders encountered beyond excavation boundaries would be managed in place consistent with current cinder management practices (see Section 5.1.2). Excavation would be achieved using conventional excavation equipment such as backhoes and front-end loaders. Site preparation activities, such as clearing utilities, and vegetation clearing and grubbing, would be conducted. Excavation depths would not exceed the depth of the top of groundwater. Decontamination facilities for equipment and personnel would be located at a centralized decontamination area. Off-site disposal of soil includes transportation and disposal of contaminated soil at an appropriately permitted landfill facility based on waste characterization sampling results. DTSC-approved clean soil currently stockpiled in the RES, or imported soil with concentrations meeting DTSC Information Advisory, Clean Imported Fill Material requirements (DTSC 2001), would be placed and compacted as backfill in each excavation. LUCs related to soil are required to restrict residential development and are described below.

(1) A deed restriction would be recorded to prohibit residential use consisting of a residence, mobile home, or factory-built housing constructed or installed for use as residential human habitation. In addition, certain commercial uses defined as “sensitive uses” will also be prohibited. Sensitive uses consist of (a) a hospital for humans, (b) a public or private school for persons less than 18 years of age, (c) a day care center for children, or (d) any permanently occupied habitation other than those used for industrial purposes. If future redevelopment conditions warrant, UC may apply at a later time to remove a restriction or apply for a variance from the restriction.

(2) 5-year reviews and reporting would be conducted to ensure the continued effectiveness of the LUCs, specifically compliance with the deed restrictions.

A SMP would be implemented to support the LUCs by providing a framework to prohibit uncontrolled land excavation or disturbance activities which may expose workers or visitors to unsafe environmental contaminants. The SMP ensures that soils disturbed during future construction or redevelopment projects will be sampled and managed to ensure no uncontrolled exposures to unknown or unidentified contaminants within the RES occur. The SMP will be implemented for all future projects impacting subsurface soils; the SMP is intended to meet the requirement of excavation to commercial reuse for future projects based on adherence to the Category I and II screening criteria.

The SMP prescribes protocols for DTSC notification; soil sampling, data analyses, soil management or disposal practices; and final reporting. Soil sampling is based on prescribed sampling frequency, depths, and chemicals which are determined based on the size and location of the proposed construction or maintenance project. Soil management and disposal practices are based on comparison of soil sample results to Category I and II screening criteria, and final reporting is conducted through submittal of a completion report once the individual project has been completed.

Alternative S-4, LUCs: Alternative S-4 involves LUCs that restrict use of the property to prohibit activities that could result in human exposure to contaminated soil, groundwater, or vapors underlying the RES. The LUCs would be composed of the ICs summarized in Alternative S-3. Under this alternative, soil would be left in place without implementing any containment, removal, or treatment actions.

Alternative S-5, Asphalt Cap, LUCs, and SMP (MFA only): Alternative S-5 involves construction of a single-layer asphalt cap over the areas containing mercury at concentrations greater than the remedial goal; Alternative S-5 is only evaluated for the MFA. Site preparation activities, such as clearing utilities, vegetation clearing and grubbing, and grading, would be conducted. The asphalt cap would consist of a subbase preparation layer and a 6-inch layer of asphalt. The asphalt cap would prevent direct contact exposure to contaminated soil, and restrict the potential migration of contaminants through the action of wind erosion and surface run-off. Alternative S-5 would require LUCs consistent with those described in Alternative S-3 to restrict residential development at the Site and additional monitoring and maintenance to ensure the integrity of the cap is not breached. Alternative S-5 would include the implementation of an SMP as described under Alternative S-3.

3.3.2 Groundwater Alternatives

Carbon tetrachloride and TCE have been identified as COCs in groundwater at the Site. The remedy for contaminants in groundwater originating from the former Zeneca Site, including TCE and its breakdown components, is subject to the Zeneca Order, and will meet the RAOs identified for groundwater at the Site. Groundwater concentrations in areas outside of the carbon tetrachloride and TCE-impacted areas do not exceed vapor intrusion risk-based concentrations and, therefore, do not require additional evaluation within this RAW; however, site-wide groundwater will continue to be monitored under the proposed groundwater monitoring program (Tetra Tech 2012). The purpose of the groundwater monitoring is to provide yearly reviews of current conditions to allow for evaluation of new or changing concentrations, and permit inclusion of new monitoring wells if necessary, or increased remedial monitoring or actions if necessary. If future groundwater monitoring results were to indicate a need for additional sampling or remedial action in the future, the groundwater remedy does not preclude more active remediation. In addition, FSW Phases IV and V will evaluate risk to ecological receptors; if it is found that groundwater concentrations pose risk to aquatic receptors, remedial action may be warranted in addition to actions proposed within this RAW.

The Carbon Tetrachloride Area is predominantly within the NOS, which has been identified as a natural area that UC plans to protect from development and maintain in its natural condition. Future construction of buildings over the plume is not planned to occur within the NOS. Groundwater flows from northeast to southwest in the vicinity of the Carbon Tetrachloride Area. Current groundwater concentrations of carbon tetrachloride and its degradation daughter products (chloroform, dichloromethane, and chloromethane) in the RES downgradient of the Carbon Tetrachloride Area are below VI risk-based concentrations, and therefore, do not pose a current risk. Building 280B, located cross-gradient of the Carbon Tetrachloride Area, is an abandoned building with no current or planned future tenants. The alternatives evaluated in the following subsections address the potential future vapor intrusion pathway for existing Building 280A and potential future construction in the RES downgradient of the Carbon Tetrachloride Area.

The identification of a contaminant soil source for the impacted groundwater will be addressed as a part of the NOS investigation during Phase IV field activities.

The following four alternatives were developed for the Carbon Tetrachloride Area:

Alternative GW-1, No Action: DTSC guidance requires that the no-action alternative be carried through the detailed analysis of alternatives. Under the no-action alternative, no response actions will be taken at the site. Groundwater would be left in place without implementing any LUCs, containment, removal, treatment, or any other mitigating actions.

Alternative GW-2, Permeable Reactive Barrier, LUCs, and Groundwater Monitoring: A funnel and gate permeable reactive barrier (PRB) would be designed to treat carbon tetrachloride in groundwater as the groundwater moves through the PRB. A 120-foot PRB would be installed between two sets of 100-foot sheet-piling funnel. The PRB is estimated to be a 2-foot-wide treatment zone consisting of zero-valent iron (ZVI). Pilot or treatability studies, including soil sampling, would be conducted to ensure proper design parameters and confirm the radius of impacted groundwater prior to implementation of final remedy. LUCs would consist of a deed restriction and 5-year reporting. A deed restriction would be recorded to (1) prohibit beneficial use of groundwater; and (2) prohibit groundwater extraction, except for dewatering and/or treatment purposes (extracted groundwater must be handled in accordance with all laws and as described in the treatment plan or SMP). Five-year reviews and reporting would be conducted to ensure the continued effectiveness of the LUCs, specifically compliance with the deed restriction. Alternative GW-2 would also include 5 years of annual groundwater performance monitoring to evaluate whether the PRB was effectively reducing carbon tetrachloride and its degradation daughter product concentrations to below the commercial vapor intrusion risk-based concentrations.

Alternative GW-3, In Situ Bioremediation, LUCs, and Groundwater Monitoring: The in situ bioremediation (ISB) treatment system would consist of installing approximately 15 to 25 injection point wells within the carbon tetrachloride plume to anaerobically biodegrade carbon tetrachloride in groundwater. The well layout would consist of two lines of 2-inch diameter injection point wells surrounding piezometer CTP with additional injection point wells located at the grab groundwater locations that had detected results. Pilot or treatability studies, including soil sampling, would be conducted to ensure proper design parameters and confirm the radius of impacted groundwater prior to implementation of final remedy. LUCs would consist of a deed restriction and 5-year reporting, as described under Alternative GW-2. Alternative GW-3 would also include 5 years of annual groundwater performance monitoring to evaluate whether the ISB system was reducing carbon tetrachloride and its degradation daughter product concentrations to less than the commercial vapor intrusion risk-based concentrations.

Alternative GW-4, Monitored Natural Attenuation and LUCs: Monitored natural attenuation (MNA) refers to the reliance on natural attenuation processes to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods (EPA 1999). Natural attenuation processes include a variety of physical, chemical, and biological processes that, under favorable conditions, reduce the mass, toxicity, mobility, volume, and/or concentration of contaminants in soil and/or groundwater. EPA guidance (EPA 1998) identifies three lines of evidence that can be used to estimate natural attenuation of chlorinated VOCs:

(1) Historical ground water and/or soil chemistry data that demonstrate a trend of decreasing contaminant mass and/or concentration over time.

(2) Hydrogeologic and geochemical data that can be used to demonstrate indirectly the type(s) of natural attenuation processes active at the site, and the rate at which such processes will reduce contaminant concentrations to required levels.

(3) Data from field or microcosm studies that directly demonstrate the occurrence of a particular natural attenuation process at the site and its ability to degrade the contaminants of concern.

Groundwater data for the Carbon Tetrachloride Area indicate that carbon tetrachloride has been detected in piezometer CTP at concentrations greater than its remedial goal of 2.63 µg/L; chloroform, a degradation daughter product, has been detected at concentrations below its commercial VI risk-based concentration of 25.5 µg/L; and dichloromethane and chloromethane, the next degradation daughter products, have not been detected above detection limits. Groundwater data, collected since 2010, show a slight decreasing trend in concentrations of carbon tetrachloride and its daughter product, chloroform. Existing geochemical data indicate that various MNA parameters, such as dissolved oxygen (DO), pH, and oxygen reduction potential (ORP), are within the range that is conducive to natural attenuation of carbon tetrachloride. Table 3-8 presents historical groundwater data for the Carbon Tetrachloride Area with a comparison to typical MNA parameter values, showing that MNA is a viable alternative for the Carbon Tetrachloride Area.

Alternative GW-4 would consist of installing approximately 6 monitoring wells or piezometers in an array surrounding piezometer CTP to better define the carbon tetrachloride plume extent and characteristics. Soil samples, to identify a potential contaminant soil source for the impacted groundwater, would be collected during well installation. For cost estimating purposes, Alternative GW-4 includes 1 year of quarterly groundwater performance monitoring and 4 years of annual groundwater performance monitoring, with wells being analyzed for MNA parameters, carbon tetrachloride, chloroform, dichloromethane, chloromethane, and methane.

After the first year of quarterly monitoring, the effectiveness of Alternative GW-4 will be evaluated based on a weight-of-evidence approach consisting of the following factors:

- Changes in chemical concentrations of carbon tetrachloride and its degradation products
- Changes in wells with detected concentrations
- Changes in groundwater gradient direction or magnitude

- Chemical parameters including: DO, ORP, pH, nitrate, sulfate, sulfide, iron (II), methane, total organic carbon, temperature, carbon dioxide, alkalinity, chloride, and hydrogen

These factors will be used to evaluate whether the estimated chemical plume boundaries have expanded, contracted, or stabilized over time; and to determine at what frequency groundwater monitoring should continue. In the event that the factors indicate that plume concentrations are increasing or that the plume boundaries are expanding, then Alternative GW-4 would include assessment for implementation of a permeable barrier or in-situ bioremediation (as discussed in Alternatives GW-2 or GW-3) as contingency measures.

LUCs would consist of a deed restriction and 5-year reporting, as described under Alternative GW-2.

3.4 Applicable or Relevant and Appropriate Requirements

The identification of ARARs is a site-specific determination and involves a two-part analysis: (1) determine whether a requirement is applicable, and (2) if the requirement is not applicable, determine whether it is relevant and appropriate. The terms "applicable", "relevant and appropriate" are defined by the NCP as follows:

> Applicable Requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site" (40 CFR 300.5).

> Relevant and Appropriate Requirements are "those cleanup standard, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (40 CFR 300.5).

There are three types of ARARs: chemical-, location-, and action-specific requirements. Chemical-specific ARARs are health-or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical cleanup values. These values establish the acceptable amount or concentration of a chemical found in, or discharged to, the environment that is protective of human health or ecological receptors. Chemical-specific ARARs for the potential actions at the Site are summarized in Table 3-9.

Location-specific ARARs address unique or sensitive areas such as floodplains, historic places, wetlands and other ecosystems and restrict activities that are potentially harmful because of where they take place. Location-specific ARARs for the potential actions at the Site are summarized in Table 3-9.

Action-specific requirements are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous substances that are triggered by the particular remedial activities selected to accomplish a remedy. Examples of action-specific

ARARs are the Resource Conservation and Recovery Act (RCRA) regulations for hazardous waste treatment, storage, and disposal. Action-specific ARARs for the proposed actions at the Site are summarized in Table 3-9.

In addition to ARARs, to-be-considered (TBC) guidance and regulations are usually evaluated. The RBC is a University-owned property, and as such, TBC guidelines such as local land use regulations, general plans, grading plans, zoning, and municipal ordinances do not apply. Work within UC's mission performed on land owned or controlled by the UC Regents is exempt under the state constitution from compliance with local land use regulations.

4.0 ALTERNATIVES EVALUATION

The RAW alternatives analysis process evaluates the alternatives identified in Section 3.3 for effectiveness, implementability, and cost using a rating scale of not effective, slightly effective, moderately effective, very effective, and highly effective. The three criteria are described in detail in Section 3.2.5. The soil alternatives are evaluated separately for each of the three geographic areas: MFA, Corporation Yard, and remainder of the RES as shown below. PCB-impacted soil will be excavated and disposed of off-site in accordance with TSCA; therefore, the soil alternatives will not be evaluated for the PCB Areas.

Alternative	PCB Areas	MFA	Corporation Yard	Remainder of the RES
S-1. No Action		√	√	√
S-2. Excavation to Unrestricted Use	√*	√	√	√
S-3. Excavation to Commercial Use, LUCs, and SMP		√	√	√
S-4. LUCs		√	√	√
S-5. Asphalt Cap, LUCs, and SMP		√		
* PCB remediation will follow TSCA requirements.				

The groundwater alternatives are evaluated for the Carbon Tetrachloride Area only. The TCE-impacted area will be remediated under the former Zeneca Order; therefore, groundwater alternatives are not evaluated for the TCE-impacted area. Alternatives were not evaluated for Site-wide groundwater beyond the Carbon Tetrachloride Area. The Site-wide groundwater will continue to be monitored under the on-going groundwater monitoring program (Tetra Tech 2012) as a part of the proposed remedy.

Alternative	Carbon Tetrachloride Area	TCE-Impacted Groundwater	Site-wide Groundwater
GW-1. No Action	√		
GW-2. PBR, LUCs, and Groundwater Monitoring	√		
GW-3. ISB, LUCs, and Groundwater Monitoring	√		
GW-4. MNA and LUCs	√		
Remediation under the former Zeneca Site Investigation and Remediation Order (IS/E-RAO 06/07-005)		√	
Continued Groundwater Monitoring and LUCs			√

4.1 CLEANUP OF PCB AREAS

PCB remediation has not been delegated by the federal government to the states; therefore, the federal TSCA must be followed. In accordance with TSCA and specifically 40 CFR 761.61 (a)(4)(i)(A), which defines cleanup levels for bulk PCB remediation waste, including soil, and

40 CFR 761.61(b), which describes performance-based disposal, PCB-impacted soil with total PCB concentrations greater than 1 mg/kg will be excavated and disposed of off-site at an appropriate waste landfill. Because TSCA is prescriptive, alternatives were not evaluated for PCB-impacted soil. Figure 4-1 shows the proposed PCB excavation areas. The cost estimate for remediating approximately 15 cubic yard of PCB-impacted soil is presented in Table 4-1.

4.2 EVALUATION OF ALTERNATIVES FOR MFA

The following subsections present the alternatives evaluation for the MFA. The primary risk driver at the MFA is mercury; the only other contaminants exceeding remedial goals include cinders-related metals arsenic and lead, which will be managed following the current cinder management protocols which do not require excavation, and PCBs, which will be addressed as part of the PCB Area cleanup, described in Section 4.1.

4.2.1 MFA Alternative S-1 – No Action

Under Alternative S-1, no action would be taken. Mercury contaminated soil would be left in place as is, without implementation of institutional controls, source containment, removal, treatment, or other mitigative measures. PCB-impacted soil with total PCB concentrations greater than 1 mg/kg will be excavated and disposed of off-site as a separate action and is not included in this MFA alternative.

Effectiveness. The no-action alternative is not protective of human health and does not reduce the toxicity, mobility, or volume of contamination. Alternative S-1 is protective in the short term because ongoing site management practices do not allow for any exposures to soils beneath the current asphalt or gravel surface without UC oversight and worker protection measures. Alternative S-1 is not protective in the long-term because it does not provide any controls to prevent future exposure in the event of future soil disturbance, or reduce known elevated concentrations of mercury. Alternative S-1 is not effective.

Implementability. No construction, operation, or resources would be required to implement Alternative S-1. Alternative S-1 is highly effective for the implementability criterion.

Cost. No capital or O&M costs are associated with Alternative S-1 because no resources are required and no ECs, ICs, or actions would be undertaken. Alternative S-1 is highly effective with respect to the cost criterion.

4.2.2 MFA Alternative S-2 – Excavation to Unrestricted Use

Under Alternative S-2, cinders and soil concentrations greater than the unrestricted risk-based concentrations would be excavated from the MFA and disposed of off-site at an appropriately permitted landfill facility based on waste characterization sampling results. DTSC-approved clean soil currently stockpiled in the RES would be placed and compacted as backfill in each excavation. If additional backfill is required, DTSC-approved clean soil would be obtained from an off-site source. The areas proposed for excavation to unrestricted risk-based concentrations are shown in Figure 4-2; the area proposed for excavation was determined based on existing data, historic data, and knowledge of historical activities, such as former building footprint orientations and mercury fulminate production processes. Based on these proposed areas, it is estimated that approximately 14,300 cubic yards of soil would require excavation and disposal.

PCB-impacted soil with total PCB concentrations greater than 1 mg/kg will be excavated and disposed of off-site as a separate action and is not included in this MFA alternative.

Effectiveness. Alternative S-2 is effective because soil containing chemicals at concentrations greater than unrestricted risk-based concentrations would be removed from the MFA and disposed of in an approved off-site landfill, thereby providing overall protectiveness in the event of future unrestricted exposure. Alternative S-2 would be implemented to meet ARARs. Alternative S-2 is effective in the long term because it does not require additional maintenance and monitoring to ensure its effectiveness and does not rely on LUCs to restrict future land use; however, in the short term, Alternative S-2 may cause negative impacts, including increased truck traffic through the surrounding community as excavated soil is transported off site. Another negative impact of implementing Alternative S-2 is that more soil than is necessary to meet the proposed future use will be excavated and disposed of, thereby unnecessarily occupying landfill space. Although this alternative does not involve treatment, Alternative S-2 would reduce contaminant volume at the MFA. Overall, Alternative S-2 is determined to be very effective for the MFA.

Implementability. Alternative S-2 is implementable based on the ease and availability of obtaining the equipment and resources to conduct the alternative. Alternative S-2 is difficult to implement due to the potentially large volume of soil to be excavated and disposed. Implementability of Alternative S-2 is slightly effective for the MFA.

Cost. Costs for excavating, characterizing, transporting, and disposing of soil with mercury concentrations greater than commercial worker risk-based concentrations, and backfilling of excavations with clean soil are estimated as $7,541,003, and may vary depending on the amount of soil that requires Class I or Class II disposal. MFA Alternative S-2 costs are shown in Table 4-2. No O&M costs are associated with Alternative S-2 because soil will be removed to unrestricted levels. The relative cost for Alternative S-2 is considered high, therefore Alternative S-2 is not effective under the cost criterion for the MFA.

4.2.3 MFA Alternative S-3 – Excavation to Commercial Use, LUCs, and SMP

Under Alternative S-3, soil with mercury concentrations associated with historical operations by the CCC that are greater than remedial goals would be excavated from the MFA and disposed of off-site at an appropriately permitted landfill facility based on waste characterization sampling results. DTSC-approved clean soil currently stockpiled in the RES would be placed and compacted as backfill in each excavation. The areas proposed for excavation are shown in Figure 4-3; the areas proposed for excavation were determined based on existing data, historic data, and knowledge of historical activities, such as former building footprint orientations and mercury fulminate production processes. Figure 4-4 shows a cross-section of the MFA, including the areas proposed for excavation. Based on these proposed areas, it is estimated that approximately 1,500 cubic yards of soil would require excavation and disposal. Cinders encountered within proposed excavation areas will be excavated and disposed of off-site. Cinders observed beyond the proposed excavation area boundaries will be managed in place, consistent with the current cinder management protocols.

Alternative S-3 includes LUCs prohibiting future residential development and requires implementation of a SMP. The SMP provides a framework to prohibit uncontrolled land excavation or disturbance activities which may expose workers or visitors to unknown or unidentified unsafe environmental contaminants. The SMP ensures that soils disturbed during future construction or redevelopment projects will be sampled and managed to ensure no uncontrolled exposures to unknown or unidentified contaminants within the MFA occur. The SMP also includes a cinders management plan. The SMP will be implemented for all future projects impacting subsurface soils. PCB-impacted soil with total PCB concentrations greater than 1 mg/kg remedial goal will be excavated and disposed of off-site as a separate action and is not included in this MFA alternative.

Effectiveness. Alternative S-3 is effective because soil containing mercury greater than the remedial goals would be removed from the MFA and disposed of in an approved off-site landfill, thereby providing overall protectiveness by eliminating the potential for commercial workers exposure to unsafe concentrations of mercury in soil. Alternative S-3 would be implemented to meet ARARs. Although this alternative does not involve treatment, Alternative S-3 is effective in the long term because it would reduce contaminant volume at the MFA and LUCs and the SMP would manage residual risk effectively. Alternative S-3 is effective in the short term, because the excavation areas focus on source removal, resulting in smaller excavation volumes than proposed in Alternative S-2, thereby minimizing the impact to the surrounding community from disposal truck traffic and conserving landfill space by excavating only soil necessary to meet reuse standards. LUCs and the SMP will effectively mitigate potential exposure to any other contaminants, including cinders, during any future soil disturbance activities. Overall, Alternative S-3 is determined to be very effective for the MFA.

Implementability. Alternative S-3 is implementable based on the ease and availability of obtaining the equipment and resources to conduct the alternative and implementing the LUCs and SMP. Alternative S-3 is implementable due to the moderate volume of soil to be excavated and disposed. LUCs and the SMP are easily implemented. Alternative S-3 is very implementable for the MFA.

Cost. Costs for excavating, characterizing, transporting, and disposing of soil with concentrations greater than the remedial goals and backfilling of excavations are estimated as $1,158,152. MFA Alternative S-3 costs are shown in Table 4-3. O&M costs are associated with maintaining and monitoring the LUCs. Costs are not included for implementation of the SMP because of the speculative nature of implementing the SMP. The relative cost for Alternative S-3 is moderate; therefore, Alternative S-3 is moderately effective under the cost criterion for the MFA.

4.2.4 MFA Alternative S-4 – LUCs

Under Alternative S-4, LUCs would prohibit future residential development. LUCs would be implemented that restrict use of the MFA to prohibit activities that could result in human exposure to contaminated soil, groundwater, or vapors underlying the MFA. The existing fence and signs posted surrounding the MFA would remain in place and prevent direct exposure to soil containing mercury concentrations that exceed the remedial goal. The LUCs would be composed of the ICs summarized below.

(1) A deed restriction would be recorded to prohibit residential use consisting of a residence, mobile home, or factory-built housing constructed or installed for use as residential human habitation. In addition, certain commercial uses defined as "sensitive uses" will also be prohibited unless appropriate and approved engineering controls are implemented that are protective of the sensitive use receptors. Sensitive uses consist of (a) a hospital for humans, (b) a public or private school for persons less than 18 years of age, (c) a day care center for children, or (d) any permanently occupied habitation other than those used for industrial purposes.

(2) A deed restriction would be recorded to prohibit groundwater extraction and beneficial use of groundwater, except for dewatering purposes during construction activities and extraction related to remediation.

(3) A deed restriction would be recorded to require maintenance of existing fencing at the MFA.

(4) 5-year reviews and reporting would be conducted to ensure the continued effectiveness of the ICs, specifically compliance with the deed restrictions.

PCB-impacted soil with total PCB concentrations greater than 1 mg/kg remedial goal will be excavated and disposed of off-site as a separate action and is not included in this MFA alternative.

Effectiveness. Alternative S-4 provides overall protectiveness by eliminating soil exposure pathways through existing fencing and deed restrictions. Alternative S-4 would be implemented to meet ARARs. Alternative S-4 is effective in the long-term because exposure to chemicals is limited physically by existing fencing and asphalt and gravel ground cover and sensitive receptor use will be restricted through deed restrictions; however, Alternative S-4 may hinder future redevelopment because contamination left in place will need to be addressed at the time of redevelopment. Alternative S-4 is effective in the short term because ongoing site management practices do not allow for any exposures to soils beneath the current asphalt or gravel surface without UC oversight and worker protection measures and no Site disturbances would occur; therefore, Site workers and the community would not be impacted by implementation of this alternative. Alternative S-4 would not reduce contaminant toxicity, mobility, or volume through treatment. Alternative S-4 is moderately effective for the MFA.

Implementability. Alternative S-4 is implementable based on the ease of establishing deed restrictions and maintaining fences. Alternative S-4 is highly implementable at the MFA.

Cost. Costs for developing LUC documentation is estimated as $17,078. MFA Alternative S-4 costs are shown in Table 4-4. O&M costs are associated with maintaining and monitoring the LUCs. The relative cost for Alternative S-4 is low; therefore Alternative S-4 is very effective under the cost criterion for the MFA.

4.2.5 MFA Alternative S-5 – Asphalt Cap, LUCs, and SMP

Under Alternative S-5, mercury concentrations in soil greater than the remedial goal would be covered with an asphalt cap. DTSC-approved clean fill currently stockpiled in the RES would be placed and compacted as subbase, as needed, across an area that encompasses the MFA excavation areas shown on Figure 4-3. The area proposed for capping, shown on Figure 4-5, was determined based on existing data, historic data, and knowledge of historical activities, such as former building footprint orientations and mercury fulminate production processes. Based on these proposed area to be capped, it is estimated that approximately 433 cubic yards of asphalt and 433 cubic yards of soil as sub-base would be required to cap the area. Alternative S-5 includes LUCs prohibiting future sensitive receptor development. Alternative S-5 also includes implementation of a SMP. PCB-impacted soil with total PCB concentrations greater than the 1 mg/kg remedial goal will be excavated and disposed of off-site as a separate action and is not included in this MFA alternative.

> **Effectiveness.** Alternative S-5 provides overall protection because soil containing mercury concentrations greater than the remedial goal would be capped, thereby eliminating the potential for commercial exposure to mercury in soil. Alternative S-5 would be implemented to meet ARARs. Alternative S-5 is moderately effective in the long term because contaminants would be left in place and maintaining the integrity of the cap may limit potential redevelopment options; however capping and LUCs are considered reliable controls for residual risk. Alternative S-5 is effective in the short term, because the soil for capping subbase would be obtained from existing on-site soil stockpiles, thereby posing limited impact to the surrounding community from truck traffic; however, asphalt would need to be transported to the MFA. Alternative S-5 would not reduce contaminant toxicity, mobility, or volume through treatment. LUCs and implementation of the SMP effectively mitigate potential exposure to any other contaminants, including cinders, during any future soil disturbance activities. Overall, Alternative S-5 is moderately effective for the MFA.
>
> **Implementability.** Alternative S-5 is easily implementable based on the ease and availability of obtaining the equipment and resources to conduct the alternative and implementing the LUCs and SMP. Alternative S-5 is implementable from the perspective of the moderate volume of soil and asphalt required to create the cap and the on-site availability of soil as subbase material. LUCs are easily implemented. Alternative S-5 is very implementable at the MFA.
>
> **Cost.** Costs for capping are estimated as $238,651. Alternative S-5 costs are shown in Table 4-5. O&M costs are associated with maintaining and monitoring the cap and LUCs. Costs are not included for implementation of the SMP because of the speculative nature of implementing the SMP. The relative cost effectiveness for Alternative S-5 is moderate.

4.3 Comparative Analysis of Alternatives for MFA

This section compares each of the five alternatives for the MFA presented individually in Section 4.2. The alternatives are compared against each other based on the three evaluation criteria (effectiveness, implementability, and cost) discussed in Section 3.2.5. This analysis provides a comparison of the relative advantages and disadvantages of each alternative. Table 4-6 presents a comparative analysis summary for soil alternatives.

4.3.1 Effectiveness

Alternative S-2 provides the most overall protection because contaminants are removed and the Site would be available for unrestricted use. Alternative S-3 provides the second best level of protection because mercury at concentrations greater than commercial use levels would be removed by excavation. Alternatives S-4 and S-5 provide the third best overall level of protection by eliminating the exposure pathway by existing fencing and deed restrictions under Alternative S-4 and by capping under Alternative S-5. Alternative S-1, no action, would not actively change existing conditions at the MFA and would not provide overall protection or any significant long-term effectiveness or permanence.

All alternatives can be implemented in a manner that allows compliance with ARARs, although ARARs are not applicable for Alternative S-1.

For long-term effectiveness, Alternatives S-2 and S-3, excavation and off-site disposal, eliminate the exposure pathway by means of removing soil contaminated with mercury from the MFA, effectively reducing contaminant volume and lessening the potential for future exposure. Taking into consideration the planned future commercial use of the area, Alternative S-2 is excessive, whereas Alternative S-3 meets the requirements for the planned future use. Alternative S-4, LUCs, would maintain the MFA as is and would hinder future development because mercury-impacted soil would remain in place and would need to be addressed at the time of redevelopment. Alternative S-5, capping, effectively eliminates the exposure pathway by means of an asphalt barrier, but leaves contamination in place. The asphalt cap would be relatively impermeable and would therefore minimize infiltration to groundwater; however, because mercury does not appear to be mobile, it is unnecessary for protection of groundwater. Alternative S-5 would hinder future redevelopment activities as the cap would likely need to be breached during any soil disturbances in the area and mercury-impacted soil would need to be addressed at the time of redevelopment.

In the short term, Alternatives S-1 and S-4 can be executed quickly and pose the least impact to the surrounding community, followed by Alternative S-5. Alternatives S-2 and S-3 would require the most time to implement and would pose the most impact to the surrounding community, with Alternative S-2 requiring the most time; therefore this alternative is the least effective with respect to the short-term effectiveness criterion.

None of the alternatives reduce toxicity, mobility, or volume through treatment; however, Alternatives S-2 and S-3 would reduce contaminant volume at the MFA.

Taking into consideration all of the components of the effectiveness criterion, Alternative S-3 is the most effective for the MFA because it eliminates the exposure pathway to the extent needed to meet the requirements of the future use without hindering future development, followed by Alternative S-5, Alternative S-2, Alternative S-4, and finally Alternative S-1.

4.3.2 Implementability

Alternative S-1, no action, requires no construction, operation, or resources and is therefore the most implementable of the five alternatives for the MFA. After Alternative S-1, Alternative S-4, LUCs, is the next most easily implemented alternative. The remaining alternatives are equally technically feasible and administratively feasible. Alternative S-5, asphalt cap and Alternative S-3 are equally implementable, followed by Alternative S-2, due to the volume of soil to be excavated. Alternatives S-3 and S-2, excavation and disposal, are relatively implementable, both would involve construction equipment and trucking of materials; Alternative S-2 is more complex than Alternative S-3, based on soil volumes.

4.3.3 Cost Effectiveness

Alternative S-1, no action, is highly cost effective because it has no cost to implement. Alternative S-4 is very effective, Alternatives S-3 and S-5 are moderately effective, and Alternative S-2 is not cost effective because it is the most expensive to implement. Costs for each of the MFA alternatives are shown below.

MFA Alternative	S-1	S-2	S-3	S-4	S-5
Cost	$0	$7,541,003	$1,158,152	$17,078	$238,651

4.3.4 Recommended Alternative for MFA

Although Alternative S-4, LUCs, scores highest in the evaluation presented in Table 4-6, the recommended alternative for the MFA is Alternative S-3, excavation of mercury-impacted soil to the remedial goal and off-site disposal. The rationale for recommending Alternative S-3 is because it eliminates the exposure pathway to the extent needed to meet the requirements of the anticipated future use at the Site and will not hinder future development, and can be implemented in a reasonable amount of time at a reasonable cost. In addition, Alternative S-3 is recommended because of the ongoing commitment by UC to conduct source removal of elevated mercury concentrations at the MFA prior to redevelopment to meet commercial standards.

MFA Alternatives	S-1	S-2	**S-3**	S-4	S-5
Effectiveness	1.8	4.2	**4.6**	3.6	4
Implementability	5	2	**4**	5	4
Cost	5	1	**3**	4	3

Rating scale: 1 = not effective; 2 = slightly effective; 3 = moderately effective; 4 = very effective; 5 = highly effective.

Alternative S-3 is the recommended alternative for the MFA.

4.4 Evaluation of Alternatives for Corporation Yard

The following subsections present the alternatives evaluation for the Corporation Yard. Figure 2-8 shows the areas within the Corporation Yard that exceed commercial worker risk-based concentrations, background levels, and the TSCA criterion. The primary risk drivers at the Corporation Yard are PCBs, BAP (EQ), and dioxins. Cinders-related metals, arsenic and lead, are also present in the Corporation Yard at concentrations exceeding remedial goals; however, they will be addressed under the current cinders management protocol which does not require excavation. No current exposure to chemicals in soil at concentrations above remedial goals exists at the Corporation Yard because a majority of the area is covered in crushed gravel or pavement and disturbance of subsurface soils is prohibited at the Site without the explicit oversight of the UC Berkeley Office of Environmental Health and Safety (EH&S). The Corporation Yard borders the former Zeneca property; therefore, implementation of any of the Corporation Yard alternatives will be coordinated with the neighboring responsible parties to ensure there are no conflicts with the implementation of soil or groundwater remedies for either property. PCBs will be addressed as part of the PCB remediation, as discussed in Section 4.1 and have not been included in the following remedial alternatives proposed for the Corporation Yard.

4.4.1 Corporation Yard Alternative S-1 – No Action

Under Alternative S-1, no action would be taken. Contaminated soil would be left in place as is, without implementation of LUCs, source containment, removal, treatment, or other mitigative measures. PCB-impacted soil with total PCB concentrations greater than 1 mg/kg will be excavated and disposed of off-site as a separate action and is not included in this Corporation Yard alternative.

Effectiveness. The no-action alternative is not protective of human health and does not reduce the toxicity, mobility, or volume of contamination. Alternative S-1 is protective in the short term because ongoing site management practices do not allow for exposures to soils beneath the current asphalt or gravel surface without UC oversight and worker protection measures. Alternative S-1 is not protective in the long term because it does not provide any controls to prevent future exposure in the event of future soil disturbance activities. Alternative S-1 is not effective.

Implementability. No construction, operation, or resources would be required to implement Alternative S-1. Alternative S-1 is highly implementable.

Cost. No capital or O&M costs are associated with Alternative S-1 because no resources are required and no ECs, ICs, or actions would be undertaken. Alternative S-1 is highly effective with respect to the cost criterion.

4.4.2 Corporation Yard Alternative S-2 – Excavation to Unrestricted Use

Under Alternative S-2, cinders and soil concentrations greater than the unrestricted risk-based concentrations would be excavated from the Corporation Yard and disposed of off-site at an appropriately permitted landfill facility based on waste characterization sampling results. DTSC-approved clean soil currently stockpiled in the RES would be placed and compacted as backfill in each excavation. An area proposed for excavation was estimated based on existing data, historic data, and knowledge of historical activities. It is estimated that approximately 37 cubic yards of soil from the Corporation Yard would require excavation and disposal. Figure 4-6 was developed to show the estimated excavation footprint for this alternative. PCB-impacted soil with total PCB concentrations greater than the 1 mg/kg remedial goal will be excavated and disposed of off-site as a separate action and is not included in this Corporation Yard alternative.

Effectiveness. Alternative S-2 is effective because cinders and soil containing chemicals at concentrations greater than unrestricted risk-based concentrations or background would be removed from the Corporation Yard and disposed of in an approved off-site landfill, thereby providing overall protectiveness in the event of future unrestricted exposure. Alternative S-2 would be implemented to comply with ARARs. Alternative S-2 is effective in the long-term because residual risk would be reduced; however, in the short term, Alternative S-2 may impact the surrounding community with the increase in disposal truck traffic in the area as well as occupying potentially unwarranted landfill space. Although this alternative does not involve treatment, Alternative S-2 would reduce contaminant volume at the Corporation Yard. Overall, Alternative S-2 is determined to be very effective for the Corporation Yard.

Implementability. Alternative S-2 is implementable based on the ease and availability of obtaining the equipment and resources to conduct the alternative. Alternative S-2 is difficult to implement from the perspective of the potentially large volume of soil to be excavated and disposed. Implementability of Alternative S-2 is slightly effective at the Corporation Yard.

Cost. Costs for excavating, characterizing, transporting, and disposing of soil with chemical concentrations greater than unrestricted risk-based concentrations, and backfilling of excavations with clean soil are estimated as $257,957, depending on the amount of soil that requires Class I or Class II disposal. Corporation Yard Alternative S-2 costs are shown in Table 4-7. No O&M costs are associated with Alternative S-2 because soil will be removed to unrestricted levels. Alternative S-2 is not cost effective.

4.4.3 Corporation Yard Alternative S-3 – Excavation to Commercial Use, LUCs, and SMP

Under Alternative S-3 for the Corporation Yard, chemical concentrations in soil greater than the remedial goals would be excavated and disposed of off-site at an appropriately permitted landfill facility based on waste characterization sampling results. DTSC-approved clean soil currently stockpiled in the RES would be placed and compacted in each excavation. The areas proposed for excavation are shown in Figure 4-7; the area proposed for excavation was determined based on existing data, historic data, and knowledge of historical activities. It is estimated that approximately 15 cubic yards of soil would require excavation and disposal. Cinders encountered within proposed excavation areas will be excavated and disposed of off-site. Cinders - and cinder-related metals arsenic and lead at concentrations exceeding the remedial goals - observed beyond the proposed excavation area boundaries will be managed in place, consistent with the current cinder management protocols. Alternative S-3 includes LUCs prohibiting future sensitive receptor development and requires implementation of a SMP. The SMP provides a framework to prohibit uncontrolled land excavation or disturbance activities which may expose workers or visitors to unknown or unidentified unsafe environmental contaminants. The SMP ensures that soils disturbed during future construction or redevelopment projects will be sampled and managed to ensure no uncontrolled exposures to unknown or unidentified contaminants within the Corporation Yard occur. The SMP will be implemented for all future projects impacting subsurface soils. PCB-impacted soil with total PCB concentrations greater than the 1 mg/kg remedial goal will be excavated and disposed of off-site as a separate action and is not included in this Corporation Yard alternative.

Effectiveness. Alternative S-3 is effective because soil containing chemicals greater than remedial goals would be removed from the Corporation Yard and disposed of in an approved off-site landfill, thereby achieving overall protectiveness by eliminating the potential for commercial workers exposure to unsafe concentrations of chemicals in soil. Alternative S-3 would be implemented to comply with ARARs. Alternative S-3 is effective in the long term because it reduces residual risk and the LUCs provide reliable controls. Alternative S-3 is effective in the short term. Although this alternative does not involve treatment, Alternative S-3 would reduce contaminant volume at the Corporation Yard. Overall, Alternative S-3 is determined to be very effective for the Corporation Yard.

Implementability. Alternative S-3 is implementable based on the ease and availability of obtaining the equipment and resources to conduct the alternative and implementing the LUCs and SMP. Alternative S-3 is implementable from the perspective of the volume of soil to be excavated and disposed. Overall, Alternative S-3 is very implementable at the Corporation Yard.

Cost. Costs for excavating, characterizing, transporting, and disposing of soil with chemical concentrations greater than remedial goals, backfilling of excavations and implementing the SMP are estimated at $160,284. Corporation Yard Alternative S-3 costs are shown in Table 4-8. O&M costs are associated with maintaining and monitoring the LUCs. Costs are not included for implementation of the SMP because of the speculative nature of implementing the SMP. The relative cost for Alternative S-3 is moderate.

4.4.4 Corporation Yard Alternative S-4 – LUCs

Under Alternative S-4, LUCs would prohibit future sensitive receptor development. No current exposure to chemicals in soil at concentrations above remedial goals exists at the Corporation Yard because a majority of the area is covered in crushed gravel or pavement and disturbance of subsurface soils is prohibited at the Site without the explicit oversight of EH&S; therefore, no signage or fencing is required at the Corporation Yard. PCB-impacted soil with total PCB concentrations greater than 1 mg/kg will be excavated and disposed of off-site as a separate action and is not included in this Corporation Yard alternative.

Effectiveness. Alternative S-4 provides overall protectiveness by eliminating exposure pathways through deed restrictions. Alternative S-4 would be implemented to comply with ARARs. Alternative S-4 is effective in the long term because exposure to chemicals is limited by restricting sensitive receptor use; however, Alternative S-4 may hinder future redevelopment because contamination left in place will need to be addressed at the time of redevelopment. Alternative S-4 is effective in the short term because ongoing site management practices do not allow for exposures to soils beneath the current paved or gravel surface without UC oversight and worker protection measures. Alternative S-4 would not reduce contaminant toxicity, mobility, or volume through treatment. Overall, Alternative S-4 is moderately effective for the Corporation Yard.

Implementability. Alternative S-4 is implementable based on the ease of establishing deed restrictions. Alternative S-4 is implementable from the perspective of limiting soil disturbance activities until necessary for redevelopment. Alternative S-4 is very implementable at the Corporation Yard.

Cost. Costs for developing LUC documentation is estimated at $17,078. Corporation Yard Alternative S-4 costs are shown in Table 4-9. O&M costs are associated with maintaining and monitoring the LUCs. Alternative S-4 is very cost effective.

4.5 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR CORPORATION YARD

This section compares each of the four Corporation Yard alternatives presented individually in Section 4.4. The alternatives are compared against each other based on the three evaluation criteria (effectiveness, implementability, and cost) discussed in Section 3.2.5. This analysis provides a comparison of the relative advantages and disadvantages of each alternative. Table 4-6 presents a comparative analysis summary for soil alternatives.

4.5.1 Effectiveness

Alternative S-2 provides the most overall protection because contaminants are removed and the Corporation Yard would be available for unrestricted use. Alternative S-3 provides the second most protection because contaminants greater than remedial goals would be removed. Alternative S-4 provides overall protectiveness by eliminating exposure pathways through deed restrictions. Alternative S-1, no action, would not actively change existing conditions at the Corporation Yard and would not provide overall protection or any significant long-term effectiveness or permanence.

All alternatives can be implemented in a manner that allows compliance with ARARs, although ARARs are not applicable for Alternative S-1.

For long-term effectiveness, Alternatives S-2 and S-3, excavation and off-site disposal, eliminate the exposure pathway by means of removing soil contaminated with BAP (EQ) and dioxins, effectively reducing contaminant volume and lessening the potential for future exposure. Taking into consideration the planned future commercial use of the area, Alternative S-2 is excessive, whereas Alternative S-3 meets the requirements for the planned future use. Alternative S-4 is effective in the long term because exposure to chemicals is limited by restricting sensitive receptor use; however, Alternative S-4 may hinder future redevelopment because contamination left in place will need to be addressed at the time of redevelopment. Alternative S-1 does not provide any controls to prevent future exposure in the event of unauthorized future soil disturbance activities.

In the short term, Alternatives S-1 and S-4 can be executed quickly and pose the least impact to the surrounding community. Alternatives S-2 and S-3 would require more time to implement and would pose the most impact to the surrounding community, with Alternative S-2 requiring the most time.

None of the alternatives reduce toxicity, mobility, or volume through treatment; however, Alternatives S-2 and S-3 would reduce contaminant volume, by excavation and off-site disposal, at the Corporation Yard.

Taking into consideration all of the components of the effectiveness criterion, Alternative S-3 is the most effective for the Corporation Yard because it eliminates the exposure pathway to the extent needed to meet the requirements of the future use without hindering future development, followed by Alternative S-4, Alternative S-2, and finally Alternative S-1.

4.5.2 Implementability

Alternatives S-1, no action, and S-4, LUCs, require no construction, operation, or resources and are therefore the most implementable of the four alternatives for the Corporation Yard. After Alternative S-1 and Alternative S-4, Alternatives S-2 and S-3, excavation and disposal, are relatively equally implementable in that both would involve construction equipment and trucking of materials; however Alternative S-2 involves more soil excavation and time.

4.5.3 Cost Effectiveness

Alternative S-1, no action, is highly cost effective because it has no cost to implement. Alternative S-4 is very effective, Alternative S-3 is moderately effective, and Alternative S-2 is not cost effective because it is the most expensive to implement. Costs for each of the Corporation Yard alternatives are shown below.

Corporation Yard Alternative	S-1	S-2	S-3	S-4
Cost	$0	$257,957	$160,284	$17,078

4.5.4 Recommended Alternative for Corporation Yard

Based on the evaluation presented in Sections 4.4 and 4.5 and summarized in Table 4-6, Alternative S-3 is the recommended alternative for the Corporation Yard because it is the most cost-effective alternative protective of human health consistent with the future use planned for this area.

Corporation Yard Alternatives	S-1	S-2	**S-3**	S-4
Effectiveness	1.8	4.2	**4.6**	3.6
Implementability	5	2	**4**	4
Cost	5	1	**3**	4

Rating scale: 1 = not effective; 2 = slightly effective; 3 = moderately effective; 4 = very effective; 5 = highly effective.

4.6 Evaluation of Alternatives for Remainder of the RES

The following subsections present the alternatives evaluation for the remainder of the RES. Figure 2-8 shows sampling locations within the RES that exceed commercial worker risk-based concentrations, background levels, or the TSCA criterion. Insufficient data were available to conduct Step 2 of the HHRA; therefore, no chemicals have been identified as risk drivers. The results of Step 1 of the HHRA indicate that concentrations of arsenic, lead, mercury, BAP (EQ), total PCBs (and individual Aroclors-1248, -1254, and -1260), chlordane, iron, thallium, and dioxin TEQ exceed the commercial worker risk-based concentrations, background levels, or TSCA criterion in at least one sample collected in the RES. Chlordane and thallium are not considered RES-wide COCs because only one sample result for each compound exceeded the commercial worker risk-based concentration. Likewise, iron is also not considered to be a RES-wide COC because it is considered an essential nutrient, and only two results exceeded the commercial worker risk-based concentration. Dioxin TEQ is not considered a RES-wide contaminant because there is only one likely source area in the Corporation Yard. It is anticipated that the contaminants of concern in the remainder of the RES will be similar to those found throughout the MFA and Corporation Yard and are likely to include mercury, cinders-related metals (arsenic and lead), PCBs, and PAHs. Cinders-related metals will be addressed under the cinders management protocols described in the SMP.

Because of the speculative nature of implementing each of the soil alternatives at the remainder of the RES, costs were not developed for the remainder of the RES alternatives and the costs are discussed qualitatively.

4.6.1 RES Alternative S-1 – No Action

Under Alternative S-1, no action would be taken. Contaminated soil would be left in place as is, without implementation of LUCs, source containment, removal, treatment, or other mitigative measures. PCB-impacted soil with total PCB concentrations greater than 1 mg/kg will be excavated and disposed of off-site as a separate action and is not included in this RES alternative.

Effectiveness. The no-action alternative is not protective of human health and does not reduce the toxicity, mobility, or volume of contamination. Alternative S-1 is protective in the short term because ongoing site management practices do not allow for any soil disturbance without EH&S oversight and worker protection measures. Alternative S-1 is not protective in the long term because it does not provide any controls to prevent future exposure in the event of future soil disturbance activities. Alternative S-1 is not effective.

Implementability. No construction, operation, or resources would be required to implement Alternative S-1. Alternative S-1 is highly implementable.

Cost. No capital or O&M costs are associated with Alternative S-1 because no resources are required and no ECs, ICs, or actions would be undertaken. Alternative S-1 is highly effective with respect to the cost criterion.

4.6.2 RES Alternative S-2 – Excavation to Unrestricted Use

Under Alternative S-2, cinders and soil concentrations greater than the unrestricted risk-based concentrations or background would be excavated from the remainder of the RES and disposed of off site at an appropriately permitted landfill facility based on waste characterization sampling results. DTSC-approved clean soil would be placed and compacted as backfill in each excavation. A figure was not developed to show the estimated excavation footprint for this alternative because of the unknown locations and plans for future construction projects. PCB-impacted soil with total PCB concentrations greater than the 1 mg/kg remedial will be excavated and disposed of off-site as a separate action and is not included in this RES alternative.

Effectiveness. Alternative S-2 is effective because soil containing chemicals greater than unrestricted risk-based concentrations or background would be removed from the remainder of the RES and disposed of in an approved off-site landfill, thereby providing overall protectiveness in the event of future unrestricted exposure. Alternative S-2 would be implemented to comply with ARARs. Alternative S-2 is effective in the long term because residual risk would be reduced; however, in the short term, Alternative S-2 may impact the surrounding community with the increase in disposal truck traffic in the area as well as occupying potentially unwarranted landfill space. Although this alternative does not involve treatment, Alternative S-2 would reduce contaminant volume at the remainder of the RES. Overall, Alternative S-2 is determined to be very effective for the remainder of the RES.

Implementability. Alternative S-2 is implementable based on the ease and availability of obtaining the equipment and resources to conduct the alternative. Alternative S-2 is difficult to implement from the perspective of the potentially large volume of soil to be excavated and disposed. Alternative S-2 is slightly implementable.

Cost. Costs for excavating, characterizing, transporting, and disposing of soil with chemical concentrations greater than unrestricted risk-based concentrations, and backfilling of excavations are anticipated to be extremely high. No O&M costs are associated with Alternative S-2 because soil will be removed to unrestricted levels. Alternative S-2 is not cost effective.

4.6.3 RES Alternative S-3 – Excavation to Commercial Use, LUCs, and SMP

Under Alternative S-3 for the remainder of the RES, chemical concentrations in soil greater than the remedial goals would be excavated and disposed of off-site at an appropriately permitted landfill facility based on waste characterization sampling results. DTSC-approved clean soil would be placed and compacted in each excavation. These activities would only be conducted in the event of future soil disturbance or construction project, consistent with the SMP, remedial goals, and Category I and II screening criteria described in Section 3.0

A figure was not developed to show the estimated excavation footprint for this alternative because of the unknown locations and plans for future construction projects. Alternative S-3 includes LUCs prohibiting future residential development and requires implementation of a SMP to meet the commercial reuse goals. PCB-impacted soil with total PCB concentrations greater than the 1 mg/kg remedial goal will be excavated and disposed of off-site as a separate action and is not included in this RES alternative.

Effectiveness. Alternative S-3 is effective because soil containing chemicals greater than remedial goals would be removed from the remainder of the RES and disposed of in an approved off-site landfill, thereby overall providing protectiveness by eliminating the potential for commercial workers exposure to unsafe concentrations of chemicals in soil. Alternative S-3 would be implemented to comply with ARARs. Alternative S-3 is effective in the long-term because it reduces residual risk and the LUCs are reliable controls; however, in the short term, increased truck traffic may impact the surrounding community. Although this alternative does not involve treatment, Alternative S-3 would reduce contaminant volume at the remainder of the RES. Overall, Alternative S-3 is determined to be very effective for the remainder of the RES.

Implementability. Alternative S-3 is implementable based on the ease and availability of obtaining the equipment and resources to conduct the alternative and implementing the LUCs. Alternative S-3 is implementable from the perspective of the volume of soil to be excavated and disposed; however, implementation may be less efficient since not coordinated with proposed redevelopment. Overall, Alternative S-3 is very implementable at the remainder of the RES.

Cost. Costs for excavating, characterizing, transporting, and disposing of soil in accordance with the SMP are anticipated to be moderate. O&M costs are associated with maintaining and monitoring the LUCs. Alternative S-3 is moderately cost effective.

4.6.4 RES Alternative S-4 – LUCs

Under Alternative S-4, LUCs would prohibit future residential development. PCB-impacted soil with total PCB concentrations greater than the 1 mg/kg remedial goal will be excavated and disposed of off-site as a separate action and is not included in this RES alternative.

Effectiveness. Alternative S-4 provides overall protectiveness by eliminating exposure pathways through deed restrictions. Alternative S-4 would be implemented to comply with ARARs. Alternative S-4 is effective in the long term because exposure to chemicals is limited by restricting residential development; however, Alternative S-4 may hinder future redevelopment because contamination left in place will need to be addressed at the time of redevelopment. Alternative S-4 is effective in the short term because ongoing site management practices do not allow for soil disturbance without EH&S oversight and worker protection measures. Alternative S-4 would not reduce contaminant toxicity, mobility, or volume through treatment. Overall, Alternative S-4 is moderately effective for the remainder of the RES.

Implementability. Alternative S-4 is implementable based on the ease of establishing deed restrictions. Alternative S-4 is implementable from the perspective of limiting soil disturbance activities until necessary for redevelopment. Alternative S-4 is very implementable at the remainder of the RES.

Cost. Costs for developing LUC documentation are estimated to be low. O&M costs are associated with maintaining and monitoring the LUCs. Alternative S-4 is very cost effective.

4.7 Comparative Analysis of Alternatives for Remainder of the RES

This section compares each of the four RES alternatives presented individually in Section 4.6. The alternatives are compared against each other based on the three evaluation criteria discussed in Section 3.2.5. This analysis provides a comparison of the relative advantages and disadvantages of each alternative. Table 4-6 presents a comparative analysis summary for soil alternatives.

4.7.1 Effectiveness

Alternative S-2 provides the most overall protection because contaminants are removed and all areas would be available for unrestricted use. Alternative S-3 provides the second most protection because contaminants greater than commercial use levels would be removed or eliminated from future commercial exposure. Alternative S-4 provides overall protectiveness by eliminating exposure pathways through deed restrictions. Alternative S-1, no action, would not actively change existing conditions at the remainder of the RES and would not provide overall protection or any significant long-term effectiveness or permanence.

All alternatives can be implemented in a manner that allows compliance with ARARs, although ARARs are not applicable for Alternative S-1.

For long-term effectiveness, Alternatives S-2 and S-3, excavation and off-site disposal, eliminate the exposure pathway by means of removing soil contaminated with chemicals that exceed remedial goals, effectively reducing contaminant volume and lessening the potential for future exposure. Taking into consideration the planned future commercial use of the area, Alternative S-2 is excessive, whereas Alternative S-3 meets the requirements for the planned future use. Alternative S-4 is effective in the long term because exposure to chemicals is limited by restricting sensitive receptor use; however, it may hinder future redevelopment because contamination left in place will need to be addressed at the time of redevelopment Alternative S-1 does not provide any controls to prevent future exposure in the event of unauthorized future soil disturbance activities.

In the short term, Alternatives S-1 and S-4 can be executed quickly and pose the least impact to the surrounding community. Alternatives S-2 and S-3 would require the most time to implement and would pose the most impact to the surrounding community, with Alternative S-2 requiring the most time.

None of the alternatives reduce toxicity, mobility, or volume through treatment; however, Alternatives S-2 and S-3 would reduce contaminant volume, by excavation and off-site disposal.

Taking into consideration all of the components of the effectiveness criterion, Alternative S-3 is the most effective for the remainder of the RES because it eliminates the exposure pathway to the extent needed to meet the requirements of the future use without hindering future development, followed by Alternative S-4, Alternative S-2, and finally Alternative S-1.

4.7.2 Implementability

Alternatives S-1, no action, and S-4, LUCs, require no construction, operation, or resources and are therefore the most implementable of the four alternatives for the remainder of the RES. After Alternatives S-1 and S-4, Alternatives S-2 and S-3, excavation and disposal, are relatively equally implementable in that both would involve construction equipment and trucking of materials; however Alternative S-2 involves significantly more soil excavation and time.

4.7.3 Cost Effectiveness

Alternative S-1, no action, is highly cost effective because it has no cost to implement. Alternative S-4 is very effective, Alternatives S-3 is moderately effective, and Alternative S-2 is not cost effective because it is the most expensive to implement. Qualitative costs for each of the remainder of the RES alternatives are shown below.

RES Alternative	S-1	S-2	S-3	S-4
Cost	No cost	Extremely High	Moderately High	Moderately Low

4.7.4 Recommended Alternative for Remainder of the RES

Based on the evaluation presented in Sections 4.6 and 4.7 and summarized in Table 4-6, Alternative S-3 is the recommended alternative for the remainder of the RES because it ranks the highest in comparison to the other alternatives in protectiveness of human health consistent with the future use planned for this area.

Remainder of the RES	S-1	S-2	**S-3**	S-4
Effectiveness	1.8	4.2	**4.6**	3.6
Implementability	5	2	**4**	4
Cost	5	1	**3**	4

Rating scale: 1 = not effective; 2 = slightly effective; 3 = moderately effective; 4 = very effective; 5 = highly effective.

4.8 Evaluation of Alternatives for Carbon Tetrachloride Area

Figure 2-9 shows the groundwater areas that exceed the remedial goal of commercial VI risk-based concentrations; vapor intrusion has been identified as the primary pathway of concern. The groundwater risk drivers are carbon tetrachloride and TCE. The remedy for contaminants in groundwater originating from the former Zeneca Site, including TCE, is subject to the Zeneca Order. Groundwater with contaminants originating from the former Zeneca Site is not subject to this RAW.

The following subsections present the alternatives evaluation for the Carbon Tetrachloride Area. The Carbon Tetrachloride Area is predominantly within the NOS, which has been identified as a natural area that UC plans to protect from development and maintain in its natural condition. Future construction of buildings over the plume will not occur within the NOS. Groundwater flows from northeast to southwest in the vicinity of the Carbon Tetrachloride Area. Current groundwater concentrations of carbon tetrachloride and its degradation daughter products (chloroform, dichloromethane, and chloromethane) in the RES downgradient of the Carbon Tetrachloride Area are below VI risk-based concentrations, and therefore, do not pose a current risk. Building 280B, located cross-gradient of the Carbon Tetrachloride Area, is an abandoned building with no current or planned future tenants. The alternatives evaluated in the following subsections address the potential future vapor intrusion pathway for existing Building 280A and potential future construction in the RES downgradient of the Carbon Tetrachloride Area. The identification of contaminant soil source for the impacted groundwater will be addressed as a part of the NOS investigation during Phase IV field activities.

4.8.1 Alternative GW-1 – No Action

Under Alternative GW-1, no action would occur at the Carbon Tetrachloride Area near Building 280B. No effort would be undertaken to contain, remove, monitor, or treat groundwater in the area.

Effectiveness. Existing conditions are considered protective of human health and the environment under current land use at the Carbon Tetrachloride Area. Alternative GW-1 would be moderately effective in the short term because no complete exposure pathway exists. Alternative GW-1 has moderate effectiveness in the long term because carbon tetrachloride is likely to naturally degrade and attenuate; however, it does not include any controls to prevent exposure of potential future receptors should the plume migrate to developed areas and an exposure pathway be completed. Although carbon tetrachloride will naturally degrade, under Alternative GW-1, carbon tetrachloride would not be treated or monitored and the toxicity, mobility, and volume would not be reduced by treatment. Alternative GW-1 is determined to have moderate effectiveness.

Implementability. No construction, operation, or resources would be required to implement Alternative GW-1. Alternative GW-1 is highly implementable.

Cost. No capital or O&M costs are associated with Alternative GW-1 because no resources are required and no ECs, ICs, or actions would be undertaken. Alternative GW-1 is highly effective with respect to the cost criterion.

4.8.2 Alternative GW-2 – PRB, LUC, and Groundwater Monitoring

Existing conditions are considered protective of human health and the environment under current land use at the Carbon Tetrachloride Area. No complete exposure pathways currently exist. Alternative GW-2 would be implemented to protect against potential future completed exposure pathways, should the plume migrate from the NOS to the RES. Alternative GW-2 consists of two retained GRAs: (1) active groundwater remediation using ZVI in a PRB and (2) LUCs, including groundwater monitoring. A funnel and gate PRB would be designed to treat carbon tetrachloride in groundwater as the groundwater moves through the PRB. A 120-foot PRB would be installed between two sets of 100-foot sheet-piling funnel. The PRB is estimated to be a 2-foot-thick treatment zone consisting of ZVI. Pilot or treatability studies, including soil sampling, would be conducted to ensure proper design parameters and confirm radius of impacted groundwater prior to implementation of the final remedy. LUCs would consist of a deed restriction and 5-year reporting. A deed restriction would be recorded to (1) prohibit use of groundwater; and (2) prohibit groundwater extraction, except for dewatering and/or treatment purposes (extracted groundwater must be handled in accordance with all laws and as described in the treatment plan or SMP). Five-year reviews and reporting would be conducted to ensure the continued effectiveness of the LUCs, specifically compliance with the deed restriction. Alternative GW-2 would also include 5 years of annual groundwater performance monitoring to evaluate whether the PRB was effectively reducing carbon tetrachloride and its degradation daughter product concentrations to below the commercial vapor intrusion risk-based concentrations. Figure 4-8 shows a schematic of the proposed Alternative GW-2 treatment PRB.

Effectiveness. Alternative GW-2 would provide overall protectiveness by reducing carbon tetrachloride concentrations in groundwater. Alternative GW-2 would be implemented to comply with ARARs. Because the PRB would permanently reduce the mass of carbon tetrachloride in groundwater, Alternative GW-2 would be effective in the long term by reducing toxicity and volume through treatment. In the short term, installation of the PRB system may be detrimental to the Coastal Terrace Prairie, part of the NOS slated for protection as natural area. Overall, Alternative GW-2 is rated very effective.

Implementability. The PRB system, consisting of sheet pile "funnels" and ZVI "slurry wall" is technically and administratively feasible. The PRB system would be standard construction, and materials and labor are readily available. Underground utilities, specifically along Starling Way, that may traverse the PRB system may make the PRB installation practically infeasible. In addition, potential damage to the Coastal Terrace Prairie during installation of the PRB system may make the PRB installation practically infeasible. Alternative GW-2 is moderately implementable.

Cost. Costs include materials and labor for installing the funnel and gate PRB and initial treatability testing. Alternative GW-2 costs are shown in Table 4-10. O&M costs are associated with maintaining and monitoring the LUCs and groundwater monitoring. The estimated cost for alternative GW-2 is $1,232,913. Alternative GW-2 is not cost effective.

4.8.3 Alternative GW-3 – ISB, LUCs, and Groundwater Monitoring

Existing conditions are considered protective of human health and the environment under current land use at the Carbon Tetrachloride Area. No completed exposure pathways currently exist. Alternative GW-3 would be implemented to protect against potential future completed exposure pathways, should the plume migrate from the NOS to the RES. Alternative GW-3 consists of two retained GRAs: (1) active groundwater remediation using enhanced ISB in a well network and (2) LUCs, including groundwater monitoring. The ISB treatment system would consist of 15 to 25 injection point wells that would be installed within the carbon tetrachloride plume near piezometer CTP to inject a chemical substrate to anaerobically enhance biodegradation of carbon tetrachloride in groundwater. The estimated well layout, shown in Figure 4-9, would consist of 2-inch-diameter injection point wells installed in two parallel rows of seven wells each. One 2-inch injection point well would be installed at each of the grab groundwater locations where carbon tetrachloride was detected. One round of injection is assumed to be adequate. Pilot or treatability studies, including soil sampling, would be conducted to ensure proper design parameters including identifying the most effective chemical substrate and to confirm the radius of impacted groundwater prior to implementation of a final remedy. LUCs would consist of a deed restriction and 5-year reporting. A deed restriction would be recorded to (1) prohibit use of groundwater; and (2) prohibit groundwater extraction, except for treatment purposes (extracted groundwater must be handled in accordance with all laws and as described in the treatment plan or SMP). Five-year reviews and reporting would be conducted to ensure the continued effectiveness of the LUCs, specifically compliance with the deed restriction. Alternative GW-3 would also include 5 years of annual groundwater performance monitoring to evaluate whether the ISB system was reducing carbon tetrachloride and its degradation daughter product concentrations to less than the commercial vapor intrusion risk-based concentrations.

Effectiveness. Alternative GW-3 would provide overall protection by reducing carbon tetrachloride concentrations in groundwater, targeting carbon tetrachloride detections. Alternative GW-3 would be implemented to comply with ARARs. Because the ISB well network would permanently reduce the mass of carbon tetrachloride in groundwater, Alternative GW-3 would be effective in the long term and in reducing toxicity and volume through treatment. In the short term, installation of the ISB well network system is minimally disruptive to the Coastal Terrace Prairie. Overall, Alternative GW-3 is rated very effective.

Implementability. Wells installed in the Carbon Tetrachloride Area would be standard construction, and materials and labor are readily available. Other materials such as lactic acid, sodium lactate, or Hydrogen Release Compound for biostimulation are also widely used and available. Alternative GW-3 is very implementable.

Cost. Costs include materials and labor for installing the ISB well network and initial treatability testing. Alternative GW-3 costs are shown in Table 4-11. O&M costs are associated with maintaining and monitoring the LUCs and groundwater monitoring. The estimated cost for alternative GW-3 is $380,507. The relative cost for Alternative GW-3 is moderate.

4.8.4 Alternative GW-4 – MNA and LUCs

Existing conditions are considered protective of human health and the environment under current land use at the Carbon Tetrachloride Area. No complete exposure pathways currently exist because no structures exist within the NOS. Alternative GW-4 would be implemented to protect against potential future completed exposure pathways, should the plume migrate from the NOS to the RES. Groundwater data for the Carbon Tetrachloride Area indicate that carbon tetrachloride has been detected in piezometer CTP at concentrations greater than the remedial goal of 2.63 µg/L; chloroform, a degradation daughter product, has been detected at concentrations below the remedial goal of 25.5 µg/L; and dichloromethane and chloromethane, the next degradation daughter products, have not been detected above detection limits. Groundwater data, collected since 2010, show a slight decreasing trend in concentrations of carbon tetrachloride and its daughter product, chloroform. Existing geochemical data indicate that various MNA parameters, such as DO, pH, and ORP, are within the range that is conducive to natural attenuation of carbon tetrachloride. Table 3-6 presents groundwater data for the Carbon Tetrachloride Area with a comparison to typical MNA parameter values, showing that MNA is a viable alternative for the Carbon Tetrachloride Area.

Alternative GW-4 would consist of installing approximately 6 piezometers in an array surrounding piezometer CTP, as shown on Figure 4-10, to better define the carbon tetrachloride plume characteristics. Soil samples, to identify a potential contaminant soil source for the impacted groundwater, would be collected during piezometer installation. Alternative GW-4 includes 1 year of quarterly groundwater performance monitoring and 4 years of annual groundwater performance monitoring, with samples analyzed for MNA parameters, carbon tetrachloride concentration, and degradation daughter product concentrations.

After the first year of quarterly monitoring, the effectiveness of MNA will be evaluated based on a weight-of-evidence approach consisting of the following factors:

- Changes in chemical concentrations of carbon tetrachloride and its degradation products
- Changes in wells with detected concentrations
- Changes in groundwater gradient magnitude or direction
- Chemical parameters including: dissolved oxygen, ORP, pH, nitrate, sulfate, sulfide, iron (II), methane, total organic carbon, temperature, carbon dioxide, alkalinity, chloride, and hydrogen

These factors will be used to evaluate whether the estimated chemical plume boundaries have expanded, contracted, or stabilized over time; and to determine at what frequency groundwater monitoring should continue. In the event that the factors indicate that plume concentrations are increasing or that the plume boundaries are expanding, then Alternative GW-4 would include assessment for implementation of Alternative GW-2 or GW-3 as contingency measures.

LUCs would consist of a deed restriction and 5-year reporting. A deed restriction would be recorded to (1) prohibit use of groundwater; and (2) prohibit groundwater extraction, except for dewatering and/or treatment purposes (extracted groundwater must be handled in accordance with all laws and as described in the treatment plan or SMP). Five-year reviews and reporting would be conducted to ensure the continued effectiveness of the LUCs, specifically compliance with the deed restriction.

Effectiveness. Alternative GW-4 is protective of human health because no current exposure pathway exists and carbon tetrachloride concentrations in groundwater are expected to naturally decline. Alternative GW-4 would be implemented to comply with ARARs. In the long term, Alternative GW-4 is likely to be effective and it includes controls to identify potential exposure of future receptors should the downgradient RES be developed and an exposure pathway be completed. Alternative GW-4 is effective in the short term because MNA is not invasive and allows nature to degrade the carbon tetrachloride, thereby permanently reducing the mass of carbon tetrachloride in groundwater. Overall, Alternative GW-4 is rated very effective.

Implementability. Alternative GW-4 is technically and administratively implementable. Monitoring wells installed in the Carbon Tetrachloride Area would be standard construction, and materials and labor are readily available. Alternative GW-4 is highly implementable.

Cost. Costs include materials and labor for installing the MNA monitoring well network. Alternative GW-4 costs are shown in Table 4-12. O&M costs are associated with maintaining and monitoring the LUCs and groundwater monitoring. The estimated cost for alternative GW-4 is $336,244. Alternative GW-4 is very cost effective.

4.9 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR CARBON TETRACHLORIDE AREA

This section compares each of the four groundwater alternatives presented individually in Section 4.8. The alternatives are compared against each other based on the three evaluation criteria discussed in Section 3.2.5. This analysis provides a comparison of the relative advantages and disadvantages of each alternative. Table 4-13 presents a comparative analysis summary for groundwater alternatives.

4.9.1 Effectiveness

Existing conditions are considered protective of human health and the environment under current land use at the Carbon Tetrachloride Area. No complete exposure pathways currently exist; therefore, each of the alternatives is equally protective of human health and the environment. In addition, each of the alternatives will reduce the carbon tetrachloride concentrations in groundwater over time.

All alternatives can be implemented in a manner that allows compliance with ARARs, although ARARs are not applicable for Alternative GW-1.

Alternatives GW-2, GW-3, and GW-4 are equally effective in the long-term because each of the three alternatives is likely to have similar residual risk in terms of remaining carbon tetrachloride concentrations in groundwater and similarly adequate and reliable release controls (monitoring). Alternative GW-1 is least effective in the long-term because it does not include release controls or a means to monitor residual risk.

In the short term, Alternative GW-1 is moderately effective because it does not involve any impacts to workers or the environment during implementation, and it can be executed quickly. However, because no monitoring will occur, there could be unknown impacts associated with changes in groundwater concentrations associated with the known carbon tetrachloride concentrations. Alternative GW-4 is the next most effective in the short term because impacts during construction and implementation of the alternative are limited to well installation and sampling. Alternative GW-3 is the third most effective in the short term, as impacts include similar impacts as Alternative GW-4. Alternative GW-2 is the least effective in the short term because installation of the PRB will have the most negative impact on the Coastal Terrace Prairie. Alternatives GW-2, GW-3, and GW-4 will take similar amounts of time to implement.

Alternatives GW-2, GW-3, and GW-4 all reduce toxicity, mobility, or volume through treatment; however, Alternatives GW-2 and GW-3 would likely effect change more quickly. Alternative GW-1 does not include treatment; however, natural attenuation will occur but will not be monitored.

Taking into consideration all of the components of the effectiveness criterion, Alternative GW-4 is the most effective for the Carbon Tetrachloride Area because it allows natural processes to reduce carbon tetrachloride concentrations with minimal impact to the Coastal Terrace Prairie, followed by Alternative GW-1, Alternative GW-3, and finally Alternative GW-2.

4.9.2 Implementability

Alternative GW-1, no action, requires no construction, operation, or resources and is therefore the most implementable of the four alternatives for the Carbon Tetrachloride Area. Alternative GW-4 is the next most implementable, followed by Alternatives GW-3 and GW-2. Alternative GW-3 is more technically feasible than Alternative GW-2 because installation causes a lesser disruption to the surrounding area, including the Coastal Terrace Prairie.

4.9.3 Cost Effectiveness

Alternative GW-1, no action, is highly cost effective because it has no cost to implement. Alternative GW-4 is very effective, Alternative GW-3 is moderately effective, and Alternative GW-2 is not cost effective because it is the most expensive to implement. Costs for each of the Carbon Tetrachloride Area alternatives are shown below.

Alternative	GW-1	GW-2	GW-3	GW-4
Cost	$0	$1,232,913	$380,507	$336,244

4.9.4 Recommended Alternative for Carbon Tetrachloride Area

Alternative GW-4 scores the highest based on the evaluation presented in Sections 4.8 and 4.9 and summarized in Table 4-13 and is the recommended alternative for the Carbon Tetrachloride Area because of active monitoring and evaluation of site conditions, use of natural degradation processes, and minimal impact to the Coastal Terrace Prairie. In addition, Alternative GW-4 includes a weight-of-evidence approach for determining whether the potential risk posed by the Carbon Tetrachloride Area has been reduced and includes active remedial contingency measures in the event it is not successful.

Carbon Tetrachloride Alternatives	GW-1	GW-2	GW-3	**GW-4**
Effectiveness	3	4	4.2	**4.4**
Implementability	5	3	4	**5**
Cost	5	1	3	**4**

Rating scale: 1 = not effective; 2 = slightly effective; 3 = moderately effective; 4 = very effective; 5 = highly effective.

4.10 Cleanup of TCE-Impacted Areas

Because contaminants in groundwater originating from the former Zeneca Site, including TCE and its breakdown components, are subject to the Zeneca Order, alternatives were not evaluated. Figure 2-9 shows the groundwater sampling locations with contaminant concentrations exceeding the remedial goal. The remediation of TCE-impacted groundwater will meet the groundwater RAOs developed in this RAW.

4.11 Site-wide Groundwater

Although analyte concentrations in groundwater outside of the Carbon Tetrachloride Area and TCE-impacted area along the eastern property boundary do not exceed commercial VI risk-based concentrations, the remainder of groundwater at the Site will continue to be monitored under the on-going groundwater monitoring program (Tetra Tech 2012) and be included within the recommended remedy. Because concentrations are below the RAOs for the site, alternatives were not evaluated. If remedial goals for carbon tetrachloride and TCE are exceeded, UC will conduct a soil gas investigation in the vicinity of the piezometer where the goal was exceeded. Soil gas results will be evaluated according to DTSC and EPA guidance documents (DTSC 1994, 2011, 2013; EPA 2014). Soil gas screening criteria to be presented in the proposed remedy for the adjacent former Zeneca site will also be considered when evaluating contaminants originating from the former Zeneca site. DTSC will be consulted during the evaluation and UC will proceed with appropriate actions to protect all applicable human receptors. The cost estimate for continuing the Site-wide groundwater monitoring plan is presented in Table 4-14.

4.12 Overall Recommended Alternatives

Sections 4.1 through 4.11 presented the individual and comparative analyses of alternatives for the PCB Areas, MFA, Corporation Yard, remainder of the RES, the Carbon Tetrachloride Area, TCE-impacted groundwater, and Site-wide groundwater. Based on the analyses presented in Sections 4.1 through 4.11, Table 4-6, and Table 4-13, the table below summarizes the recommended alternatives.

Area	Recommended Alternative
PCB Areas	Excavation to TSCA Self-Implementing Standards: High Occupancy, No Conditions, Off-Site Disposal
MFA	Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of SMP
Corporation Yard	Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of SMP
Remainder of the RES	Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of SMP
Carbon Tetrachloride Area	Alternative GW-4: Monitored Natural Attenuation and LUCs
TCE-Impacted Groundwater	Remediation under the former Zeneca Site Investigation and Remediation Order (IS/E-RAO 06/07-005)
Site-Wide Groundwater	Continued Monitoring and LUCs

5.0 REMOVAL ACTION IMPLEMENTATION

This section describes each of the components of the recommended alternatives for the RES and site-wide groundwater. An overview of the recommended alternatives is presented below.

Soil Remedy

- Excavation of PCB–impacted soils at the Building 112 and Building 150 Transformer Areas and three areas within the Corporation Yard with total PCB concentrations exceeding the TSCA high occupancy without further conditions threshold (1 mg/kg) remedial goal, as shown on Figure 4-1.
- Excavation of mercury-impacted soil at the MFA with concentrations exceeding the remedial goal (275 mg/kg), as shown on Figure 4-3.
- Excavation of BAP (EQ)-impacted soil with concentrations exceeding the remedial goal (0.4 mg/kg) and dioxin-impacted soil with concentrations greater than the remedial goal (1.64E-05 mg/kg) at the Corporation Yard, as shown on Figure 4-7.
- Management of cinders encountered during soil excavations.
- Implementation of site-wide LUCs consisting of deed restrictions identifying the future use of the Site as commercial only, and mandating that future site soil disturbance or soil movement be conducted under the SMP.
- Implementation of the SMP which provides a framework for excavation and soil management, in conjunction with redevelopment or construction projects for chemicals in soil exceeding Category I or II screening level remedial goals within the RES.

Groundwater Remedy

- Monitoring natural attenuation of groundwater with carbon tetrachloride concentrations exceeding the remedial goal (2.63 µg/L) at the western edge of the Coastal Terrace Prairie.
- Continuing groundwater monitoring at the Former RFS Site.
- Treatment and monitoring of contaminants in groundwater originating from the former Zeneca Site, including TCE and its breakdown components, under the Zeneca Order.
- Implementation of site-wide LUCs consisting of deed restrictions prohibiting groundwater extraction for purposes other than groundwater monitoring/treatment or construction dewatering.

This section provides a description of the specific activities or protocols to be followed to successfully implement the soil and groundwater remedies.

The preparation of a RAW is appropriate when the estimated cost of the removal action is less than $2,000,000. For this RAW, the estimated costs of the remedy for the RES through implementation of the SMP are not included, since those costs are unknown and dependent on redevelopment actions not yet planned. Costs are also not included for the implementation of a remedy for TCE-impacted groundwater.

The estimated cost of the specific RAW actions is $1,905,233, as shown in Table 5-1.

5.1 Soil Excavations

This section describes the planned excavations, confirmation sampling, waste characterization and disposal, cinder management, site restoration, and documentation for the proposed excavations.

PCB-Impacted Soils

Soil with concentrations of total PCBs greater than the remedial goal of 1 mg/kg will be excavated. Based on sampling conducted to date, six excavation areas have been identified (see Figure 4-1). The excavations include three areas within the Corporation Yard and two areas associated with transformers near Building 150 and Building 112. The Building 112 transformer area is located within the footprint of the MFA excavations, but the PCB excavation activities near Building 112 will be handled separately from the MFA excavation described below. The excavation depths will extend a half-foot beyond the depth of the sample exceeding the TSCA criterion, and confirmation samples will ensure that no impacted soils exceeding the criteria are left on site.

The estimated total in-place volume of soil PCB-impacted soils to be excavated based on current characterization data is 15 cubic yards.

Mercury-Impacted Soils at the MFA

Soil with concentrations of mercury greater than the remedial goal of 275 mg/kg will be excavated with the goal of removing the majority of the mass of mercury-affected soil in the MFA. Based on sampling and analysis conducted to date, several excavation areas have been identified for soil removal and off-site disposal (see Figure 4-3).

Three previously-sampled boring locations with mercury concentrations exceeding 275 mg/kg are not proposed for soil removal:

- Boring MF-111 – The mercury concentration in the surface soil sample was detected at 280 mg/kg. MF-111 is not in close proximity to the MFA source areas and the detection appears isolated from other soil samples exceeding the 275 mg/kg cleanup goal. The sample result likely represents an isolated detection associated with a false-positive concentration of mercury outside of the source area. Sampling will be conducted at MF-111 prior to excavation activities to confirm that contamination above the cleanup goal is not present in the area. If contamination is present, the area will also be included for excavation.

- Boring MFA07 – Represents isolated elevated mercury concentrations at depth (490 mg/kg at 10 to 10.5 feet bgs and 370 mg/kg at 12 to 12.5 feet bgs); mercury concentrations in soil from this location collected at depths between 0 and 10 feet bgs do not exceed 275 mg/kg, the highest concentration being 11 mg/kg at 2 to 2.5 feet bgs.

- Borings BLDG 102-3 and BLDG 102-4 – The reported mercury concentrations of 280 mg/kg and 330 mg/kg were from samples collected from under an existing building. Future excavation activities or soil management for soil beneath Building 102 will be addressed under the SMP and will include soil excavation and off-site disposal consistent with the remedial goals of the MFA.

These sample locations are shown on Figure 4-3.

During the construction of Asphalt Pad C, a layer of clean fill soil ranging from 2 to 4 feet thick was imported in 2003 and overlaid with asphalt pavement so that the asphalt pad would be higher than the original ground surface. For soil sample locations located within the Asphalt Pad C area, the sample depth elevation data has been normalized to reference the current ground surface (which includes the existing asphalt pad surface). The proposed excavation depths in the MFA are all also measured from the current ground surface, which includes the clean fill layer above the original ground surface at Asphalt Pad C. Figure 4-3 shows cross section A-A' through the MFA excavations, which illustrates the elevation of the current ground surface, fill placed in the Asphalt Pad C area, and proposed excavations. A plan view of the cross section A-A' is also shown on Figure 4-4. The clean fill above original grade will be segregated during excavation (using Figure 4-4 elevations as a guide to minimize cross contamination), stockpiled, and characterized to ensure the clean fill has not been impacted by any underlying mercury-contamination. The volume of this soil is estimated at 93 in-place cubic yards and is not expected to require off-site disposal.

The estimated total in-place volume of soil from the MFA for excavation and off-site disposal based on current site characterization data is 1,433 cubic yards.

BAP (EQ)- and Dioxin-Impacted Soils at the Corporation Yard

Soils with chemical concentrations greater than the remedial goals will be excavated and disposed of off site at an appropriately permitted landfill facility. Based on previous characterization data, PCBs; BAP (EQ); dioxins; and pyrite cinders-related metals, arsenic, and lead; are present in the Corporation Yard at concentrations exceeding remedial goals. The PCB-impacted soils will be excavated as described previously in this section. The cinders-related metals at the Corporation Yard which are not collocated with PCBs, BAP (EQ), or dioxins are not proposed for excavation. These cinders will be managed in place consistent with the cinder management protocols within the SMP. The areas impacted by BAP (EQ) and dioxins proposed for excavation are shown in Figure 4-7.

The estimated in-place volume of soil from the Corporation Yard for excavation and off-site disposal based on current site characterization data is 15 cubic yards.

5.1.1 Site Preparation and Mobilization

Site preparation activities include utility clearance, measurement and evaluation of current groundwater levels, ensuring compliance with the SWPPP, and preparation of a health and safety plan (HSP). Two field activities must occur before work can begin: the abandonment of piezometer MFA which is located in the excavation footprint, and additional soil sampling in the area of boring MF-111 to further characterize mercury concentrations in the vicinity of this sampling location. Approval to proceed will be obtained, as needed, from regulatory agencies before commencing removal action activities. Following these activities, mobilization can commence.

Permits and Notifications

Land use actions within projects owned and controlled by the UC Regents are not subject to local municipal permits, such as tree and grading permits. This approach is consistent with the conditions included in the LRDP California Environmental Quality Act (CEQA) document. The following notifications and permits will be prepared before implementation of the removal action:

- UC Berkeley will approve contractor personnel and subcontracts for access consistent with UC Berkeley policies.
- DTSC notification at least 14 days in advance of field work.
- On-site worker and employee notifications.
- Amend the existing Notice of Intent (NOI) and Storm Water Pollution Prevention Plan (SWPPP) or create a new NOI and SWPPP in compliance with the Construction General Permit and upload to the California State Water Resources Control Boards' Storm Water Multiple Application and Report Tracking System database.
- Well abandonment and well construction permit for piezometer MFA from Contra Costa County Environmental Health Department.

Utility Clearance

Before excavation activities begin, an underground utility location service will be contacted to locate and document utilities, and a final visual inspection for subsurface utilities will be made, including a review of drawings and site markings. Underground utilities will be cleared and marked on the ground with indications (standard colors, letters, and numbers) of the assumed type of utility using a private utility locator with assistance from UC Maintenance and Facilities staff. The location and type of utilities will also be compared with existing subsurface utility maps. This information will be provided to the EH&S for approval prior to excavation activities.

Evaluation of Groundwater Levels

The proposed excavation area depths vary from 3 to 10 feet. Depth to groundwater varies at the MFA and may be as shallow as 3 to 5 feet bgs in the rainy season. Prior to the start of excavation activities, the depth to groundwater will be measured at the two nearest existing groundwater piezometers at the site (piezometers MFA and CCC3). Groundwater water level data will assist the field team to determine at what depth groundwater is likely to occur while excavating soils. Maximum depth of the Corporation Yard excavations is 3 feet bgs and groundwater is not anticipated to be present at this depth.

Storm Water Pollution Prevention Plan Compliance

The current SWPPP that was developed for stockpiling of clean soils in the RES may be modified to incorporate information about excavation activities in the MFA (4LEAF, Inc. 2013), or a new SWPPP will be completed. The SWPPP will outline the Best Management Practices (BMP) that shall be used to prevent erosion or runoff of soil, silts, gravel, non-stormwater discharges, hazardous chemicals, or other materials that are prohibited by the General Construction Permit from being discharged from the project boundaries. The SWPPP will include specific references to regulatory guidelines and applicable UC standard operating procedures.

Health and Safety Plan

All staff, consultants, or contractors entering the exclusion or decontamination zones during the excavation activities shall read and comply with the requirements set forth in a site-specific HSP which will be submitted to DTSC; subcontractors are required to either adopt the prime contractor's HSP or prepare one of their own. All contractors will be responsible for operating in accordance with the most current requirements of Title 8, California Code of Regulations, Section 5192 and Title 29, CFR, Section 1910.120 (29 CFR 1910.120), Standards for HAZWOPER. On-site personnel will be responsible for operating in accordance with all applicable regulations of the Occupational Safety and Health Administration (OSHA) as outlined in 8 California Code of Regulations General Industry and Construction Safety Orders and 29 CFR 1910 and 29 CFR 1926, Construction Industry Standards, as well as other applicable federal and state laws and regulations. All personnel working at the site shall have reviewed and signed the HSP, and a safety meeting shall be conducted at the beginning of each work day to review potential site hazards and safe working procedures.

Because the MFA excavation depth is greater than 4 feet, the contractor will be required to submit to UC Berkeley EH&S a plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazards of caving ground during the excavation, as appropriate. The proposed plan will comply with the State of California Construction Safety Orders and Title 24 of the California Code of Regulations. If the detailed plan varies from such shoring system standards, it shall be prepared by a registered civil or structural engineer.

Piezometer Closure and Replacement

Following the groundwater level measurement, the existing piezometer MFA, which is located in the footprint of the proposed excavation, will be abandoned properly prior to the excavation of the area. A replacement piezometer will be proposed to DTSC prior to abandoning piezometer MFA. The existing piezometer will be overdrilled and abandoned, and the replacement piezometer will be installed, according to Contra Costa County Environmental Health regulations, following completion of all excavation and reporting activities. The replacement piezometer location and elevation will be surveyed by a licensed surveyor. The replacement piezometer will be developed to accommodate use for future monitoring activities.

Pre-Excavation Sampling

UC will conduct pre-excavation sampling at the MFA to supplement existing characterization and collect additional samples near boring MF-111 which was identified as a possible false-positive result. If additional sampling indicates concentrations of mercury exceeding the cleanup goal, the area will be included in the excavation. A technical memorandum outlining the sampling strategy will be provided to DSTC prior to sampling.

Mobilization

Mobilization tasks include:

- Mobilizing personnel, equipment, subcontractors, and materials to the Site and preparing the Site for work activities. The areas within the work zone limits will be cleared of rubbish, trash, vegetation, trees, and debris.

- Identifying and marking the exclusion, decontamination, and support zones. The exclusion zone will include all areas of excavation and truck loading. The decontamination zone for personnel, equipment, and vehicles exiting the exclusion zone will be located adjacent to the exclusion zone. The support zone will be located in the designated work zone but outside the exclusion and decontamination zones. The support zone will be used to temporarily store equipment, vehicles, and personnel. See Figure 5-1 for the locations of these zones.

- Establishing an entrance and exit from the work zones.

- Erecting temporary fencing around each of the work zones, which may include equipment storage areas and exclusion, decontamination, support zones and temporary soil stockpile areas located adjacent to an excavation site. The intent is to protect the equipment, allow site control for a safe working environment, and prevent unauthorized entry into the work zones.

Coordination with RFS maintenance staff regarding securing or rerouting existing utility lines affected by the planned work, if necessary. All utilities in the vicinity of the excavation footprints will be disconnected or depowered prior to excavation.

5.1.2 Excavation

Security and Access

During excavation activities, access to all work areas will be limited to authorized personnel. A sign-in log will be maintained to document entry and exit of all personnel.

Excavation of PCB-Impacted Soils

Soil excavation is required at the PCB Areas where total PCBs exceed the TSCA criterion of 1 mg/kg for high occupancy without further conditions. The PCB excavation areas are limited in size and are not expected to extend to a depth greater than 3.0 feet bgs. Each excavation area, depth, and in-place volume of soil to be excavated is identified on Figure 4-1. Access to the areas surrounding the transformers at Building 112 and Building 150 will be coordinated with EH&S and RFS Facilities and Maintenance staff because these transformers are currently active and will need to be taken off-line before excavation activities commence.

Excavation of Mercury-Impacted Soils at the MFA

Any utilities identified in the excavation footprint will be disconnected prior to the MFA excavation. Buildings 110 and 102, which are in the vicinity of the MFA planned excavations are not occupied and shoring will not be required near the base of buildings, unless safety concerns are identified. Excavation and backfill will proceed along the foundation of the buildings in increments so that no more than 10 feet of foundation is exposed without lateral soil support at one time. It is not anticipated that building foundations will be exposed.

Clean soil that was placed on top of the original ground surface in calendar year 2003 during the construction of Asphalt Pad C will be segregated and stockpiled in a separate soil pile. These soils will be sampled and used as backfill material once excavation is complete. Water shall be applied to the soil surface to mitigate potential dust generation during all intrusive activities.

Excavation areas and anticipated depths based on sampling data are shown on Figure 4-3. The maximum planned depth of excavation at the MFA is 10 feet bgs, or to depth of groundwater if shallower; the excavation depths will not extend below the level of first-encountered groundwater. Soils will be excavated to the planned footprint and depth; at least one confirmation sample will be collected at the base and one sidewall of each portion of the excavation, as described in Section 5.1.3, for comparison to the mercury remedial goal of 275 mg/kg. Additional lateral or vertical excavation may be needed if mercury concentrations in confirmation samples exceed the criterion in an excavation sidewall or bottom; however, no portion of the excavation will be expanded with depth beyond a depth of 10 feet below original grade. Excavation activities will be conducted in a safe manner with proper sloping of sidewalls. Workers will not be allowed to enter excavations when the excavations are deeper than 4 feet unless the excavation plan prepared by the contractor includes appropriate design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazards of caving ground during the excavation. The plan will comply with the State of California Construction Safety Orders and Title 24 of the California Code of Regulations. If the detailed plan varies from such shoring system standards, it shall be prepared by a registered civil or structural engineer.

Continuous observation of soil will be required as it is excavated to observe the trench or excavation bottom and sidewalls for indications of potential contamination such as pyrite cinders or elemental mercury, or unusual debris, such as buried intact containers, and archaeological artifacts. If workers observe suspected pyrite cinders, elemental mercury, or buried containers, EH&S will be notified prior to proceeding with excavation, and the locations will be documented in field notes and on the project site plan. The contractor will follow EH&S directions on handling and disposal of unusual debris found during excavation activities.

Excavation of BAP (EQ)- and Dioxin-Impacted Soils

Soil excavation is required at four separate areas in the Corporation Yard; these excavation areas are limited in size and are not expected to extend to a depth greater than 3 feet bgs. Each excavation area, depth, and in-place volume of soil to be excavated is identified on Figure 4-7. At excavation areas 1 and 3, concrete will need to be removed from the surface, and the excavation depth will then begin from the surface below the removed concrete.

Identification and Management of Cinders

Any cinders present within the soil excavated during the cleanup actions at the PCB areas, MFA, or Corporation Yard will be included as a part of the characterization and soil profiling activities for off-site disposal. If beneficial for profiling, the cinders may be segregated upon excavation.

Incidental cinders identified along or outside the boundaries of the excavations following confirmation sampling will not be excavated; these cinders will be managed in place according to Section 5.2.3 of the SMP. EH&S will ensure cinder locations are documented within EH&S files.

5.1.3 Confirmation Sampling

Following the completion of the excavations to the dimensions presented in Figures 4-1, 4-3, and 4-7, confirmation samples will be collected to ensure no contamination exceeding the cleanup goals is left in place. The following sections describe the procedures for the collection of confirmation soil samples. Included is a discussion of the criteria for determining soil sample locations, soil sampling procedures, and analytical testing methods.

5.1.3.1 Confirmation Soil Sample Locations

Confirmation soil samples will be collected within each of the excavation areas, and will include both bottom and sidewall samples. For excavation areas where groundwater is anticipated to infill the excavation, an attempt will be made to collect confirmation samples from the bottoms of the excavations immediately after excavation to obtain an unsaturated sample.

The horizontal location and depth of each confirmation sample will be accurately recorded on the as-built plans and all final confirmation sample results will be recorded for presentation in the Completion Report.

PCB Confirmation Sampling

PCB confirmation sampling will follow the TSCA confirmation sampling guidance in 40 CFR Part 761.280. PCB excavation confirmation samples will be collected on a 1.5-meter grid basis, at the limits of each PCB soil excavation. At least one confirmation sample will be collected at the bottom of each excavation and at least one sample will be collected from each excavation sidewall. Based on results from characterization sampling, confirmation samples will be collected and analyzed for PCBs only for those areas that contain only PCBs. For those PCB Areas where other COCs are present, the confirmation samples will be analyzed for each of the COCs identified in the excavation area.

The remedial goal for total PCBs is a not-to-exceed value. If total PCBs are present at concentrations exceeding 1 mg/kg in a sidewall sample, then the excavation will be expanded 3 feet laterally as long as the additional excavation does not threaten to undermine buildings or utility pipelines that are not scoped for removal. If a bottom confirmation sample's total PCB concentration exceeds 1 mg/kg, the excavation will be expanded 1 foot vertically unless groundwater prevents the expansion of the excavation to the deeper depth.

At each location where the confirmation samples contain total PCBs at concentrations exceeding 1 mg/kg and the excavation was expanded as described above, a secondary confirmation sample will be collected and analyzed at the new excavation boundary. If the secondary confirmation sample result exceeds 1 mg/kg, then the excavation will again be widened or deepened as described above. The excavation and confirmation sampling process will continue to repeat until excavation boundaries meet the TSCA criterion or DTSC and EPA will be consulted if the TSCA criterion cannot be met within the maximum physical limits described above.

MFA Confirmation Sampling

Confirmation soil samples will be collected from the excavations to confirm sufficient mercury-impacted soil has been removed. Samples will be collected no less frequently than every 25 feet. Sidewall samples will be collected at appropriate depths based on the distribution of mercury at that location; samples will be collected from the same depth interval of existing samples with mercury concentrations exceeding 275 mg/kg; more than one sidewall sampling depth may be necessary in some locations. At least one confirmation sample will be collected at the base and the sidewall of each portion of the excavation.

Excavation activities will be considered complete when the mercury concentrations in the confirmation samples collected from the bottoms and sidewalls are less than the remedial goal of 275 mg/kg, unless otherwise approved by DTSC. The 95UCL value for the MFA, or for individual excavations, may be used as the mercury concentration to compare against the remedial goal. A minimum of ten confirmation samples must be collected to calculate a 95 UCL; if there are less than ten confirmation samples, the maximum concentration must meet the remedial goal of 275 mg/kg, unless otherwise approved by DTSC.

If mercury is present at a concentration exceeding 275 mg/kg, then the excavation will be expanded either laterally for sidewall samples or vertically for bottom samples with the provision that excavation will not extended to such depth as to extend into standing groundwater. To address sidewall samples that do not meet the remediation criteria, the excavation will be expanded approximately 5 feet laterally. To address bottom confirmation samples that do not meet the remediation criteria, the excavation will be expanded approximately 1 foot vertically.

At any location where the sidewall or bottom of the excavation was expanded as described above, a secondary confirmation sample shall be collected at the extended excavation boundary, and mercury concentrations will again be compared to the remedial goal. The excavation and confirmation sampling process will continue to repeat until mercury concentrations meet the remedial goal or groundwater is encountered.

Once the mercury cleanup goal is met, the final confirmation samples will also be analyzed for metals, PCBs, and PAHs to document concentrations of any additional chemicals remaining in place at the MFA.

Before placing backfill, if soil exceeding cleanup goals is to be left-in-place, with DTSC concurrence, snow fence, or other type of demarcation, will be placed along the bottom and sides of the excavation, to indicate the extent to which soil was excavated and backfilled. Any such locations will be surveyed and documented within EH&S files.

Corporation Yard Confirmation Sampling

At least one confirmation sample will be collected at the bottom of each excavation and at least one sample will be collected from each excavation sidewall from the excavation areas in the Corporation Yard. Confirmation samples will be collected and analyzed for either PAHs to assess the BAP (EQ) or dioxins, depending on the COC identified for each excavation. For those excavations where COCs are collocated, the confirmation samples will be analyzed for each of the COCs identified in the excavation area.

Arsenic and lead were identified as COCs for the Corporation Yard; however, these metals are associated with known cinders areas. Confirmation samples will be analyzed for arsenic and lead to determine concentrations associated with cinders remaining in soil, however results will not be used to determine the lateral and vertical extents of the excavation. COCs associated with pyrite cinders will be managed in place consistent with SMP Section 5.2.3. Soil containing arsenic and lead collocated with PAH and dioxins will be excavated. Remaining soil containing arsenic and lead associated with cinders will be managed in place.

Excavation activities will be considered complete when the 95 UCL for BAP (EQ) and dioxin (TEQ) calculated using the results of the confirmation samples collected from the bottoms and sidewalls of all excavations within the Corporation Yard are less than the remedial goals of

0.4 mg/kg of BAP (EQ) and 1.64E-05 mg/kg of dioxin (TEQ), unless otherwise approved by DTSC. A minimum of ten confirmation samples must be collected to calculate a 95 UCL; if there are less than ten confirmation samples, the maximum concentration must meet the remedial goals of 0.4 mg/kg and 1.64E-05 mg/kg.

If COCs are present at concentrations exceeding the remedial goals of 0.4 mg/kg of BAP (EQ) or 1.64E-05 mg/kg of dioxin (TEQ), then the excavation will be expanded either laterally for sidewall samples or vertically for bottom samples with the provision that the excavation does not threaten to undermine buildings or utility pipelines that are not scoped for removal, or will not extend to such depth as to extend into standing groundwater. To address sidewall samples that do not meet the remediation criteria, the excavation will be expanded approximately 3 feet laterally. To address bottom confirmation samples that do not meet the remediation criteria, the excavation will be expanded approximately 1 foot vertically.

At any location where the sidewall or bottom of the excavation was expanded as described above, a secondary confirmation sample shall be collected at the extended excavation boundary, and COC concentrations will again be compared to the remedial goals. The excavation and confirmation sampling process will continue to repeat until COC concentrations meet the criteria or the maximum physical limits described above.

5.1.3.2 Soil Sampling Procedures

The methodology for soil confirmation sample collection is provided below. Generally, the following procedures will be used for sample collection:

- Sampling equipment (e.g., trowel, gloves, etc.) that might come into contact with the sample will be dedicated, disposable, or decontaminated as described below.
- Using a stainless-steel trowel, hand auger, or disposable scoop, a sufficient quantity of surface soil to completely fill the laboratory sample container(s) specified for the sample location will be collected.
- For all excavations greater than 4 feet deep, confirmation soil samples will be collected from soil contained in the excavation equipment buckets to avoid personnel from entering the excavations.
- Any surface slough and smearing will be removed from the excavation sidewall or bottom before a sample is collected.
- The field team will document soil confirmation sample locations using a handheld global positioning system where possible; sample locations in deep excavations will be estimated visually and with photos.
- A sample label will be affixed to the sealed sample jar to identify the sample.
- The sealed sample jar will be placed in bubble wrap and placed in an iced cooler.
- Using the appropriate chain-of-custody and shipping procedures consistent with the Phase I FSW (Tetra Tech 2010), the samples will be packaged and shipped or hand-delivered to the laboratory for analysis.

5.1.3.3 Sampling Equipment Decontamination Procedures

Reusable sampling tools will be decontaminated before sampling begins and between sample locations. Reusable sampling tools will be decontaminated by scrubbing in a solution of potable water and nonphosphate detergent (Alconox or Liquinox). The tools will then be double-rinsed with distilled water. Sampling tools that are not used immediately after decontamination will be allowed to air dry and wrapped in plastic.

5.1.3.4 Analytical Methods

Confirmation samples will be analyzed at a state-certified laboratory for mercury, metals, PCBs, PAHs, and dioxin. Initial confirmation samples will be analyzed on expedited turnaround times to enable the rapid identification of the final excavation boundaries. Mercury and PCB samples will be analyzed in triplicate to help quantify any potential laboratory error.

The analytical methods and requirements are presented below. Analytical detection limits are provided in Table C2-3 of the Sampling and Analysis Plan (Exhibit C2 of Attachment C)

Analytical Requirements for Confirmation Samples

Matrix	Analytical Group	Analytical Method	Containers	Sample Volume	Preservation Requirements	Maximum Holding Time (preparation /analysis)
Soil	Mercury	SW-846 EPA 7471	8 ounce glass jar	15 grams (triplicate analysis)	Cool, 4°C ± 2°	28 days/28 days
Soil	Metals	SW-846 EPA 6020		5 grams	Cool, 4°C ± 2°	180 days/180 days
Soil	PCBs	SW-846 EPA 8082		30 grams	Cool, 4°C ± 2°	14 days/40 days
Soil	PAHs	SW-846 EPA 8270 SIM		30 grams	Cool, 4°C ± 2°	14 days/40 days
Soil	Dioxin	EPA 8290		10 grams	Cool, 4°C ± 2°	30 days/45 days

Notes:

°C Degrees Celsius
EPA Environmental Protection Agency
PAH Polycyclic aromatic hydrocarbons
PCB Polychlorinated biphenyls
SW Solid Waste

5.1.3.5 Sample Documentation and Handling

Sample documentation and handling will be conducted according the Phase I FSW (Tetra Tech 2010).

5.1.4 Stockpiles

Soil will be excavated directly into trucks for off-site disposal or into roll-off bins; however, should temporary soil stockpiling be necessary or is selected by the remediation contractor, the stockpiles will be constructed in accordance with the remediation waste staging requirements in the HSC (California HSC, Division 20, Chapter 6.5, Article 2, Section 25123.3[b][4][B]) and 40 CFR, Section 264.554, as follows:

- Stockpiles will be constructed within the work zone and on a level surface. Stockpiles will be constructed to minimize the footprint of the stockpile area. The stockpile will remain covered with a minimum of 6-millimeter (mil) plastic except when soil is being placed or removed.
- The soil stockpiles will be constructed with berms (or straw wattle) and plastic liners (20-mil-thick minimum on the bottom in paved areas, 60-mil base in unpaved areas).
- The stockpile covers will be weighed down with sand bags or other means so that the stockpiles remain covered during periods of high winds and rain events. Site controls, including security fencing, around the piles will be maintained in good condition at all times, including during non-working hours, until the stockpiles are removed from the work zone.
- Erosion control measures will be employed to minimize the contribution of stockpiled soil to surface runoff and wind-generated particulate matter.
- Hazardous waste will not be stockpiled for longer than 90 days.
- The stockpiled soils will not contain free liquids.
- The stockpiles will be inspected in accordance with the SWPPP to verify that the BMPs for windblown dispersion and precipitation runoff and run-on are functioning properly.
- After stockpiles are removed from the Site, the stockpile area and any structures or equipment associated with the stockpile area will be inspected visually and sampled if contamination is possible. Any areas determined to have residual contamination will be remediated as necessary within 30 days after this determination is made.
- The stockpile area will be certified by a registered engineer or geologist for compliance with the above measures.

5.1.5 Backfill

Clean soil currently stockpiled in the RES, and previously approved for use as backfill in the RES by DTSC will be used as backfill for the planned excavations. The origin of the stockpiled soil is the soil formerly underlying the Computational Research and Theory facility at the LBNL campus in Berkeley, California. The total amount of backfill required for the MFA excavation is estimated to be 2,250 cubic yards.

Soil excavated from Asphalt Pad C that was placed in calendar year 2003 above the original ground surface may also be used as backfill if it meets DTSC requirements for backfill material.

In the event that backfill from an alternate source is used, the soil will be sampled and the results evaluated to ensure it meets DTSC requirements for clean backfill. Under no circumstances will any fill containing concentrations of chemicals exceeding the remedial goals or hazardous waste criteria be used as backfill. Excavations will remain open until confirmation sampling results have been received and reviewed by EH&S and DTSC. It is not anticipated that excavations will remain open longer than 30 days.

Soil will be placed in uniform lifts of 8 inches or less (uncompacted thickness) and wheel-rolled into place with a sheepsfoot roller or equivalent. Compaction testing using a nuclear gauge will be conducted at a minimum frequency of one test per 250 cubic yards of backfill installed. The compaction goal for the backfill will be 90 percent relative compaction. If pumping conditions of the soil are observed during compaction, additional passes of the sheepsfoot roller will be prescribed to increase the relative field density. Soil placement and compaction will be continuously observed to establish consistent results for the installed backfill.

The excavation areas will be backfilled to meet current surrounding grades. Soil used for the final lifts will be suitable and placed properly to encourage growth of vegetation in the MFA and suitable for asphalt, gravel, or concrete surfaces at the PCB and Corporation Yard excavations. The disturbed portions of the work zone area, including onsite truck routes, staging areas, and decontamination areas, will be finished to current grades.

5.1.6 Dust and Erosion Controls

Soil will be managed to prevent dust, spills to the ground or water, transport into storm drains, and exposure to people or the environment. Excavation, transportation, and handling of all soil must result in no visible dust at the fence line of the excavation. Any soil material proposed to be placed as fill, whether from an off-site source or on-site source will be kept covered or moist to facilitate eventual compaction and to control dust during earthwork operations. A water truck or water tank will be available to supply water in sufficient quantity on the job site while earthwork operations are underway. Sufficient water will be applied to suppress dust while exercising care to avoid generating runoff to any area outside the project boundaries. Dust control measures will be implemented, as appropriate and necessary, beginning with site mobilization and continuing during all phases of the construction activities. Water will not be applied if there is a possibility of spreading contaminated soil or leaching contaminants from the soil or if it results in hazardous working conditions.

Soil management will be in compliance with the SWPPP for stockpiling of soils (4LEAF, Inc. 2013), as modified for the action. Contractors will not be allowed to stockpile material containing or suspected to contain hazardous waste or contamination unless covered and protected from rain or wind erosion for the duration of the construction project. Stockpiles of material containing hazardous waste or contamination will be placed on plastic sheeting of adequate thickness to contain the soils or in roll-off bins and will not be placed in areas that may be potentially affected by surface run-on or run-off. Contaminated and clean soils material will not be allowed to enter storm drains, inlets, or waters of the State. The plastic sheeting used to cover the soil must be anchored to the ground and weighted as necessary to securely and completely cover the stockpiled soil to prevent wind-blown dust from being generated.

If the excavation is to be conducted when rain is possible, the site work must be carefully executed to contain potentially contaminated surface water, groundwater in excavations, muddy soils within the project area, and prevent off-site tracking of sediment and soils to adjoining roads. All stockpiled soil must be managed in accordance with the requirements outlined in the SWPPP and Section 5.1.4.

5.1.7 Air Monitoring

Exposure monitoring and air sampling will be conducted to monitor possible airborne levels of contaminants down-wind from any excavation and stockpile areas, and ensure that all on- and off-site workers and communities are protected. The monitoring will help assure that excavation activities do not pose unacceptable concentrations to project personnel or any down-wind human receptors.

Air monitoring will be performed during all soil disturbance and excavation activities. Based on the known COCs, real-time dust monitoring and mercury vapor monitoring will be performed during excavation activities to be performed in the MFA and real-time dust monitoring will be performed during excavation activities to be performed in the PCB areas and Corporation Yard. A complete description and rationale for the air monitoring is included as Attachment D, Air Monitoring Plan.

Perimeter Dust Monitoring

Air monitoring will be performed at the fenced perimeter of the various excavation areas to verify that dust control measures are adequate. Dust emissions will be minimized by spraying water on excavation-equipment buckets during excavation and dumping to eliminate visible dust as discussed in Section 5.1.6. Real-time air monitoring of total dust will be performed using real-time aerosol monitors (MIE Personal Data Rams [PDR]) with data loggers to provide immediate information for the total dust levels present. The lower detection limit for the operating range of the PDR is 0.001 milligrams per cubic meters. The particle size maximum range of response for the PDR is 0.1 to 10 micro meters.

The PDRs will be set to automatically log dust levels over 5-minute periods and will be visually checked approximately every hour during the work day and the value manually recorded in the field logs by an on-site UC Berkeley representative to verify equipment operation and compliance with the target action levels. The data will be downloaded into a computer daily and will be posted on the RFS Environmental Website (http://rfs-env.berkeley.edu, or equivalent address) within one week.

Dust measurements will be recorded upwind of the excavation area at the start of work in the morning and after lunch break at mid-day to determine ambient dust concentrations for that day.

The PDRs will be positioned along excavation fence lines at locations most likely to be in the direction of off-site dust migration from each excavation area depending on the identified wind direction on the day and time of work. Two PDRs will be placed at a height of 5 feet on fences in the downwind direction of the excavation area to monitor for dust being generated in the excavation and one PDR will be placed upwind of the excavation to measure ambient dust concentrations.

Wind speed and direction will be continuously monitored using a portable calibrated wind sock. Wind speed will also be measured every hour using a hand-held anemometer and the readings recorded in the daily field notes. The contractor will be notified verbally (and documented in the daily field notes) to stop work if real-time dust monitoring shows that perimeter action levels for dust are exceeded or if sustained wind speeds exceed 15 miles per hour (sustained for 15 minutes).

The following action levels have been calculated for fugitive dust concentrations for the perimeter (or fence line) of each excavation area:

- MFA - 34 micrograms per cubic meter ($\mu g/m^3$) dust concentration (in addition to the daily measured ambient dust levels).
- Building 112 and 150 PCB Areas - 50 $\mu g/m^3$ dust concentration (in addition to the daily measured ambient dust levels).
- Corporation Yard - 16 $\mu g/m^3$ dust concentration (in addition to the daily measured ambient dust levels).

The methodology for calculating the dust action levels is presented in Attachment D. The perimeter dust action levels are protective of the most sensitive off-site receptors including children, elderly, and the ill.

Mercury Vapor Monitoring

Real-time mercury vapor monitoring will be performed near the work zone as well as at the fenced perimeter of the MFA excavation area. The mercury vapor monitoring will be conducted using Lumex RA-915 mercury vapor meters equipped with data loggers (or equivalent real time vapor monitor with equivalent detection limits). The Lumex RA-915 meter has a detection limit of 0.002 $\mu g/m^3$ for mercury. Mercury vapor monitoring in and near the work zone will be performed using a hand-held meter and the perimeter monitoring will be performed by positioning Lumex vapor meters at a height of 5 feet on fences along each side of the excavation area (a total of four monitors). A portable Lumex meter will also be utilized by designated UC Berkeley representatives to monitor for mercury vapor in the immediate vicinity of the MFA excavation area.

The Lumex vapor meters placed along the excavation perimeter fencing will be set to log mercury vapor levels over 5-minute periods and will be will be visually read approximately every hour during the work day and manually recorded in the field logs by an on-site UC Berkeley representative to verify equipment operation and compliance with the target action levels. The data will be downloaded into a computer daily and will be posted on the RFS Environmental Website (http://rfs.berkeley.edu) within 2 working days.

An action level of 0.6 $\mu g/ m^3$ has been established for mercury vapors as measured at the MFA excavation fences. The action level is based on the Cal/EPA OEHHA acute reference exposure level (REL) value for 1-hour exposures to mercury and inorganic mercury compounds (Cal/EPA OEHHA 2013). Additionally, an 8-hour average mercury concentration will be calculated daily from the Lumex vapor data and compared to the Cal/EPA OEHHA 8-hour REL of 0.03 $\mu g/m^3$ to ensure exposures over an 8-hour work day are not exceeding the REL. The 8-hour REL is also protective of on-site staff that work in nearby buildings and for off-Site residents that live at the nearby Marina Bay housing development.

A stop work notice will be issued to the contractor if vapor concentrations exceed the action level in any of the four perimeter Lumex vapor meters and work will not be allowed to resume until the mercury vapor levels measured at the excavation fence line are less than the action level.

5.1.8 Heavy Equipment Decontamination

An exclusion zone will be established around the excavation areas. Access to and from the exclusion zone by personnel and equipment will be controlled to mitigate risks and prevent the spread of contamination from heavy equipment. Decontamination procedures for workers will be established in the HSP.

Two lined decontamination pads appropriately sized for storage and treatment of all anticipated rinse water will be constructed as shown on Figure 5-1. The pads will be sized to collect decontamination water and overspray. Collection and removal of the decontamination water and precipitation captured in the decontamination pads will be conducted utilizing sumps, dikes, ditches, and holding tanks as required. The decontamination pad designs will be approved by EH&S prior to construction.

All wastes, including liquid wastes and non-hazardous or hazardous contaminated soils, will be managed to prevent uncontrolled releases outside of the project area.

All vehicles exiting the site will be inspected to be free of mud on tires, wheel wells, undercarriage and other exposed surfaces outside the covered truck bed or roll-off bin. Vehicles will be cleaned as necessary prior to leaving the decontamination area.

5.1.9 Noise

Field activities during the proposed remedial action are not expected to exceed City of Richmond noise ordinance guidelines. Noise reduction measures, including using quiet construction equipment, particularly air compressors, will be used whenever possible. All construction equipment powered by internal combustion engines shall be properly muffled and maintained. All stationery noise-generating construction equipment such as tree grinders and air compressors are to be as far as is practical from existing residences. Unnecessary idling of internal combustion engines shall be prohibited. Sources of impulsive sound and jack hammers shall not be used on Sundays and holidays, except for emergencies.

5.1.10 Waste Management

Wastes generated during excavation and investigation will include hazardous and nonhazardous soil, decontamination water, and other investigation-derived waste (IDW). Wastes will be handled and stored according to the protocols below and all state and federal laws. Storage containers will be in good condition and constructed of materials that are compatible with the material to be stored. Each container will be clearly labeled with an identification number and a written log will be kept to track the source of contaminated material in each temporary storage container. Samples of soils and liquids will be collected and analyzed for contaminated material in conformance with state and federal criteria as well as to the requirements of the treatment or landfill facility, as further described below.

Hazardous or Contaminated Soils

For temporary storage of contaminated soil or hazardous soil remediation waste storage, securely covered stockpiles, drums, or metal containers will be utilized. Drums and other metal containers must be appropriately labeled per all applicable legal requirements.

Stockpiles will be constructed to isolate stored contaminated material from the environment. Stockpiles will be placed on and covered with a chemically resistant geomembrane liner free of holes and other damage. Stockpiles will be managed in compliance with the SWPPP for the action, to prevent pollutants from being discharged from the project boundaries.

Roll-off bins used to temporarily store contaminated material will be water-tight. A cover will be placed over the bins to prevent precipitation from contacting the stored material. Excavated soil containing pyrite cinder must be segregated and stored in covered bins, drums, or other suitable container.

Nonhazardous or Clean Soils

Excavation and sampling activities may generate nonhazardous soil waste. Soils that are considered potentially clean will be segregated from contaminated or hazardous soils until characterized. Soils from beneath Asphalt Pad C that were placed above the original grade in calendar year 2003 will be segregated, sampled, and reused as backfill following completion of excavation activities. Soils with chemical analysis results that do not exceed state or federal hazardous waste criteria concentrations are considered nonhazardous soils. Nonhazardous waste may be disposed of off site as nonhazardous waste.

Decontamination Water

Liquid collected from personnel and equipment decontamination operations will be temporarily stored in drums or other suitable containers. Water from heavy equipment decontamination, excavations and stockpile areas will be temporarily stored in tanks, drums, or other suitable containers. Stored wastewater containers will be appropriately labeled per all applicable legal requirements.

Aqueous waste will be analyzed per the requirements of the Richmond Field Station City of Richmond Wastewater Permit and the SWPPP. If analytical test results show that the water is not contaminated and within limits for sanitary sewer or on-site discharge then it will be disposed of via the sanitary sewer or into an approved on site location per the SWPPP. Wastewater not suitable for on-site disposal will be characterized, profiled, and disposed of offsite per Section 5.1.11.

5.1.11 Waste Classification, Loading, Transport, and Disposal

Soil excavation activities will generate wastes described in Section 5.1.10. Soil and water wastes will be characterized in order to profile the wastes for proper disposal. If existing data for the excavated soil is deemed by UC as sufficient to meet disposal facility profiling requirements, it may be placed directly from the excavation into the transportation hauling trucks. If, however, the selected disposal facilities require additional profiling, or if EH&S elects to conduct additional waste profiling, samples will be collected from the excavated soil and analyzed for the constituents specified by the selected disposal facilities. In this case, soil from each excavation area will be segregated, characterized, and profiled for proper off-site disposal.

Waste characterization samples will be collected to adequately meet the representativeness and variability goals identified in EPA SW-846. Results from site characterization and confirmation sampling will be used to meet the variability goals identified in EPA SW-846. If necessary, additional composite samples will be collected from the soil piles during their generation to meet the EPA SW-846 goals for representativeness. These samples will be sent to a laboratory for analysis of the same constituents as the excavation confirmation samples, as well as for leaching potential for mercury using the California Waste Extraction Test (WET) Leachate and federal Toxicity Characteristic Leaching Procedure Leachate (TCLP) methods.

One water sample will be collected to characterize the decontamination water produced at the MFA, PCB areas, and Corporation Yard. Samples will be analyzed for the same constituents and confirmation sampling.

Waste profiling will follow a three step process based on the waste characterization results, as described below.

- Step 1. Characterization results will be compared to the California Total Threshold Limit Concentration (TTLC) criteria. If the characterization results are greater than 20 times the criteria, then the sample must also be analyzed by the TCLP method to determine if it is federal RCRA characteristic waste. If the TCLP results exceed the TCLP limits, then the waste is classified as RCRA hazardous.
- Step 2. If the characterization results are greater than the TTLC-Wet Weight value, then the waste is considered California Hazardous Waste under the California Code of Regulations, Title 22, Chapter 11.
- Step 3. If the characterization results are greater than 10 times the Soluble Threshold Limit Concentration (STLC), then sample will also be evaluated by California WET method. If the California WET result is greater than the STLC, then the waste is classified a California Hazardous Waste or Non-RCRA waste.

IDW waste including PPE and disposable sampling equipment will be disposed as nonhazardous solid waste or hazardous solid waste, consistent with the soil or water determinations identified previously. Storage of IDW and soil stockpiles will not be allowed on the coastal terrace prairie grasslands.

<u>Waste Classification</u>

Waste codes applicable to each hazardous waste stream will be identified based on the requirements in 40 CFR 261 and California Title 22 California Code of Regulation 66261, and any other applicable state law or regulation. All applicable treatment standards in 40 CFR 268 and state land disposal restrictions will be identified and a determination will be made as to whether or not the waste meets or exceeds the standards. Waste characterization samples will be evaluated against land disposal restriction requirements to ensure that any hazardous wastes are properly treated before hazardous waste is land disposed. Waste profiles, analyses, classification and treatment standards will be according to the requirements of receiving facility and will be reviewed and approved by EH&S prior to any waste disposal activities.

A waste acceptance letter will be obtained from the selected disposal facility. Waste profile sample results and documentation will be included in the excavation completion report discussed in Section 5.1.16.

<u>Loading Procedures</u>

Upon receiving clearance, drivers for designated transportation haulers will enter the work zone and drive in the direction of the designated loading area. Soil will be loaded using appropriate equipment, such as a front-end loader, excavator, or backhoe. Truck drivers will remain in the trucks while loading is in progress to minimize the potential for exposing the driver to dust during loading and moving equipment hazards. Loading will be performed in a way that minimizes the potential for spill or dust creation, such as by minimizing drop distances into the truck beds. If needed, water spraying may be implemented to suppress potential dust while loading.

Vehicles will not be allowed to idle for greater than 5 minutes as per Title 13 California Code of Regulation Section 2485. Once the loading is complete, the axle scales will be checked to confirm that the truck is within legal load limits. If necessary, adjustments will be made to the load until the legal load limit is reached.

From the loading area, the driver will proceed to a staging area, where all hauled material will be covered. The end-dump truck boxes or bins will be covered with tarpaulins or fixed lids.

After the load has been covered, the truck will proceed to a truck decontamination area. Figure 5-1 shows the proposed location for the truck and equipment decontamination areas. For dry-weather decontamination, any soil present on the outside of the truck will be brushed off with a broom. In most cases, this will be sufficient to allow egress from the site. If dry-broom cleaning is not successful in cleaning the truck, a pressure washer or steam cleaner will be used to clean the tires, fenders, and other parts of the truck. Personnel operating the pressure washer or steam cleaner will wear appropriate PPE, as required by a site-specific HSP. The truck will drive into a temporary decontamination cell that will allow collection of the wash water and debris. The temporary decontamination cell will be constructed using plastic film on the ground and soil berms under the edges of the plastic to contain the water. The temporary decontamination cell material, debris, and wastewater will be sampled and appropriately disposed of.

Tank trucks, if needed for the disposal of decontamination water, will load from a temporary storage tank using their onboard vacuum pumps and appropriate hoses. The truck will proceed to a truck decontamination area. If soil is present on the outside of the truck, it will be brushed off with a broom. Additional truck decontamination will be conducted as described previously, if necessary. Tank trucks are not anticipated to be used for these actions.

Truck loading may be initiated as early as 7:00 a.m. and will cease by approximately 4:00 p.m. These hours of operation will have a minimum impact on traffic in the area by hauling during non-commute hours.

After decontamination, trucks will deposit full roll-off bins in the Asphalt Pad B staging area located west of the MFA. Roll-off bins will be temporarily labeled with placards indicating the excavation areas from which the soil was excavated. Waste characterization sampling will be conducted consistent with the disposal facility requirements. Once waste characterization sampling results are available, roll-off bins will be appropriately placarded according to contents.

After decontamination procedures, trucks will proceed to an inspection location prior to leaving the secured area and onto South 46th Street. At this location, trucks will be inspected and receive the necessary transportation paperwork. The inspection will include a visual decontamination check and a visual check of tire conditions, latches, proper covering, placarding, and hauling documents. Adjustments based on the inspection will be made before the truck leaves the work zone. The inspection results will be recorded in the daily construction logs kept by the onsite construction manager.

A street sweeper will be used on South 46st Street as it approaches Meade Street to ensure no fugitive soil reached Meade Street for the first 3 days of field activities. After 3 days, the need to continue street sweeping will be evaluated on a daily basis.

Waste Transportation

Impacted soil generated during the removal action will be transported to a permitted landfill facility for disposal using roll-off bins or through direct loading into transport trucks. The capacity of each truck roll-off bin is approximately 20 cubic yards of soil. The removal actions in the PCB Areas, the MFA, and Corporation Yard will be conducted in a segregated manner and conducted consecutively; therefore, cubic yardages and numbers of roll-off bins are estimated by geographic area.

Geographic Area	Cubic Yards of Soil	Roll-off Bins
PCB Areas	15	1
MFA	1,500	0 (MFA soils will be directly loaded in to trucks)
Corporation Yard	15	1

Soils will be excavated directly into truck-mounted roll-off bins, dump trucks, or placed in temporary stockpiles within each geographic area. Open-top roll-off bins will be covered before leaving the work zone. Asphalt Pad B will be used as a staging area for empty roll-off bins and full roll-off bins or soil stockpiles awaiting waste characterization sampling results.

Soil suitable for disposal at a Class I solid waste facility is anticipated to be transported to Clean Harbors' Buttonwillow Facility in Buttonwillow, California. Soil suitable for disposal at a Class II solid waste facility is anticipated to be transported to Altamont Landfill in Livermore, California. Figures 5-2 and 5-3 show the anticipated transportation route from the RBC to the Buttonwillow and Altamont facilities. It is estimated that approximately 20 trucks per day will be leaving the site for approximately 4 weeks, depending on any additional volumes of soil generated as a result of confirmation sampling and additional unanticipated excavation. If an alternate disposal facility is identified prior to excavation activities, DTSC will be notified. A detailed transportation plan will be prepared following selection of the transportation contractor and will include the final selected disposal facility.

Only Department of Transportation-(DOT) licensed transporters will be allowed to transport the soil. The contracted transporter(s) will be required to submit proof of a valid hauler registration, valid commercial driver's license, and valid hazardous waste endorsement (which includes fingerprinting and a criminal background check by the Transportation Security Administration). The transporter will be required to ensure that the vehicles used to transport hazardous waste are properly registered, operated, and placarded in compliance with all local, state, and federal requirements. All drivers will be required to provide proof of a valid driver's license.

Manifests will be used for transporting hazardous wastes as required by 40 CFR 263 or any applicable state law or regulation. Transportation will comply with all requirements in the DOT referenced regulations in the 49 CFR series. Manifests and waste profiles will be reviewed and approved by EH&S prior to any waste transportation activities. Land disposal restriction notifications will be prepared as required by 40 CFR 268 and any applicable state law or regulation for each shipment of hazardous waste and will be reviewed and approved by EH&S. Hazardous waste manifests will be prepared for each shipment of waste shipped offsite using instructions in 40 CFR 761, Sections .207 and .208 and all other applicable requirements. Soil waste will be removed from the site in compliance with all U. S. DOT regulations and will be covered to prevent soil loss during transport.

Waste Disposal

No soils will be removed from the site for off-site disposal without EH&S permission. Soils designated for off-site disposal will first be sampled according to the requirements of the potential receiving facility and in compliance with all state and federal waste classification requirements. All contaminated nonhazardous or hazardous soil waste will be disposed at an appropriately permitted landfill or treatment facility. PPE and disposable sampling equipment will be disposed of offsite as hazardous or nonhazardous waste.

5.1.12 Traffic Controls, Transportation Plan

Transportation to and from the excavation area will be planned to minimize disruption to operations and to the surrounding community. Truck traffic will be controlled by radio or phone communication to control the number of trucks on stand-by at the excavation area, and en-route on local roads. Flagmen will be placed as needed to direct traffic on local roads surrounding the excavation area. All trucks must follow posted speed limits. Community notification of truck traffic associated with the excavation and off-site removal will be through the DTSC work notification of the project. A transportation plan will be prepared by the contractor following selection and contract award. All drivers will be provided with and required to maintain a copy of the transportation plan. The DTSC work notification for the project will include notification to the community regarding truck traffic associated with the excavation and off-site removal. Contractors will prepare a transportation plan following contractor selection and contract award. All drivers will be provided with and will be required to maintain a copy of the transportation plan. DTSC will require that all removed and excavated soil will be transported from excavation sites according to all federal, state, and local requirements. DTSC will require impacted soils to be transported only along routes that avoid residential and business neighborhoods consistent with the proposed truck route in Figure 5-2.

5.1.13 Offsite Spill Contingency Plan

Although BMPs will be applied during loading and transportation of waste to reduce the possibility of spilled material that could affect human health and the environment, procedures can be followed to reduce the impact to the human health and the environment. Should an offsite release occur during transport, the following recommended steps will be communicated with the transportation contractor:

- If possible, stop the vehicle safely, move off the roadway, and isolate the vehicle and waste material to minimize additional accidents.
- Assist any injured personnel.
- Survey the situation and identify any injured parties; determine immediate cause and potential implications.

- Call for emergency assistance by dialing 911.
- Report the incident using the 24-hour emergency contact information included on the hazardous waste manifest.
- Report the incident to State of California Office of Emergency Services by contacting the California State Warning Center (916/845-8911).
- Report the incident to the City of Richmond's Emergency Services Manager, Kathy Gerk (510/620-6866).
- If possible and safe, contain spilled materials.
- Make arrangements as soon as possible to clean up the spilled material and transport it to the appropriate facility.
- Complete an incident report.

In the event of a spill, the transporter will contact EH&S, who will assist with the coordination of any spill response measures necessary, depending on the location and magnitude of the spill.

5.1.14 Site Restoration

Excavations will be backfilled after all contaminated materials have been removed and confirmation test results have been evaluated by EH&S and DTSC. Excavations are not anticipated to remain open longer than 30 days. Before placing backfill, snow fence, or other type of demarcation, will be placed along the bottom and sides of the excavation, if soil exceeding any cleanup goals is to be left-in-place, to indicate the extent to which soil was excavated and backfilled. Any such locations will be surveyed and documented within EH&S files.

Clean soil currently stockpiled in the RES, and previously approved for use as backfill in the RES by DTSC, is planned for use as backfill for the planned excavations. The origin of the stockpiled soil is the soil formerly underlying the Computational Research and Theory facility at the LBNL campus in Berkeley, California.

The excavation areas will be backfilled to meet current surrounding grades. Soil used for the final lifts will be suitable and placed properly to encourage growth of vegetation in the MFA and suitable for asphalt, gravel, or concrete surfaces at the PCB and Corporation Yard excavations. Additionally, the disturbed portions of the work zone area, including onsite truck routes, staging areas, and decontamination areas, will be hydromulched and reseeded according to the SWPPP to prevent erosion.

5.1.15 Recordkeeping

<u>Field Records</u>

A daily log will be maintained by an EH&S representative, and the following information will be recorded, as applicable:

- Daily activities and on-site personnel

- Air monitoring data
- Excavation activities and depths
- Confirmation samples collected
- Vehicle transport information, including vehicle ID, driver name, trucking company, and approximate weight or volume of load
- Communications, comments, or remarks

Manifesting

If a waste is determined to be hazardous, a manifest will be generated for each load to accompany the load to the disposal facility. Non-hazardous wastes must be shipped using a non-hazardous waste manifest to be kept with the transported to the disposal location. EH&S will complete the generator section, or verify the accuracy of forms prepared by the disposal site. EH&S staff or University- delegated representative and the transporter will sign the manifest before the load leaves the site. Manifest records will be maintained by EH&S for at least 3 years. EH&S will track receipt of the signed manifest copy from the disposal facility and file an exception report with DTSC, if necessary.

5.1.16 Completion Reporting

Following the completion of the soil excavation activities, a completion report will be prepared describing site conditions, quantity of materials removed from each area of contamination, quantities of soil and liquid materials disposed and the receiving facilities, chain-of-custody forms; and sources of backfill. The completion report will also document the groundwater remedy construction activities.

The report will include copies of all chemical results, chain-of-custody forms, manifests, land disposal restriction notifications, daily observation reports and photographs, air monitoring data, and certifications of final disposal issued by the disposal facility.

Record drawings will be prepared showing limits of each excavation, limits of contamination left in place, known underground utilities, sample locations and depths, and sample identification numbers. On-site stockpile, storage, loading, and disposal areas used will also be shown on the drawings. Photographs will be presented to document progress of the work.

Any deviations from the RAW will be documented in the completion report. The completion report will be submitted to DTSC for review. A final report, which addresses DTSC review comments, will be submitted to DTSC.

5.2 Land Use Controls for Soil

In addition to the specific soil excavation activities discussed in Section 5.1, prescriptive soil management guiding future activities will be conducted as a part of the recommended remedy for soil within the entire RES. The prescriptive soil measures, or LUCs, consist of deed restrictions identifying the future use of the former RFS Site as commercial only, and mandating that future site soil disturbance or soil movement be conducted under the SMP.

5.2.1 Deed Restrictions

LUCs that restrict use of the property to prohibit activities that could result in human exposure to contaminated soil, groundwater, or vapors will be recorded in the property deed, including all areas within the RES. The deed restrictions associated with soil are presented below.

1. A deed restriction would be recorded to prohibit residential use consisting of a residence, mobile home, or factory-built housing constructed or installed for use as residential human habitation. In addition, certain commercial uses defined as "sensitive uses" will also be prohibited. Sensitive uses consist of (a) a hospital for humans, (b) a public or private school for persons less than 18 years of age, (c) a day care center for children, or (d) any permanently occupied habitation other than those used for industrial purposes. If future redevelopment conditions warrant, UC may apply at a later time to remove a restriction or apply for a variance from the restriction.
2. A deed restriction will mandate that future site soil disturbance or soil movement be conducted under the SMP provided in Attachment C of this RAW, and as described below.

5.2.2 SMP Protocols

The SMP has been prepared to support the LUCs by providing a framework to prohibit uncontrolled land excavation or disturbance activities which may expose workers or visitors to unsafe environmental contaminants. The SMP ensures that soils disturbed during future construction or redevelopment projects will be sampled and managed to ensure no uncontrolled exposures to unknown or unidentified contaminants within the RES occur. The SMP will be implemented for all future projects impacting subsurface soils and is included as Attachment C to this document. The SMP is intended to meet the requirement of excavation to commercial reuse for future projects.

The SMP prescribes protocols for DTSC notification; community notification; soil sampling, data analyses, soil management or disposal practices; and final reporting. DTSC notification is conducted through the submittal of SMP checklist forms throughout the process. Community notification is conducted similarly to past notification processes (e.g., through DTSC work notices, posting of documents to DTSC's Envirostor database, regularly scheduled town hall meetings for RBC workers and tenants, routine email communications to staff at RBC, providing hard copies of primary environmental documents and SMP forms available for review in Building 478). SMP Forms and required documentation will be available for review at the RFS environmental website (http://www.rfs-env.berkeley.edu/index.html, or equivalent address).

Soil sampling is based on prescribed sampling frequency, depths, and chemicals which are determined based on the size and location of the proposed construction or maintenance project. Soil management and disposal practices are based on comparison of soil sample results to established management categories, and final reporting is conducted through submittal of a completion report once the project has been completed. The three primary components of the SMP and overview of the protocols are presented below.

1. Project Description and Determination of Sampling. The first component of the SMP is providing descriptions of projects that may impact subsurface soils and are therefore subject to the SMP, including building demolition, construction, excavation, redevelopment, utility repair, or significant landscaping. BMPs and the determination of sampling needs will be identified and based on the project description. Small projects with minimal impacts to soil, such as minor landscaping, emergency utility repairs, small research installations, and other similar conditions, will be subject to sampling for worker health and safety and/or soil disposal under the oversight of UC EH&S. For projects subject to the SMP requirements, EH&S will provide a project description and determination of sampling by submitting *SMP Form A, Project Overview* (Exhibit C1 of Attachment C) to DTSC prior to initiation of the project.

2. Sampling Design, Data Evaluation, and Soil Management. The SMP provides sampling protocols for projects requiring sampling in the previous step. Sampling protocols consist of identifying the number of sampling locations per defined area (density), sampling intervals (depths), and COCs to be analyzed by the laboratory. The protocols are based on the size of the proposed soil disturbance (horizontal and vertical) and history of area (former operations or previous sampling data). The SMP allows for UC EH&S to conduct soil sampling according to these protocols without requiring prior DTSC approval. If the specific protocols are not followed, UC EH&S will request approval of the sampling approach from DTSC.

   Following sampling activities, data will be compared to Category I and II criteria presented in Table 3-1 and the SMP (Attachment C). Soil with concentrations less than Category I criteria is suitable for on-site reuse within the project area described in SMP Form A. Soil with concentrations less than Category II criteria may be managed in place – which consists of being covered with 2 feet of Category I soil, or managed beneath a roadway, parking, or building structure, thereby eliminating the exposure pathway to potential receptors. Soil with concentrations greater than Category II screening criteria will be properly profiled and disposed of off-site, or proposed to be managed in place with DTSC concurrence. Documentation of this information is provided in *SMP Form B, Sampling, Data Evaluation, and Soil Management Action* (Exhibit C1 of Attachment C). SMP Form B will be submitted to DTSC for review. UC EH&S will attach appropriate documentation of soil management practices, including a sampling strategy memorandum, data summary report, and soil excavation or on-site management plan if appropriate. If soil is not managed according to the prescriptive SMP protocols, UC EH&S will request approval of the sampling and cleanup approach from DTSC.

3. Completion Reporting. Following completion of all sampling, soil management practices, and project completion, UC will prepare a report summarizing the sampling design, data results and evaluation, soil management practices, and final site conditions. Notification to DTSC and documentation of this information will be provided in *SMP Form C, Completion Reporting* (Exhibit C1 of Attachment C), which will include the completion report as an attachment.

   UC EH&S will conduct reviews of the SMP at least annually during periods when projects are occurring to evaluate protocols, notifications, and sampling requirements to ensure they continue to meet the intended purpose of the SMP. Suggested improvements or changes to the SMP will be proposed to DTSC and documented formally as a part of the 5-year review process of the RAW. Copies of completed SMP Forms will also be included as a part of the 5-year review of the RAW.

5.3 GROUNDWATER REMEDY

The proposed groundwater remedy is composed of (1) monitoring natural attenuation of carbon tetrachloride at the western edge of the Coastal Terrace Prairie, (2) continued groundwater monitoring throughout the Site, (3) implementation of the remedy for TCE and its breakdown components originating from the former Zeneca site under the Zeneca Order, and (4) implementation of Site-wide LUCs consisting of deed restrictions prohibiting groundwater extraction for purposes other than groundwater monitoring/treatment or construction dewatering.

5.3.1 Carbon Tetrachloride Remedy

The proposed alternative for the Carbon Tetrachloride Area includes MNA of groundwater. MNA would consist of installing up to 6 piezometers piezometer in and downgradient of the carbon tetrachloride plume. Any new piezometers installed will be incorporated into the Site groundwater monitoring program.

5.3.1.1 Site Preparation

Approval to proceed will be obtained, as needed, from regulatory agencies before commencing monitoring well installation action activities. Other site preparation activities include utility clearance, evaluation of current groundwater levels, implementation of grasslands protection measures, and preparation of a HSP.

Permits and Notifications

Land use actions within projects owned and controlled by the UC Regents are not subject to local municipal permits, such as tree and grading permits. The following notifications and permits will be prepared before implementation of the removal action:

- EH&S will approve contractor personnel and subcontracts for access consistent with UC Berkeley policies
- DTSC notification at least 14 days in advance of field work
- On-site worker and employee notifications
- Well construction permits from Contra Costa County Environmental Health Department

EH&S will ensure that precautions are implemented to minimize any potential impacts to sensitive natural communities or grasslands identified in the NOS during the installation of monitoring wells.

Utility Clearance

Before well installation activities begin, an underground utility location service will be contacted to document utilities and a final visual inspection for subsurface utilities will be made, including a review of drawings and site markings. Underground utilities will be cleared and marked on the ground with indications (standard colors, letters, and numbers) of the assumed type of utility using a private utility locator with assistance from UC Maintenance and Facilities staff. The location and type of utilities will also be compared with existing subsurface utility maps. This information will be provided to the EH&S for approval prior to excavation activities.

Evaluation of Groundwater Levels

The proposed monitoring wells will be installed downgradient of piezometer CTP. Groundwater level measurements will be collected from CTP and nearby piezometers B280B, B280A, B300, and GEO to get a sense of the general groundwater depth in the area during the installation to help place the well screens at the correct intervals.

Implementation of Grasslands Protection Measures

Temporary fencing (or other methods of demarcation in the event installation of fencing will cause a greater impact to the grasslands) will be used to indicate the route that vehicles associated with the installation of the groundwater monitoring must use, consistent with the recommendations in the RBC Coastal Terrace Prairie Management Plan (UC 2014, Appendix G). Temporary construction fencing in the grasslands, if needed, will consist at minimum of steel t-posts and 4 feet tall red plastic netting.

Preparation of a Health and Safety Plan

All staff, consultants, or contractors entering the exclusion or decontamination zones during the excavation activities will read and comply with the requirements set forth in a site-specific HSP; subcontractors are required to either adopt the prime contractor’s HSP or prepare one of their own. All contractors will be responsible for operating in accordance with the most current requirements of Title 8, California Code of Regulations, Section 5192 and Title 29, CFR, Section 1910.120 (29 CFR 1910.120), Standards for HAZWOPER. On-site personnel will be responsible for operating in accordance with all applicable regulations of the OSHA as outlined in 8 California Code of Regulations General Industry and Construction Safety Orders and 29 CFR 1910 and 29 CFR 1926, Construction Industry Standards, as well as other applicable federal and state laws and regulations. All personnel working at the site shall have reviewed and signed the HSP, and a safety meeting shall be conducted at the beginning of each work day to review potential site hazards and safe working procedures.

5.3.1.2 Groundwater Monitoring Well Installation

Six piezometers will be installed in accordance with the Phase I FSW (Tetra Tech 2010). Cuttings and well screen placement will be logged by a geologist. Boreholes will be drilled with a hollow-stem auger drill rig. The screened interval of the piezometers will be 10 feet, positioned so that the screen interval extends 2 feet above the estimated groundwater table.

Wells will be constructed from 2-inch-diameter schedule 40 polyvinyl chloride (PVC) blank casing with 2-inch-diameter schedule 40 PVC screen with 0.01-inch slot size. Soil samples will be collected for analysis of VOCs during the well installation based on readings from a photoionization detector or every 5 feet. The wells will be developed according to the protocols in the Phase I FSW (Tetra Tech 2010).

Installation of groundwater monitoring wells will occur in the least disturbing way possible such as only when there is no potential for equipment or vehicles to permanently damage the grasslands. Soils will be monitored to ensure they are sufficiently dry to support vehicles and equipment to avoid causing ruts. Installation of wells will not occur during the wet season. Well sampling will be conducted in a manner that will minimize impacts to the prairie. Portable groundwater equipment will be used to conduct routine groundwater sampling to avoid unnecessary impacts to the vegetation and soils.

All IDW generated will be drummed and sampled and disposed of off-site at an appropriately permitted landfill facility based on waste characterization sampling results. Storage of IDW will not be allowed on the coastal terrace prairie grasslands.

5.3.1.3 Evaluation of Effectiveness

The effectiveness of MNA will be evaluated based on a weight-of-evidence approach consisting of the following factors:

- Changes in chemical concentrations of carbon tetrachloride and its degradation products
- Changes in wells with detected concentrations
- Changes in groundwater gradient direction or magnitude
- Chemical parameters including: dissolved oxygen, ORP, pH, nitrate, sulfate, sulfide, iron (II), methane, total organic carbon, temperature, carbon dioxide, alkalinity, chloride, and hydrogen

These factors will be used to evaluate whether the estimated chemical plume boundaries have expanded, contracted, or stabilized over time. In the event that the factors indicate that plume concentrations are increasing or that the plume boundaries are expanding, then recommended remedy would include assessment for implementation of a permeable barrier or ISB (as discussed in Alternatives GW-2 or GW-3) as contingency measures.

On-going monitoring for groundwater impacted by carbon tetrachloride will continue under the groundwater monitoring program described below, in addition to any additional monitoring deemed necessary to evaluate the continued effectiveness of the selected remedy. Additional monitoring will be determined based the evaluation of results from the new monitoring wells installed.

5.3.2 Site-Wide Groundwater Monitoring

Groundwater throughout the Site, including the carbon tetrachloride and TCE-impacted areas, will continue to be monitored under the on-going Site-wide groundwater monitoring program (Tetra Tech 2013). The purpose of Site-wide groundwater monitoring is to provide yearly reviews of current conditions to allow for evaluation of new or changing concentrations, and permit inclusion of new monitoring wells if necessary, or increased remedial monitoring or actions if necessary. If future groundwater monitoring results were to indicate a need for additional sampling or remedial action in the future, the groundwater remedy does not preclude more active remediation. In addition, FSW Phases IV and V will evaluate risk to ecological receptors; if it is found that groundwater concentrations pose risk to aquatic receptors, remedial action may be warranted in addition to actions proposed within this RAW.

In addition to the analytes monitored in previous years, samples will be collected from wells in the Carbon Tetrachloride Area for MNA parameters, carbon tetrachloride, and carbon tetrachloride degradation daughter products to assess whether natural attenuation is occurring at the Carbon Tetrachloride Area, consistent with Section 5.3.1.

5.3.3 TCE Treatment and Monitoring

The remedy for contaminants in groundwater originating from the former Zeneca Site, including TCE and its breakdown components, is subject to the Zeneca Order and will meet the RAOs identified for groundwater.

On-going monitoring for groundwater impacted by TCE will continue under the current Site-wide groundwater monitoring program, in addition to any requirements necessary for contaminants in groundwater originating from the former Zeneca Site subject to the Zeneca Order.

5.3.4 LUCs for Groundwater

LUCs that restrict use of the property to prohibit activities that could result in human exposure to contaminated soil, groundwater, or vapors will be recorded in the property deed, including all areas discussed in this RAW. The LUCs for groundwater would consist of a deed restriction recorded to prohibit groundwater extraction and beneficial use of groundwater, except for dewatering or treatment purposes during construction activities.

6.0 CALIFORNIA ENVIRONMENTAL QUALITY ACT CONSIDERATIONS

The UC has prepared an EIR which evaluates the potential for environmental impacts from implementation of the proposed RBC LRDP (UC 2014). The EIR is a public informational document for use by UC decision-makers and the public, as it informs the UC Regents, responsible agencies, trustee agencies, and the public of the proposed project's environmental effects. The EIR is intended to identify, publicly disclose and evaluate potential environmental consequences of the proposed project presented in the LRDP, to identify mitigation measures that would lessen or avoid significant adverse impacts, and to examine feasible alternatives to the project.

The CEQA requires that before a decision can be made by a state or local government agency to approve a project that may have significant environmental effects, an EIR must be prepared that fully describes the environmental effects of the project. Pursuant to Public Resources Code Section 21080.09, the UC is required to prepare an EIR when an LRDP is prepared or updated.

6.1 PROJECT DESCRIPTION AND EIR CONTENT

The UC has established a new major research campus at properties it owns in Richmond, California, as described in the LRDP. The LRDP is a joint proposal of the UC, as the operating and management contractor of the LBNL and the UC Berkeley. The campus will provide for development of additional facilities for use by LBNL and UC Berkeley, and foster opportunities and synergisms between LBNL, UC Berkeley, and institutional or industry counterparts to conduct energy, environment, and health related research and development.

The RBC site will continue to be owned by the UC, but some of the facilities developed on the RBC site may be used by LBNL to accomplish the missions and activities assigned and funded by U.S. Department of Energy. Because the RBC will be a joint use campus, some of the existing buildings as well as new buildings on the RBC site will be occupied by UC Berkeley teaching and research programs.

The LRDP addresses sustainability, land use, access and circulation, utilities and infrastructure, and open space and landscaping, and provides for development of up to 5.4 million square feet of new research, development, and support space at the site and an employee population of 10,000 at full implementation of the LRDP in the year 2050. The adoption of an LRDP does not constitute a commitment to, or final decision to implement, any specific project, construction schedule, or funding priority; the LRDP provides guidelines for future development.

In addition analyzing the impacts of construction and operation associated with development under the LRDP, the 2014 LRDP EIR evaluates historic contamination at developable portions of the RBC site within the RFS Site currently subject to the RFS Site Investigation and Remediation Order. The discussion of cleanup activities presented in the EIR includes the activities in this RAW. The EIR references DTSC approval of this RAW as a requirement of the RAW actions addressing historic contamination at the RFS Site.

6.2 ROLES AND RESPONSIBILITIES

The UC is the lead agency for the EIR that examines the overall effects of implementation of the proposed 2014 LRDP for purposes of CEQA. The EIR was prepared pursuant to the applicable provisions of the CEQA and its implementing guidelines (CEQA Guidelines), and the UC Procedures for Implementation of the California Environmental Quality Act (UC CEQA Procedures).

DTSC is the responsible agency for the activities described in the RAW, as discussed in the LRDP and EIR. The responsible agency is the public agency which proposes to carry out or approve a project, for which a lead agency has prepared an EIR. For the purposes of CEQA, the term "responsible agency" includes all public agencies other than the lead agency which have discretionary approval power over the project.

The EIR provides information that will inform DTSC decision-making on the actions identified within this RAW for addressing historic pollutants within portions of the RFS Site proposed for development and currently subject to the DTSC site investigation and remediation order.

6.3 CEQA PROCESS

On January 3, 2013, the UC sent a copy of the Notice of Preparation (NOP) for the draft EIR to governmental agencies, organizations, and interested persons for a 30-day review. The NOP was circulated through the Office of Planning and Research, State Clearinghouse. The UC held a public scoping meeting on January 23, 2013. The public scoping period ended on February 3, 2013.

On November 15, 2013, the UC issued the draft 2014 LRDP and the draft 2014 LRDP EIR. An earlier draft of the LRDP was published for community review in August 2013. The EIR was circulated through the Office of Planning and Research, State Clearinghouse. A public review period occurred beginning on November 15, 2013 through January 15, 2014, including a public hearing conducted on December 11, 2013.

Following the public review period, comments on the adequacy of the draft EIR, submitted within the review period, were addressed in the Final EIR. The Final EIR includes the responses to draft EIR written and verbal comments, a mitigation monitoring and reporting program, any changes made to the EIR, and any additional information concerning the project.

UC Regents approved and certified the Final EIR, and approved establishment of the RBC on May 15, 2014.

Following the UC Regents' certification of the Final EIR, DTSC considered the RAW for approval, subject to input, comments, and changes occurring as a result of the RAW and EIR public review processes. The RAW public review process is presented in Section 7.0 Public Participation. Publication of this Final RAW indicates that DTSC has approved the RAW and supports RAW implementation.

7.0 PUBLIC PARTICIPATION

Following initial review by and incorporation of DTSC comments, the Public Draft version of the RAW was made available for public review at the RFS environmental website at http://rfs-env.berkeley.edu, at the information repository at the Richmond Public Library, at the DTSC office, and on DTSC's Envirostor website. A fact sheet provided information about the proposed removal action, including information about the history, levels of contaminants found, possible health effects from contaminant exposures, proposed removal action activities, precautions to minimize worker exposure, controls to reduce dust, truck route for off-site disposal of excavated materials, public participation activities, and contact information.

The public review period for this document occurred between November 25, 2013 and January 17, 2014. DTSC provided notification of a public meeting, which was conducted on December 5, 2013 to gather community input on the proposed alternatives. Following completion of the public comment period, the RAW was revised in response to the comments received. Responses to all written and verbal comments received are summarized in the responsiveness summary within this final RAW (Attachment E). DTSC has approved this final RAW and proposed alternatives for implementation.

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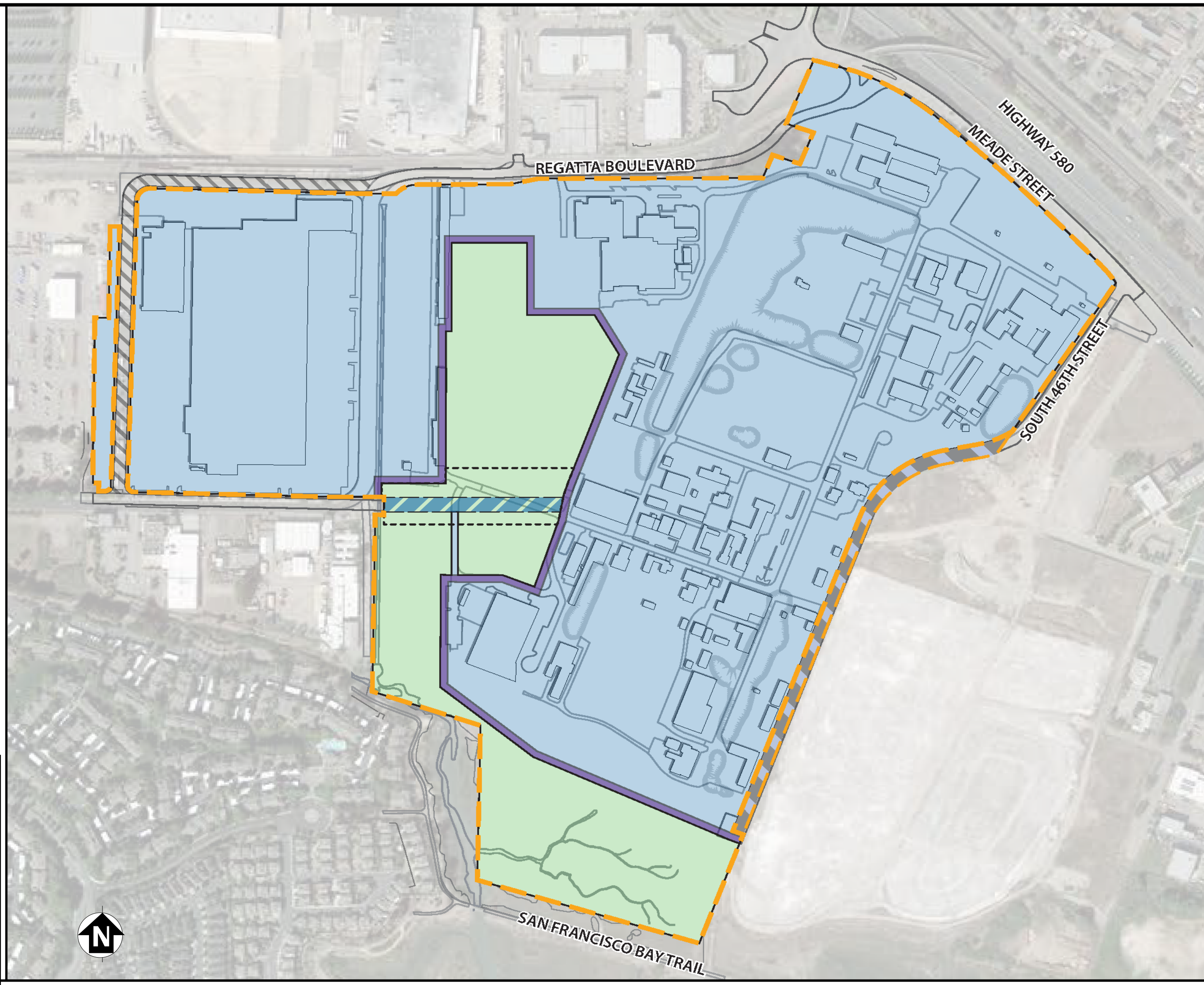
FIGURES

LEGEND

- Property Boundary 134.0 acres
- Natural Open Space 25.0 acres
- Research, Education & Support 107.6 acres
- Potential Road Alignment through Natural Open Space* 0.8 acres
- Zone of Potential Road Alignment through Natural Open Space
- Private Road: 1/3 UC Undivided Interest 0.6 acres
- 25' Buffer Zone
- City of Richmond Realigned Regatta Boulevard

* NOTE: The potential road alignment is illustrative. A road with similar dimensions may be aligned differently but will fall within the Zone of Potential Road Alignment through Natural Open Space.

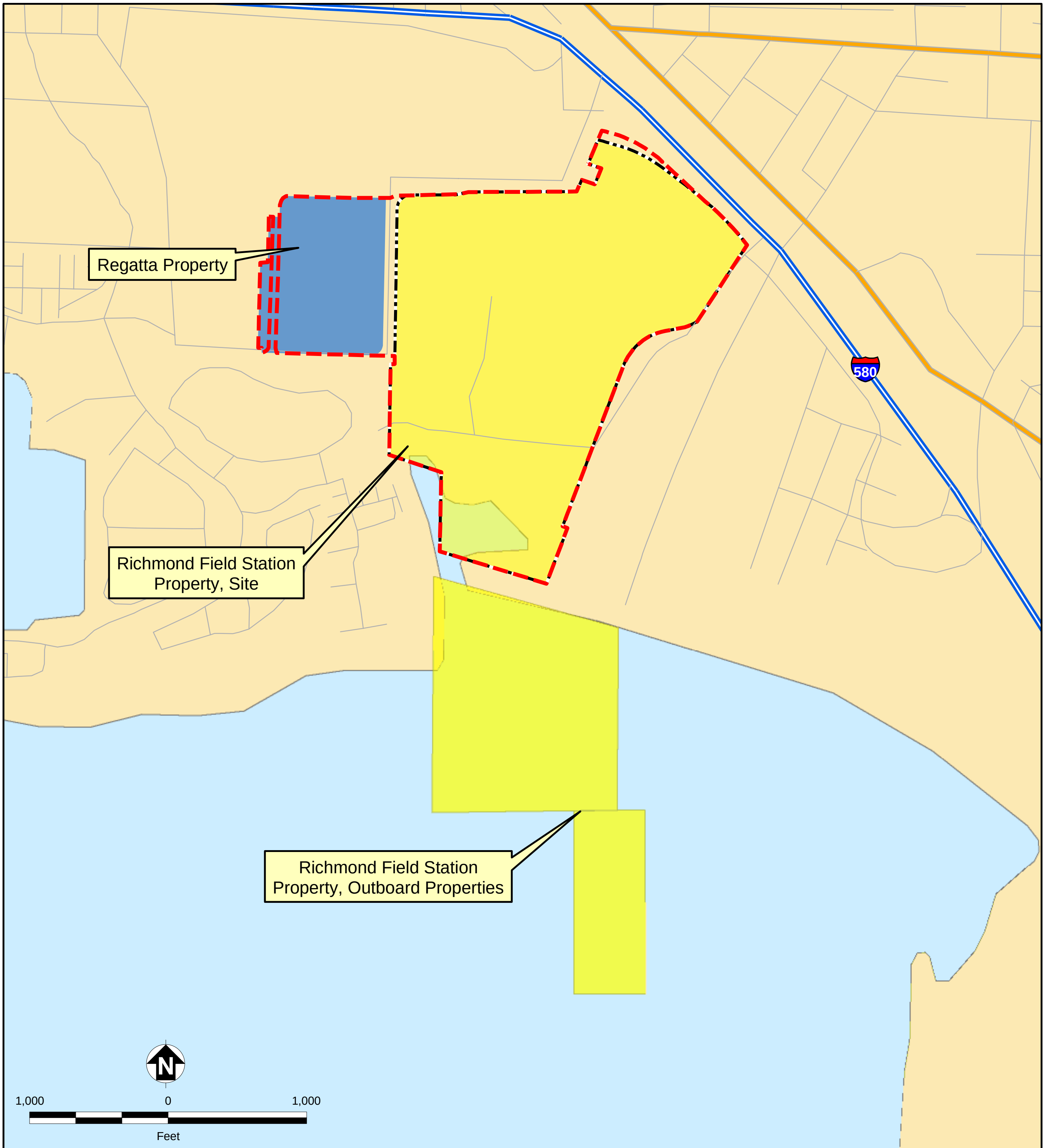


TETRA TECH

Richmond Bay Campus

FIGURE 1-1
RICHMOND BAY CAMPUS LOCATION MAP

Removal Action Workplan



Richmond Field Station Property

Portion of RFS Property Subject to DTSC order, Defined as "Site"

Regatta Property

Richmond Bay Campus

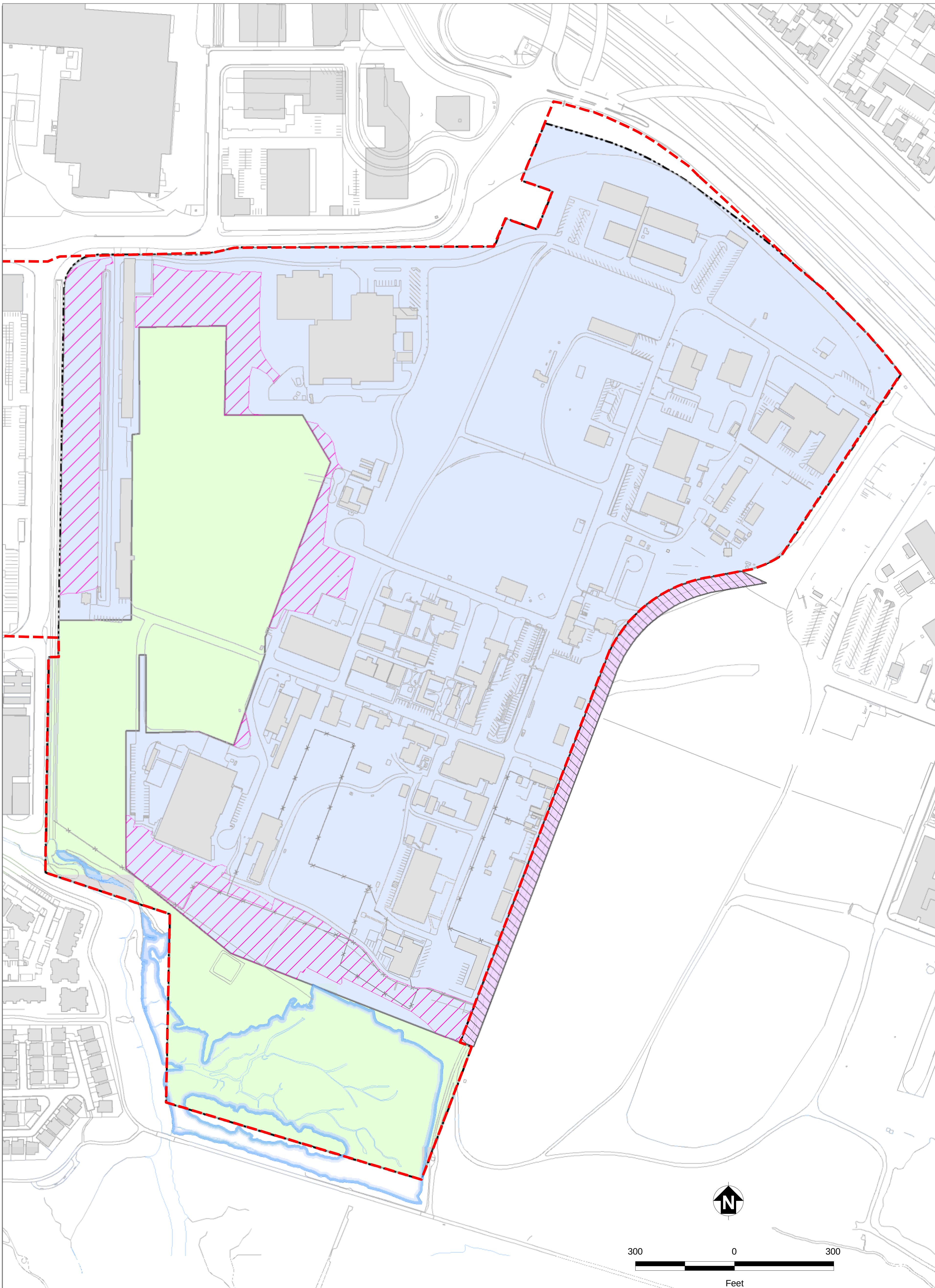
Note:
DTSC Department of Toxic Substances Control
RFS Richmond Field Station

TETRA TECH

Richmond Bay Campus

FIGURE 1-2
UNIVERSITY OF CALIFORNIA PROPERTIES

Removal Action Workplan



Research, Education & Support Area within the Site

Natural Open Space

The portion of South 46th Street owned by UC and Zeneca under a 1/3 and 2/3 shared interest is subject to the RAW

Habitat within RES Area

Portion of RFS Property Subject to DTSC order, Defined as "Site"

Richmond Bay Campus

Roads and Other Landscape Features

Marsh Boundary

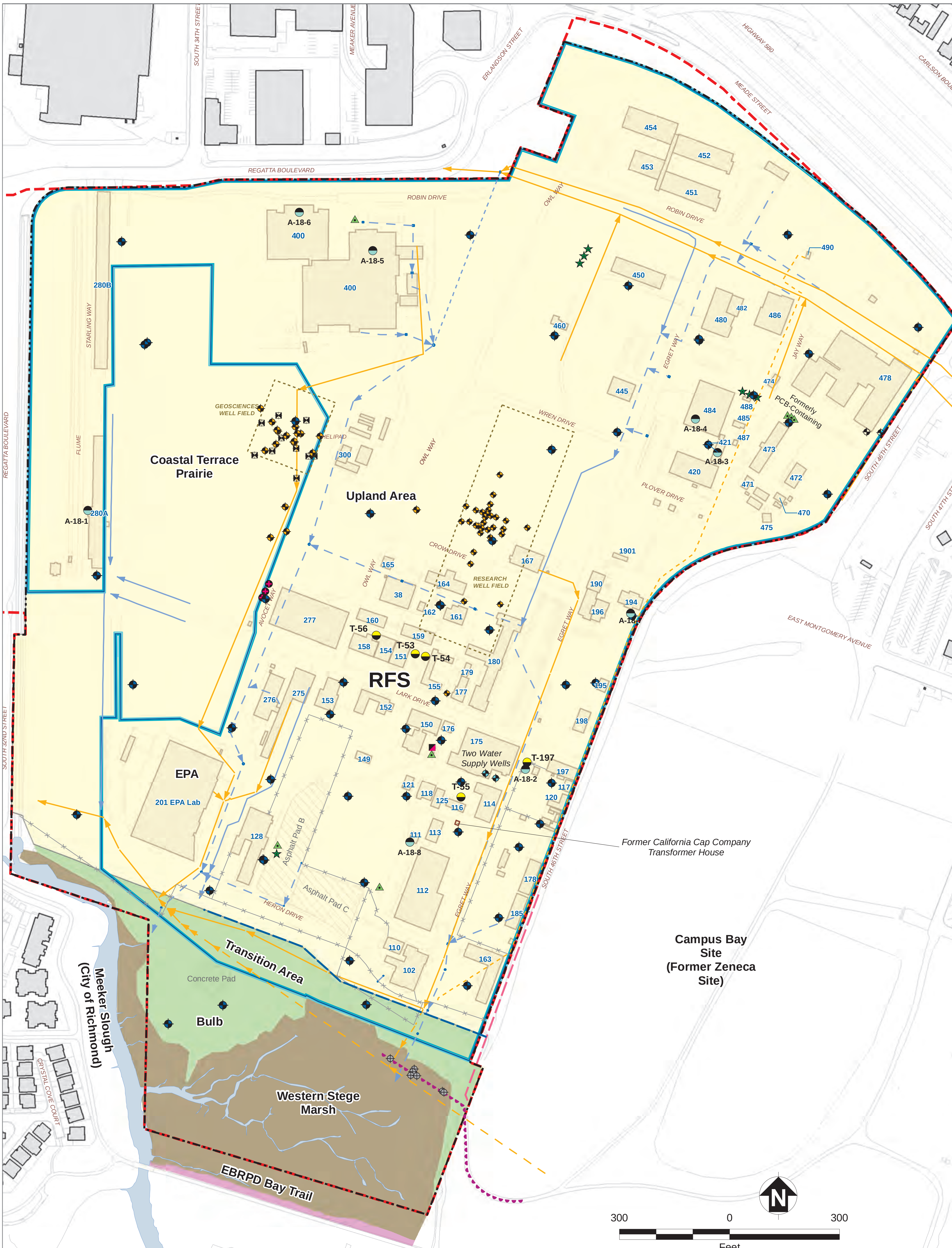
Note:
DTSC Department of Toxic Substances Control
RAW Removal Action Workplan
RES Research, Education, & Support
RFS Richmond Field Station
UC University of California

TETRA TECH

Richmond Bay Campus

FIGURE 1-3
RESEARCH, EDUCATION AND SUPPORT AREA AND NATURAL OPEN SPACE WITHIN SITE BOUNDARY

Removal Action Workplan



Research, Education & Support Area within the Site
Bay Trail
Marsh
Transition (Including Bulb)
Upland
Aboveground Storage Tank (AST)
Former Underground Storage Tank (UST)
Open Well (Not in Use)
Closed Well (Pressure Grouted)
Open Piezometer
Open Geosciences Well
BAPB Wells on RFS Property
Zeneca Wells on RFS Property

Transformer Locations:
Pad-Supported, Non PCB-Containing
Pad-Supported, Former PCB-Containing (Removed)
Pole-Mounted, Non PCB-Containing
Pole-Mounted, Former PCB-Containing (Removed)
Well Field Boundary
Portion of RFS Property Subject to DTSC order, Defined as "Site"
Richmond Bay Campus
Existing Building (Building Numbers Shown in Blue)
Fenceline
Former Seawall (Approximate)

Slurry Wall
Biologically Active Permeable Barrier Wall
Asphalt/Concrete Pads
Surface Water
Sanitary Sewer Lines:
Existing Sewer Line
Removed Sewer Line
Abandoned Sewer Line
Storm Drain Lines:
Open Swale
Underground Culvert
Underground Culvert, Abandoned (Grouted at Manholes)

Note:

BAPB	Biologically Active Permeable Barrier
DTSC	Department of Toxic Substances Control
EBRPD	East Bay Regional Parks District
EPA	Evironmental Protection Agency
PCB	Polychlorinated biphenyls
RFS	Richmond Field Station

TETRA TECH

Richmond Bay Campus

FIGURE 2-1
PHYSICAL FEATURES MAP

Removal Action Workplan

11/22/2013 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Physical_Features.mxd TtEMI-OAK yashekia.evans

- Cordgrass (*Spartina foliosa*)
- Salty Susan (*Jaumea carnosa*)
- Bulrush (*Scirpus americanus*)
- Saltgrass (*Distichlis spicata*)
- Pickleweed (*Salicornia virginica*)
- Ecotone
- Restored Native Upland
- Seasonal Freshwater Wetlands
- Monarch Roosting Area
- Disturbed Coastal Terrace Prairie
- Non Native Dominated Grassland on Fill
- Ornamental Trees
- Eucalyptus
- Non-Native Transitional Upland
- Mud
- Coastal Terrace Prairie
- Drainage Swale
- Restoration Plot
- RES Area
- Natural Open Space Area
- Portion of RFS Property Subject to DTSC order, Defined as "Site"
- Richmond Bay Campus
- Existing Building
- Roads and Other Landscape Features
- Marsh Boundary
- Surface Water

Note:
DTSC Department of Toxic Substances Control
RES Research, Education, and Support
RFS Richmond Field Station

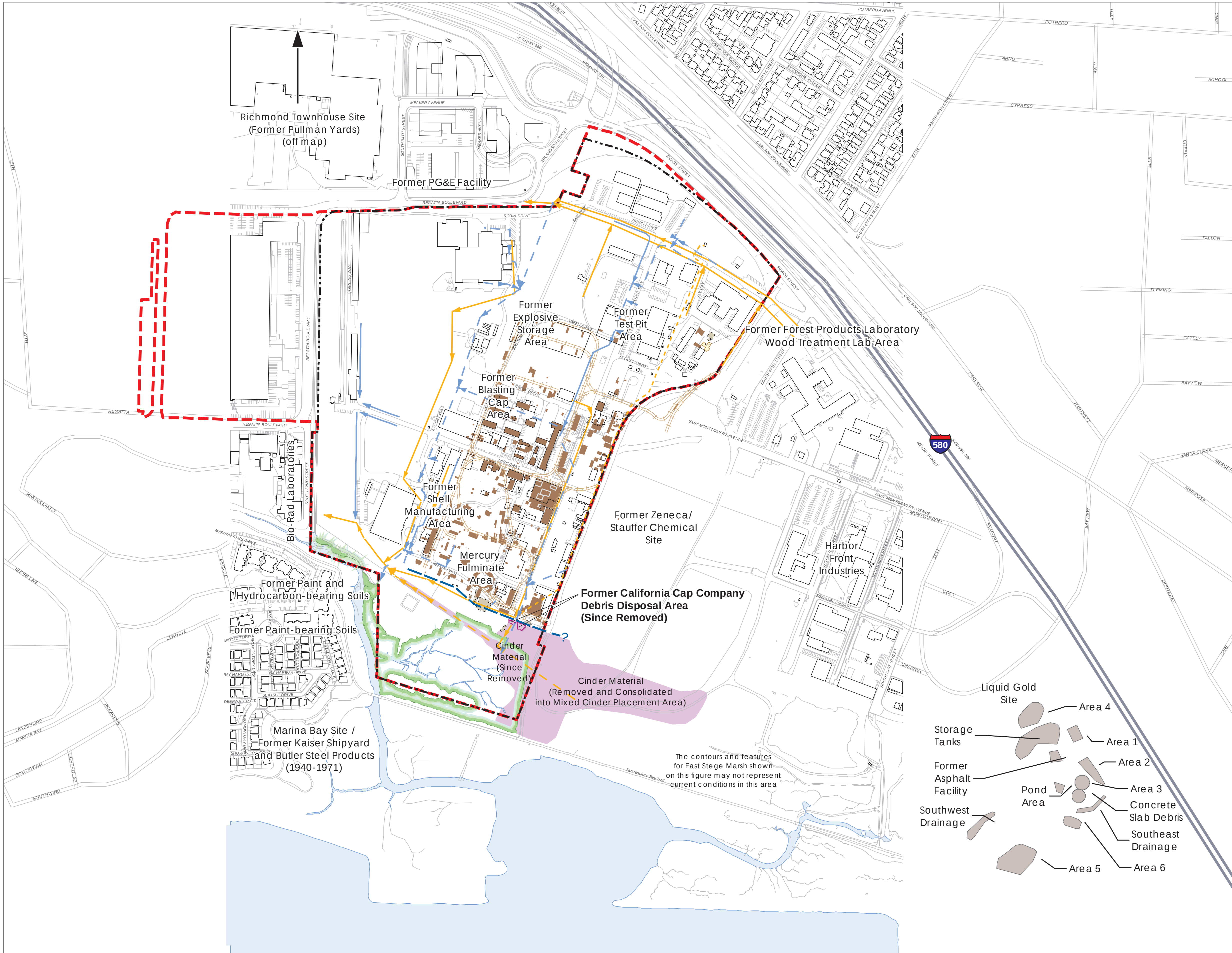
TETRA TECH

Richmond Bay Campus

FIGURE 2-2
HABITAT AND WETLANDS

Removal Action Workplan

9/24/2013 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Habitat_Wetlands_Map.mxd TtEMI-OAK yashekia.evans



Potential Source Areas (Some Locations are Approximate):
- Former California Cap Company Facilities
- Former Pyrite Cinders (Since Removed)
- Removed or Relocated Building (RFS)
- Former California Cap Company Debris Disposal Area (Since Removed)
- Former California Cap Company Tramway
- Portion of RFS Property Subject to DTSC order, Defined as "Site"
- Richmond Bay Campus
- Existing Building
- Roads and Other Landscape Features
- Marsh Boundary
- Former Seawall (Approximate)
- Surface Water

Sanitary Sewer Lines:
- Existing Sewer Line
- Removed Sewer Line
- Abandoned Sewer Line

Storm Drain Lines:
- Open Swale
- Underground Culvert

Sources:
1. URS. 2000. Field Sampling and Analysis Results, University of California Berkeley,Richmond Field Station/Stege Marsh. December.

2. Former California Cap Company building information is based on Sanborn maps from 1930 and 1941 and an earlier undated map signed by "J. Geo. Smith, C.E., Emeryville."

Notes:
Cinder material removed from UC was consolidated into mixed cinder placement area on former Zeneca site.

DTSC	Department of Toxic Substances Control
PG&E	Pacific Gas and Electric Company
RFS	Richmond Field Station
UC	University of California
URS	URS Corporation

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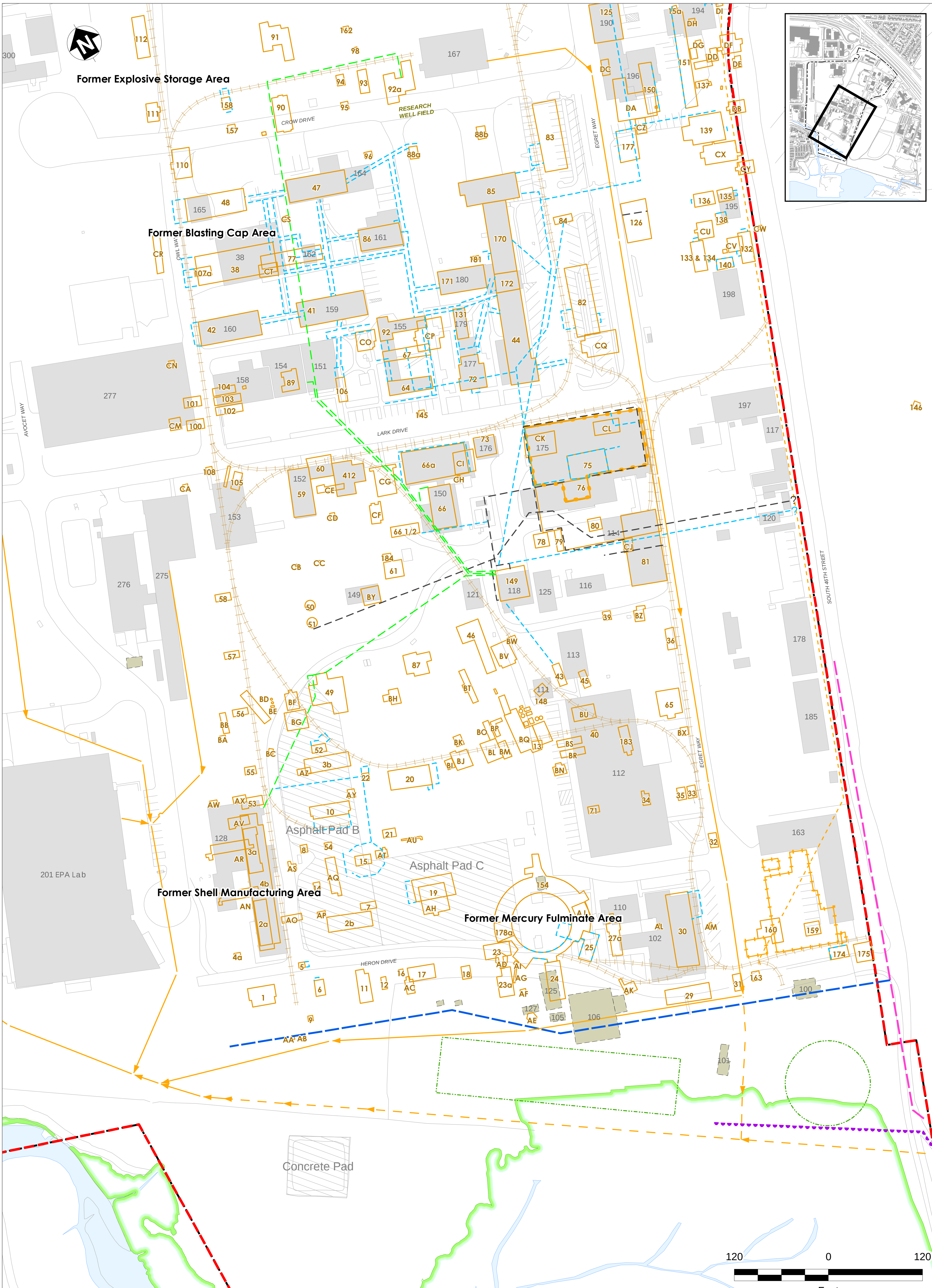
Richmond Bay Campus

FIGURE 2-3
HISTORIC POTENTIAL SOURCE AREAS FROM FORMER INDUSTRIAL OPERATIONS (PRE 2002)

Removal Action Workplan

9/24/2013 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Historic_Potential_Source_Areas.mxd TtEMI-OAK yashekia.evans



Existing Building
Roads and Other Landscape Features
Removed or Relocated Building (RFS)
Former California Cap Company Facilities/Buildings
Former Pacific Cartridge Company Buildings
Former U.S. Briquette Company Building
Former California Cap Company Tramway
Former SERL Pond
Portion of RFS Property Subject to DTSC order, Defined as "Site"

Richmond Bay Campus
Marsh Boundary
Former Seawall (Approximate)
Slurry Wall
Biologically Active Permeable Barrier Wall
Asphalt/Concrete Pads
Surface Water

Sanitary Sewer Lines:
Existing Sewer Line
Removed Sewer Line
Abandoned Sewer Line

Former California Cap Company Utilities:
Natural Gas Line
Fuel Line
Hydraulic Line

Notes:
1. Some locations are approximate.

2. Former California Cap Company facility information is based on Sanborn maps from 1930 and 1941 and an earlier undated map signed by "J. Geo. Smith, C.E., Emeryville."

DTSC Department of Toxic Substances Control
RFS Richmond Field Station
SERL Sanitary Engineering Reseach Laboratory

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FIGURE 2-4
LOCATION OF FORMER AND CURRENT FACILITIES IN THE CENTRAL PORTION OF SITE

Removal Action Workplan

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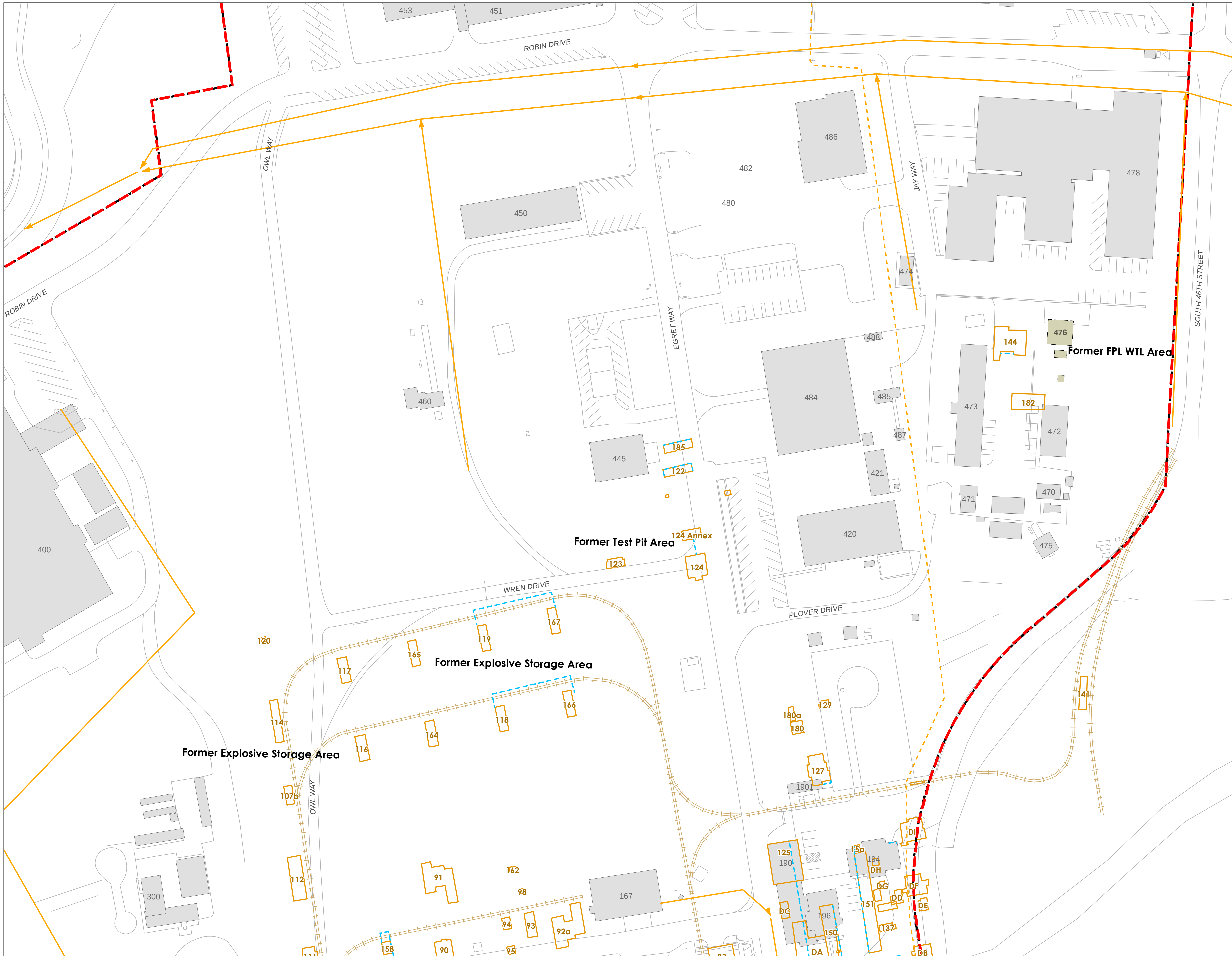

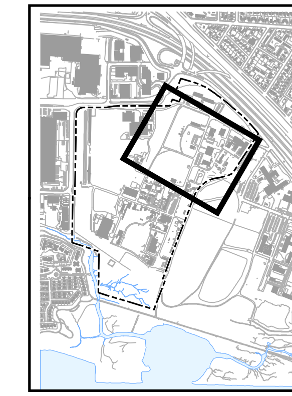

Existing Building

Removed or Relocated Building (RFS)

Former California Cap Company Facilities/Buildings

Former California Cap Company Tramway

Former California Cap Company Natural Gas Line

Portion of RFS Property Subject to DTSC order, Defined as "Site"

Richmond Bay Campus

Roads and Other Landscape Features

Sanitary Sewer Lines:

Existing Sewer Line

Removed Sewer Line

Abandoned Sewer Line

Notes:
1. Some locations are approximate.

2. Former California Cap Company facility information is based on Sanborn maps from 1930 and 1941 and an earlier undated map signed by "J. Geo. Smith, C.E., Emeryville."

DTSC	Department of Toxic Subsances Control
FPL	Forest Products Laboratory
RFS	Richmond Field Station
WTL	Wood Treatment Lab

120 0 120

Feet

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FIGURE 2-5
LOCATION OF FORMER AND CURRENT FACILITIES IN THE NORTHERN PORTION OF SITE

Removal Action Workplan

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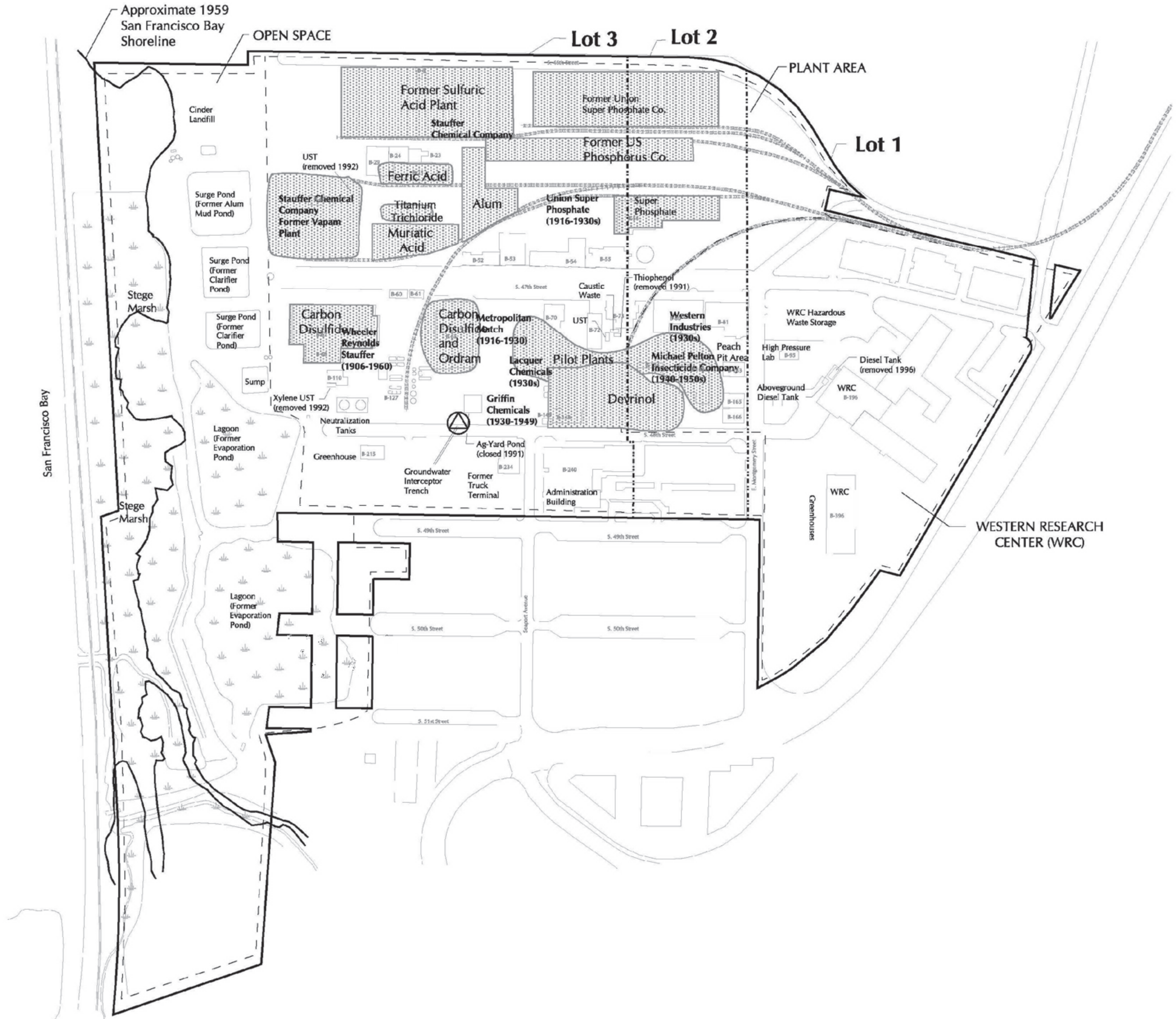

LEGEND

- Capture well
- Property boundary
- Lot boundary
- Open Space, Plant Area, or WRC boundary
- 1959 San Francisco Bay shoreline
- Bay Trail
- Marsh/Wetland Area
- Historical manufacturing areas

ABBREVIATIONS

UST Underground Storage Tank

NOTE

Historical business names and dates are shown in boldface.

Source:
LFR Levine Fricke (LFR). 2005c. "Current Conditions Report, Lot 3, 1200 South 47th Street, Campus Bay, Richmond, California." July 29.

300 0 300
Feet

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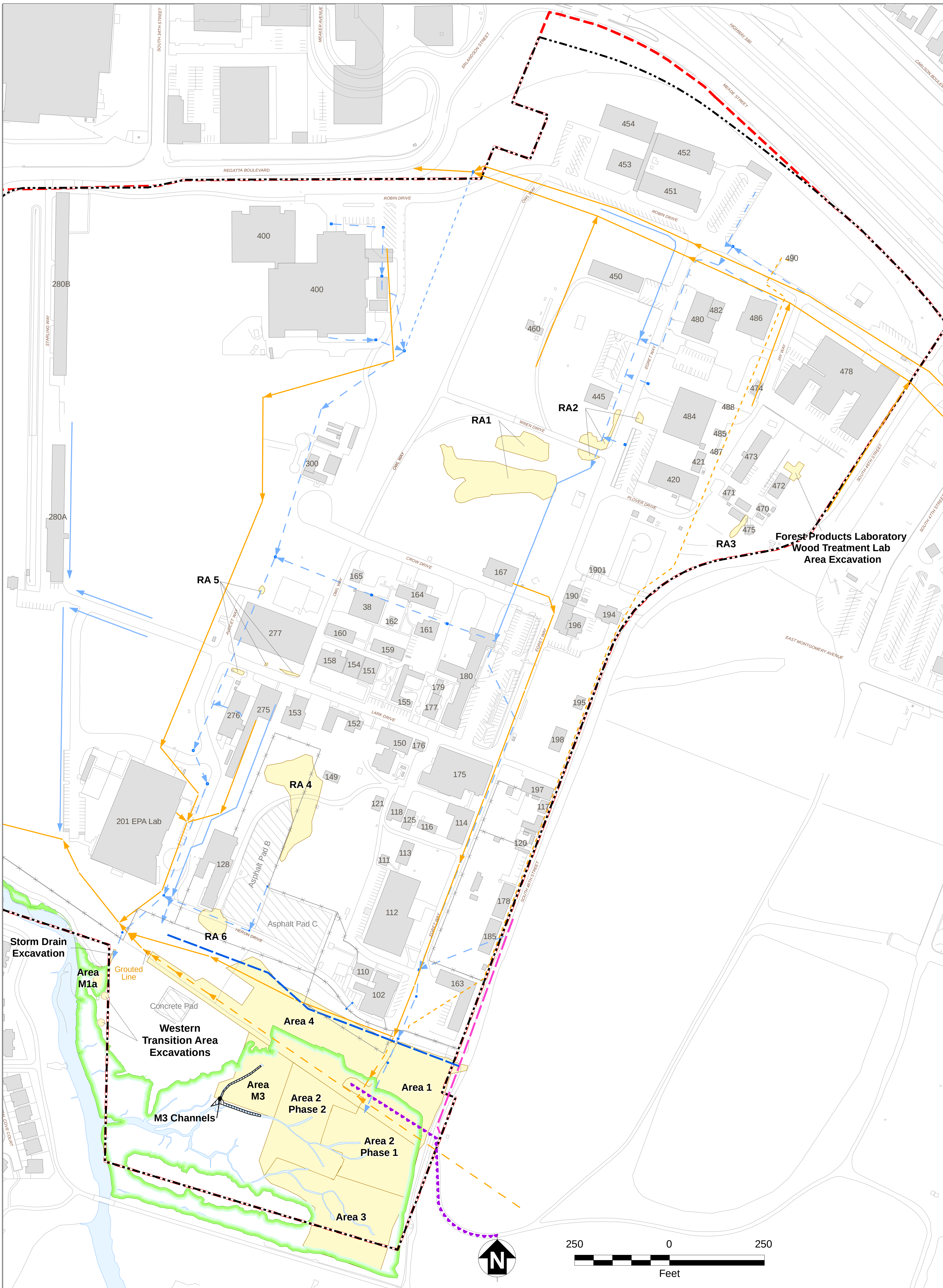
Richmond Bay Campus

FIGURE 2-6
HISTORICAL BUSINESS, MANUFACTURING AREAS, AND SITE FEATURE LOCATIONS - FORMER ZENECA SITE
Removal Action Workplan



Remediated Areas
Phase 3 Marsh Channel Widening
Portion of RFS Property Subject to DTSC order, Defined as "Site"
Richmond Bay Campus
Existing Building
Roads and Other Landscape Features
Fenceline
Marsh Boundary
Former Seawall (Approximate)
Slurry Wall
Biologically Active Permeable Barrier Wall

Asphalt/Concrete Pads
Surface Water
Storm Drain Lines:
Open Swale
Underground Culvert
Underground Culvert, Abandoned (Grouted at Manholes)
Sanitary Sewer Lines:
Existing Sewer Line
Removed Sewer Line
Abandoned Sewer Line

Note:
DTSC Department of Toxic Substances Control
RA Remediation Area
RFS Richmond Field Station

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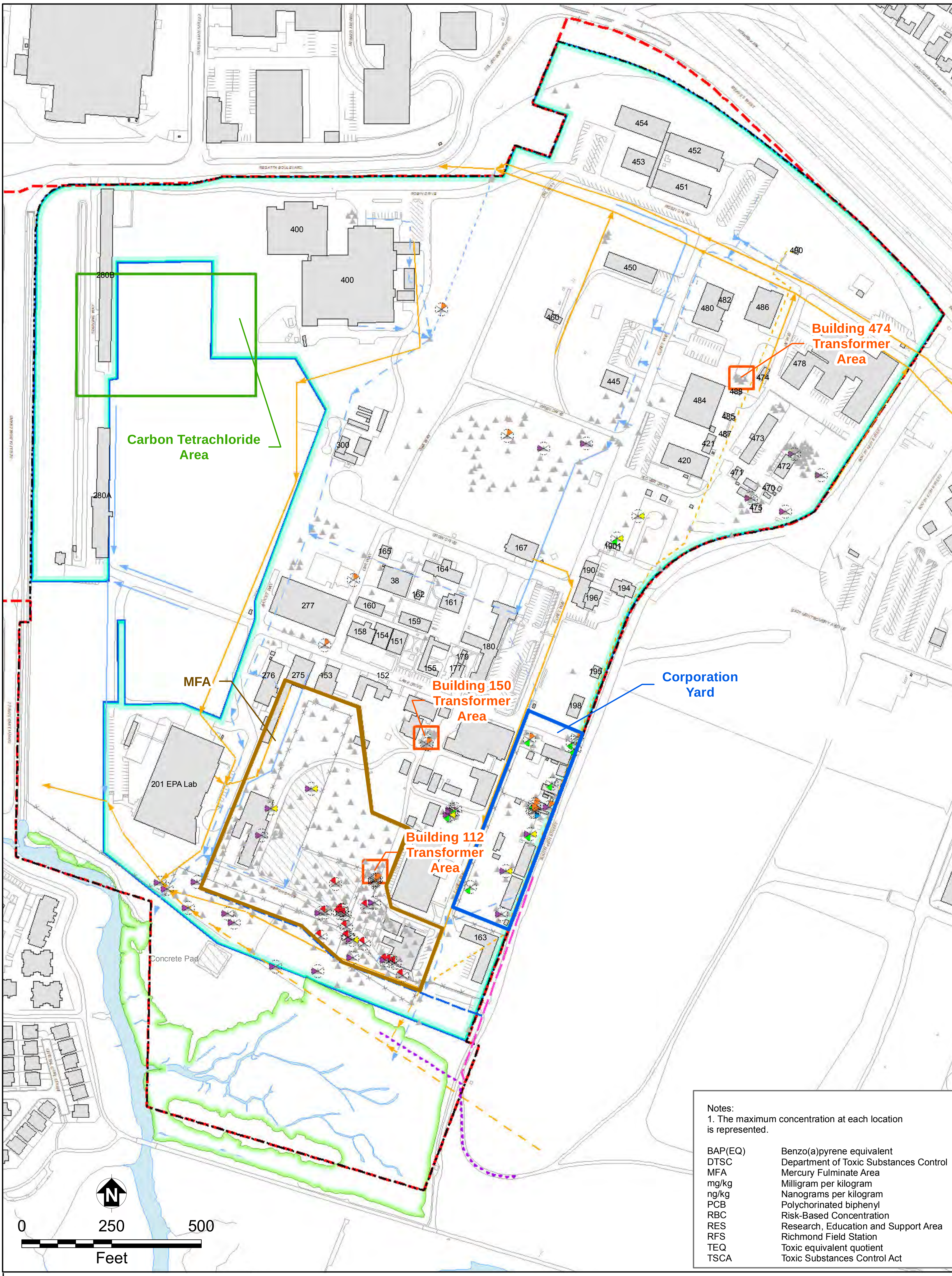
Richmond Bay Campus

FIGURE 2-7
COMPLETED REMEDIATION AREAS

Removal Action Workplan

11/7/2013 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Completed Remediation_Areas.mxd TtEMI-OAK carolyn.ferlic



Notes:
1. The maximum concentration at each location is represented.

BAP(EQ)	Benzo(a)pyrene equivalent
DTSC	Department of Toxic Substances Control
MFA	Mercury Fulminate Area
mg/kg	Milligram per kilogram
ng/kg	Nanograms per kilogram
PCB	Polychorinated biphenyl
RBC	Risk-Based Concentration
RES	Research, Education and Support Area
RFS	Richmond Field Station
TEQ	Toxic equivalent quotient
TSCA	Toxic Substances Control Act

Soil Sampling Locations

- All Chemical Concentrations < Remedial Goals
- Mercury Concentrations[1] ≥ 275 mg/kg (Commercial RBC)
- PCB Concentrations[1] ≥ 1 mg/kg (TSCA High Occupancy, No Conditions)
- Lead Concentrations[1] ≥ 320 mg/kg (Commercial RBC)
- Dioxin TEQ Concentrations[1] ≥ 16.4 ng/kg (Commercial
- BAP(EQ) Concentrations[1] ≥ 0.4 mg/kg (Background)
- Arsenic Concentrations[1] ≥ 16 mg/kg (Background)

Area Boundaries

- MFA
- Corporation Yard
- Transformer
- Carbon Tetrachloride

- Slurry Wall
- Biologically Active Permeable Barrier
- Former Seawall (Approximate)
- Fenceline
- Asphalt/Concrete Pads
- Buildings
- Marsh Boundary
- Surface Water
- RES Area within the
- Portion of RFS Property Subject to DTSC order, Defined as
- Richmond Bay Campus
- Roads and other Landscape Features

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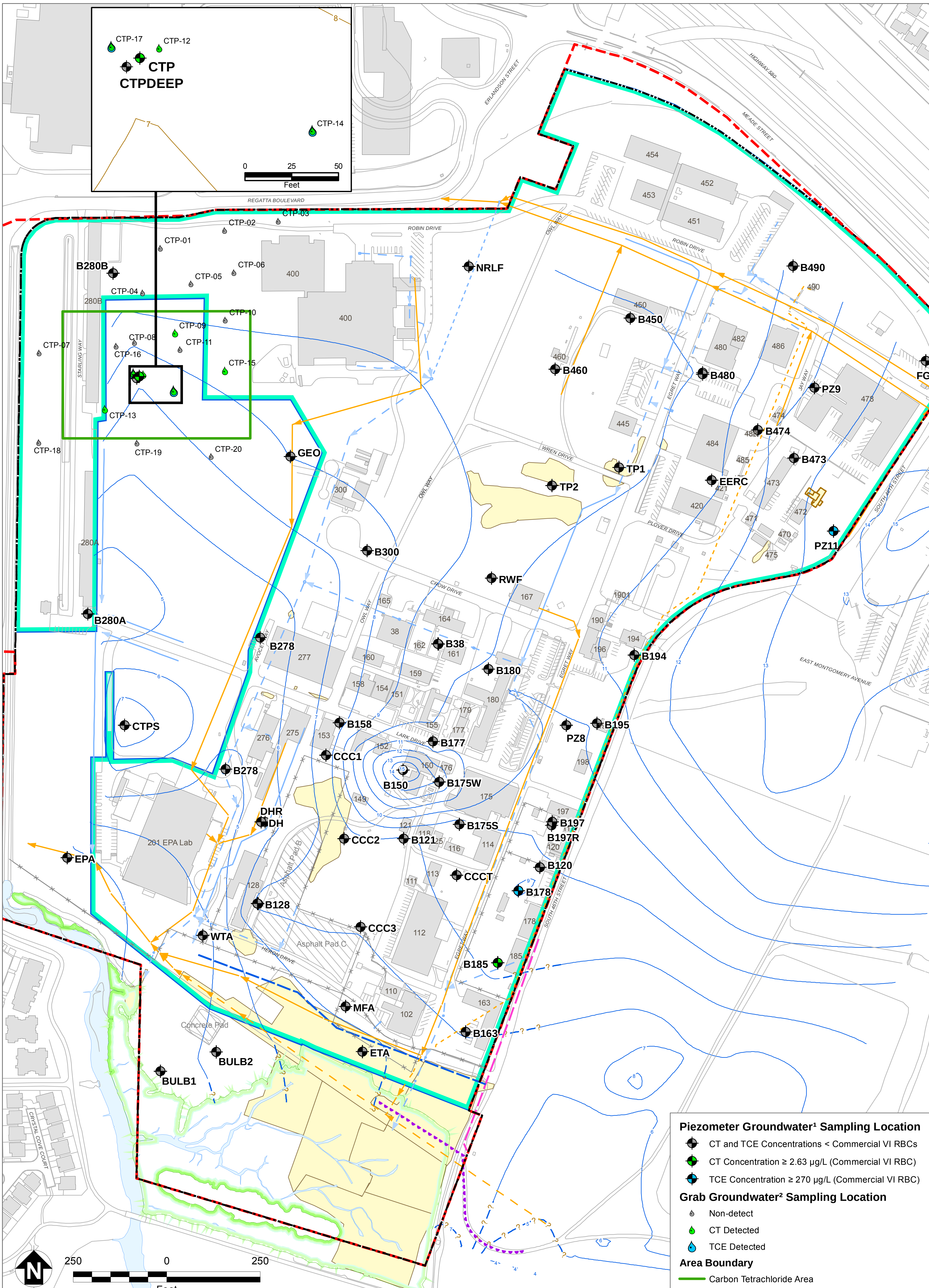
Richmond Bay Campus

FIGURE 2-8
RES SOIL SAMPLING LOCATIONS WITH REMEDIAL GOAL EXCEEDANCES

Removal Action Workplan

7/17/2014 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\RES Soil Sampling RBC and PCB Exceedances.mxd TtEMI-OAK yashekia.evans



April 2012 Groundwater Contour
Remediated Areas
Research, Education & Support Area within the Site
Portion of RFS Property Subject to DTSC order, Defined as "Site"
Richmond Bay Campus
Existing Building
Marsh Boundary
Road or Other Landscape Feature
Fenceline
Former Seawall (Approximate)
Slurry Wall
Biologically Active Permeable Barrier Wall

Asphalt/Concrete Pads
Surface Water
Sanitary Sewer Lines:
Existing Sewer Line
Removed Sewer Line
Abandoned Sewer Line
Storm Drain Line:
Open Swale
Underground Culvert
Underground Culvert, Abandoned (Grouted at Manholes)

Notes:
1 The maximum concentration at each location is represented.
2 Grab groundwater samples are not considered to be high quality data, therefore the concentrations detected were not compared to screening criteria. The target of the investigation was to confirm or deny the existence of an upgradient source of carbon tetrachloride, therefore this figure indicates whether carbon tetrachloride was detected at each location.

CT Carbon Tetrachloride
DTSC Department of Toxic Substances Control
µg/L Micrograms per liter
RBC Risk-Based Concentration
RFS Richmond Field Station
TCE Trichloroethene
VI Vapor Intrusion

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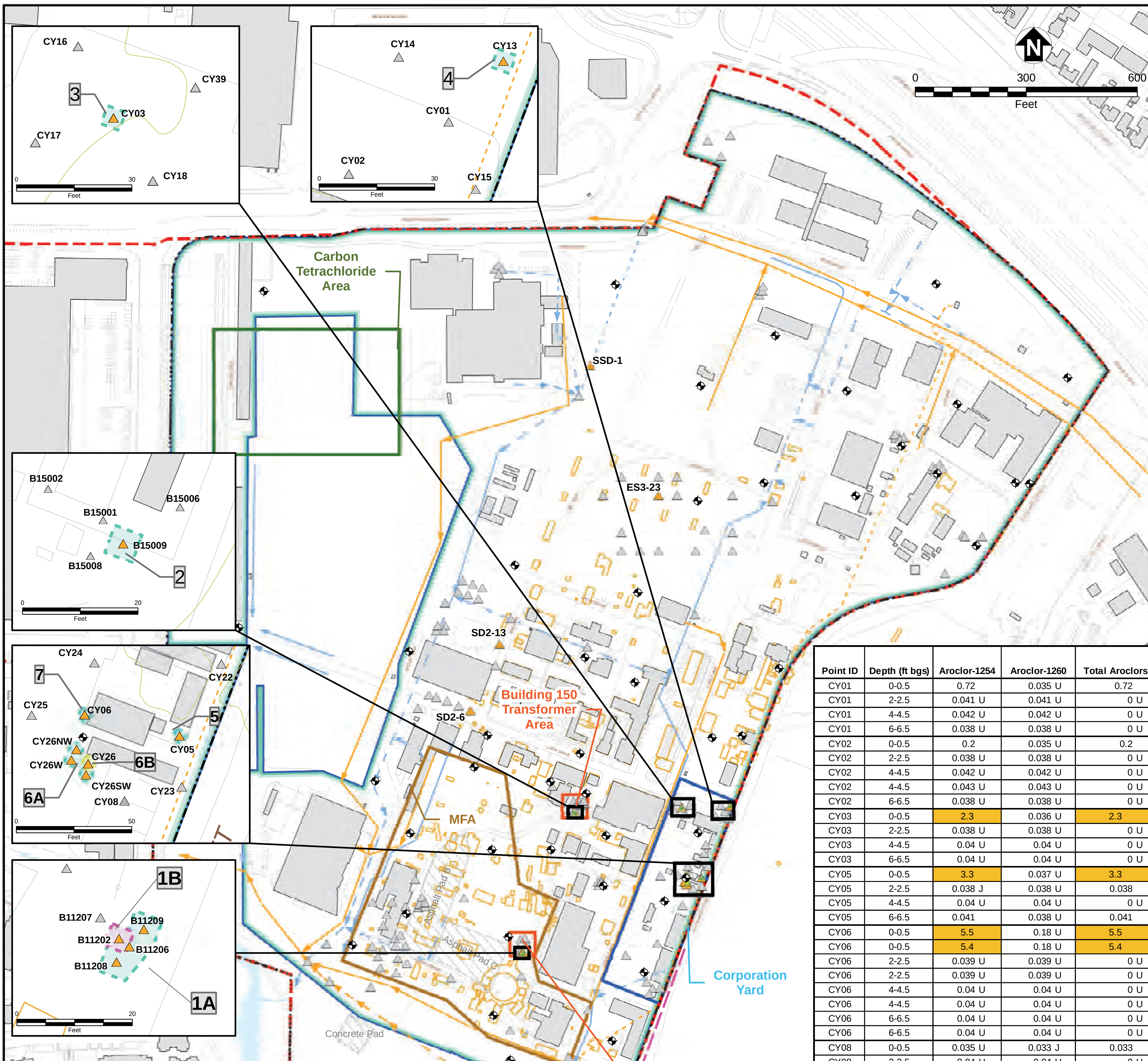
FIGURE 2-9
GROUNDWATER SAMPLING LOCATIONS WITH COMMERCIAL VI RISK-BASED CONCENTRATION EXCEEDANCES

Removal Action Workplan

7/17/2014 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Groundwater Sampling Locations with RBC Exceedances.mxd TtEMI-OAK yashekia.evans



Point ID	Depth (ft bgs)	Aroclor-1254	Aroclor-1260	Total Aroclors
CY01	0-0.5	0.72	0.035 U	0.72
CY01	2-2.5	0.041 U	0.041 U	0 U
CY01	4-4.5	0.042 U	0.042 U	0 U
CY01	6-6.5	0.038 U	0.038 U	0 U
CY02	0-0.5	0.2	0.035 U	0.2
CY02	2-2.5	0.038 U	0.038 U	0 U
CY02	4-4.5	0.042 U	0.042 U	0 U
CY02	4-4.5	0.043 U	0.043 U	0 U
CY02	6-6.5	0.038 U	0.038 U	0 U
CY03	0-0.5	2.3	0.036 U	2.3
CY03	2-2.5	0.038 U	0.038 U	0 U
CY03	4-4.5	0.04 U	0.04 U	0 U
CY03	6-6.5	0.04 U	0.04 U	0 U
CY05	0-0.5	3.3	0.037 U	3.3
CY05	2-2.5	0.038 J	0.038 U	0.038
CY05	4-4.5	0.04 U	0.04 U	0 U
CY05	6-6.5	0.041	0.038 U	0.041
CY06	0-0.5	5.5	0.18 U	5.5
CY06	0-0.5	5.4	0.18 U	5.4
CY06	2-2.5	0.039 U	0.039 U	0 U
CY06	2-2.5	0.039 U	0.039 U	0 U
CY06	4-4.5	0.04 U	0.04 U	0 U
CY06	4-4.5	0.04 U	0.04 U	0 U
CY06	6-6.5	0.04 U	0.04 U	0 U
CY06	6-6.5	0.04 U	0.04 U	0 U
CY08	0-0.5	0.035 U	0.033 J	0.033
CY08	2-2.5	0.04 U	0.04 U	0 U
CY08	4-4.5	0.042 U	0.042 U	0 U
CY08	6-6.5	0.039 U	0.039 U	0 U
CY13	0-0.5	4.3	0.0043 U	4.3
CY13	2-2.5	0.0054 J	0.0022 UJ	0.0054
CY14	0-0.5	0.0017 J	0.0022 U	0.0017
CY14	0-0.5	0.00078 UJ	0.0022 UJ	0 U
CY14	2-2.5	0.00078 UJ	0.0022 UJ	0 U
CY15	0-0.5	0.021 U	0.8	0.8
CY15	2-2.5	0.0044 J	0.0022 UJ	0.0044
CY16	0-0.5	0.064	0.0043 U	0.064
CY16	2-2.5	0.00078 UJ	0.0022 UJ	0 U
CY17	0-0.5	0.054 J	0.0022 UJ	0.054
CY17	2-2.5	0.00078 UJ	0.0022 UJ	0 U
CY18	0-0.5	0.072 J	0.0022 UJ	0.072
CY18	0-0.5	0.045 J	0.0022 UJ	0.045
CY18	2-2.5	0.0031 J	0.0022 UJ	0.0031
CY22	0-0.5	0.019	0.0022 U	0.019
CY22	2-2.5	0.055 J	0.0022 UJ	0.055
CY23	0-0.5	0.6	0.055 UJ	0.6
CY23	2-2.5	0.36	0.055 U	0.36
CY24	0-0.5	0.082	0.0022 U	0.082
CY24	2-2.5	0.014	0.0022 U	0.014
CY25	0-0.5	0.00078 U	0.0022 U	0 U
CY25	2-2.5	0.00078 U	0.0022 U	0 U
CY26	0-0.5	110	2.2 U	110
CY26	2-2.5	7.2	0.22 U	7.2
CY26NW	0-0.5	1.1	0.022 U	1.1
CY26SW	0-0.5	8.3	0.22 U	8.3
CY26W	0-0.5	12	0.22 U	12
CY39	0-0.5	0.062	0.0022 U	0.062
CY39	2-2.5	0.17 J	0.0022 UJ	0.17

Point ID	Depth (ft bgs)	Aroclor-1248	Aroclor-1254	Aroclor-1260	Total Aroclors
B11202	0-0.5	35	0.29 U	0.29 U	35
B11202	1.5-2	2.2	0.036 U	0.036 U	2.2
B11206	0-0.5	0.012 U	24	0.022	24
B11206	1.5-2	0.0024 UJ	0.14 J	0.0044 UJ	0.14
B11206	3-3.5	0.0012 UJ	0.04 J	0.0022 UJ	0.04
B11207	0-0.5	0.0012 U	0.0073 J	0.0022 U	0.0073
B11207	1.5-2	0.0012 U	0.007 J	0.0022 U	0.007
B11207	3-3.5	0.0012 UJ	0.00078 UJ	0.0022 UJ	0 U
B11207	3-3.5 - Dup	0.0012 U	0.00078 U	0.0022 U	0 U
B11208	0-0.5	0.03 U	1.4	0.055 U	1.4
B11208	1.5-2	0.012 U	0.19	0.022 U	0.19
B11208	3-3.5	0.0012 U	0.14	0.0022 U	0.14
B11209	0-0.5	0.12 U	4.5	0.22 U	4.5
B11209	1.5-2	0.012 U	0.56	0.022 U	0.56
B11209	3-3.5	0.0012 U	0.13	0.0022 U	0.13

Point ID	Depth (ft bgs)	Aroclor-1248	Aroclor-1254	Aroclor-1260	Total Aroclors
B15001	0-0.5	0.64	0.037 U	0.037 U	0.64
B15001	1.5-2	0.039 U	0.039 U	0.039 U	0 U
B15002	0-0.5	0.037 U	0.028 J	0.036 J	0.064
B15002	1.5-2	0.04 U	0.04 U	0.04 U	0 U
B15006	0-0.5	0.035 U	0.028 J	0.034 J	0.062
B15006	1.5-2	0.04 U	0.04 U	0.04 U	0 U
B15008	0-0.5	0.0012 U	0.052	0.0022 U	0.052
B15008	1.5-2	0.0012 U	0.018	0.0022 U	0.018
B15009	0-0.5	0.033 U	0.021 U	1.7	1.7
B15009	1.5-2	0.0012 UJ	0.14 J	0.0022 UJ	0.14
B15010	0-0.5	0.0034 U	0.048	0.0062 U	0.048
B15010	1.5-2	0.0012 U	0.024	0.0022 U	0.024
B15010	1.5-2 - Dup	0.0012 U	0.023	0.0022 U	0.023

Excavation Site	EST. Depth (ft bgs)	EST. Area (ft²)	EST. Volume (cy)
1A	1	58	2.15
1B	2.5	16	1.48
2	1	25	0.93
3	1	25	0.93
4	1	25	0.93
5	1	25	0.93
6A	1	92	3.41
6B	3	25	2.78
7	1	25	0.93
Total		**316**	**14.45**

PCB Concentrations[1 2]

- PCB Concentrations[1 2] < 1 mg/kg (TSCA High Occupancy, No Conditions)
- PCB Concentrations[1 2] ≥ 1 mg/kg (TSCA High Occupancy, No Conditions)

PCB Excavation Footprint and Depth (ft bgs)

- 1 ft
- 2.5 ft
- 3 ft

Area Boundaries

- Transformer Areas
- Carbon Tetrachloride Area
- Corporation Yard
- MFA
- Research, Education & Support Area within the Site
- Richmond Bay Campus

- Portion of RFS Property Subject to DTSC order, Defined as "Site"
- Buildings
- Former California Cap Company Facilities/Buildings
- Roads other Landscape Features
- Piezometer Groundwater Monitoring Well
- Slurry Wall
- Asphalt/Concrete Pads
- Surface Water

Sanitary Sewer Lines:

- Existing Sewer Line
- Removed Sewer Line
- Abandoned Sewer Line

Storm Drain Lines:

- Open Swale
- Underground Culvert
- Underground Culvert, Abandoned (Grouted at Manholes)

Notes:
Results in table are presented in mg/kg.

1	Total PCB concentration is the sum of detected concentrations of Aroclors-1248, -1254, and -1260 in each sample. The maximum concentration at each location is represented.
2	Results for locations ES3-23, SD2-6, SD2-13, and SSD-1 are not presented in the tables and are not proposed for cleanup because they are not associated with any transformer area or any transformer maintenance activities.
bgs	Below ground surface
cy	Cubic yards
DTSC	California Department of Toxic Substances Control
Dup	Duplicate Sample
EST	Estimated
ft	Feet
J	Estimated
MFA	Mercury Fulminate Area
mg/kg	Milligram per kilogram
PCB	Polychlorinated biphenyl
RES	Research, Education & Support
RFS	Richmond Field Station
TSCA	Toxic Substances Control Act
U	Not Detected

TETRA TECH

Richmond Bay Campus

FIGURE 4-1
PCB EXCAVATION AREAS

Removal Action Workplan

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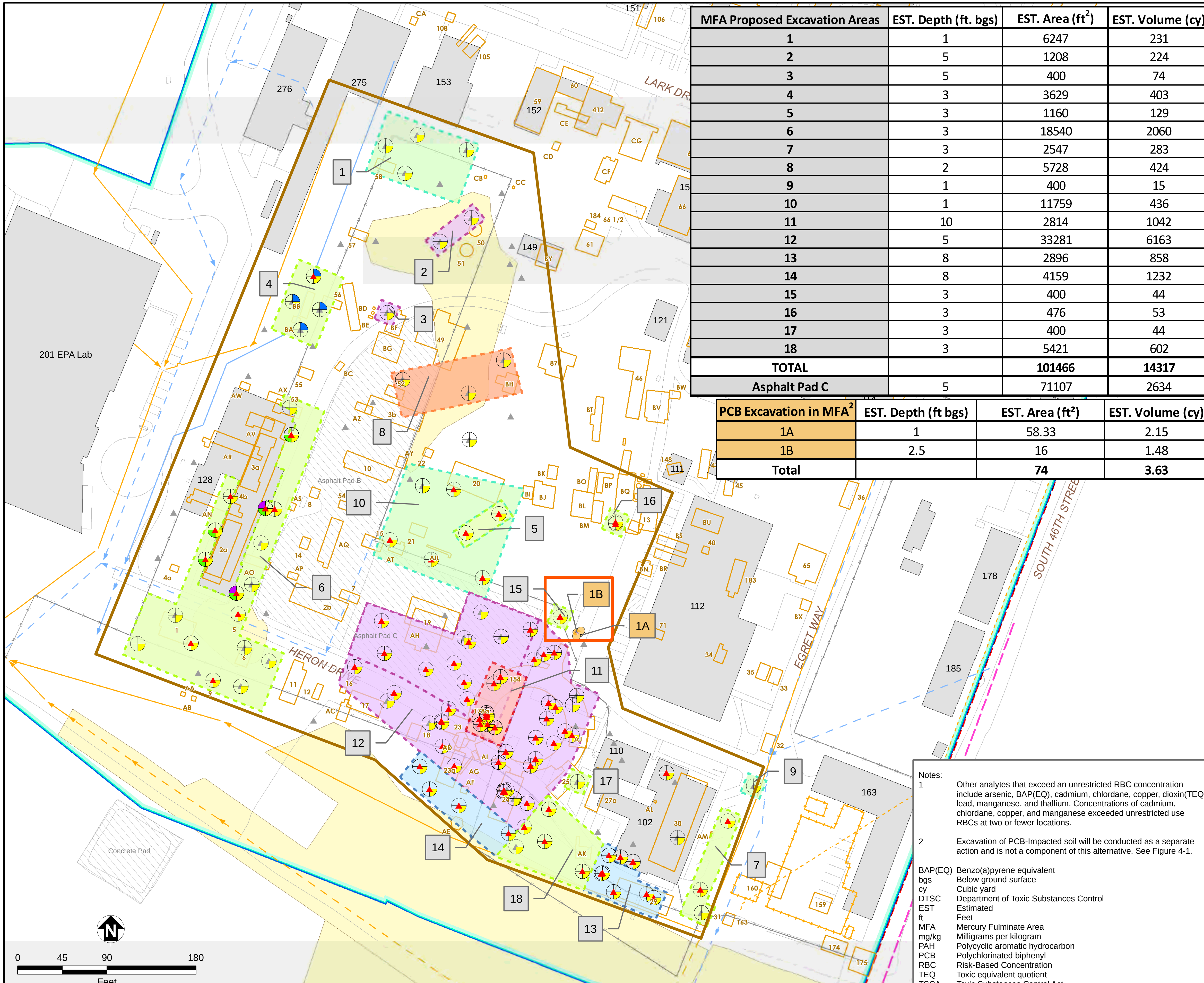
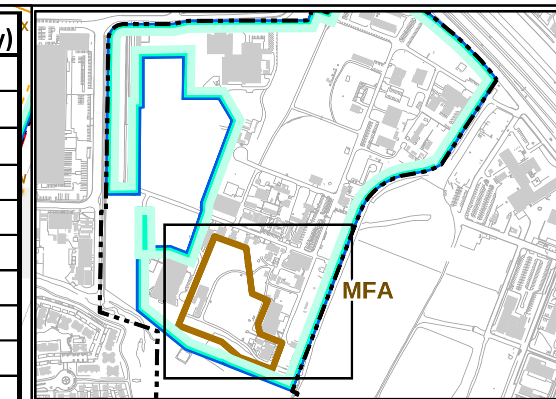


MFA Proposed Excavation Areas	EST. Depth (ft. bgs)	EST. Area (ft^2)	EST. Volume (cy)
1	1	6247	231
2	5	1208	224
3	5	400	74
4	3	3629	403
5	3	1160	129
6	3	18540	2060
7	3	2547	283
8	2	5728	424
9	1	400	15
10	1	11759	436
11	10	2814	1042
12	5	33281	6163
13	8	2896	858
14	8	4159	1232
15	3	400	44
16	3	476	53
17	3	400	44
18	3	5421	602
TOTAL		**101466**	**14317**
Asphalt Pad C	5	71107	2634

PCB Excavation in MFA[2]	EST. Depth (ft bgs)	EST. Area (ft^2)	EST. Volume (cy)
1A	1	58.33	2.15
1B	2.5	16	1.48
Total		**74**	**3.63**



Soil Sampling Locations

- All Analyte Concentrations < Unrestricted RBCs or Background
- Mercury Concentrations ≥ 22.8 mg/kg (Unrestricted RBC)
- PCB Concentrations ≥ 1 mg/kg (TSCA High Occupancy, No Conditions)
- Dioxin Concentrations ≥ Unrestricted RBC or Background[1]
- Metals Concentrations ≥ Unrestricted RBC or Background[1]
- PAH Concentrations ≥ Unrestricted RBC or Background[1]
- Pesticide Concentrations ≥ Unrestricted RBC or Background[1]

Proposed MFA Excavation Footprint and Depth (ft bgs)

- 1 ft
- 2 ft
- 3 ft
- 5 ft
- 8 ft
- 10 ft

PCB Excavation Footprint and Depth (ft bgs)[2]

- 1 ft
- 2.5 ft

Boundaries

- Building 112 Transformer Area
- MFA

Former California Cap Company Facilities/Buildings

- Former California Cap Company Facility/Building
- Former Pacific Cartridge Company Building
- Former U.S. Briquette Company Building
- Remediated Areas
- Research, Education & Support Area within the Site
- Portion of RFS Property Subject to DTSC order, Defined as "Site"
- Existing Building
- Roads and Other Landscape Feature
- Fenceline
- Slurry Wall
- Asphalt/Concrete Pads
- Surface Water

Sanitary Sewer Lines:

- Existing Sewer Line
- Removed Sewer Line
- Abandoned Sewer Line

Storm Drain Lines:

- Open Swale
- Underground Culvert
- Underground Culvert, Abandoned (Grouted at Manholes)

Notes:

1 Other analytes that exceed an unrestricted RBC concentration include arsenic, BAP(EQ), cadmium, chlordane, copper, dioxin(TEQ), lead, manganese, and thallium. Concentrations of cadmium, chlordane, copper, and manganese exceeded unrestricted use RBCs at two or fewer locations.

2 Excavation of PCB-Impacted soil will be conducted as a separate action and is not a component of this alternative. See Figure 4-1.

BAP(EQ)	Benzo(a)pyrene equivalent
bgs	Below ground surface
cy	Cubic yard
DTSC	Department of Toxic Substances Control
EST	Estimated
ft	Feet
MFA	Mercury Fulminate Area
mg/kg	Milligrams per kilogram
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
RBC	Risk-Based Concentration
TEQ	Toxic equivalent quotient
TSCA	Toxic Substances Control Act

TETRA TECH

Richmond Bay Campus

FIGURE 4-2
PROPOSED UNRESTRICTED REMEDIATION AREAS IN MFA

Removal Action Workplan

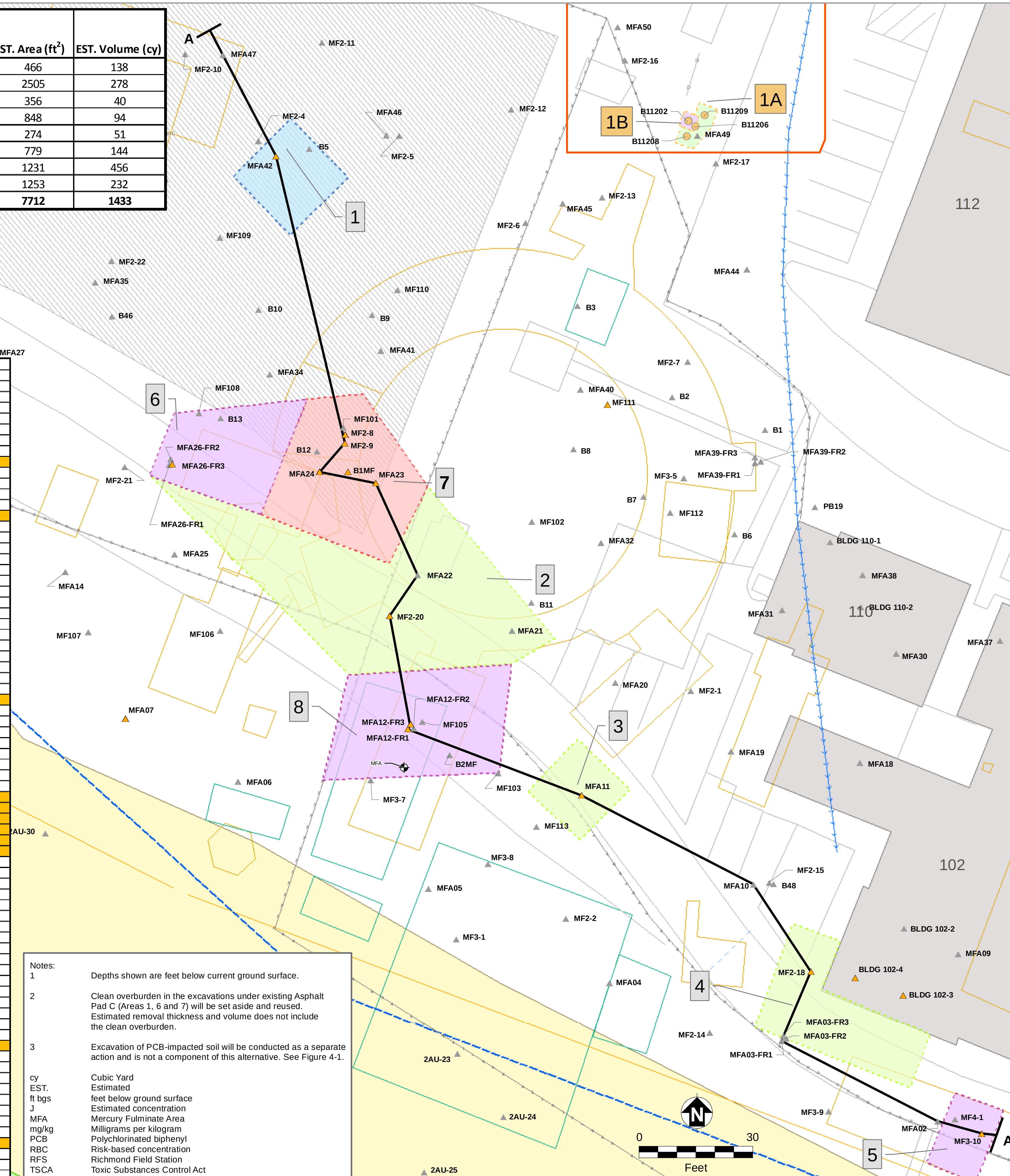
11/22/2013 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Proposed Unrestricted Remediation Areas in MFA.mxd TtEMI-OAK yashekia.evans

MFA Excavation Areas	EST. Depth of Excavation (ft. bgs) [1,2]	EST. Removal Thickness (ft) [2]	EST. Thickness of Clean overburden (ft) [2]	EST. Area (ft^2)	EST. Volume (cy)
1	10	8	2	466	138
2	3	3	0	2505	278
3	3	3	0	356	40
4	3	3	0	848	94
5	5	5	0	274	51
6	5 to 9	5	0 to 4	779	144
7	10 to 14	10	0 to 4	1231	456
8	5	5	0	1253	232
TOTAL				7712	1433

PCB Excavation in MFA[3]	EST. Depth (ft bgs)	EST. Area (ft^2)	EST. Volume (cy)
1A	1	58.33	2.15
1B	2.5	16	1.48
Total		**74**	**3.63**

Point ID	Depth (ft)	Result
B12	4.2-7.2	180
B13	0-3	7.4
B1MF	5.5-5.5	317
B2MF	1.15-1.15	11
B2MF	1.5-1.5	4.39
B2MF	4-4	2.6
B2MF	6.5-6.5	0.46
B2MF	9-9	0.12
B2MF	11.5-11.5	1.63
B2MF	14-14	2.03
B5	1.81-4.81	19
MF101	4.59-4.59	45
MF101	6.59-6.59	54
MF101	9.59-9.59	67
MF103	0-0	50
MF103	1.76-1.76	11
MF103	4.76-4.76	13
MF105	0-0	4.6
MF105	1.85-1.85	15
MF105	4.85-4.85	9.2
MF108	4.31-4.31	220
MF108	8.31-8.31	11
MF108	11.31-11.31	0.33
MF2-18	0.5-0.5	370
MF2-18	2.5-2.5	11
MF2-18	4-4	180
MF2-18	7.5-7.5	0.098
MF2-18	10.5-10.5	0.11
MF2-20	0.27-0.27	470
MF2-20	1.77-1.77	380
MF2-20	3.27-3.27	82
MF2-20	4.77-4.77	38
MF2-20	6.77-6.77	17
MF2-8	10.77-10.77	370
MF2-8	12.77-12.77	810
MF2-8	14.27-14.27	360
MF2-9	5-5	1100
MF2-9	7.5-7.5	2.5
MF2-9	10.5-10.5	22
MF2-9	12.5-12.5	0.29
MF2-9	15-15	55
MF2-9	16.5-16.5	3.1
MF2-9	17-17	0.91
MF2-9	19-19	0.61
MF3-10	0-0.5	930
MF3-10	2-2.5	8.1
MF3-10	4-4.5	940
MF3-10	4-4.5	0.15
MF3-10	6-6.5	0.1
MF3-10	8-8.5	0.13
MF3-10	9.5-10	0.13
MF4-1	0-0.5	75
MF4-1	2-2.5	0.15
MF4-1	4-4.5	1
MF4-1	6-6.5	0.035
MF4-1	7.5-8	0.053
MFA03-FR2	0-0.5	230
MFA03-FR2	2-2.5	120
MFA03-FR2	4-4.5	57
MFA03-FR2	6-6.5	76
MFA03-FR3	0-0.5	3.2
MFA03-FR3	2-2.5	20
MFA03-FR3	4-4.5	22
MFA03-FR3	6-6.5	14
MFA11	0-0.5	990
MFA11	0-0.5	47
MFA11	2-2.5	28
MFA11	4-4.5	8.6
MFA11	6-6.5	2.8
MFA12-FR1	0-0.5	14
MFA12-FR1	2-2.5	0.036J
MFA12-FR1	2-2.5	8800
MFA12-FR1	4-4.5	5.7
MFA12-FR1	6-6.5	0.31
MFA12-FR1	8-8.5	0.26
MFA12-FR1	10-10.5	42
MFA12-FR1	12-12.5	16

Point ID	Depth (ft)	Result
MFA12-FR2	0-0.5	13
MFA12-FR2	2-2.5	0.034J
MFA12-FR2	4-4.5	1.4
MFA12-FR2	6-6.5	5.9
MFA12-FR2	8-8.5	22
MFA12-FR2	10-10.5	180
MFA12-FR2	12-12.5	0.53
MFA12-FR3	0-0.5	21
MFA12-FR3	2-2.5	920J
MFA12-FR3	4-4.5	5.9
MFA12-FR3	6-6.5	0.19
MFA12-FR3	8-8.5	5.2
MFA12-FR3	10-10.5	1.6
MFA12-FR3	12-12.5	400
MFA21	0-0.5	150
MFA21	2-2.5	9.2
MFA21	4-4.5	23
MFA21	6-6.5	2.5
MFA21	8-8.5	0.11J
MFA21	10-10.5	0.3
MFA21	12-12.5	0.059J
MFA22	0-0.5	96
MFA22	2-2.5	80
MFA22	4-4.5	23
MFA22	6-6.5	3.1
MFA22	8-8.5	0.55
MFA22	10-10.5	0.42
MFA22	12-12.5	1.7
MFA23	2-2.5	110
MFA23	3.5-4	2.5
MFA23	5.5-6	580
MFA23	7.5-8	27
MFA23	9.5-10	11
MFA23	11.5-12	190
MFA23	13.5-14	87
MFA23	15.5-16	140
MFA24	3.3-3.8	0.31
MFA24	4-4.5	1.3
MFA24	5.3-5.8	250
MFA24	6-6.5	650
MFA24	7.3-7.8	550
MFA24	8-8.5	900
MFA24	9.3-9.8	1200
MFA24	10-10.5	890
MFA24	11.3-11.8	750
MFA24	13.3-13.8	260
MFA24	15.3-15.8	180
MFA26-FR1	0-0.5	5.4
MFA26-FR1	2-2.5	7.3
MFA26-FR1	4-4.5	13
MFA26-FR1	6-6.5	1.7
MFA26-FR1	8-8.5	1.3
MFA26-FR1	10-10.5	3.9
MFA26-FR1	12-12.5	1.4
MFA26-FR2	0-0.5	12
MFA26-FR2	2-2.5	61
MFA26-FR2	4-4.5	38
MFA26-FR2	6-6.5	1.7
MFA26-FR2	8-8.5	0.19
MFA26-FR2	10-10.5	3.6
MFA26-FR2	12-12.5	2.5
MFA26-FR3	0-0.5	5.3
MFA26-FR3	2-2.5	300
MFA26-FR3	4-4.5	9
MFA26-FR3	6-6.5	0.3
MFA26-FR3	8-8.5	2.8
MFA26-FR3	10-10.5	2
MFA26-FR3	12-12.5	1.9
MFA42	3.6-4.1	2.7
MFA42	5.6-6.1	0.22
MFA42	7.6-8.1	0.17
MFA42	9.6-10.1	540
MFA42	11.6-12.1	18
MFA42	13.6-14.1	5.5
MFA42	15.6-16.1	0.22



Notes:

1 Depths shown are feet below current ground surface.

2 Clean overburden in the excavations under existing Asphalt Pad C (Areas 1, 6 and 7) will be set aside and reused. Estimated removal thickness and volume does not include the clean overburden.

3 Excavation of PCB-impacted soil will be conducted as a separate action and is not a component of this alternative. See Figure 4-1.

cy Cubic Yard
EST. Estimated
ft bgs feet below ground surface
J Estimated concentration
MFA Mercury Fulminate Area
mg/kg Milligrams per kilogram
PCB Polychlorinated biphenyl
RBC Risk-based concentration
RFS Richmond Field Station
TSCA Toxic Substances Control Act

Soil Concentrations

- Mercury concentrations < 275 mg/kg (Commercial RBC)
- Mercury concentrations ≥ 275 mg/kg (Commercial RBC)
- PCB concentrations ≥ 1 mg/kg (TSCA High Occupancy, No Conditions)

Proposed MFA Excavation Footprint and Removal Thickness (feet bgs)[1,2]

- 3 ft
- 5 ft
- 8 ft
- 10 ft

PCB Excavation Footprint and Depth (feet bgs)[3]

- 1 ft
- 2.5 ft

Area Boundary

- Building 112 Transformer Area
- Piezometer Groundwater Monitoring Well
- A-A' Cross Section (see Figure 4-4)
- Historic Drainage Ditch
- Removed or Relocated Building (RFS)
- Former California Cap Company Buildings (Approximate)
- Remediated Areas
- Existing Buildings
- Roads and Other Landscape Features
- Fenceline
- Former Seawall (Approximate)
- Asphalt/Concrete Pads

Sanitary Sewer Lines:

- Existing Sewer Line
- Removed Sewer Line
- Abandoned Sewer Line

Storm Drain Lines:

- Open Swale
- Underground Culvert
- Underground Culvert, Abandoned (Grouted at manholes)

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FIGURE 4-3 PROPOSED COMMERCIAL REMEDIATION AREAS IN MFA

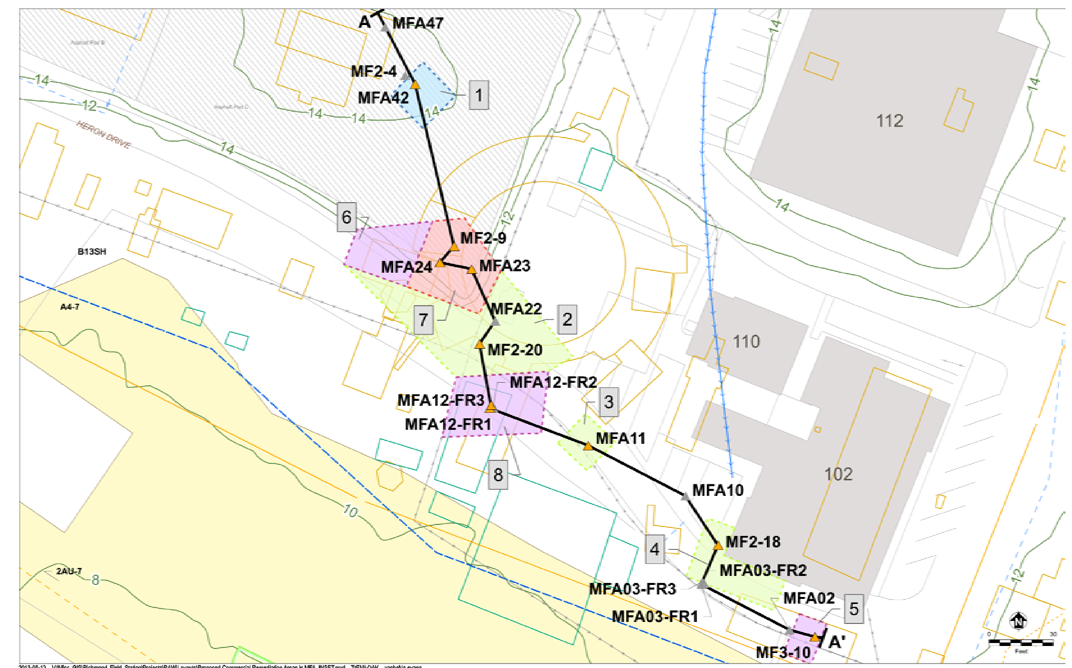
Removal Action Workplan

2013-11-21 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Proposed Commercial Remediation Areas in MFA.mxd TtEMI-OAK carolyn.ferlic.

See Figure 4-3 for a detailed version of the excavation area.

MFA Excavation Areas	EST. Thickness of Clean overburden (ft) *	EST. Depth of Excavation (ft. bgs) *	EST. Removal Thickness (ft) *	EST. Area (ft^2)	EST. Volume (cy)
1	2	10	8	466	138
2	0	3	3	2505	278
3	0	3	3	356	40
4	0	3	3	848	94
5	0	5	5	274	51
6	0 to 4	5 to 9	5	779	144
7	0 to 4	10 to 14	10	1231	456
8	0	5	5	1253	232
TOTAL				7712	1433

*Clean overburden In the excavations under existing Asphalt Pad C (Areas 1, 6 and 7) will be set aside and reused.
Estimated removal thickness and volume does not include the clean overburden.

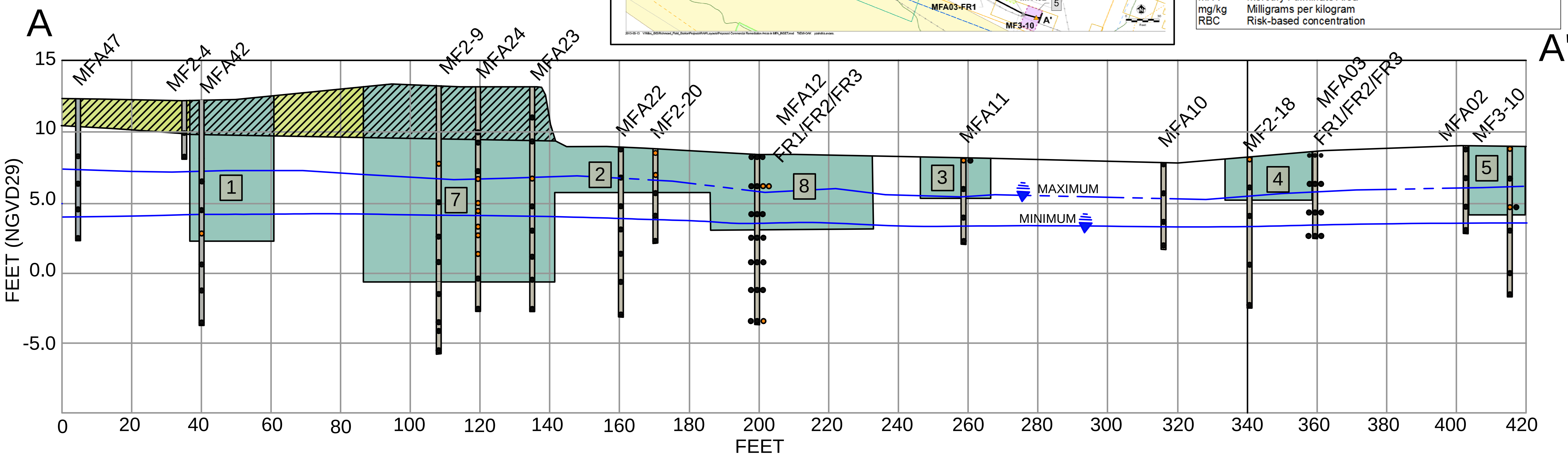


Mercury concentrations < Commercial RBC (275 mg/kg)
Mercury concentrations ≥ Commercial RBC (275 mg/kg)
A-A' Cross Section
Proposed MFA Excavation Footprint and Removal Thickness (ft)
3 ft
5 ft
8 ft
10 ft

Notes:
Depths shown are feet below current ground surface.

*Clean overburden In the excavations under existing Asphalt Pad C (Areas 1, 6 and 7) will be set aside and reused. Estimated removal thickness and volume does not include the clean overburden.

cy Cubic Yard
EST. Estimated
ft Feet
ft bgs Feet below ground surface
MFA Mercury Fulminate Area
mg/kg Milligrams per kilogram
RBC Risk-based concentration



Proposed Excavation Areas
Asphalt Pad C (to show former topography before placement)
Portion of Asphalt Pad C to be excavated
Sampled Interval - Mercury concentration < 275 mg/kg
Sampled Interval - Mercury concentration > 275 mg/kg

Soil Boring with sampled interval
Soil Boring with field replicate in interval [1]
Soil Boring with two samples in interval [1]
Estimated minimum and maximum groundwater levels based on November 2010, October 2011, April 2011, and April 2012 data

NGVD29 National Geodetic Vertical Datum of 1929
mg/kg milligrams per kilogram
bgs below ground surface

NOTES
1. Location MFA12 has field replicates and an additional sample for the 2.0 to 2.5 feet bgs interval.

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FIGURE 4-4
MFA CROSS SECTION

Remedial Action Workplan

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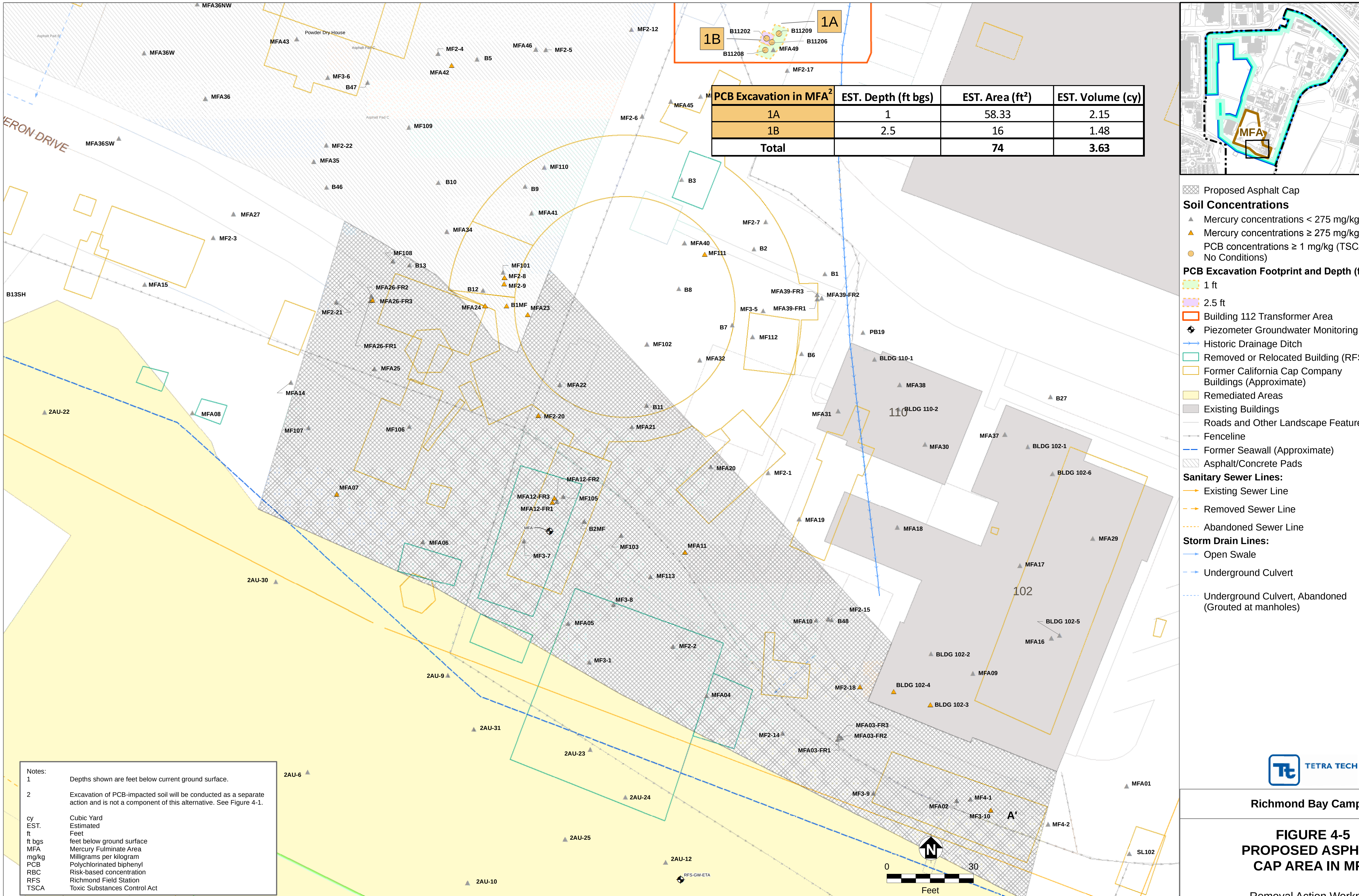

PCB Excavation in MFA[2]	EST. Depth (ft bgs)	EST. Area (ft²)	EST. Volume (cy)
1A	1	58.33	2.15
1B	2.5	16	1.48
Total		74	3.63

Notes:

1 Depths shown are feet below current ground surface.

2 Excavation of PCB-impacted soil will be conducted as a separate action and is not a component of this alternative. See Figure 4-1.

cy	Cubic Yard
EST.	Estimated
ft	Feet
ft bgs	feet below ground surface
MFA	Mercury Fulminate Area
mg/kg	Milligrams per kilogram
PCB	Polychlorinated biphenyl
RBC	Risk-based concentration
RFS	Richmond Field Station
TSCA	Toxic Substances Control Act

Proposed Asphalt Cap

Soil Concentrations

- Mercury concentrations < 275 mg/kg (Commercial RBC)
- Mercury concentrations ≥ 275 mg/kg (Commercial RBC)
- PCB concentrations ≥ 1 mg/kg (TSCA High Occupancy, No Conditions)

PCB Excavation Footprint and Depth (feet bgs)[1,2]

- 1 ft
- 2.5 ft
- Building 112 Transformer Area
- Piezometer Groundwater Monitoring Well
- Historic Drainage Ditch
- Removed or Relocated Building (RFS)
- Former California Cap Company Buildings (Approximate)
- Remediated Areas
- Existing Buildings
- Roads and Other Landscape Features
- Fenceline
- Former Seawall (Approximate)
- Asphalt/Concrete Pads

Sanitary Sewer Lines:

- Existing Sewer Line
- Removed Sewer Line
- Abandoned Sewer Line

Storm Drain Lines:

- Open Swale
- Underground Culvert
- Underground Culvert, Abandoned (Grouted at manholes)

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FIGURE 4-5
PROPOSED ASPHALT CAP AREA IN MFA

Removal Action Workplan

2013-11-21 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Proposed Asphalt Cap MFA.mxd TtEMI-OAK carolyn.ferlic.

CY Excavation Areas	EST. Depth (ft bgs)	EST. Area (ft²)	EST. Volume (cy)
1	1	288	10.7
2	1	100	3.7
3	1	100	3.7
4	1	100	3.7
5	3	100	11.1
6	1	100	3.7
TOTAL		788	36.6

PCB Excavation in CY³	EST. Depth (ft bgs)	EST. Area (ft²)	EST. Volume (cy)
3	1	25	0.93
4	1	25	0.93
5	1	25	0.93
6A	1	92	3.41
6B	3	25	2.78
7	1	25	0.93
Total		217	9.89

Soil Sample Locations¹

- All Analyte Concentrations < Unrestricted Use RBCs
- PCB Concentrations³ ≥ 1 mg/kg (TSCA High Occupancy, No Conditions)
- Lead Concentrations¹ ≥ 80 mg/kg (Unrestricted Use RBC)
- Dioxin TEQ Concentrations¹ ≥ 0.00000448 mg/kg (Unrestricted Use RBC)
- BAP (EQ) Concentrations¹ ≥ 0.4 mg/kg (Background)
- Arsenic Concentrations¹ ≥ 16 mg/kg (Background)
- Cobalt, Copper, Dieldrin, or Manganese Concentrations² ≥ Unrestricted Use RBC

Proposed CY Excavation Footprint and Depth (ft bgs)

- 1 ft
- 3 ft

Proposed PCB Excavation Footprint and Depth (ft bgs)³

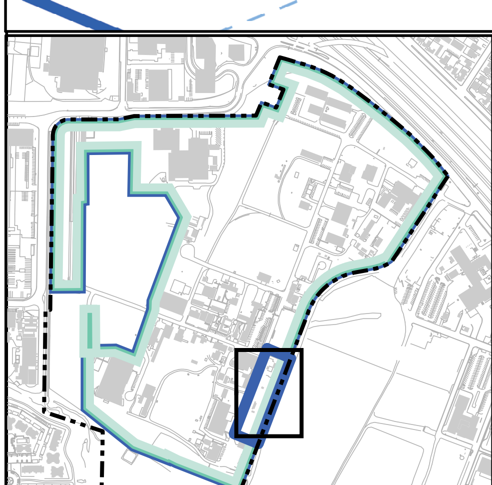
- 1 ft
- 3 ft

Notes:
1. The maximum concentration at each location is represented.

2. Concentrations of cobalt, copper, manganese, or dieldrin exceeded unrestricted use RBCs at locations indicated; for all four chemicals, concentrations were exceeded at two or fewer locations.
The unrestricted RBCs for these analytes are as follows:
Cobalt - 22.7 mg/kg
Copper - 3,040 mg/kg
Dieldrin - 0.034 mg/kg
Manganese - 1,780 mg/kg

3. Excavation of PCB-impacted soil will be conducted as a separate action and is not a component of this alternative. See Figure 4-1.

BAP(EQ)	Benzo(a)pyrene equivalent
bgs	below ground surface
CY	Corporation Yard
cy	Cubic yards
DTSC	Department of Toxic Substances Control
EST	Estimated
ft	Feet
mg/kg	Milligram per kilogram
PCB	Polychorinated biphenyl
RBC	Risk-Based Concentration
TEQ	Toxic equivalent quotient
TSCA	Toxic Substances Control Act



- Corporation Yard
- Research, Education & Support Area
- Existing Buildings
- Roads and Other Landscape Features
- Fenceline
- Former Seawall (Approximate)
- Asphalt/Concrete Pads
- Surface Water
- Existing Sewer Line
- Removed Sewer Line
- Abandoned Sewer Line

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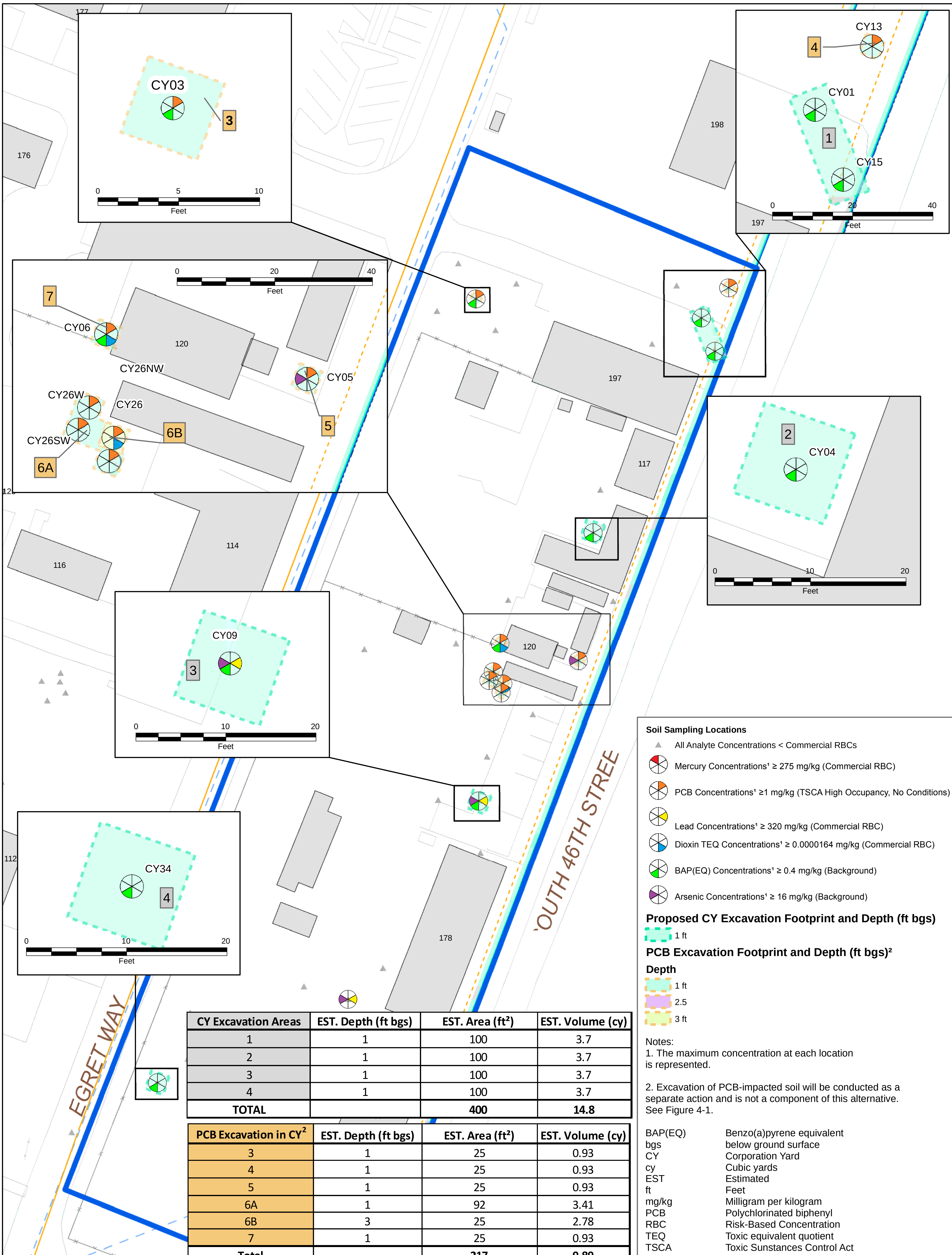
FIGURE 4-6
PROPOSED UNRESTRICTED USE REMEDIATION AREAS IN THE CORPORATION YARD

Removal Action Workplan



CY Excavation Areas	EST. Depth (ft bgs)	EST. Area (ft²)	EST. Volume (cy)
1	1	100	3.7
2	1	100	3.7
3	1	100	3.7
4	1	100	3.7
TOTAL		400	14.8

PCB Excavation in CY[2]	EST. Depth (ft bgs)	EST. Area (ft²)	EST. Volume (cy)
3	1	25	0.93
4	1	25	0.93
5	1	25	0.93
6A	1	92	3.41
6B	3	25	2.78
7	1	25	0.93
Total		217	9.89

Soil Sampling Locations

- All Analyte Concentrations < Commercial RBCs
- Mercury Concentrations[1] ≥ 275 mg/kg (Commercial RBC)
- PCB Concentrations[1] ≥1 mg/kg (TSCA High Occupancy, No Conditions)
- Lead Concentrations[1] ≥ 320 mg/kg (Commercial RBC)
- Dioxin TEQ Concentrations[1] ≥ 0.0000164 mg/kg (Commercial RBC)
- BAP(EQ) Concentrations[1] ≥ 0.4 mg/kg (Background)
- Arsenic Concentrations[1] ≥ 16 mg/kg (Background)

Proposed CY Excavation Footprint and Depth (ft bgs)

- 1 ft

PCB Excavation Footprint and Depth (ft bgs)[2]

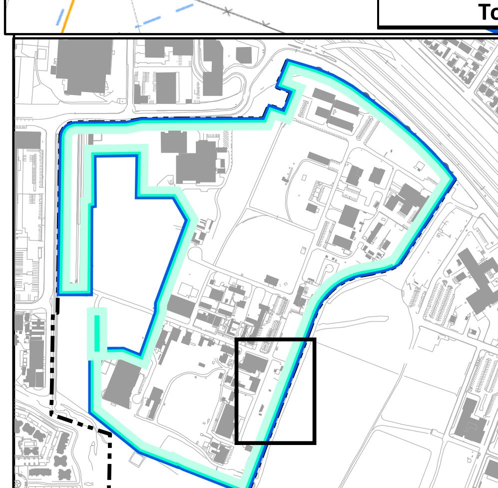
Depth

- 1 ft
- 2.5
- 3 ft

Notes:
1. The maximum concentration at each location is represented.

2. Excavation of PCB-impacted soil will be conducted as a separate action and is not a component of this alternative. See Figure 4-1.

BAP(EQ)	Benzo(a)pyrene equivalent
bgs	below ground surface
CY	Corporation Yard
cy	Cubic yards
EST	Estimated
ft	Feet
mg/kg	Milligram per kilogram
PCB	Polychlorinated biphenyl
RBC	Risk-Based Concentration
TEQ	Toxic equivalent quotient
TSCA	Toxic Sunstances Control Act



- Corporation Yard
- Fenceline
- Existing Sewer Line
- Removed Sewer Line
- Abandoned Sewer Line
- Asphalt/Concrete Pads
- Existing Buildings
- Surface Water
- Research, Education & Support Area
- Roads and Other Landscape Features

N

0 60 120
Feet

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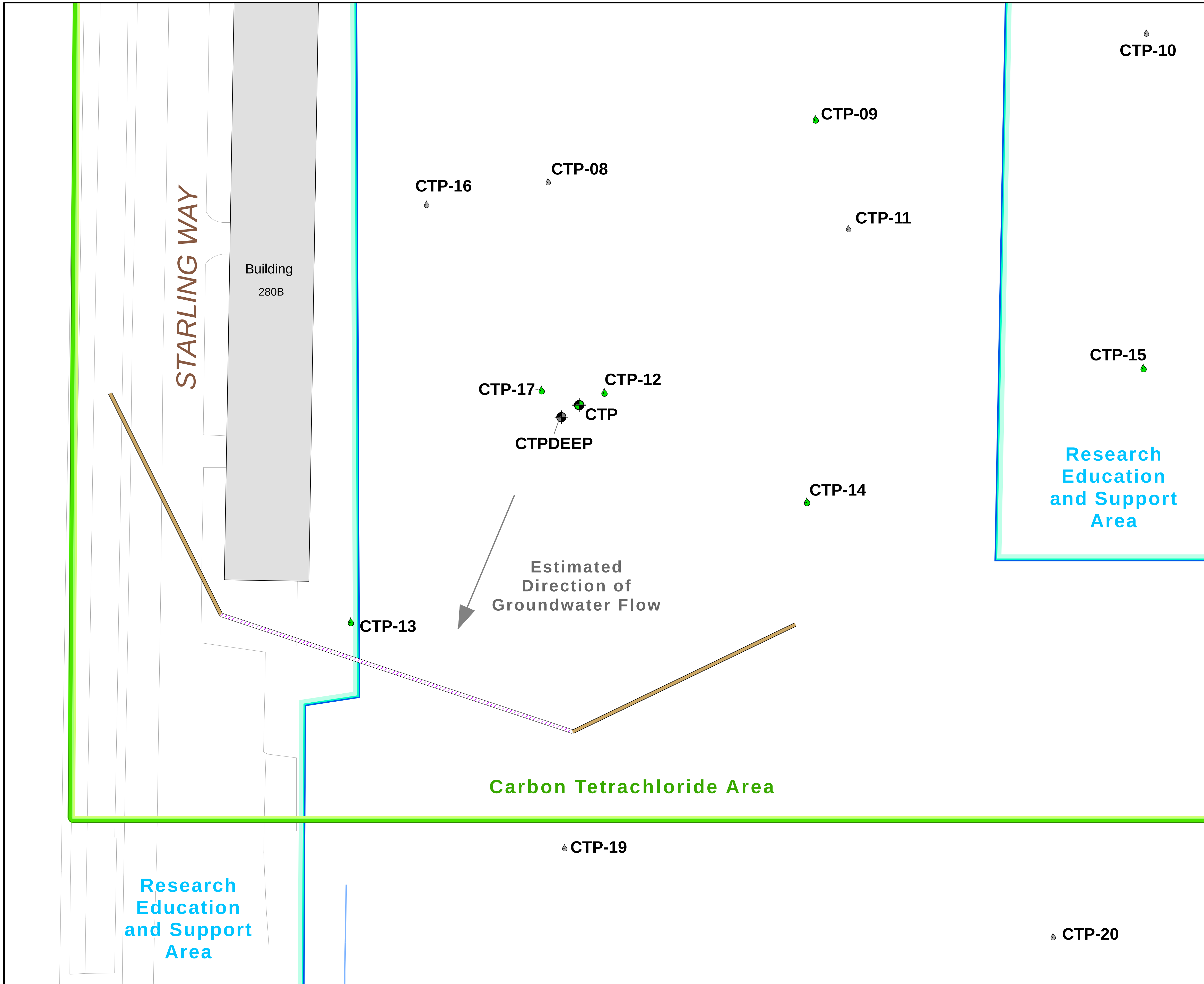
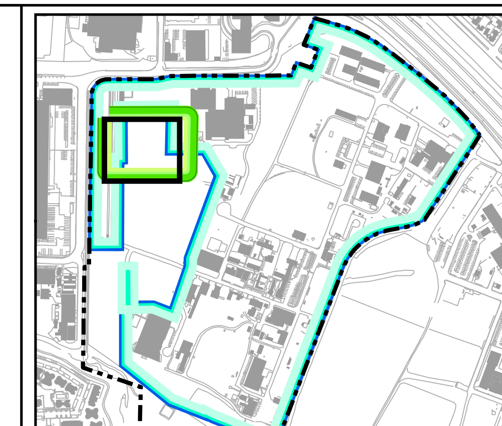
FIGURE 4-7
PROPOSED COMMERCIAL REMEDIATION AREAS IN THE CORPORATION YARD

Removal Action Workplan





Alternative GW-2 Components

Preliminary Location of Impermeable Wall

Preliminary Location of Permeable Reactive Barrier

Phase I FSW Piezometer Groundwater[1]

< 2.63 µg/L (Commercial Vapor Intrusion RBC for CT)

≥ 2.63 µg/L (Commercial Vapor Intrusion RBC for CT)

Phase III FSW Grab Groundwater[2]

Non-detect

CT Detected

Carbon Tetrachloride Area

Research, Education & Support Area

Existing Building

Roads and Other Landscape Features

Notes:

1 The maximum concentration at each location is represented.

2 Grab groundwater samples are not considered to be high quality data, therefore the concentrations detected were not compared to screening criteria. The target of the investigation was to confirm or deny the existence of an upgradient source of carbon tetrachloride, therefore this figure indicates whether carbon tetrachloride was detected at each location.

µg/L Micrograms per liter
CT Carbon tetrachloride
FSW Field Sampling Workplan
RBC Risk-Based Concentration

N

0 20 40 80
Feet

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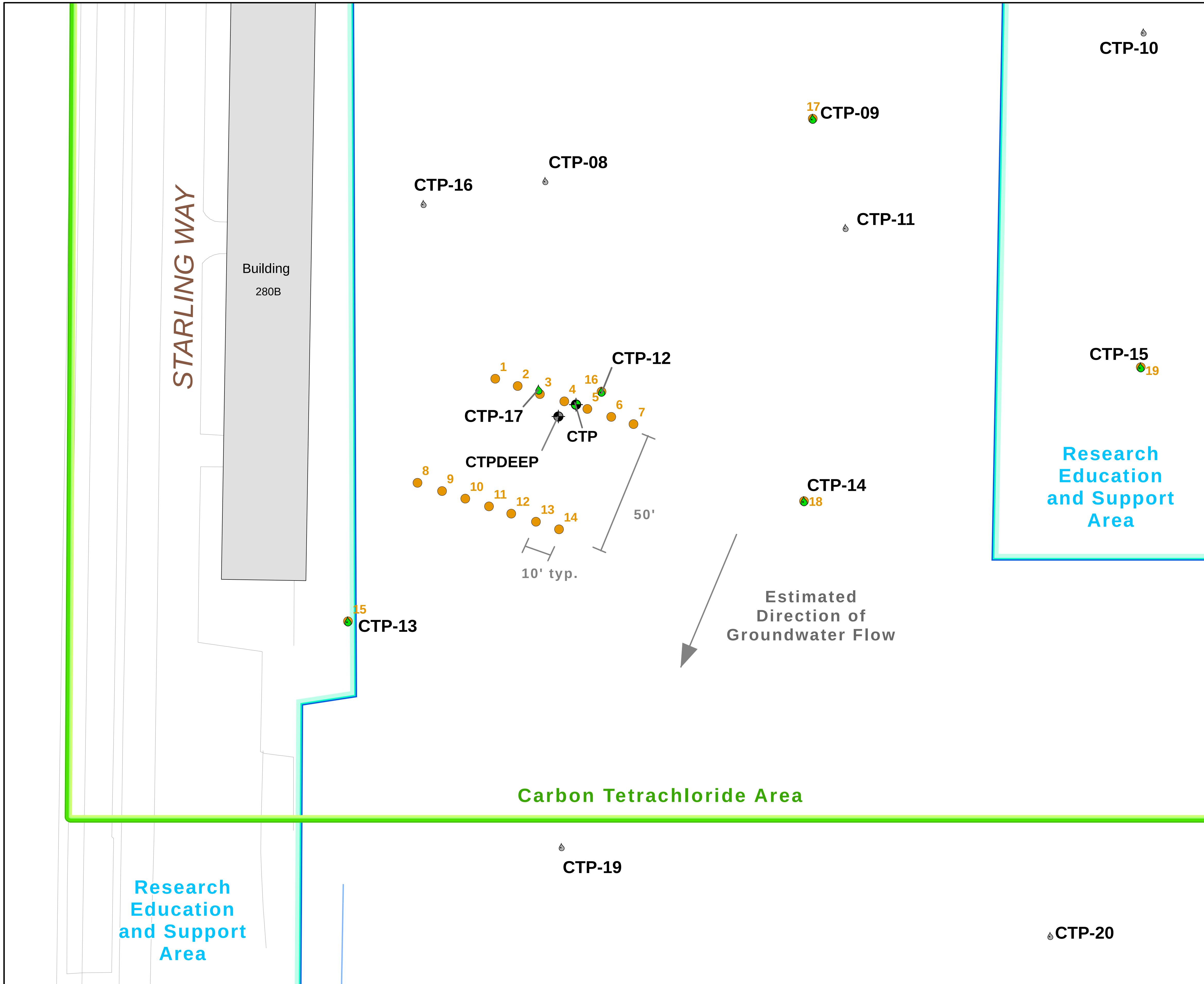
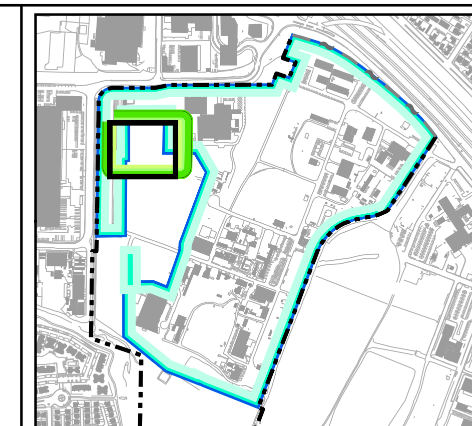
FIGURE 4-8
SCHEMATIC OF ALTERNATIVE GW-2

Removal Action Workplan

2013-11-21 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Schematic of Alternative GW-2.mxd TtEMI-AL carolyn.ferlic





Alternative GW-3 Components

- Preliminary Location of Injection Treatment Point

Phase I FSW Piezometer[1]

- < 2.63 µg/L (Commercial Vapor Intrusion RBC for CT)
- ≥ 2.63 µg/L (Commercial Vapor Intrusion RBC for CT)

Phase III FSW Grab Groundwater[2]

- Non-detect
- CT Detected
- Carbon Tetrachloride Area
- Research, Education & Support Area
- Existing Buildings
- Roads and Other Landscape Features

Notes:

1 The maximum concentration at each location is represented.

2 Grab groundwater samples are not considered to be high quality data, therefore the concentrations detected were not compared to screening criteria. The target of the investigation was to confirm or deny the existence of an upgradient source of carbon tetrachloride, therefore this figure indicates whether carbon tetrachloride was detected at each location.

µg/L Micrograms per liter
CT Carbon tetrachloride
FSW Field Sampling Workplan
RBC Risk-Based Concentration

N

0 20 40 80
Feet

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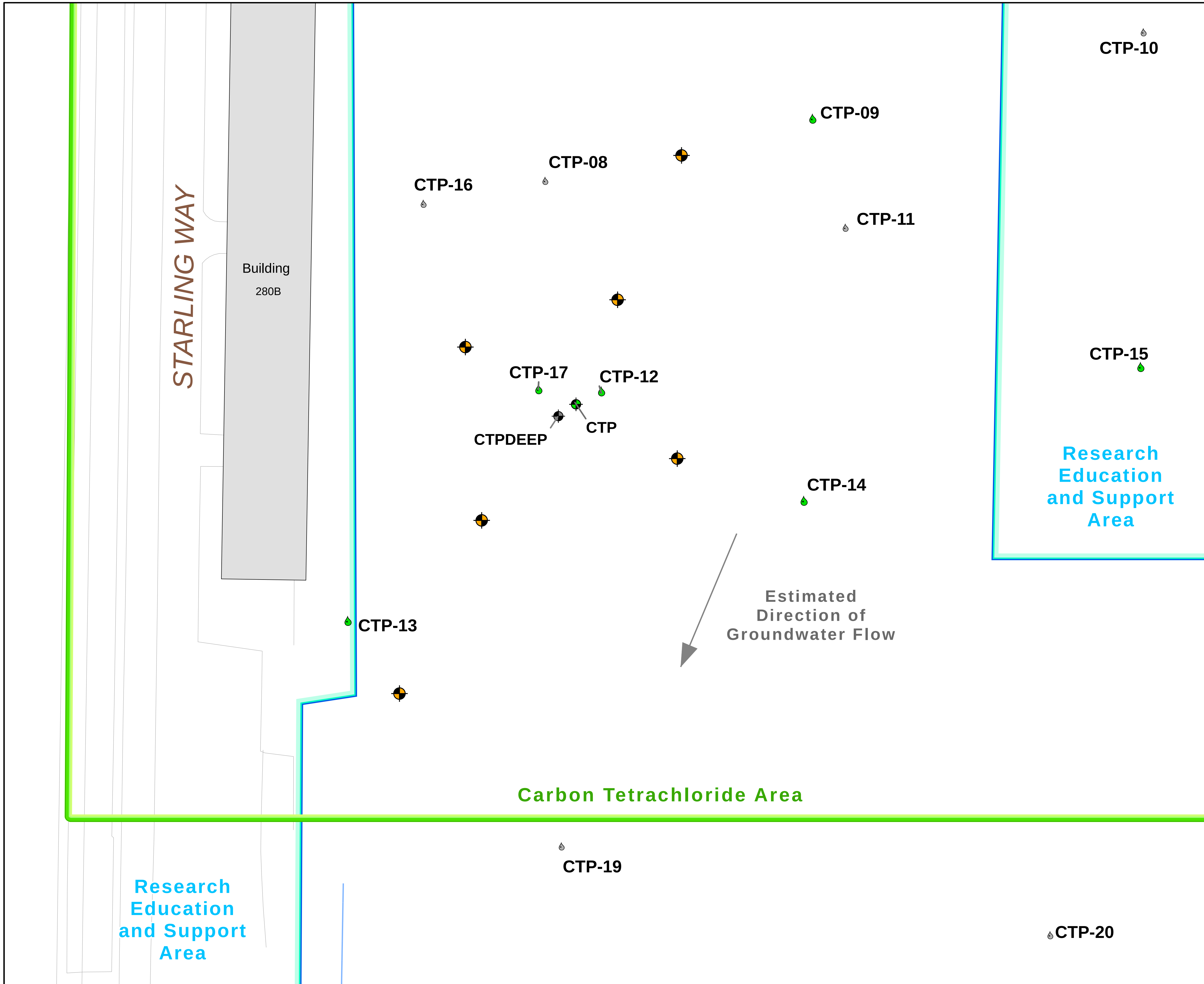
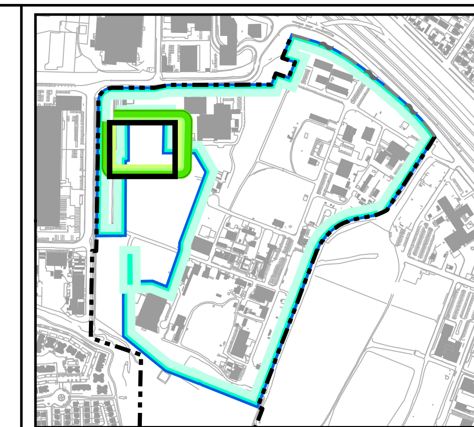
FIGURE 4-9
SCHEMATIC OF ALTERNATIVE GW-3

Removal Action Workplan

2013-11-21 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Schematic of Alternative GW-3.mxd TtEMI-AL carolyn.ferlic





Proposed Monitoring Well Location

Phase I FSW Piezometer[1]

< 2.63 µg/L (Commercial Vapor Intrusion RBC for CT)

≥ 2.63 µg/L (Commercial Vapor Intrusion RBC for CT)

Phase III FSW Grab Groundwater[2]

Non-detect

CT Detected

Carbon Tetrachloride Area

Research, Education & Support Area

Existing Buildings

Roads and Other Landscape Features

Notes:

1 The maximum concentration at each location is represented.

2 Grab groundwater samples are not considered to be high quality data, therefore the concentrations detected were not compared to screening criteria. The target of the investigation was to confirm or deny the existence of an upgradient source of carbon tetrachloride, therefore this figure indicates whether carbon tetrachloride was detected at each location.

µg/L Micrograms per liter
CT Carbon tetrachloride
FSW Field Sampling Workplan
RBC Risk-Based Concentration

N

0 20 40 80
Feet

TETRA TECH

Richmond Bay Campus

FIGURE 4-10
SCHEMATIC OF
ALTERNATIVE GW-4

Removal Action Workplan

2013-11-21 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\Schematic of Alternative GW-4.mxd TtEMI-AL carolyn.ferlic

Approximate RAW Workzones

- Exclusion Zones
- Decontamination Zones
- Support Zones
- Roll-off Bin Storage Area

Proposed Excavation Areas

- Proposed PCB Excavation Areas
- Proposed MFA Excavation Areas
- Proposed Corporation Yard Excavation Areas

- Proposed Truck Route
- Alternate Proposed Truck Route
- Proposed Fencing
- Existing Buildings
- Asphalt/Concrete Pads
- Existing Fenceline
- Portion of RFS Property Subject to DTSC order, Defined as "Site"
- Roads and Other Landscape Features

TETRA TECH

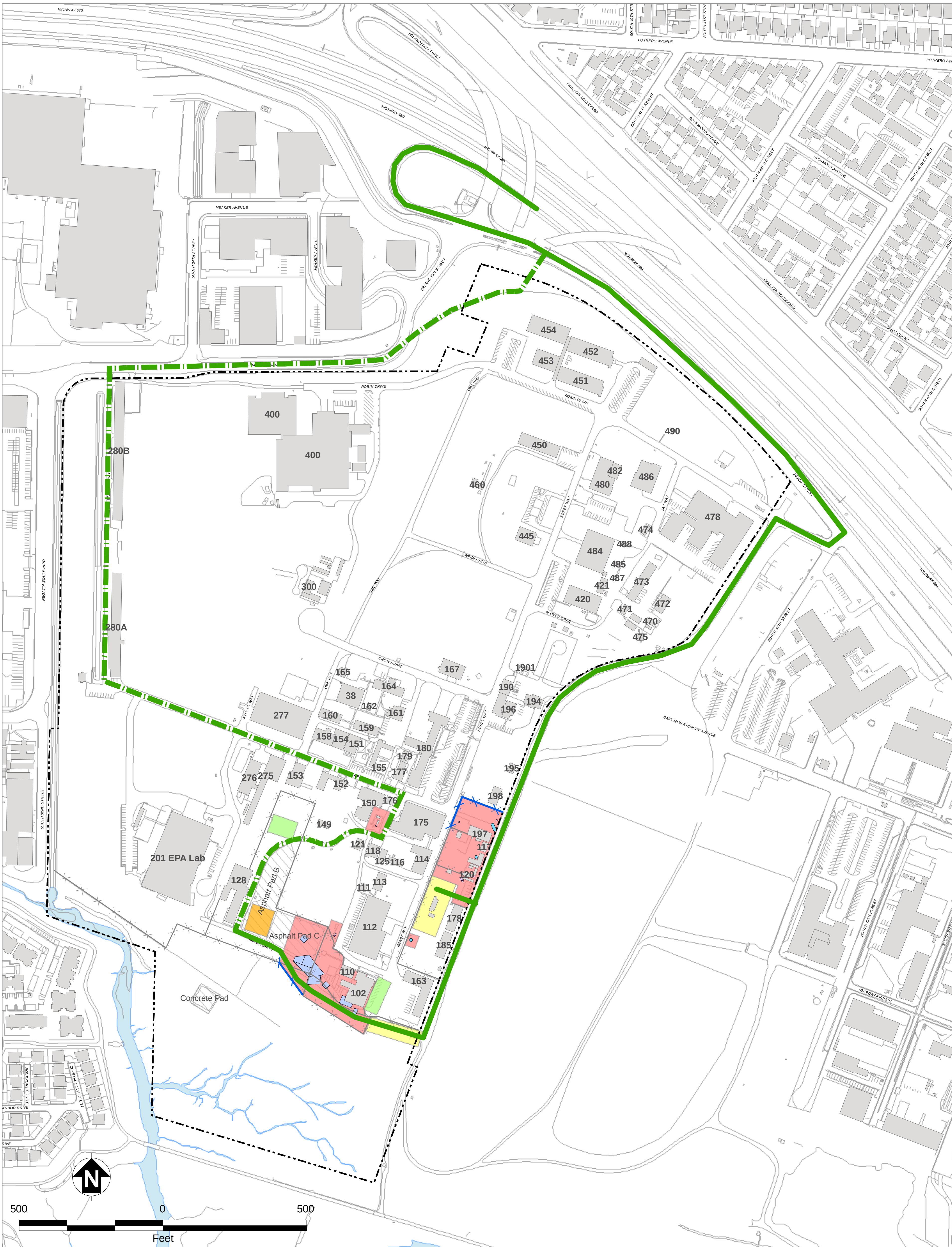
Note:
DTSC Department of Toxic Substance Control
MFA Mercury Fulminate Area
PCB Polychlorinated biphenyls
RAW Removal Action Workplan
RFS Richmond Field Station

Richmond Bay Campus

FIGURE 5-1
RAW WORK ZONES MAP

Removal Action Workplan

11/22/2013 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\RAW workzones.mxd TtEMI-OAK carolyn.ferlic



Proposed Truck Route
Alternate Proposed Truck Route
Proposed Fencing

Approximate RAW Workzones

Exclusion Zones
Decontamination Zones
Support Zones
Roll-off Bin Storage Area

Proposed Excavation Areas

Proposed PCB Excavation Areas
Proposed MFA Excavation Areas
Proposed Corporation Yard Excavation Areas

Existing Buildings
Asphalt/Concrete Pads
Existing Fenceline
Portion of RFS Property Subject to DTSC order, Defined as "Site"
Roads and Other Landscape Features

Note:
Basemap has not been updated to display the Meade Street bypass; the alternate truck route will follow the bypass.

DTSC Department of Toxic Substance Control
MFA Mercury Fulminate Area
PCB Polychlorinated biphenyls
RAW Removal Action Workplan
RFS Richmond Field Station

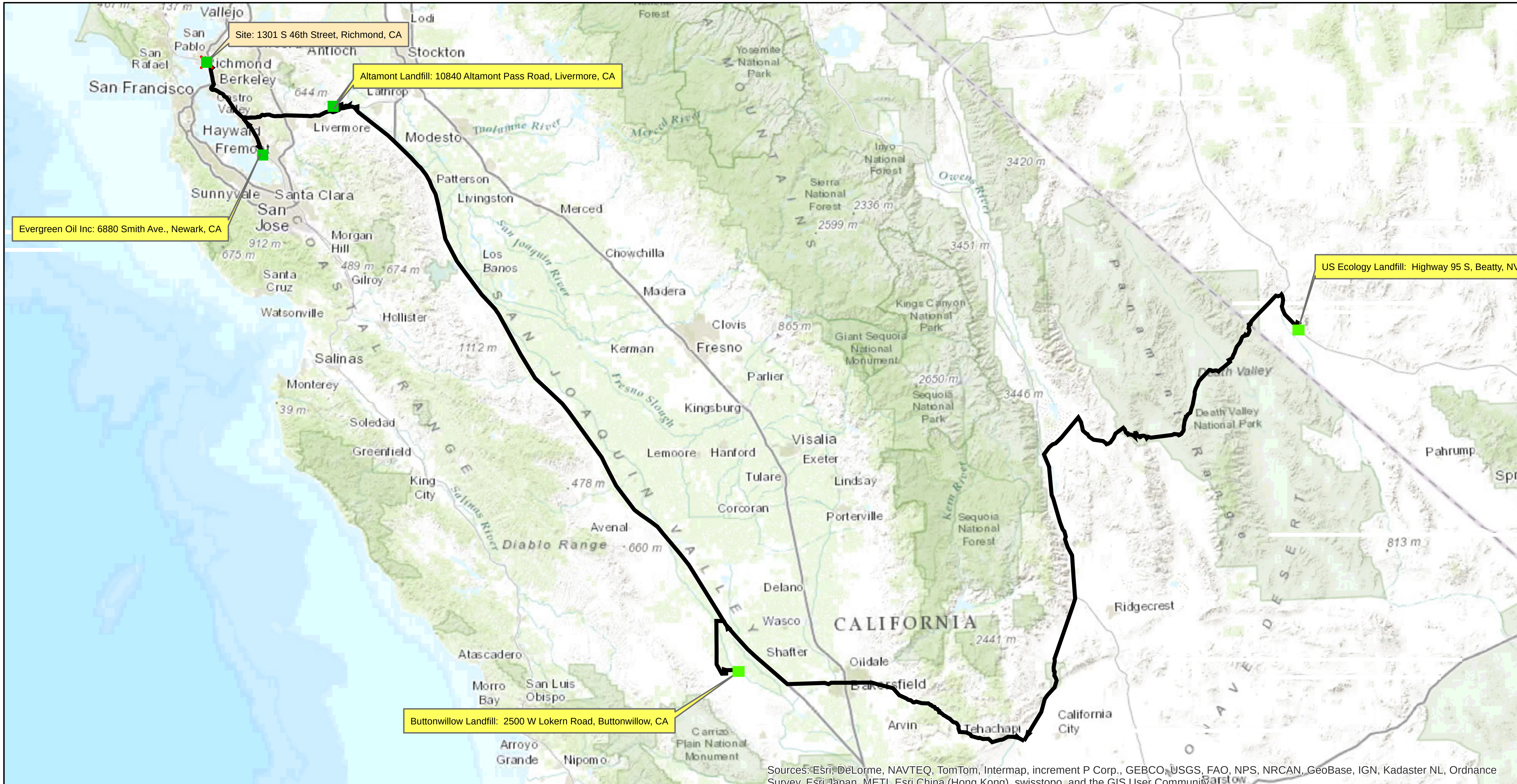
TETRA TECH

Richmond Bay Campus

FIGURE 5-2
PROPOSED
TRUCK ROUTE

Removal Action Workplan

11/22/2013 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\RAW local truck route.mxd TtEMI-OAK carolyn.ferlic



0 55,000 110,000 220,000

Feet

Richmond Bay Campus

FIGURE 5-3
TRUCK ROUTES TO LANDFILLS

Removal Action Workplan

2009-MM-DD v:\project_location\project_name.mxd TtEMI-OAK map editor

TABLES

Table 2-1. Pre-FSW Investigations for Richmond Field Station

Investigation Agency/Consultant	Purpose	Date
Site Investigations throughout RFS. Preparation of Preliminary Risk Assessment for EPA laboratory, Various consultants, DHS, EPA.	Various environmental investigations focusing on potential source areas throughout RFS. Included collection of soil, groundwater, and surface water samples.	1981 to 1999
Field Sampling and Investigation Plan (FSAP) URS Corporation	FSAP and tiered risk evaluation report developed a strategy to evaluate soil, groundwater and sediment quality at RFS, delineated the extent of contamination, and evaluated potential sources.	1999
Human Health and Ecological Tiered Risk Evaluation URS	A multi-tiered risk assessment to evaluate potential risks to human health and the environment from detected COPCs. Site-Specific Threshold Levels (SSTL) were developed. Further investigation and remediation was recommended for the Upland Area and Western Stege Marsh.	2001
Additional Soil and Groundwater Investigations in Upland Portion of Transition Area URS	Soil and groundwater samples were collected and analyzed. Elevated metal concentrations in soil and groundwater were found in association with the pyrite cinder layer. Additional monitoring wells and quarterly groundwater monitoring for VOCs was recommended.	Summer 2001
Additional Soil and Groundwater Investigations in Upland Area URS	Soil and groundwater samples were collected indicating numerous areas with metals exceeding human and ecological SSTLs.	September 2002
Mercury Treatability Study URS	Study designed to evaluate the reagent that would most effectively stabilize mercury-affected sediment and cinders at RFS. Results indicated that long-term leachability of mercury could be controlled with powder-activated carbon.	2002
Remediation Project – Initial Study (CEQA) URS	In accordance with CEQA, the study determined if there were any significant environmental effects or mitigation measures required to reduce potential environmental effects. Study recommended specific measures to reduce possible noise effects and effects on biological resources.	2003

Table 2-1. Pre-FSW Investigations for Richmond Field Station

Investigation Agency/Consultant	Purpose	Date
Biological Assessment BBL	Report addressed sensitive species and habitats that might be affected by the proposed remediation. A mitigation plan proposed actions to minimize effects and compensate for effects determined unavoidable.	2003
Groundwater, Surface Water, and Sediment Monitoring Plan BBL	Plan developed under oversight of RWQCB. The plan detailed semi-annual monitoring for up to 5 years.	2004
Indoor Air Monitoring UC, Tetra Tech	Indoor air monitoring at eight separate 24-hour events at 12 locations throughout RFS. Results were within typical indoor air quality levels.	2007 to 2008

Notes:

BBL	Blasland, Bouck & Lee
CEQA	California Environmental Quality Act
COPC	Chemical of potential concern
DHS	California Department of Health Services
EPA	U.S. Environmental Protection Agency
FSW	Field Sampling Workplan
RFS	Richmond Field Station
RWQCB	San Francisco Bay Regional Water Quality Control Board
Tetra Tech	Tetra Tech EM Inc.
UC	University of California
URS	URS Corporation
VOC	Volatile organic compound

Table 2-2. FSW Investigations for Richmond Field Station

Phase & Objective	Investigation Location(s)	Details
Phase I Groundwater sampling to determine overall groundwater characteristics, and to confirm or deny the presence of any unknown groundwater contamination issues.	Site-wide, excluding groundwater under Western Stege Marsh	Leaching contaminants in the surface and subsurface soil can contaminate groundwater. Metals and pesticides have been found in the groundwater along the eastern property boundary. Fifty-one piezometers were installed across the Site and sampled along with three existing ones. Four rounds of samples were analyzed for metals, VOCs, SVOCs, PAHs, TPH-e, TPH-p and TDS. One round of samples was also analyzed for PCBs, pesticides, and perchlorates. Groundwater monitoring is ongoing.
Phase II Soil investigations where historical activities may have adversely impacted soil.	• Current/former transformer locations • Corporation Yard (including Building 120 perimeter) • ASTs	Possible PCB contamination may persist in shallow soil investigated near the transformers. Historic chemical and equipment storage in the Corporation Yard warranted further soil investigation. DTSC concurred with UC that no soil sampling would be required at the AST locations due to the absence of staining or visual evidence of a spill at these locations and low levels of TPH detections in groundwater at RFS.
Phase III Additional soil investigations where historical activities may have adversely impacted soil. Groundwater conditions near Building 280B was investigated by collecting 20 grab groundwater samples from temporary borings and one grab groundwater sample from piezometer CTP.	• Former Dry House Explosion Area • Building 128 • EPA Building 201 soil mounds[1] • MFA • A sub-set of the transformer areas • Corporation Yard • Piezometer CTP (due to carbon tetrachloride detection in nearby groundwater)	Historical photographs of the Former Dry House showed evidence of a reported explosion within this area during CCC operations. Building 128 was used during CCC operations for numerous operations. Historical investigations of the MFA indicated elevated concentrations of mercury in soil. Phase III soil sampling supplemented historical data for the MFA and helped delineate vertical and lateral extents of known mercury-contaminated soil. Phase II investigation results warranted step-out sampling of PCBs and PAHs near some transformer locations. Phase II investigation results warranted step-out sampling at certain Corporation Yard locations for PAHs, PCBs, lead, and dioxin. Carbon tetrachloride was detected above the federal MCL during all four rounds of Phase I groundwater sampling at piezometer CTP, and was detected in downgradient wells.

Table 2-2. FSW Investigations for Richmond Field Station

Phase & Objective	Investigation Location(s)	Details
Phase IV and V These phases have not been scoped.	Likely focus on the Natural Open Space Area.	The Natural Open Space Area is outside the scope of this document.

Notes:

1	The EPA Building 201 soil mounds are not within the Research, Education, and Support (RES) Area and therefore are not discussed further in this table.
AST	Above ground storage tanks
CCC	California Cap Company
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
FSW	Field Sampling Workplan
MCL	Maximum contaminant level
MFA	Mercury Fulminate Area
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
RFS	Richmond Field Station
SVOC	Semi volatile organic compound
TDS	Total dissolved solid
TPH	Total petroleum hydrocarbons
TPH-e	Total petroleum hydrocarbons – extractables
TPH-p	Total petroleum hydrocarbons – purgeables
UC	University of California
VOC	Volatile organic compound

Table 2-3. Previous Cleanup Actions for Richmond Field Station

Cleanup Action and Location	Activities	Date
Phase 1 Transition Area, Western Stege Marsh, and Upland Area of the former Zeneca site	Excavation and treatment/stabilization of contaminated soil in the eastern portion of the Transition Area and sediment in the eastern portion of Western Stege Marsh (Areas 1 and 4). The Upland Area of the former Zeneca site was remediated in conjunction with remediation activities at RFS (URS 2003).	Fall 2002
Phase 2 Transition Area, Western Stege Marsh	Excavation and remediation in a portion of the Transition Area (Area 4), the remaining eastern portions of Western Stege Marsh (Area 2), and two areas in the central and western portions of Western Stege Marsh (Areas M3 and M1a) (URS 2004).	August 2003 to February 2004
Phase 3 Remediation Areas 1, 2, 3, 4, 5, and 6, and Western Stege Marsh	Excavation of cinder materials from upland Remediation Areas (RA) 1, 2, 3, 4, 5, and 6, and excavation of sediment to widen an existing channel and create a new channel in the north-central portion of Western Stege Marsh (formerly designated as marsh area M3) (URS 2005).	September to November 2004
Forest Product Laboratory Time-Critical Removal Action Forest Product Laboratory Wood Treatment Laboratory (FPL WTL)	Excavation of soil containing elevated concentrations of arsenic near the former FPL WTL (near Building 478). The proposed excavation limits and depths were determined by comparing the analytical results for samples collected in May and June 2007 with the project-specific remediation goal of 16 mg/kg (Tetra Tech 2007). Confirmation samples were collected following the excavation.	October 2007
Transition Area Time-Critical Removal Action Western Transition Area (WTA)	Removed surficial ash and debris in two locations where it was observed on the western edge of the WTA. Sampling results from these two areas indicated elevated levels of PCBs, and a TCRA was conducted to remove material from these two areas (Tetra Tech 2008).	October 2008

Notes:

FPL WTL	Forest Products Laboratory Wood Treatment Laboratory	RFS	Richmond Field Station
mg/kg	Milligrams per kilogram	TCRA	Time-critical removal action
PCB	Polychlorinated biphenyl	Tetra Tech	Tetra Tech EM Inc.
RA	Remediation Areas	URS	URS Corporation
		WTA	Western Transition Area

References:

Tetra Tech. 2007. “Memorandum for a Time-Critical Removal Action at the Former Forest Products Laboratory Wood Treatment Laboratory, University of California Berkeley, Richmond Field Station.” February 5.

Tetra Tech. 2008. “Implementation Summary Report for a Time-Critical Removal Action at the Forest Products Laboratory Wood Treatment Laboratory.” March 14.

URS. 2003. “Implementation Report, Phase 1 Subunit 2A, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station.” September 4.

URS. 2004. “Implementation Report, Phase 2 Subunit 2A and 2B, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station.” December 3.

URS. 2005. “Implementation Report, Phase 3 Upland Portion of Subunit 2B, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station.” June 16.

Table 3-1: Remedial Goals for Soil

Chemical [3]	Remedial Goals						
	Risk-Based Concentrations [1,2]						
	Commercial Worker	Construction Worker	Maintenance Worker	Off-Site Receptor (Inhalation)	Other Criteria	Category I Criteria [4]	Category II On-Site Management Criteria [5]
Metals							
Aluminum	100000	**20300**	100000	6860000	--	20300	100000
Antimony	367	**109**	2720	--	--	109	1090
Arsenic	**0.224**	1.58	1.58	745	16 [6]	16 [6,7]	16 [6,7]
Barium	100000	**2110**	52600	686000	--	2110	100000
Beryllium	1760	**29.0**	128	1330	--	29.0	290
Boron	100000	**33600**	100000	27400000	--	33600	100000
Cadmium	1000	**68.1**	73.0	762	--	68.1	681
Chromium	**100000**	100000	100000	--	--	100000	100000
Cobalt	273	**19.9**	34.1	356	--	19.9	199
Copper	36700	**10900**	100000	--	--	10900	100000
Iron	**100000**	100000	100000	--	--	100000	100000
Lead [7,8]	**320**	320	320	--	320 [7,8]	320 [7,8]	800 [7,8]
Manganese	20500	**212**	5300	68600	--	212	2120
Mercury [9]	275	**77.0**	1920	412000	--	77.0	275
Molybdenum	4590	**1360**	34000	--	--	1360	13600
Nickel	14900	**60.6**	1180	12300	--	60.6	606
Selenium	4590	**1340**	33500	27400000	--	1340	13400
Silver	4590	**1360**	34000	--	--	1360	13600
Thallium	9.17	**2.72**	68.0	--	--	2.72	27.2
Vanadium	4590	**1360**	34000	--	--	1360	13600
Zinc	100000	**81600**	100000	--	--	81600	100000
VOCs							
1,2-Dichloropropane	4.41	71.0	83.7	**0.993**	--	0.993	9.93
Acetone	**100000**	100000	100000	475000	--	100000	100000
Benzene	1.44	27.9	27.9	**0.320**	--	0.320	3.20
Ethylbenzene	24	393	393	**5.94**	--	5.94	59.4
m,p-Xylene	2510	2350	58700	**614**	--	614	6140
o-Xylene	2950	2730	68100	**725**	--	725	7250
Toluene	5230	3830	95700	**1440**	--	1440	14400
Trichloroethylene	5.72	15.8	93.7	**1.03**	--	1.03	10.3

Table 3-1: Remedial Goals for Soil

Chemical [3]	Remedial Goals						
	Risk-Based Concentrations [1,2]						
	Commercial Worker	Construction Worker	Maintenance Worker	Off-Site Receptor (Inhalation)	Other Criteria	Category I Criteria [4]	Category II On-Site Management Criteria [5]
SVOCs							
BAP (EQ) [10]	**0.145**	0.963	0.963	1150	0.4 [11]	0.4 [11]	1.45
1-Methylnaphthalene	**36.4**	243	243	--	--	36.4	364
2-Methylnaphthalene	1510	**403**	10100	--	--	403	4030
4-Methylphenol	47800	**13000**	100000	823000000	--	13000	100000
Acenaphthene	22600	**6050**	100000	--	--	6050	60500
Acenaphthylene	22600	**6050**	100000	--	--	6050	60500
Anthracene	100000	**30200**	100000	--	--	30200	100000
Benzo(a)anthracene	**0.880**	5.87	5.87	11500	--	0.880	8.80
Benzo(a)pyrene	**0.145**	0.963	0.963	1150	--	0.145	1.45
Benzo(b)fluoranthene	**0.88**	5.87	5.87	11500	--	0.880	8.80
Benzo(g,h,i)perylene	11300	**3020**	75600	--	--	3020	30200
Benzo(k)fluoranthene	**0.880**	5.87	5.87	11500	--	0.880	8.80
bis(2-Ethylhexyl)phthalat	**95.5**	647	647	1330000	--	95.5	955
Chrysene	**8.80**	58.7	58.7	115000	--	8.80	88.0
Dibenz(a,h)anthracene	**0.145**	0.963	0.963	2670	--	0.145	1.45
di-n-Butylphthalate	47800	**13000**	100000	--	--	13000	100000
Fluoranthene	15100	**4030**	100000	--	--	4030	40300
Fluorene	15100	**4030**	100000	--	--	4030	40300
Indeno(1,2,3-cd)pyrene	**0.880**	5.87	5.87	11500	--	0.880	8.80
Naphthalene	18.0	450	450	**3.57**	--	3.57	35.7
Phenanthrene	15100	**4030**	100000	--	--	4030	40300
Pyrene	11300	**3020**	75600	--	--	3020	30200
PCBs							
Aroclor-1242	**0.528**	3.50	3.50	5620	1 [12]	1 [12]	1 [12]
Aroclor-1248	**0.528**	3.50	3.50	5620	1 [12]	1 [12]	1 [12]
Aroclor-1254	**0.528**	2.02	3.50	5620	1 [12]	1 [12]	1 [12]
Aroclor-1260	**0.528**	3.50	3.50	5620	1 [12]	1 [12]	1 [12]
Total PCBs [13]	**1.58**	9.03	10.5	16900	1 [12]	1 [12]	1 [12]
Pesticides							
4,4'-DDD	**7.59**	52.8	52.8	46400	--	7.59	75.9
4,4'-DDE	**5.36**	37.3	37.3	33000	--	5.36	53.6
4,4'-DDT	**5.36**	37.3	37.3	33000	--	5.36	53.6

Table 3-1: Remedial Goals for Soil

Chemical [3]	Remedial Goals: Risk-Based Concentrations [1,2]: Commercial Worker	Construction Worker	Maintenance Worker	Off-Site Receptor (Inhalation)	Other Criteria	Category I Criteria [4]	Category II On-Site Management Criteria [5]
Pesticides (continued)							
Aldrin	**0.107**	0.745	0.745	654	--	0.107	1.07
alpha-BHC	**0.289**	2.01	2.01	1780	--	0.289	2.89
alpha-Chlordane	**1.40**	9.76	9.76	9420	--	1.40	14.0
beta-BHC	**1.01**	7.04	7.04	6040	--	1.01	10.1
Carbazole	**145**	934	934	291000	--	145	1450
Chlordane	**1.40**	9.76	9.76	9420	--	1.40	14.0
delta-BHC	**0.289**	2.01	2.01	1780	--	0.289	2.89
Dieldrin	**0.114**	0.792	0.792	696	--	0.114	1.14
Endosulfan I	3910	**1100**	27500	--	--	1100	11000
Endosulfan II	3910	**1100**	27500	--	--	1100	11000
Endosulfan sulfate	3910	**1100**	27500	--	--	1100	11000
Endrin	195	**54.9**	1370	--	--	54.9	549
Endrin aldehyde	195	**54.9**	1370	--	--	54.9	549
gamma-BHC (Lindane)	**1.66**	11.5	11.5	10300	--	1.66	16.6
gamma-Chlordane	**1.40**	9.76	9.76	9420	--	1.40	14.0
Heptachlor	**0.405**	2.82	2.82	2460	--	0.405	4.05
Heptachlor epoxide	**0.200**	1.39	1.39	1230	--	0.200	2.00
Mirex	**0.101**	0.704	0.704	628	--	0.101	1.01
Pentachlorophenol	**1.86**	12.2	12.2	628000	--	1.86	18.6
Dioxin							
Dioxin TEQ [14]	**0.0000164**	0.000116	0.000116	0.0843	--	0.0000164	0.000164
Explosives							
HMX	23900	**6500**	100000	--	--	6500	65000
TPH							
Diesel range organics	--	--	--	--	500 [15]	500 [15]	500 [15]
Gasoline range organics	--	--	--	--	500 [15]	500 [15]	500 [15]
Motor oil range organics	--	--	--	--	2500 [15]	2500 [15]	2500 [15]

Notes:
All values are in mg/kg.

Table 3-1: Remedial Goals for Soil

Notes (continued):

1	Risk-based concentrations are calculated in Appendix C of the Site Characterization Report (Tetra Tech 2013a). Risk-based concentrations are shown with 3 significant figures, except where the default value of 100,00 mg/kg applies (where calculated value exceeds 100,000 mg/kg). Risk-based concentrations shown are the minimum values between the cancer and noncancer multi-pathway risk-based concentrations. For the off-site receptor, the values shown are the minimum values between the cancer and noncancer inhalation pathway risk-based concentrations calculated for the unrestricted use scenario.
2	Bold values indicate the lowest of the risk-based concentrations for all potential future receptors.
3	All chemicals detected at the site are included in this table. If a chemical is detected in the future that is not included in the table, risk-based concentrations will be calculated for it, and DTSC will be consulted.
4	Category I criteria are based on the lowest of the calculated risk-based concentrations, unless background, ambient, or TSCA criterion are available, in which case the alternate values are selected and noted within this table. Category I criteria for TPH constituents are based on the RWQCB ESL.
5	Category II criteria are based on 10 times the Category I criteria, unless otherwise noted. In cases where 10 times the Category I criteria is greater than 100,000 mg/kg, the default value of 100,000 mg/kg is used.
6	The background level for arsenic (16 mg/kg) was established for the adjacent Campus Bay Site and approved by DTSC for the former RFS Site (Erler & Kalinowski, Inc. 2007; DTSC 2007). The arsenic remedial goal is a not to exceed value, except in cases where arsenic is associated with cinders in soil (see note 7).
7	If lead or arsenic is associated with cinders, manage on site per Section 5.2.3 of the SMP. If not associated with cinders, investigate further, determine if source is present, and dispose of off-site.
8	A risk-based concentration was not calculated for lead. Rather, the industrial CHHSL of 320 mg/kg (Cal/EPA OEHHA 2009) was used for the commercial, construction, and maintenance worker scenarios. The Category II lead value is based on industrial RSL from EPA (2012).
9	The toxicity criteria for mercuric chloride was used as a surrogate for mercury to calculate the risk-based concentration.
10	The toxicity criteria for benzo(a)pyrene was used as a surrogate for BAP (EQ) to calculate the risk-based concentration.
11	The ambient level for BAP (EQ) (0.4 mg/kg) is based on the 95 UCL concentration of the ambient dataset for BaP (EQ) in surface soils in Northern California (DTSC 2009; Environ Corporation and others 2002).
12	The other criterion is based on the TSCA High Occupancy, no further conditions threshold criterion for total PCBs from EPA (2005). The TSCA criterion is a not-to-exceed value.
13	PCB COCs include Aroclor-1248, Aroclor-1254, and Aroclor-1260. The receptor-specific risk-based concentration for total PCBs is the sum of the individual risk-based concentrations for the three COCs. The TSCA criteria for Aroclors of 1 mg/kg is applicable for total PCBs (the sum of all detected individual Aroclors in a particular sample).
14	The toxicity criteria for 2,3,7,8-TCDD was used as a surrogate for Dioxin TEQ to calculate the risk-based concentration.
15	Criteria for TPH constituents are based on the RWQCB ESL (RWQCB 2013).

--	Not applicable	DTSC	California Department of Toxic Substances Control
95 UCL	95th percentile Upper Confidence Limit of the arithmetic mean	EPA	U.S. Environmental Protection Agency
BAP (EQ)	Benzo(a)pyrene equivalent	ESL	Environmental Screening Level
BHC	Hexachlorocyclohexane	HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
Cal/EPA	California Environmental Protection Ageny	mg/kg	Milligrams per kilogram
CHHSL	California human health screening level	OEHHA	Office of Environmental Health Hazard Assessment
COC	Chemical of concern	PCB	Polychlorinated biphenyl
DDD	Dichlorodiphenyldichloroethane	RBC	Risk-based concentration
DDE	Dichlorodiphenyldichloroethylene	RSL	Regional Screeing Level
DDT	Dichlorodiphenyltrichloroethane	RWQCB	California Regional Water Quality Control Board

Table 3-1: Remedial Goals for Soil

Notes (continued):

SMP	Soil management plan	TPH	Total petroleum hydrocarbons
SVOC	Semivolatile organic compound	TSCA	Toxic Substances Control Act
TCDD	Tetrachlorodibenzo-p-dioxin	VOC	Volatile organic compound
TEQ	Toxic equivalency quotient		

References:

Cal/EPA OEHHA. 2009. "Revised California Human Health Screening Levels for Lead." Integrated Risk Assessment Branch, OEHHA, Cal/EPA. September.

DTSC. 2007. Letter to Doug Mosteller from Barbara Cook Concurring on the Recommendation of 16 mg/kg Arsenic as a Good Estimator of the Upper Range of the Ambient Distribution of Arsenic at the Campus Bay Site. October 1.

DTSC. 2009. Use of the Northern and Southern California Polynuclear Aromatic Hydrocarbon (PAH) Studies in the Manufactured Gas Plant Site Cleanup Process. July.

Environ Corporation, Entrix, IRIS Environmental, and Env America. 2002. Background Levels of Polycylic Aromatic Hydrocarbons in Northern California Surface Soil. Prepared for: Pacific Gas and Electric Company and U.S. Navy. June 7.

EPA. 2005. PCB Site Revitalization Guidance Under the Toxic Substances Control Act. November. Available online at: http://www.epa.gov/osw/hazard/tsd/pcbs/pubs/pcb-guid3-06.pdf.

EPA. 2012. "Regional Screening Levels." Screening Levels for Chemical Contaminants. November.

Erler & Kalinowski, Inc. 2007. Technical Memorandum: Background Concentrations of Arsenic in Soil at Campus Bay, Campus Bay Site, Richmond, California. July 23.

RWQCB. 2013. “February 2013 Update to Environmental Screening Levels.” February. Available on-line at: http://www.waterboards.ca.gov/rwqcb2/water_issues/programs/esl.shtml.

Tetra Tech. 2013. Site Characterization Report, Research, Education, and Support Area and Groundwater within the Richmond Field Station Site. May 28.

Table 3-2: Selected Soil Remedial Goals for Mercury Fulminate Area, Corporation Yard, and Polychlorinated Biphenyl Areas

	Selected Remedial Goals			
Chemical	**MFA**	**Corporation Yard**	**PCB Areas**	**Rationale**
Arsenic [1]	--	NA	--	Background
Lead [1]	--	NA		CHHSL
Mercury	275	--	--	Commercial risk-based concentration
BAP (EQ) [2]	--	0.4	--	Ambient
Aroclor-1248 [3]	--	--	1	TSCA High Occupancy, No Cap
Aroclor-1254 [3]	--	--	1	TSCA High Occupancy, No Cap
Aroclor-1260 [3]	--	--	1	TSCA High Occupancy, No Cap
Total PCBs [3]	--	--	1	TSCA High Occupancy, No Cap
Dioxin TEQ [4]	--	0.0000164	--	Commercial risk-based concentration

Notes:

All values are in mg/kg.

1 Arsenic and lead in the Corporation Yard are associated with cinders, therefore there are not remedial goals for these COCs. Manage cinder-containing soil on site per Section 5.2.3 of the SMP.

2 The toxicity criteria for benzo(a)pyrene was used as a surrogate for BAP (EQ). Ambient levels for BAP (EQ) (0.4 mg/kg) are based on the 95 UCL concentration of the ambient dataset for BaP EQ in surface soils in Northern California (DTSC 2009; Environ Corporation and others 2002).

3 TSCA High Occupancy, no further conditions threshold criterion for total PCBs from EPA (2005). The TSCA criterion is a not to exceed value.

4 The toxicity criteria for 2,3,7,8-TCDD was used as a surrogate for Dioxin TEQ.

--	Not applicable
BAP (EQ)	Benzo(a)pyrene equivalent
Cal/EPA	California Environmental Protection Ageny
CHHSL	California human health screening level
COC	Chemical of concern
DTSC	California Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
mg/kg	Milligrams per kilogram
NA	Not applicable (see note 1)
OEHHA	Office of Environmental Health Hazard Assessment
PCB	Polychlorinated biphenyl
TCDD	Tetrachlorodibenzo-p-dioxin
TEQ	Toxic equivalency quotient
TSCA	Toxic Substances Control Act

References:

Cal/EPA OEHHA. 2009. "Revised California Human Health Screening Levels for Lead." Integrated Risk Assessment Branch, OEHHA, Cal/EPA. September.

DTSC. 2007. Letter to Doug Mosteller from Barbara Cook Concurring on the Recommendation of 16 mg/kg Arsenic as a Good Estimator of the Upper Range of the Ambient Distribution of Arsenic at the Campus Bay Site. October 1.

DTSC. 2009. Use of the Northern and Southern California Polynuclear Aromatic Hydrocarbon (PAH) Studies in the Manufactured Gas Plant Site Cleanup Process. July 1.

Environ Corporation, Entrix, IRIS Environmental, and Env America. 2002. Background Levels of Polycylic Aromatic Hydrocarbons in Northern California Surface Soil. Prepared for: Pacific Gas and Electric Company and U.S. Navy. June 7.

EPA. 2005. Polychlorinated Biphenyl (PCB) Site Revitalization Guidance Under the Toxic Substances Control Act. November. Available online at: http://www.epa.gov/osw/hazard/tsd/pcbs/pubs/pcb-guid3-06.pdf.

Erler & Kalinowski, Inc. 2007. Technical Memorandum: Background Concentrations of Arsenic in Soil at Campus Bay, Campus Bay Site, Richmond, California. July 23.

Tetra Tech. 2013. Site Characterization Report, Research, Education, and Support Area and Groundwater within the Richmond Field Station Site. May 28.

Table 3-3: Remedial Goals for Groundwater

	Remedial Goals		
	Risk-Based Concentrations		
Chemical	**Commercial Worker (Vapor Intrusion into Indoor Air)**	**Construction Worker (in a Construction Trench)**	**Maintenance Worker (in a Construction Trench)**
Carbon Tetrachloride [1]	2.63	2.68	2.68
Trichloroethylene [2]	270	890	890

Notes:

All values are in µg/L.

1 Risk-based concentrations for carbon tetrachloride are calculated in Appendix C of the Site Characterization Report (Tetra Tech 2013a). Risk-based concentrations are shown with 3 significant figures. Risk-based concentrations shown are the minimum values between the cancer and noncancer multi-pathway risk-based concentrations.

2 Risk-based concentrations for trichloroethylene are a site-specific goals established by DTSC for the Campus Bay site (Terraphase 2008, 2012a).

µg/L Micrograms per liter
DTSC California Department of Toxic Substances Control

References:

Terraphase. 2008. Revised Human Health Risk Assessment and Calculation of Site-Specific Goals for Lots 1, 2, and 3. Campus Bay Site, Richmond, California. April 30.

Terraphase. 2012a. Response to Department of Toxic Substances Control Comments Regarding the “Revised TCE Risk Evaluation.” Campus Bay Site, Richmond, California. July 19.

Tetra Tech. 2013. Site Characterization Report, Research, Education, and Support Area and Groundwater within the Richmond Field Station Site. May 28.

Table 3-4. Evaluation Criteria

RAW Evaluation Criterion	FS/RAP Evaluation Criterion	Description
1. Effectiveness	1. Overall Protection of Human Health and the Environment	This criterion describes how each alternative, as a whole, protects human health and the environment and indicates how each chemical source is to be eliminated, reduced, or controlled.
	2. Compliance with ARARs	This criterion evaluates each alternative's compliance with ARARs or, if an ARAR waiver is required, how the waiver is justified. ARARs consider chemical-, location-, and action-specific concerns.
	3. Long-Term Effectiveness and Permanence	This criterion evaluates the long-term effectiveness of each alternative in protecting human health and the environment after the remedial action is complete. Factors considered for protection of the environment include magnitude of residual risks and adequacy and reliability of release controls.
	4. Reduction of Toxicity, Mobility, or Volume through Treatment	This criterion evaluates the anticipated performance for each alternative's specific treatment technologies to reduce the toxicity, mobility, or volume of hazardous substances.
	5. Short-Term Effectiveness	This criterion examines the short-term effectiveness of each alternative in protecting human health and the environment during the construction and implementation period of the remedy. The factors considered in evaluation of short-term effectiveness include protection of the community during remedial actions, protection of workers during remedial actions, environmental effects that would result from construction or implementation of the alternative, and the time required to complete the remedial action.
2. Implementability	6. Implementability	This criterion evaluates the technical and administrative feasibility of each alternative and the availability of required resources such as services and materials.
3. Cost	7. Cost	This criterion evaluates the capital and operation and maintenance costs for each alternative. The accuracy of costs developed typically ranges from minus 30 to plus 50 percent.
Not Applicable	8. State Acceptance[1]	This criterion is not required for a RAW. For FS/RAPs, this criterion evaluates the technical and administrative issues and concerns the state may have about each of the alternatives.
Not Applicable	9. Community Acceptance[2]	This criterion is not required for a RAW. For FS/RAPs, this criterion evaluations the issues and concerns the public may have about each alternative.

Table 3-4. Evaluation Criteria

Notes:

1. State acceptance is evaluated and addressed when DTSC and other State agencies provide comments on the Draft RAW.
2. Community acceptance is evaluated and addressed when public comments are received during the public comment period and the public meeting held for the RAW.

ARAR	Applicable or relevant and appropriate requirement
DTSC	Department of Toxic Substances Control
FS	Feasibility Study
RAP	Remedial Action Plan
RAW	Removal Action Workplan

Table 3-5. Preliminary Screening of General Response Actions and Process Options for the RES Area Soil

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Comment
No Action	None	None	No Action	Not effective	Not applicable	No capital or O&M cost	NCP requires the no action alternative to be carried through to detailed analysis.
Land Use Controls	Intitutional Controls	Deed Restrictions	Prohibits activities not specified for the designated land use and requires implementation of a soil management plan. Property use restrictions in all deeds for property within RFS RES area.	Effectiveness depends on future enforcement of deed restrictions	Easily implemented	Low capital and no O&M costs	Deed restrictions retained for further evaluation as a potential remedial alternative component.
Source Containment	Cap	Soil/ Maintained Landscaping	Clean soil cover and maintained vegetative cover	Effective; eliminates direct exposure pathway	Easily and quickly implemented	Moderate capital and low O&M costs	Soil cap retained for further evaluation for MFA because it can be implemented in conjunction with future development.
		Clay	Low-permeability, compacted clay cover	Effective; eliminates direct exposure pathway	Easily and quickly implemented	Moderate capital and low O&M costs	Clay cap retained for further evaluation because will act as a visual, as well as physical, barrier.
		Asphalt	Low-permeability, sprayed or poured asphalt cover	Effective; eliminates direct exposure pathway	Easily and quickly implemented	Moderate capital and low O&M costs	Asphalt cap eliminated from further evaluation because it would have limited lifetime considering furture development.
		Concrete	Low-permeability, formed and poured concrete cover	Effective; eliminates direct exposure pathway	Easily and quickly implemented	Moderate capital and low O&M costs	Concrete cap eliminated from further evaluation because it would have limited lifetime considering future development and cost.

Table 3-5. Preliminary Screening of General Response Actions and Process Options for the RES Area Soil

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Comment
Treatment	In Situ Treatment	Solidification and Stabilization	Multiple augered equipment mix contaminated soil in place with organic polymer, cement, lime, water, and siliceous material for solidification.	Effective for reducing solubility of metals, but not effective in reducing bioavailability from direct exposure to soils	Moderately implementable; project timing and available area are limited	Moderate capital and low O&M costs	In Situ solidification/stabilization eliminated from further evaluation due to ineffective for RES exposure pathway and solidified material being a potential impediment to future development.
		Electrokinetic Separation	Application of a low-intensity direct current through the soil between ceramic electrodes. Mobilizes charged species, causing ions and water to move toward the electrodes.	Moderately effective; concentrates contaminants at electrode for removal and treatment	Low implementability; buried metallic or insulating material can induce variability in conductivity of soil	Moderate capital costs; may be impacted by energy requirements	Electrokinetic separation eliminated from further consideration because of limited implementability and cost.
		Vitrification	High temperature treament that reduces mobility of metals by incorporating them in a chemically durable, leach resistant, vitreous mass. Process may cause contaminants to volatilize.	Moderately effective at mitigating mobility; may cause volitilization--off-gas treatment/ containment likely necessary	Low implementability; difficult to implement over large areas	High capital and O&M (uses large amounts of energy)	Vitrification eliminated from further consideration because of limited implementability and high cost.
		Soil Flushing	Solution of water/chemicals/extractant is injected into or sprayed onto the area of contamination, mobilizing contamminants by dissolution. The contaminant-bearing flushing solution is collected and pumped to surface for treatment or disposal.	Low effectiveness; flushing of contaminants from surface may contaminate subsurface soil and groundwater	Low implementability; may be difficult to implement for variable depth contamination and capture of flushing fluid	Low capital costs and moderate O&M	Soil flushing eliminated from further consideration because of limited effectiveness and implementability.
		Phytoremediation	Plants are used to remove, transfer, stabilize, or destroy contaminants in soil.	Limited effectiveness; plants may accumulate high levels of metals and require treatment prior to disposal	Low implementability; likely to require large number of plants over treatment area; not compatible with future development	Moderate capital and moderate O&M	Phytoremediation eliminated from further consideration because of limited effectiveness and implementability.
	Ex Situ Treatment	Chemical Extraction	Soil is excavated and mixed with extractant (acid or solvent). Separation of extractant and treated soils required; treatment/disposal of extractant/contaminants required.	Acid extraction effective for metals; solvent extraction effective for PCBs, VOCs	Moderate implementability; equipment/extractants readily available; treatment train relatively cumbersome	Moderate to high capital and no O&M	Chemical extraction eliminated from further consideration because of cost and complexity of treatment train.
		Off-Site Solidification and Stabilization	Mixture of contaminated soil with organic polymer, cement, lime, water, and siliceous material for solidification, conducted off site.	Effective for reducing solubility of metals to levels appropriate for landfill disposal	Easily and quickly implemented	Moderate to high capital and no O&M costs	Off-site solidification/stabilization retained for futher consideration because contaminant levels may require stabilization prior to disposal.

Table 3-5. Preliminary Screening of General Response Actions and Process Options for the RES Area Soil

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Comment
Removal	Soil Excavation/ Backfill	Mechanical Excavation/ Backfill	Removal of contaminated soil using conventional construction equipment such as backhoes and front-end loaders	Effective; eliminates direct exposure pathway	Easily and quickly implemented	Low to high capital costs depending on soil volume and no O&M costs	Excavation retained for further evaluation because contaminants are removed from site.
Disposal	Off-Site Commercial	Class I, II, or PCB Landfill	Transport to and placement of excavated soil at appropriate landfill (Class I, Class II, or PCB)	Effective; eliminates direct exposure pathway	Easily and quickly implemented	Moderate to high capital and no O&M costs	Off-site disposal retained for further evaluation because contaminants are removed from site.
	On-Site Disposal	On-Site Placement	Transport to and placement of excavated soil at on-site location dictated by future development. Placement location must follow SMP.	Effective; eliminates direct exposure pathway	Easily and quickly implemented	Low capital and low O&M costs	On-site placement eliminated from further evaluation due to coordination and restriction issues related to future development.

Notes:

1. Option was retained for further evaluation as componenet of an alternative (blue)
2. Option was eliminated from further evaluation (gray)
3. Chemicals of concern in the RES Area include PCBs, mercury, cinders-related metals (arsenic, lead), BAP, and Dioxin.

BAP	Benzo(a)pyrene	O&M	Operation & maintenance	RFS	Richmond Field Station
MFA	Mercury fulminate area	PCB	Polychlorinated biphenyl	VOC	Volatile organic compound
NCP	National Contingency Plan	RES	Research, Education, and Support		

Table 3-6. Preliminary Screening of General Response Actions and Process Options for Groundwater

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Comment
No Action	None	None	No Action	Not effective	Not applicable	No capital or O&M cost	NCP requires the no action alternative to be carried through to detailed analysis
Land Use Controls	Institutional Controls	Deed Restrictions	Prohibits activities not specified for the designated land use, specifically, prohibiting well installation and groundwater use. Property use restrictions in all deeds for property within RFS RES area.	Effectiveness depends on future enforcement of deed restrictions	Easily implemented	Low capital and low O&M costs	Deed restrictions retained for further evaluation as a potential remedial alternative component.
	Engineering Controls	Engineering Controls	Vapor barrier/vapor extraction system implemented as part of future building construction.	Effective in mitigating indoor air pathway	Easily implemented as component of future construction	Moderate capital and low O&M costs	Engineering controls eliminated from further evaluation because Carbon Tetrachloride Area is predominantly within the NOS Area, which has been identified as a natural area that the University plans to protect from development and maintain in its natural condition. Future construction of buildings over the plume will not occur in the NOS Area.
	Monitoring	Monitoring	Collect groundwater samples and measurements from monitoring wells or direct push equipment to assess water quality, water level, and gradient.	Effective in assessing groundwater contaminant concentrations and movement	Easily implemented	Low capital and O&M costs	Groundwater monitoring retained for futher evaluation as a potential remedial alternative component.
Removal	Groundwater Extraction	Vertical Extraction Wells	Removal of contaminated groundwater using conventional pumping equipment, including well network.	Moderately effective; effectiveness impacted by amount of groundwater that can be extracted in impacted zone	Easily implemented; however, implementation must minimize impact to coastal terrace prairie	Moderate capital and O&M costs	Groundwater extraction eliminated from futher evaluation because of implementability and cost.

Table 3-6. Preliminary Screening of General Response Actions and Process Options for Groundwater

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Comment
Containment	Vertical Barriers	Slurry Wall	Subsurface barrier consisting of vertically excavated trench filled with slurry, a mixture of soil, bentonite, and water with a hydraulic conductivity of <10^{-6}. Groundwater extraction and treatment may also be required in conjuntion with a slurry wall to prevent groundwater mounding or flow around the wall.	Potentially effective in minimizing groundwater movement; however, likely to require groundwater extraction to prevent mounding	Implementable; must be implemented to minimize damage to coastal terrace prairie. Access to slurry wall must be maintained through site development	Moderate to high capital costs and moderate O&M costs	Slurry walls eliminated from further evaluation because similar effectiveness as gradient control technologies with higher cost.
	Gradient Control	Extraction Wells	Extract groundwater from a series of vertical wells to create a capture zone , thereby preventing impacted groundwater from migrating downgradient	Potentially effective in minimizing groundwater movement; effectiveness impacted by amount of groundwater that can be extracted downgradient of impacted zone	Implementable; must be implemented to minimize damage to coastal terrace prairie. Access to well network must be maintained through site development	Moderate to high capital costs and moderate O&M costs	Extraction wells eliminated from further evaluation because of effectiveness and high cost.
		Interceptor Trench	Extract groundwater from trench backfilled with permeable media to intercept and collect impacted groundwater	Effective in capturing impacted groundwater	Implementable; requires excavation in saturated zone; must be implemented to minimize damage to coastal terrace prairie. Access to trench must be maintained through site development	Moderate capital costs and moderate O&M costs	Interceptor trench eliminated from further evaluation because of implementability and cost.

Table 3-6. Preliminary Screening of General Response Actions and Process Options for Groundwater

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Comment
Treatment	In Situ Treatment	Air Sparging	Injection of air into saturated zone through system of injection wells to increase volatilization	Potentially effective; CT not expected to sorb to soil; however, boring logs indicate clayey material not likely to be conducive to air sparging	Moderately easy to implement and maintain	Moderate capital and O&M costs	Air sparging eliminated from further evaluation because of limited effectiveness in clayey soil.
		Passive/Reactive Treatment Wall	Trench or tightly spaced direct-push injection wells, placed downgradient of impacted zone, are filled/injected with treatment media, such as activated carbon impregnated with nano-scale iron, to treat CT as groundwater flows through permeable reactive barrier (PRB)	Effective; contaminants are adsorbed by the carbon, thereby co-locating with the reactive iron which treats contaminants by reductive dechlorination	Implementable; must be implemented to minimize damage to coastal terrace prairie. Access to trench/well network must be maintained through treatment completion	Moderate capital and low O&M costs	PRB retained for further evaluation because it reduces CT concentration.
		Anaerobic Enhanced Bioremediation	Inject electron donor substrates and nutrients to increase the rate of in situ bioremediation (ISB) of organic contaminants by indigenous microbes	Effective; initial pilot test results at Zeneca indicate successful dechlorination of TCE to cis-1,2-DCE, VC and ethene	Implementable; ERD substrates were successfully pilot tested at Zeneca during 2006 and 2010	Moderate capital and low O&M costs	Enhanced bioremediation retained for futher evaluation because it is likely to reduce CT concentrations.
		Monitored Natural Attenuation	Monitored natural attenuation involves allowing natural biological processes to occur and monitoring the natural degradation process by collecting groundwater samples and measurements from monitoring wells or direct push equipment to assess water quality, inclucing degradation parameters; water level; and gradient.	Moderately effective based on viability of indigenous bacteria's ability to break down carbon tetrachloride	Easily implemented	Low capital and O&M costs	MNA is retained for further evaluation as a potential remedial alternative component.

Table 3-6. Preliminary Screening of General Response Actions and Process Options for Groundwater

General Response Action	Remedial Technology Type	Process Option	Description	Effectiveness	Implementability	Cost	Comment
Treatment	Ex Situ Treatment	Air Stripping	VOCs are removed from groundwater by passing air through the water stream. The air stirpping off-gas may require treatment prior to discharge to remove VOCs	Effective for removing most VOCs from extracted groundwater	Implementable	Variable, depending on groundwater flow rate and VOC composition and concentration, and whether off-gas must be treated	Ex situ air stripping eliminated from further evaluation because it seems less efficient than other treatment technologies
		Carbon Adsorption	VOCs are adsorbed onto granular activated carbon or specialized resins	Effective for removing most VOCs from extracted groundwater	Implementable	Variable, depending on groundwater flow rate and VOC composition and concentration	Ex situ carbon adsorption eliminated from further evaluation because it seems less efficient than other treatment technologies

Notes:
1. Option was retained for further evaluation for internal Navy meeting
2. Option was removed from further evaluation
3. The chemical of concern in groundwater is carbon tetrachloride.
4. The exposure pathway of concern is the vapor intrusion to indoor air pathway.

cis-1,2-DCE	cis-1,2-dichloroethene	NOS	Natural Open Space	VC	Vinyl chloride
CT	Carbon tetrachloride	O&M	Operations and Maintenance	VOC	Volatile organic compound
ERD	Enhanced reductive dechlorination	PRB	Permeable reactive barrier		
ISB	In Situ bioremediation	RES	Research, Education, and Support		
MNA	Monitored natural attenuation	RFS	Richmond Field Station		
NCP	National Contingency Plan	TCE	Trichloroethene		

TABLE 3-7. PROPOSED ALTERNATIVES

Alternative Number	Alternative Description
S-1	**No Action**
S-2	**Excavation to Unrestricted Use and Off-Site Disposal:** Excavate soils with chemical concentrations exceeding unrestricted risk based concentrations (RBC); make assumptions about volume of soil exceeding unrestricted RBCs and volume of soil containing cinders. Off-site disposal at appropriate landfills.
S-3	**Excavation to Commercial Use, Off-Site Disposal, Land Use Controls (LUC), and Implementation of Soil Management Plan:** Excavate soils with chemical concentrations exceeding remedial goals. Off-site disposal of excavated soil at appropriate landfills. LUCs consisting of deed restrictions prohibiting residential reuse and requiring implementation of soil management plan (SMP).
S-4	**LUCs:** LUCs to consist of deed restrictions prohibiting residential reuse.
S-5	**Asphalt Cap and LUC (Mercury Fulminate Area Only):** Install asphalt cap over MFA soils where mercury exceeds commercial RBCs; LUCs consisting of deed restrictions prohibiting residential reuse and requiring implementation of SMP.
GW-1	**No Action**
GW-2	**Permeable Reactive Barrier (PRB), LUCs, and monitoring:** Install a PRB downgradient of carbon tetrachloride plume (or eastern side of Buildings 280A and 280B) to treat carbon tetrachloride plume as it migrates through barrier; LUCs to prohibit use of groundwater; monitoring to assess effectiveness of PRB.
GW-3	**In Situ Bioremediation (ISB), LUCs, and monitoring:** Develop network of wells to inject substrate to enhance biodegradation of carbon tetrachloride. LUCs to prohibit use of groundwater; monitoring to assess effectiveness of ISB.
GW-4	**Monitored Natural Attenuation and LUCs:** Allow natural biological processes to occur and monitor the contaminant and daughter product reduction over time. LUCs to prohibit use of groundwater.

Table 3-8. Monitored Natural Attenuation Parameters Comparison[1]

			Piezometer															
			CTP					GEO (Upgradient)					B280A (Downgradient)				
Analysis	Value Amenable to MNA (Bioremediation)	Interpretation	9/30/2010	4/14/2011	10/6/2011	4/3/2012	4/4/2013	9/30/2010	4/20/2011	10/6/2011	4/6/2012	4/4/2013	9/16/2010	4/14/2011	10/6/2011	4/3/2012	4/4/2013
Oxygen	<0.5 mg/L; not >5mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	2.79	1.46	2.9	1.08	2.49	2.7	0.28	0.27	1.3	1.75	0.24	0.36	0.2	0.32	1.9
Nitrate	<1 mg/L	At higher concentrations may compete with reductive pathway															
Iron II	>1 mg/L	Reductive pathway possible	150	44J	50U	50U		100U	89UJ	50U	50U		100U	24J	120	50U	
Sulfate	<20 mg/L	At higher concentrations may compete with reductive pathway															
Sulfide	>1 mg/L	Reductive pathway possible															
Methane	<0.5 mg/L >0.5 mg/L	VC oxidizes Ultimate reductive daughter product, VC Accumulates															
Oxidation Reduction Potential (ORP) against Ag/AgCl electrode[2]	<50 millivolts (mV) <-100mV 673mV 560mV 493mV 464mV	Reductive pathway possible Reductive pathway likely reductive potential of CT reductive potential of CF reductive potential of DCM reductive potential of CM	-80	40	-9	292	20	204	80	56	280	99	209	71	112	293	144
pH	5 < pH < 9 5 > pH >9	Optimal range for reductive pathway Outside optimal range for reductive pathway	7.72	7.96	7.5	7.03	6.81	7.63	7.76	7.7	7.14	7.03	7.49	7.75	7.44	6.92	6.86
TOC	> 20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic															
Temperature	> 20^{o}C	At T >20^{o}C biochemical process is accelerated	16.74	15.45	16.05	15.17	14.56	17.49	14.65	17.1	15.02	14.28	19.6	16.36	19.3	16.33	15.73
Carbon Dioxide	>2x background	Ultimate oxidative daughter product															
Alkalinity	>2x background	Results from interaction between CO_2 and aquifer minerals															
Chloride	>2x background	Daughter product of organic chlorine															
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate															
Hydrogen	<1 nM	VC oxidized															
Carbon Tetrachloride	µg/L	Material released	19	16	25	14	18	1.1	1.2	1	0.9	1	0.9	1.1	1.4	0.9	1.3
Chloroform	µg/L	Daughter product of Carbon Tetrachloride	8.6	5.5	7.6	6.6	8.4	1	0.7	0.5	0.8UJ	0.7	0.5U	0.2J	0.1J	0.5U	0.3J
Dichloromethane	µg/L	Daughter product of Chloroform	0.4J	10U	10UJ	10U	10U	0.5U	10U	10UJ	10U	10U	0.5U	10U	10UJ	10U	10U
Methyl Chloride (Chloromethane)	µg/L	Daughter product of Dichloromethane	0.5U	1U	1U	1U	1U	0.5U	1U	1U	1U	1U	0.5UJ	1U	1U	1U	1U

1. EPA. 1998. "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water, Table 2.3." EPA/600/R-98/128. September.

2. Reduction potential values for CT, CF, DCM, and CM from "Thermodynamics of Low Eh Reactions", J. Dolfing and J. Miller, Battelle's Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds, May 2006.

µg/L	Micrograms per liter	CT	Carbon tetrachloride	mV	Millivolt
Ag	Silver metal	DCM	Dichloromethane	nM	nanometer
AgCl	Silver cloride	EPA	U.S. Environmental Protection Agency	ORP	Oxidation reduction potential
CF	Chloroform	J	Estimated value	T	Temperature
CM	Chloromethane	mg/L	Milligrams per liter	U	Nondetected
CO_2	Carbon dioxide	MNA	Monitored natural attenuation	VC	Vinyl chloride

Table 3-9. Federal and State Applicable or Relevant and Appropriate Requirements

Chemical-Specific

Requirement	Citation	Description
Defines RCRA hazardous waste.	42 U.S.C., Chapter 82, § 6901-6991 [i]	RCRA provides criteria for determining whether a solid or liquid waste is a RCRA hazardous waste. A solid waste is characterized as toxic, based on TCLP, if the waste exceeds the TCLP maximum concentrations. Applicable for determining whether excavated soil must be managed as federal hazardous waste.
TTLCs and STLCs for classification of waste - California Code of Regulations	Cal. Code Regs. tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Title 22 of the California Code of Regulations lists the TTLCs and STLCs for classification of hazardous or extremely hazardous wastes based on standards, including ignitability, pH, reactivity and toxicity. It is applicable for determining whether excavated soil must be managed as California hazardous waste or non-hazardous waste.
Definition of non-RCRA, state regulated hazardous waste.	Cal. Code Regs. tit. 22, §§ 66261.3(a)(2)(C) or (a)(2)(F), 66261.22(a)(3) and (a)(4), 66261.24(a)(2) – (a)(8), and 66261.101	The substantive provisions of these regulations are applicable to activities that generate waste to determine if the waste is non-RCRA, state-regulated hazardous waste. It will be determined if the excavated soil meets the definition of non-RCRA, state-regulated hazardous waste when it is generated.
Definition of designated, nonhazardous waste and inert waste.	Cal. Code Regs. tit. 27, §§ 20210, 20220 and 20230	These regulations are applicable to activities that generate waste to determine if the waste is a regulated waste. It will be determined if the excavated soil meets these definitions when it is generated.
Toxic Substances Control Act	15 U.S.C §§ 2602, 40 CFR § 761.3, 40 CFR § 761.61(a)(4)(i)	The TSCA PCB regulations specify treatment, storage and disposal requirements for PCBs based on their form and concentration. TSCA Subpart D sets forth cleanup and disposal options for sites with PCBs greater than 1 mg/kg. 40 CFR § 761.61(a)(4)(i) defines bulk PCB remediation waste and states the cleanup level for bulk PCB remediation waste in high occupancy areas is $\leq$ 1 ppm.

Table 3-9. Federal and State Applicable or Relevant and Appropriate Requirements

Chemical-Specific		
Requirement	**Citation**	**Description**
RWQCB, San Francisco Bay Region, Water Quality Control Plan Chapters 2 and 3	Cal. Water Code § 13240	The Basin Plan identifies beneficial use, water quality objectives and waste discharge requirements.
California Toxics Rule	40 CFR §131.38(b)(1), (2).	The final rule, Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California, "California Toxics Rule," 65 Fed. Reg. 31682 (May 18, 2000) sets forth freshwater and saltwater criterion maximum concentrations and criterion continuous concentrations for a number of metals and chemical compounds. These include arsenic, chromium (III), chromium (VI), copper, cyanide, lead, zinc, carbon tetrachloride, asbestos, and PCBs. See Table, 65 Fed. Reg. at 31712-31715. 40 CFR §131.38(b)(1). The enforcement of the federal rule was delegated to the RWQCB.

Table 3-9. Federal and State Applicable or Relevant and Appropriate Requirements

Location-Specific		
Requirement	**Citation**	**Determination**
SWRCB Resolution 88-63	Cal. Water Code § 13140, 13240, 13245	Designates all groundwater and surface waters of the state as drinking water except where the TDS is greater than 3,000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal resource or in a water conveyance facility, or the water cannot reasonably be treated for domestic use using either best management practices or best economically achievable treatment practices.
Endangered Species Act	16 U.S.C. 1531 et seq.; 50 CFR Part 200; 50 CFR Part 402	The federal Endangered Species Act requires that actions conserve endangered species or threatened species and critical habitats.
California Endangered Species Act	FGC Div. 3, Chapter 1.5, Section 2050 et seq.; FGC Div. 4, §3005 (a); §3511; §3513	Prohibits the taking from the state of any endangered or threatened species.
Prohibits the take or possession of listed fully protected birds	Cal. Fish and Game Code § 3511	Substantive provisions of this requirement are relevant and appropriate. The California clapper rail is a fully protected bird that may be present at the site.
National Archaeological and Historic Preservation Act	16 U.S.C. §46; 36 CFR §65	Provides for the recovery and preservation of historic artifacts.

Table 3-9. Federal and State Applicable or Relevant and Appropriate Requirements

Action-Specific		
Requirement	**Citation**	**Comments**
GENERAL		
CERCLA permit waiver	42 U.S.C. 9621(e)	No Federal, State, or local permit is required for the portion of any removal or remedial action conducted entirely onsite, where such remedial action is selected and carried out in compliance with 42 U.S.C. § 9621.
CEQA - Mandates environmental impact review of certain actions taken by California governmental agencies or by private parties who are regulated by California governmental agencies, unless a categorical or statutory exemption applies.	Cal. Public Resources Code §§21000-21177 ; Cal. Code Regs. tit. 14, §§ 15000-15387	The removal action will be carried out in accordance with the requirements of CEQA.
LAND USE CONTROLS		
Provides conditions for land use restrictions applying to successive owners	Cal. Civil Code § 1471	Property owner will enter into land use covenant setting forth restrictions on use of property in accordance with this section.
Provides requirements for land use controls	Cal.Code Regs.,tit. 22, § 67391.1	This provision requires a land use covenant imposing appropriate limitations be executed and recorded when remedial or removal will result in hazardous substances or waste remaining at the levels that are not suitable for unrestricted use. Property owner will enter into a land use covenant in accordance with this section.
EXCAVATION		
Person who generates waste shall determine if the waste is a hazardous waste.	Cal. Code Regs. tit. 22, §§ 66262.10(a), and 66262.11	These regulations are applicable to any operation that generates waste. During excavation, waste will be generated and it will be determined whether the waste is RCRA hazardous waste when it is generated.
Requirements for analyzing waste for determining whether waste is hazardous.	Cal. Code Regs. tit. 22, § 66264.13(a) and (b)	These regulations are applicable to any operation that generates waste. During excavation, waste will be generated and it will be determined whether the waste is RCRA hazardous waste when it is generated.

Table 3-9. Federal and State Applicable or Relevant and Appropriate Requirements

Action-Specific

Requirement	Citation	Comments
Waste pile design and operating requirements	Cal. Code Regs. tit. 22 § 66264.251	Specifies waste pile design and operating requirements including liner design and construction.
Waste pile closure requirements	Cal. Code Regs. tit. 22, § 66264.258(a) and (b)	Specifies requirements for closure of waste piles including removal of all waste and liners and equipment and comply with closure and post-closure requirements.
Soil stockpiling requirements for non-RCRA hazardous waste	Cal. Health & Safety Code § 25123.3	Specifies requirements for stockpiles containing non-RCRA hazardous waste. Hazardous waste may be accumulated on-site for off-site disposal without a permit if specific conditions are met.
Regulatory Oversight - Soil Excavation and Handling	Cal. Health & Safety Code §25358.9 and §25356.1	Addresses permitting and oversight regarding excavation and handling of soil. Section 25358.9 of the Health and Safety Code excludes on-site work from certain hazardous waste facility permitting requirements if the work is being conducted pursuant to a removal action plan or remedial action plan approved by DTSC and the cleanup complies with all applicable laws, rules, regulations, standards, and requirements.
Health and Safety for Onsite Workers - Construction Activities - California Code of Regulations	Cal. Code Regs. Title 8 §5192 and 40 CFR §1910.120	Provides regulations regarding worker health and safety during excavation activities while implementing remedial actions.
Toxic Substances Control Act	40 CFR §761.65(c)(9); 40 CFR § 761.61(b); 40 CFR§ 761.60(e); 40 CFR§ 761.70(b); 40 CFR§ 761.75; 40 CFR§ 761.77	Requirements for the storage of bulk PCB remediation waste 40 CFR § 761.61 provides cleanup and disposal options for PCB remediation waste and subpart (b) identifies the option of performance-based disposal using existing approved disposal technologies.
Air emissions requirements	BAAQMD Regulation 6-1-302	Prohibits emissions aggregating more than three minutes in any hour an emission equal to or greater than 20 percent opacity.
Clean Water Act stormwater discharge requirements	40 CFR § 122.44(k)(2) and (4)	Best management practices will be taken to prevent construction pollutants from contacting stormwater and keep erosion products from moving off site.

Table 3-9. Federal and State Applicable or Relevant and Appropriate Requirements

Action-Specific

Requirement	Citation	Comments
California Environmental Quality Act	Cal. Code Regs. Title 11 §§15000-15387 et seq.	Mandates environmental impact review of certain actions taken by California governmental agencies or by private parties who are regulated by California governmental agencies, unless a categorical or statutory exemption applies.
Generation, Transport and Disposal Regulations California Code of Regulations and Code of Federal Regulations	Cal. Health and Safety Code §§25100-25166.5, 25179.1-.12 (land disposal restrictions ["LDRs"]), §§25244-25244.24 (waste reduction and recycling); 22 Cal. Code Regs. §§66260.10-66262.43, 66263.10-.32 66264.1-.172, 66265.16- .199; 66268.1, 66268.10-.44, 66268.48, 66268.49,.105-.113, 40 CFR § 268.40-49 (LDRs + treatment standards); 49 CFR §§171.2(f), 171.2 (g), 172.300, 172.301, 172.302, 172.303, 172.304, 172.312, 172.400 and 172.504.	Generators of hazardous waste must observe certain requirements in accumulating, storing, marking and treating the waste while on-site, and in preparing and labeling the waste for transport and disposal off site (HSC §§ 25123.3 (accumulation); 25123.5 & 25201 (treatment); 25160-25166.5, Cal. Code Regs. §§ 66263.10-.32 (transport), 25244.4; 22 Cal. Code Regs. §§ 66260.200; 66262.10-.41; 66264.1-.172; 66265.170-.177 (container storage), .190-.199 (tank storage)). Persons responsible for handling and transporting waste must receive appropriate training, and contingency/emergency planning and procedures must be in place (22 Cal. Code Regs. §§ 66262.34; 66265.16, .30-.37, .50-.56). Required records must be kept (22 Cal. Code Regs. 66262.40). These requirements may be relevant and appropriate to any future generation of hazardous wastes through remediation activities (e.g., during drilling and excavating), including manifesting and transporting those wastes off site (22 Cal. Code Regs. §§ 66262.10-66262.47). LDR requirements apply to disposal of hazardous waste to land (Cal. Code Regs. tit. 22, §§ 66268.1, 66268.10-.44, 66268.48, 66268.49,.105-.113; 40 CFR 268.40-49)

Table 3-9. Federal and State Applicable or Relevant and Appropriate Requirements

Action-Specific		
Requirement	**Citation**	**Comments**
PERMEABLE REACTIVE BARRIER AND IN SITU BIOREMEDIATION		
Safe Drinking Water Act underground injection requirements	42 U.S.C. §§ 300(f)-300(j) 40 CFR § 144.12	These requirements prohibit injection that allows movement of chemicals into underground sources of drinking water that may result in violations of maximum contaminant levels or adversely affect health. The property owner will comply with these requirements during implementation of a PRB or ISB system.
Treatability Study Exemptions	40 CFR 261.4; Cal. Code Regs., tit. 22 § 66261.4	Under 40 CFR 261.4 EPA may grant requests on a case-by-case basis for up to an additional two years for treatability studies involving bioremediation. Cal. Code Regs., tit. 22 § 66261.4(e) sets forth sampling requirements for treatability studies.
Person who generates waste shall determine if the waste is a hazardous waste.	Cal. Code Regs. tit. 22, §§ 66262.10(a), and 66262.11	These regulations are applicable to any operation that generates waste. The property owner will generate waste during the remedy implementation and it will be determined whether the waste is RCRA hazardous waste when it is generated.
Hazardous waste container requirements	Cal.Code Regs., tit. 22 § § 66264.171, 66264.172,66264.173, 66264.174, 66264.175, 66264.178	These sections specify requirements for containers of RCRA hazardous waste including maintenance, inspection, containment and removal. The property owner will comply with these requirements for any hazardous waste generated during implementation of a PRB or ISB system.
GROUNDWATER MONITORING		
Water Quality Monitoring and Response Programs	Cal.Code Regs. tit. 22 Chapter 14, Article 6, §§ 66264.90-66264.101	Article 6 sets forth requirements for groundwater monitoring programs and are relevant and appropriate. These regulations address groundwater protection standards; constituents of concern; concentration limits; monitoring points and point of compliance; compliance period; and detection, evaluation and corrective action programs.

Table 3-9. Federal and State Applicable or Relevant and Appropriate Requirements

Notes:

§	Section	ISB	In situ bioremediation
§§	Sections	PCB	Polychlorinated biphenyl
BAAQMD	Bay Area Air Quality Management District	ppm	Parts per million
Cal.	California	PRB	Permeable reactive barrier
Cal. Code Regs.	California Code of Regulations	RCRA	Resource Conservation and Recovery Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act	RWQCB	Regional Water Quality Control Board
CEQA	California Environmental Quality Act	STLC	Soluble threshold limit concentrations
CFR	Code of Federal Regulations	SWRCB	State Water Resources Control Board
DTSC	Department of Toxic Substances Control	TCLP	Toxicity characteristic leaching procedure
EPA	U.S. Environmental Protection Agency	TDS	Total dissolved solids
Fed. Reg	Federal Regulations	tit	Title
FGC	California Fish and Game Code	TSCA	Toxic Substances Control Act
gpd	Gallons per day	TTLC	Total threshold limit concentrations
HSC	California Health and Safety Code	U.S.C.	United States Code

Table 4-1. PCB Areas Cost Estimate

PCB Remediation: Excavation to TSCA High Occupancy, No Conditions

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Preconstruction - mob/demob, work plan, fencing, surveying, utility locator, pre-excavation characterization sampling, submittals, dust control, etc.	$25,000	1	LS	$25,000
2	Misc pumps	$50	5	DY	$250
3	Water storage tank (one clean and one waste)	$200	5	DY	$1,000
4	Water truck	$3,000	1	WK	$3,000
5	Decontamination water transport to Evergreen (Newark, CA)	$440	1	Truck	$440
6	Decontamination water disposal	0.95	20	GAL	$19
7	Air monitoring stations	$1,600	1	WK	$1,600
8	Excavate PCB-contaminated soils and stage in roll-off bins onsite	$30	15	BCY	$450
9	Roll-off bin rental (hold 20 CY each)	$475	2	EA	$950
10	Soil confirmation samples and analysis	$250	40	EA	$10,000
11	Haul PCB-contaminated soil (assumed to be TSCA waste) to US Ecology (Beatty NV landfill 550 mi)	$203	25	TN	$5,112
12	Landfill disposal of hazardous waste soil	$198	25	TN	$4,985
13	Flagman & sweeper during loading and on-site hauling	$1,500	5	DY	$7,500
14	Load & haul on-site backfill	$3	19	LCY	$56
15	Spread and compact backfill	$25	15	BCY	$375
16	Hydromulch backfilled areas	$500	1	LS	$500
			Subtotal		**$61,237**
			Construction Management (15% construction line items only)		**$9,186**
			Subtotal		**$70,422**
			Contingency (20%)		**$14,084**
			Total		**$84,507**

Notes:

1. Decontamination pad required to decontaminate equipment before exiting exclusion zone; decontamination pad included in MFA alternatives.
2. The unrestricted use remediation criteria for PCBs is 1 mg/kg.
3. Confirmation sampling assumes a minimum of 5 samples per excavation (4 side-wall and 1 bottom), with additional side-wall samples collected every 25 feet for larger excavations. Analyses include: PCBs.
4. AC=Acre; BCY=Bank (in place) cubic yard; DY=day; EA=Each; Gal=Gallon; Hr=Hour; LCY=Loose (excavated or stockpiled) cubic yard; LS=Lump sum; LUC=Land use control; MFA=Mercury Fulminate Area; mg/kg=milligram per kilogram; NPV=Net present value; O&M=Operation & maintenance; PCB=Polychlorinated biphenyl; RCRA=Resource Conservation and Recovery Act; RES=Research, Education, and Support; SF=Square feet; SY=Square yard; SVOC=Semivolatile organic compound; TCLP=Toxicity characteristic leaching procedure; TN=Ton; TSCA=Toxic Substances Control Act; ug/L=micrograms per Liter; WK=Week; YR=Year

Table 4-2. MFA Alternative S-2 Cost Estimate

Alternative S-2: Excavation to Unrestricted Use and Off-Site Disposal

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Preconstruction - mob/demob, work plan, fencing, surveying, utility locator, submittals, dust control, etc.	$50,000	1	LS	$50,000
2	Decontamination pad	$43	391	TN	$16,720
3	Bottom liner for decontamination pad	$1	6,000	SF	$7,920
4	Prep decontamination pad area	$2	1,333	SY	$2,667
5	Misc pumps	$50	60	DY	$3,000
6	Water truck	$3,000	12	WK	$36,000
7	Water storage tank (one clean and one waste)	$200	60	DY	$12,000
8	Decontamination water transport to Evergreen (Newark, CA)	$440	9	Truck	$3,960
9	Decontamination water disposal	0.95	43,700	GAL	$41,515
10	Air monitoring stations	$11,100	12	WK	$133,200
11	Excavation containment tent for MFA	$50,000	1	LS	$50,000
12	Demolish, haul, and recycle asphalt from a portion of the paved storage pad	$44	527	TN	$23,175
13	Excavate clean fill beneath pavement for later use as potential backfill	$5	1,317	BCY	$6,584
14	Well abandonement/replacement (piezometer MFA)	$10,000	1	LS	$10,000
15	Excavate mercury contaminated soils into trucks	$20	14,300	BCY	$286,000
16	Soil confirmation samples and analysis	$600	400	EA	$240,000
17	Haul mercury contaminated soil to Buttonwillow, CA landfill (260 mi and 22 tons per load) (assumed to be non RCRA, CA Class I waste	$110	24,024	TN	$2,652,250
18	Landfill disposal of hazardous waste soil (assumed to be non RCRA, CA Class I waste)	$58	24,024	TN	$1,381,380
19	Load onsite fill & haul to MFA for use as backfill	$3	17,875	LCY	$53,625
20	MFA backfill placement	$25	14,300	BCY	$357,500
21	Hydromulch backfilled areas	$7,000.000	1	LS	$7,000
22	Flagman & sweeper during loading and on-site hauling	$1,500	60	DY	$90,000
				Subtotal	**$5,464,495**
				Construction Management (15% capital cost line items only)	**$819,674**
				Subtotal	**$6,284,169**
				Contingency (20%)	**$1,256,834**
				Total	**$7,541,003**

Notes:

1. Decontamination pad required to decontaminate equipment before exiting excavation work area; pad assumed to be 80 feet x 40 feet.
2. Unrestricted use alternative assumes that approximately 14,300 cubic yards of mercury-contaminated soil will be excavated and disposed of at an offsite landfill.
3. Threshold remediation criteria for mercury for unrestricted use = 22.8 mg/kg.
4. Haul cost assumes use of end dump trucks and does not include cost for sealed bed trucks which may be needed for soil with high moisture content.
5. If TCLP extraction test for mercury exceeds 20 ug/L, then the soil must be treated at a mercury retort or incineration facility prior to landfilling. The estimated disposal cost above does not include pretreatment.
6. Confirmation sampling assumes a minimum of 5 samples per excavation (4 side-wall and 1 bottom), with additional side-wall samples collected every 25 feet for larger excavations. Analyses include: metals, SVOCs, PAHs, and PCBs.
7. Piezometer MFA will be abandoned and replaced.
8. AC=Acre; BCY=Bank (in place) cubic yard; DY=day; EA=Each; Gal=Gallon; Hr=Hour; LCY=Loose (excavated or stockpiled) cubic yard; LS=Lump sum; LUC=Land use control; MFA=Mercury Fulminate Area; mg/kg=milligram per kilogram; NPV=Net present value; O&M=Operation & maintenance; PCB=Polychlorinated biphenyl; RCRA=Resource Conservation and Recovery Act; RES=Research, Education, and Support; SF=Square feet; SY=Square yard; SVOC=Semivolatile organic compound; TCLP=Toxicity characteristic leaching procedure; TN=Ton; TSCA=Toxic Substances Control Act; ug/L=micrograms per Liter; WK=Week; YR=Year

Table 4-3. MFA Alternative S-3 Cost Estimate

Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, Land Use Controls, and Soil Management Plan

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Preconstruction - mob/demob, work plan, fencing, surveying, utility locator, submittals, dust control, etc.	$50,000	1	LS	$50,000
2	Decontamination pad	$43	196	TN	$8,360
3	Bottom liner for decontamination pad	$1	4,000	SF	$5,280
4	Prep decontamination pad area	$2	444	SY	$889
5	Misc pumps	$50	20	DY	$1,000
6	Water truck	$3,000	4	WK	$12,000
7	Water storage tank (one clean and one waste)	$200	40	DY	$8,000
8	Decontamination water transport to Evergreen (Newark, CA)	$440	1	Truck	$440
9	Decontamination water disposal	0.95	2,300	GAL	$2,185
10	Air monitoring stations	$6,600	4	WK	$26,400
11	Excavation containment tent for MFA	$50,000	1	LS	$50,000
12	Demolish, haul, and recycle asphalt from a portion of the paved storage pad	$44	37	TN	$1,638
13	Excavate clean fill beneath pavement for later use as potential backfill	$5	93	BCY	$465
14	Well abandonement/replacement (piezometer MFA)	$10,000	1	LS	$10,000
15	Excavate mercury contaminated soils into trucks	$20	1,500	BCY	$30,000
16	Soil confirmation samples and analysis	$600	200	EA	$120,000
19	Haul mercury contaminated soil to Buttonwillow, CA landfill (260 mi and 22 tons per load) (assumed to be non RCRA, CA Class I waste)	$110	2,520	TN	$278,208
20	Landfill disposal of hazardous waste soil (assumed to be non RCRA, CA Class I waste)	$58	2,520	TN	$144,900
21	Load onsite fill & haul to MFA for use as backfill	$3	1,875	LCY	$5,625
22	MFA backfill placement	$25	1,500	BCY	$37,500
23	Hydromulch backfilled areas	$1,500	1	LS	$1,500
24	Flagman & sweeper during loading and on-site hauling	$1,500	20	DY	$30,000
	O&M Costs				
25	LUC five year reviews (NPV for 6 reviews over 30 years)	$17,078	1	LS	$17,078
				Subtotal	**$841,468**
				Construction Management (15% capital cost line items only)	**$123,658**
				Subtotal	**$965,127**
				Contingency (20%)	**$193,025**
				Total	**$1,158,152**

Notes:

1. Decontamination pad required to decontaminate equipment before exiting RES Area; pad assumed to be 80 feet x 20 feet.
2. Commercial use alternative assumes that approximately 1,500 cubic yards of mercury-contaminated soil will be excavated and disposed of at an offsite landfill.
3. Threshold remediation criteria for mercury for commercial use = 275 mg/kg.
4. If TCLP extraction test for mercury exceeds 20 ug/L, then the soil must be treated at a mercury retort or incineration facility prior to landfilling. The estimated disposal cost above does not include pretreatment.
5. Confirmation sampling assumes a minimum of 5 samples per excavation (4 side-wall and 1 bottom), with additional side-wall samples collected every 25 feet for larger excavations. Analyses include: metals, SVOCs, PAHs, and PCBs.
6. Piezometer MFA will be abandoned and replaced.
7. Net Present Value at 7% discount
8. AC=Acre; BCY=Bank (in place) cubic yard; DY=day; EA=Each; Gal=Gallon; Hr=Hour; LCY=Loose (excavated or stockpiled) cubic yard; LS=Lump sum; LUC=Land use control; MFA=Mercury Fulminate Area; mg/kg=milligram per kilogram; NPV=Net present value; O&M=Operation & maintenance; PCB=Polychlorinated biphenyl; RCRA=Resource Conservation and Recovery Act; RES=Research, Education, and Support; SF=Square feet; SY=Square yard; SVOC=Semivolatile organic compound; TCLP=Toxicity characteristic leaching procedure; TN=Ton; TSCA=Toxic Substances Control Act; ug/L=micrograms per Liter; WK=Week; YR=Year

Table 4-4. MFA Alternative S-4 Cost Estimate

Alternative S-4: Land Use Controls

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Five-year site visit	$125	8	HR	$1,000
2	Five-year planning department visit	$125	12	HR	$1,500
3	Five year review letter	$125	24	HR	$3,000
4	Five year review clerical and administrative fees	$60	4	HR	$240
	Five-Year Subtotal				$5,740
	Construction Management (15% capital cost line items only)				**$861**
	Subtotal				**$6,601**
	Contingency (20%)				**$1,320**
	Total				**$7,921**
	Net Present Value of 6 reviews over 30 years at 7%				**$17,078**

Notes:

1. LUCs include deed restrictions prohibiting residential use.
2. Alternative assumes 30 years of LUCs.
3. Net Present Value at 7% discount
4. HR=Hour; LUC=Land use control

Table 4-5. MFA Alternative S-5 Cost Estimate

Alternative S-5: Asphalt Cap and Land Use Controls

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Preconstruction - mob/demob, work plan, fencing, surveying, utility locator, submittals, dust control, etc.	$20,000	1	LS	$20,000
2	Water truck	$3,000	1	WK	$3,000
3	Well abandonement/replacement (piezometer MFA)	$10,000	1	LS	$10,000
4	Load onsite soil fill & haul to MFA for use as sub-cap	$3	542	LCY	$1,625
5	Spread soil on MFA cap with excavator	$20	433	BCY	$8,667
6	Compact soil on MFA cap	$10	433	BCY	$4,333
7	Purchase/transport/laying asphalt for cap	$4.40	23,400	SF	$102,960
8	Flagman & sweeper during loading and on-site hauling	$1,500	5	DY	$7,500
	O&M Costs				
9	LUC five year reviews (NPV for 6 reviews over 30 years)	$17,078	1	LS	$17,078
				Subtotal	**$175,163**
				Construction Management (15% construction line items only)	**$23,713**
				Subtotal	**$198,876**
				Contingency (20%)	**$39,775**
				Total	**$238,651**

Notes:

1. Threshold remediation criteria for mercury for commercial use = 275 mg/kg
2. Cap is assumed to cover remediation areas, as shown in Figure 4-5.
3. Piezometer MFA will be abandoned and replaced.
4. Net Present Value at 7% discount
5. AC=Acre; BCY=Bank (in place) cubic yard; DY=day; EA=Each; Gal=Gallon; Hr=Hour; LCY=Loose (excavated or stockpiled) cubic yard; LS=Lump sum; LUC=Land use control; MFA=Mercury Fulminate Area; mg/kg=milligram per kilogram; NPV=Net present value; O&M=Operation & maintenance; PCB=Polychlorinated biphenyl; RCRA=Resource Conservation and Recovery Act; RES=Research, Education, and Support; SF=Square feet; SY=Square yard; SVOC=Semivolatile organic compound; TCLP=Toxicity characteristic leaching procedure; TN=Ton; TSCA=Toxic Substances Control Act; ug/L=micrograms per Liter; WK=Week; YR=Year

Table 4-6. Soil Alternatives Comparative Analysis

Alternative Description	Alternative S-1 No Action	Alternative S-2 Excavation to Unrestricted Use and Off-Site Disposal	Alternative S-3 Excavation to Commercial Use, Off-Site Disposal, LUCs, and SMP	Alternative S-4 Land Use Controls	Alternative S-5 Asphalt Cap at MFA, LUCs, and SMP
MFA					
Effectiveness	1.8	4.2	4.6	3.6	3.6
Overall Protectiveness	1	5	5	5	5
ARARs Compliance	1	5	5	5	5
Short-term Effectiveness	5	1	3	5	4
Long-term Effectiveness	1	5	5	2	3
Reduction of T, M, V	1	5	5	1	1
Implementability	5	2	4	5	4
Cost	5	1	3	4	3
Cost	$0	$7,541,003	$1,158,152	$17,078	$238,651
Score[1]	11.8	7.2	11.6	12.6	10.6
Rank[2]	2	5	3	1	4
Corporation Yard					
Effectiveness	1.8	4.2	4.6	3.6	
Overall Protectiveness	1	5	5	5	
ARARs Compliance	1	5	5	5	
Short-term Effectiveness	5	1	3	5	
Long-term Effectiveness	1	5	5	2	
Reduction of T, M, V	1	5	5	1	
Implementability	5	2	4	4	
Cost	5	1	3	4	
Cost	$0	$257,957	$160,284	$17,078	
Score[1]	11.8	7.2	11.6	11.6	
Rank[2]	2	4	3	1	
Remainder of RES					
Effectiveness	1.8	4.2	4.6	3.6	
Overall Protectiveness	1	5	5	5	
ARARs Compliance	1	5	5	5	
Short-term Effectiveness	5	1	3	5	
Long-term Effectiveness	1	5	5	2	
Reduction of T, M, V	1	5	5	1	
Implementability	5	2	4	4	
Cost	5	1	3	4	
Score[1]	11.8	7.2	11.6	11.6	
Rank[2]	2	4	3	1	

Notes:

1. Rating scale: 1 = not effective; 2 = slightly effective; 3 = moderately effective; 4 = very effective; 5 = highly effective. Individual scores are provided for each of the effectiveness subcategories; however, only the effectiveness, implementability, and cost ratings are summed to generate the Alternative score. Overall protection and ARARs compliance are threshold criteria and receive either a 1 or a 5 rating based on whether the alternative meets the criterion.

2. Rank is the relative order of numberic scores for alternatives.

ARAR Applicable or Relevant and Appropriate Requirements
LUC Land Use Control
MFA Mercury Fulminate Area
RES Research, Education, and Support
SMP Soil Management Plan
T, M, V Toxicity, Mobility, or Volume

Table 4-7. Corporation Yard Alternative S-2 Cost Estimate

Alternative S-2: Excavation to Unrestricted Use and Off-Site Disposal

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Preconstruction - mob/demob, work plan, fencing, surveying, utility locator, submittals, dust control, etc.	$25,000	1	LS	$25,000
2	Misc pumps	$50	10	DY	$500
3	Water truck	$3,000	2	WK	$6,000
4	Water storage tank (one clean and one waste)	$200	10	DY	$2,000
5	Decontamination water transport to Evergreen (Newark, CA)	$440	1	Truck	$440
6	Decontamination water disposal	0.95	100	GAL	$95
7	Air Monitoring Stations	$1,600	2	WK	$3,200
8	Excavate contaminated soils and stage in roll-off bins	$20	37	BCY	$740
9	Roll-off bin rental (hold 20 CY each)	$475	2	EA	$950
10	Soil confirmation samples and analysis	$600	200	EA	$120,000
11	Haul contaminated soil to Buttonwillow, CA landfill (260 mi and 22 tons per load) (assumed to be non RCRA, CA Class I waste)	$110	62	TN	$6,862
12	Landfill disposal of hazardous waste soil (assumed to be non RCRA, CA Class I waste)	$58	62	TN	$3,574
13	Load onsite fill & haul to Corporation Yard for use as backfill	$3	46	LCY	$139
14	Back fill placement	$25	37	BCY	$925
15	Hydromulch backfilled areas	$1,500	1	LS	$1,500
16	Flagman & sweeper during loading and on-site hauling	$1,500	10	DY	$15,000
				Subtotal	**$186,925**
				Construction Management (15% construction line items only)	**$28,039**
				Subtotal	**$214,964**
				Contingency (20%)	**$42,993**
				Total	**$257,957**

Notes:

1. Decontamination pad required to decontaminate equipment before exiting RES Area; decontamination pad included in MFA alternatives.
2. Threshold remediation criteria for chemicals for unrestricted use = unrestricted RBC or background levels
3. Confirmation sampling assumes a minimum of 5 samples per excavation (4 side-wall and 1 bottom), with additional side-wall samples collected every 25 feet for larger excavations. Analyses include: metals, SVOCs, PAHs, and PCBs.
4. AC=Acre; BCY=Bank (in place) cubic yard; DY=day; EA=Each; Gal=Gallon; Hr=Hour; LCY=Loose (excavated or stockpiled) cubic yard; LS=Lump sum; LUC=Land use control; MFA=Mercury Fulminate Area; mg/kg=milligram per kilogram; NPV=Net present value; O&M=Operation & maintenance; PCB=Polychlorinated biphenyl; RCRA=Resource Conservation and Recovery Act; RES=Research, Education, and Support; SF=Square feet; SY=Square yard; SVOC=Semivolatile organic compound; TCLP=Toxicity characteristic leaching procedure; TN=Ton; TSCA=Toxic Substances Control Act; ug/L=micrograms per Liter; WK=Week; YR=Year

Table 4-8. Corporation Yard Alternative S-3 Cost Estimate

Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, Land Use Controls, and Soil Management Plan

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Preconstruction - mob/demob, work plan, fencing, surveying, utility locator, submittals, dust control, etc.	$20,000	1	LS	$20,000
2	Misc pumps	$50	5	DY	$250
3	Water truck	$3,000	1	WK	$3,000
4	Water storage tank (one clean and one waste)	$200	5	DY	$1,000
5	Decontamination water transport to Evergreen (Newark, CA)	$440	1	Truck	$440
6	Decontamination water disposal	0.95	100	GAL	$95
7	Air Monitoring Stations	$1,600	1	WK	$1,600
8	Excavate contaminated soils and stage in roll-off bins	$20	15	BCY	$300
9	Roll-off bin rental (hold 20 CY each)	$475	2	EA	$950
8	Soil confirmation samples and analysis	$600	100	EA	$60,000
11	Haul contaminated soil to Buttonwillow, CA landfill (260 mi and 22 tons per load) (assumed to be non RCRA, CA Class I waste)	$110	25	TN	$2,782
12	Landfill disposal of hazardous waste soil (assumed to be non RCRA, CA Class I waste)	$58	25	TN	$1,449
13	Load onsite fill & haul to Corporation Yard for use as backfill	$3	19	LCY	$56
14	Backfill placement	$25	15	BCY	$375
15	Hydromulch backfilled areas	$1,500	1	LS	$1,500
16	Flagman & sweeper during loading and on-site hauling	$1,500	5	DY	$7,500
	O&M Costs				
17	LUC five year reviews (NPV for 6 reviews over 30 years)	$17,078	1	LS	$17,078

Subtotal	**$118,375**
Construction Management (15% construction line items only)	**$15,195**
Subtotal	**$133,570**
Contingency (20%)	**$26,714**
Total	**$160,284**

Notes:

1. Decontamination pad required to decontaminate equipment before exiting RES Area; decontamination pad included in MFA alternatives.
2. Corporation Yard commercial excavation volume is estimated at 22 cubic yards based on proposed excavations shown onFigure 4-7.
3. Threshold remediation criteria for chemicals for commercial use = commercial RBC or background levels
4. Confirmation sampling assumes a minimum of 5 samples per excavation (4 side-wall and 1 bottom), with additional side-wall samples collected every 25 feet for larger excavations. Analyses include: metals, SVOCs, PAHs, and PCBs.
5. AC=Acre; BCY=Bank (in place) cubic yard; DY=day; EA=Each; Gal=Gallon; Hr=Hour; LCY=Loose (excavated or stockpiled) cubic yard; LS=Lump sum; LUC=Land use control; MFA=Mercury Fulminate Area; mg/kg=milligram per kilogram; NPV=Net present value; O&M=Operation & maintenance; PCB=Polychlorinated biphenyl; RCRA=Resource Conservation and Recovery Act; RES=Research, Education, and Support; SF=Square feet; SY=Square yard; SVOC=Semivolatile organic compound; TCLP=Toxicity characteristic leaching procedure; TN=Ton; TSCA=Toxic Substances Control Act; ug/L=micrograms per Liter; WK=Week; YR=Year

Table 4-9. Corporation Yard Alternative S-4 Cost Estimate

Alternative S-4: Land Use Controls

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Five-year site visit	$125	8	HR	$1,000
2	Five-year planning department visit	$125	12	HR	$1,500
3	Five year review letter	$125	24	HR	$3,000
4	Five year review clerical and administrative fees	$60	4	HR	$240
	Five-Year Subtotal				$5,740
	Construction Management (15% capital cost line items only)				**$861**
	Subtotal				**$6,601**
	Contingency (20%)				**$1,320**
	Total				**$7,921**
	Net Present Value of 6 reviews over 30 years at 7%				**$17,078**

Notes:

1. LUCs include deed restrictions prohibiting residential use.
2. Alternative assumes 30 years of LUCs.
3. Net Present Value at 7% discount
4. HR=Hour; LUC=Land use control

Table 4-10. Carbon Tetrachloride Area Alternative GW-2 Cost Estimate

Alternative GW-2: Permeable Reactive Barrier, Land Use Controls, and Monitoring

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Preconstruction - mob/demob, surveying, submittals, design optimization, etc.	$40,000	1	LS	$40,000
2	Install lightweight sheetpile wing walls	$32	6,000	EA	$192,000
3	Excavated slurry wall including backfill	$27	9,000	CF	$243,000
4	Soil disposal hauling	$9	417	LCY	$3,857
5	Nonhazardous soil landfill disposal cost	$23	560	TN	$13,020
6	Slurry disposal hauling.	$9	111	CY	$1,027
7	Nonhazardous slurry solidification and disposal cost	$30	111	CY	$3,330
8	Zero valent iron	$2,153	111	CY	$239,200
9	Water truck	$3,000	4	WK	$12,000
10	Water storage tank	$100	20	DY	$2,000
11	Groundwater monitoring well installation	$10,000	4	EA	$40,000
	O&M Costs				
12	LUC five year reviews (NPV for 6 reviews over 30 years)	$17,078	1	LS	$17,078
13	Groundwater Monitoring (NPV for 5 monitoring events over 5 years)	$102,500	1	LS	$102,500
				Subtotal	**$909,012**
				Construction Management (15% construction line items only)	**$118,415**
				Subtotal	**$1,027,427**
				Contingency (20%)	**$205,485**
				Total	**$1,232,913**

Notes:

1. Decontamination pad required to decontaminate equipment before exiting RES Area; decontamination pad included in MFA alternatives.
2. Haul cost assumes use of end dump trucks and does not include cost for sealed bed trucks which may be needed for soil with high moisture content.
3. Permeable Reactive Barrier consists of two 100-foot sheetpile funnel walls with a 150-foot reactive slurry zone in between.
4. Groundwater monitoring assumes one monitoring event per year for 5 years for VOCs at 4 wells.
5. CF=Cubic feet; CY=Cubic yard; DY=Day; EA=Each; LCY=Loose (excavated or stockpiled) cubic yard; LS=Lump sum; LUC=Land use control; MFA=Mercury Fulminate Area; NPV=Net present value; O&M=Operation & maintenance; RES=Research, Education, and Support; TN=Ton; VOC=Volatile organic compound; WK=Week

Table 4-11. Carbon Tetrachloride Area Alternative GW-3 Cost Estimate

Alternative GW-3: In Situ Bioremediation, Land Use Controls, and Monitoring

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Preconstruction - mob/demob, surveying, submittals, design optimization, etc.	$50,000.00	1	LS	$50,000
2	Drill and inject 1000 gallons of treatment per Geoprobe hole	$5,000.00	20	EA	$100,000
3	Hydrogen Release Compound (HRC)	$31.57	200	FT	$6,314
4	HRC Primer	$7.18	200	FT	$1,435
5	Water truck	$3,000.00	4	WK	$12,000
6	Water storage tank	$100.00	20	DY	$2,000
	O&M Costs				
7	LUC five year reviews (NPV for 6 reviews over 30 years)	$17,078	1	LS	$17,078
8	Groundwater Monitoring (NPV for 5 monitoring events over 5 years)	$102,500	1	LS	$102,500

Subtotal	**$291,327**
Construction Management (15% construction line items only)	**$25,762**
Subtotal	**$317,089**
Contingency (20%)	**$63,418**
Total	**$380,507**

Notes:

1. Decontamination pad required to decontaminate equipment before exiting RES Area; decontamination pad included in MFA alternatives.
2. In Situ Bioremediation consists of approximately 20 injection wells located in two lines near piezometer CTP and at each grab groundwater location that had carbon tetrachloride detections.
3. Injection wells are assumed to be 2-inch 20-foot piezometers.
4. Groundwater monitoring assumes one monitoring event per year for 5 years for VOCs and MNA parameters at 12 wells.
5. DY=Day; EA=Each; FT=Feet; HRC= Hydrogen release compound; LS=Lump sum; LUC=Land use control; MFA=Mercury Fulminate Area; MNA=Monitored natural attenuation; NPV=Net present value; O&M=Operation & maintenance; RES=Research, Education, and Support; VOC=Volatile organic compound; WK=Week

Table 4-12. Carbon Tetrachloride Area Alternative GW-4 Cost Estimate

Alternative GW-4: Monitored Natural Attenuation and Land Use Controls

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Install 6 groundwater monitoring wells	$10,000.00	6	EA	$60,000
2	Groundwater Monitoring for VOCs and MNA Parameters	$25,000.00	4	LS	$100,000
	O&M Costs				
3	LUC five year reviews (NPV for 6 reviews over 30 years)	$17,078	1	LS	$17,078
4	MNA Groundwater Monitoring (NPV for 5 monitoring events over 5 years)	$79,125	1	LS	$79,125
				Subtotal	**$256,203**
				Construction Management (15% construction line items only)	**$24,000**
				Subtotal	**$280,203**
				Contingency (20%)	**$56,041**
				Total	**$336,244**

Notes:

1. Monitored Natural Attenuation consists of installing approximately 6 2-inch 20-foot piezometers.
2. Groundwater monitoring assumes quarterly monitoring for one year and annual monitoring event for 4 years for VOCs and MNA parameters at 6 wells.
3. EA=Each; LS=Lump sum; LUC=Land use control; MNA=Monitored natural attenuation; NPV=Net present value; O&M=Operation & maintenance; VOC=Volatile organic compound

Table 4-13. Groundwater Alternatives Comparative Analysis

Alternative Description	Alternative GW-1 No Action	Alternative GW-2 PRB, LUCs, Monitoring	Alternative GW-3 ISB, LUCs, Monitoring	Alternative GW-4 MNA and LUCs
Carbon Tetrachloride Area				
Effectiveness	3	4	4.2	4.4
Overall Protectiveness	5	5	5	5
ARARs Compliance	1	5	5	5
Short-term Effectiveness	5	2	3	4
Long-term Effectiveness	3	4	4	4
Reduction of T, M, V	1	4	4	4
Implementability	5	3	4	5
Cost	5	1	3	4
Cost	$0	$1,232,913	$380,507	$336,244
Score[1]	13	8	11.2	13.4
Rank[2]	2	4	3	1

Notes:

1. Rating scale: 1 = not effective; 2 = slightly effective; 3 = moderately effective; 4 = very effective; 5 = highly effective. Individual scores are provided for each of the effectiveness subcategories; however, only the effectiveness, implementability, and cost ratings are summed to generate the Alternative score. Overall protection and ARARs compliance are threshold criteria and receive either a 1 or a 5 rating based on whether the alternative meets the criterion.

2. Rank is the relative order of numberic scores for alternatives.

ARAR Applicable or relevant and appropriate requirements
ISB In Situ Bioremediation
LUC Land Use Control
MNA Monitored Natural Attenuation
PRB Permeable Reactive Barrier
T, M, V Toxicity, Mobility, or Volume

Table 4-14. Site-wide Groundwater Monitoring Cost Estimate

Site-wide groundwater monitoring: Continued Monitoring

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Site-wide Groundwater Monitoring	$50,000	1	LS	$50,000
	O&M Costs				
2	LUC five year reviews (NPV for 6 reviews over 30 years)	$17,078	1	LS	$17,078
3	Site-wide Groundwater Monitoring (NPV for 5 monitoring events over 5 years)	$166,770	1	LS	$166,770
				Subtotal	**$233,848**
				Construction Management (15% construction line items only)	**$7,500**
				Subtotal	**$241,348**
				Contingency (20%)	**$48,270**
				Total	**$289,618**

Notes:

1. Groundwater monitoring assumes 5 annual monitoring event over 5 years for VOCs and MNA parameters.
2. LS=Lump sum; LUC=Land use control; MNA=Monitored natural attenuation; NPV=Net present value; O&M=Operation & maintenance; VOC=Volatile organic compound

Table 5-1. RAW Removal Action Costs

Mercury Fulminate Area: **Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
PCB Areas: **Excavation to TSCA High Occupancy Unrestricted Use and Off-Site Disposal**
Corporation Yard: **Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
Remainder of RES Area: **Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
Carbon Tetrachloride Area: **Alternative GW-4: Monitored Natural Attenuation and LUCs**
Site-wide Groundwater: **Continued Groundwater Monitoring**

	Description	Unit Cost	Quantity	Units	Subtotal
	Capital Costs				
1	Preconstruction - mob/demob, work plan, fencing, surveying, utility locator, submittals, dust control, etc.	$50,000	1	LS	$50,000
2	Decontamination pad	$43	196	TN	$8,360
3	Bottom liner for decontamination pad	$1	4,000	SF	$5,280
4	Prep decontamination pad area	$2	444	SY	$889
5	Misc pumps	$50	20	DY	$1,000
6	Water truck	$3,000	4	WK	$12,000
7	Water storage tank (one clean and one waste)	$200	40	DY	$8,000
8	Decontamination water transport to Evergreen (Newark, CA)	$440	1	Truck	$440
9	Decontamination water disposal	$1	2,300	GAL	$2,185
10	Air monitoring stations	$6,600	4	WK	$26,400
11	Excavation containment tent for MFA	$50,000	1	LS	$50,000
12	Demolish, haul, and recycle asphalt from a portion of the paved storage pad	$44	37	TN	$1,638
13	Excavate clean fill beneath pavement for later use as potential backfill	$5	93	BCY	$465
14	Well abandonement/replacement (piezometer MFA)	$10,000	1	LS	$10,000
15	Excavate mercury contaminated soils into trucks	$20	1,500	BCY	$30,000
16	Soil confirmation samples and analysis	$600	200	EA	$120,000
17	Haul mercury contaminated soil to Buttonwillow, CA landfill (260 mi and 22 tons per load) (assumed to be non RCRA, CA Class I waste)	$110	2,520	TN	$278,208
18	Landfill disposal of hazardous waste soil (assumed to be non RCRA, CA Class I waste)	$58	2520	TN	$144,900
19	Load onsite fill & haul to MFA for use as backfill	$3	1875	LCY	$5,625
20	MFA backfill placement	$25	1500	BCY	$37,500
21	Hydromulch backfilled areas	$1,500	1	LS	$1,500
22	Flagman & sweeper during loading and on-site hauling	$1,500	20	DY	$30,000

Table 5-1. RAW Removal Action Costs

Mercury Fulminate Area: **Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
PCB Areas: **Excavation to TSCA High Occupancy Unrestricted Use and Off-Site Disposal**
Corporation Yard: **Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
Remainder of RES Area: **Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
Carbon Tetrachloride Area: **Alternative GW-4: Monitored Natural Attenuation and LUCs**
Site-wide Groundwater: **Continued Groundwater Monitoring**

	Description	Unit Cost	Quantity	Units	Subtotal
23	Misc pumps	$50	5	DY	$250
24	Water storage tank (one clean and one waste)	$200	5	DY	$1,000
25	Water truck	$3,000	1	WK	$3,000
26	Decontamination water transport to Evergreen (Newark, CA)	$440	1	Truck	$440
27	Decontamination water disposal	$1	20	GAL	$19
28	Air monitoring stations	$1,600	1	WK	$1,600
29	Excavate PCB-contaminated soils and stage in roll-off bins onsite	$30	15	BCY	$450
30	Roll-off bin rental (hold 20 CY each)	$475	2	EA	$950
31	Soil confirmation samples and analysis	$250	40	EA	$10,000
32	Haul PCB-contaminated soil (assumed to be TSCA waste) to US Ecology (Beatty NV landfill 550 mi)	$203	25	TN	$5,112
33	Landfill disposal of hazardous waste soil	$198	25	TN	$4,985
34	Flagman & sweeper during loading and on-site hauling	$1,500	5	DY	$7,500
35	Load & haul on-site backfill	$3	19	LCY	$56
36	Spread and compact backfill	$25	15	BCY	$375
37	Hydromulch backfilled areas	$500	1	LS	$500
38	Misc pumps	$50	5	DY	$250
39	Water truck	$3,000	1	WK	$3,000
40	Water storage tank (one clean and one waste)	$200	5	DY	$1,000
41	Decontamination water transport to Evergreen (Newark, CA)	$440	1	Truck	$440
42	Decontamination water disposal	$1	100	GAL	$95
43	Air Monitoring Stations	$1,600	1	WK	$1,600

Table 5-1. RAW Removal Action Costs

Mercury Fulminate Area: **Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
PCB Areas: **Excavation to TSCA High Occupancy Unrestricted Use and Off-Site Disposal**
Corporation Yard: **Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
Remainder of RES Area: **Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
Carbon Tetrachloride Area: **Alternative GW-4: Monitored Natural Attenuation and LUCs**
Site-wide Groundwater: **Continued Groundwater Monitoring**

	Description	Unit Cost	Quantity	Units	Subtotal
44	Excavate contaminated soils and stage in roll-off bins	$20	15	BCY	$300
45	Roll-off bin rental (hold 20 CY each)	$475	2	EA	$950
46	Soil confirmation samples and analysis	$600	100	EA	$60,000
47	Haul contaminated soil to Buttonwillow, CA landfill (260 mi and 22 tons per load) (assumed to be non RCRA, CA Class I waste)	$110	25	TN	$2,782
48	Landfill disposal of hazardous waste soil (assumed to be non RCRA, CA Class I waste)	$58	25	TN	$1,449
49	Load onsite fill & haul to Corporation Yard for use as backfill	$3	19	LCY	$56
50	Backfill placement	$25	15	BCY	$375
51	Hydromulch backfilled areas	$1,500	1	LS	$1,500
52	Flagman & sweeper during loading and on-site hauling	$1,500	5	DY	$7,500
53	Install 6 groundwater monitoring wells	$10,000	6	EA	$60,000
54	Groundwater Monitoring for VOCs and MNA Parameters	$25,000	4	LS	$100,000
55	Site-wide Groundwater Monitoring	$50,000	1	LS	$50,000
	O&M Costs				
56	LUC five year reviews (NPV for 6 reviews over 30 years)	$17,078	1	LS	$17,078
57	MNA Groundwater Monitoring (NPV for 4 monitoring events over 4 years)	$79,125	1	LS	$79,125
58	Site-wide Groundwater Monitoring (NPV for 5 monitoring events over 5 years)	$166,770	1	LS	$166,770
				Subtotal	$1,414,897
				Construction Management (15% capital cost line items only)	$172,789
				Subtotal	$1,587,686
				Contingency (20%)	$317,537
				Total	**$1,905,223**

Table 5-1. RAW Removal Action Costs

Mercury Fulminate Area:	**Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
PCB Areas:	**Excavation to TSCA High Occupancy Unrestricted Use and Off-Site Disposal**
Corporation Yard:	**Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
Remainder of RES Area:	**Alternative S-3: Excavation to Commercial Use, Off-Site Disposal, LUCs, and Implementation of the SMP**
Carbon Tetrachloride Area:	**Alternative GW-4: Monitored Natural Attenuation and LUCs**
Site-wide Groundwater:	**Continued Groundwater Monitoring**

Description	Unit Cost	Quantity	Units	Subtotal

Notes:

1. Costs are not included for the remainder of the RES Area because of the speculative nature of implementing the SMP.
2. Decontamination pad required to decontaminate equipment before exiting RES Area; pad assumed to be 80 feet x 20 feet.
3. Threshold remediation criteria for chemicals for commercial use = commercial RBC, background levels, or TSCA criteria
4. Confirmation sampling assumes a minimum of 5 samples per excavation (4 side-wall and 1 bottom), with additional side-wall samples collected every 25 feet for larger excavations.
5. Net Present Value at 7% discount
6. AC=Acre; BCY=Bank (in place) cubic yard; DY=day; EA=Each; Gal=Gallon; Hr=Hour; LCY=Loose (excavated or stockpiled) cubic yard; LS=Lump sum; LUC=Land use control; MFA=Mercury Fulminate Area; mg/kg=milligram per kilogram; NPV=Net present value; O&M=Operation & maintenance; PCB=Polychlorinated biphenyl; RCRA=Resource Conservation and Recovery Act; RES=Research, Education, and Support; SF=Square feet; SY=Square yard; SVOC=Semivolatile organic compound; TCLP=Toxicity characteristic leaching procedure; TN=Ton; TSCA=Toxic Substances Control Act; ug/L=micrograms per Liter; WK=Week; YR=Year

ATTACHMENT A
DTSC ORDER

STATE OF CALIFORNIA
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
DEPARTMENT OF TOXIC SUBSTANCES CONTROL

In the Matter of: University of California Richmond Field Station 1301 South 46th Street Richmond, CA 94804 Respondents: The Regents of the University of California 1111 Franklin Street, 12th Floor Oakland, California 94607 Zeneca, Inc., successor to ICI Americas, Inc. 1800 Concord Pike Wilmington, DE 19850-5438 Bayer CropScience Inc., successor to Stauffer Chemical Company 2 TW Alexander Drive Research Triangle Park, NC 27709	Docket No. I/SE-RAO 06/07-004 SITE INVESTIGATION AND REMEDIATION ORDER Health and Safety Code Sections 25355.5(a)(1)(B), 25358.3(a), 58009 and 58010

I. INTRODUCTION

1.1 Parties. The California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) issues this Site Investigation and Remedial Action Order (Order) to the Regents of the University of California, Zeneca, Inc., a Delaware corporation doing business in California, and Bayer CropScience, Inc., a New York corporation (Respondents).

1.2 Property/Site. This Order applies to the property located at 1301 South 46th Street, Richmond, Contra Costa County, California 94804. The property consists of approximately 152 acres and is identified by Assessor's Parcel numbers 560060008 and 560060007 (Exhibit A-1). A map showing the Property is attached as Exhibit A-2. This Order applies to the property and the areal extent of contamination that resulted from activities on the property (hereinafter, the "Site").

1.3 Jurisdiction. This Order is issued by DTSC to Respondents pursuant to its authority under Health and Safety Code sections 25358.3(a), 25355.5(a)(1)(B), 58009 and 58010.

Health and Safety Code section 25358.3(a) authorizes DTSC to take various actions, including issuance of an order, upon DTSC's making certain determinations because of a release or a threatened release of a hazardous substance.

Health and Safety Code section 25355.5(a)(1)(B) authorizes DTSC to issue an order establishing a schedule for removing or remedying a release of a hazardous substance at a site, or for correcting the conditions that threaten the release of a hazardous substance. The order may include, but is not limited to requiring specific dates by which the nature and extent of a release shall be determined and the site adequately characterized, a remedial action plan prepared and submitted to DTSC for approval, and a removal or remedial action completed.

Health and Safety Code section 58009 authorizes DTSC to commence and maintain all proper and necessary actions and proceedings to enforce its rules and regulations; to enjoin and abate nuisances related to matters within its jurisdiction which are dangerous to health; to compel the performance of any act specifically enjoined upon any person, officer, or board, by any law of this state relating to matters within its jurisdiction; and/or on matters within its jurisdiction, to protect and preserve the public health.

Health and Safety Code section 58010 authorizes DTSC to abate public nuisances related to matters within its jurisdiction.

II. FINDINGS OF FACT

DTSC hereby finds:

2.1 Liability of Respondents. Respondents are responsible parties or liable persons as defined in Health and Safety Code section 25323.5.

2.1.1 The Regents of the University of California (UC) currently own and operate the Site, and have owned the Site since 1950.

2.1.1.1 From approximately 1870 to 1950, various companies owned and produced chemicals and explosives at the Site. Some or all of the operations included production of black powder, mercury fulminate, blasting caps and shells. Facilities for testing and storing explosives were also present. Production of explosives ceased in

1948, prior to UC purchasing the property in 1950.

2.1.1.2 Spent pyrite cinders generated during the historical industrial operations at the adjacent Zeneca Site were used as fill material on the Richmond Field Station. The spent cinders contained hazardous substances, including but not limited to mercury, lead, copper, selenium, zinc and arsenic.

2.1.1.3 UC has sponsored various types of research at the Site including a Forest Products Laboratory, seismic engineering, fire testing, hydraulic modeling, soil mechanics, sanitary engineering, transportation, environmental health, and library storage facilities. Some of these research activities and other activities may have included the use of hazardous substances.

2.1.2 Bayer CropScience, Inc. is the corporate and legal successor to Stauffer Chemical Company, Inc., and its successors in interest, which owned a portion of the Lower Keystone Blocks Section and Southeastern Section from 1920 to 1949, the adjacent Former Stauffer Chemical site from approximately 1897 to January 3, 1986, and operated at the Zeneca site from approximately 1897 to 1987. During that time hazardous substances, including spent cinders from the production of sulfuric acid were disposed at the Site by Stauffer Chemical.

2.1.3 Zeneca, Inc. owned and operated the former Stauffer Chemical site (in its own name), and as successor in interest to ICI Americas, Inc. from 1987 to December 31, 2002.

2.2 Physical Description of Site. The Site consists of a total of approximately 152 acres, with approximately 100 acres of upland, industrial-zoned land, approximately 6 acres of coastal terrace prairie, and 46 acres of marsh and tidal mudflat. Meade Street and Hoffman Boulevard off Interstate 580 bound the Site to the north, Meeker Slough/Regatta Boulevard to the west, South 46th Street to the east, and the East Bay Regional Park District (EBRPD) Bay Trail to the south. The Zeneca/Former Stauffer Chemical Site is located to the east of the property boundary.

2.2.1 The Bay Trail is located on a raised berm created originally as a rail spur by the Santa Fe Land Development Company in 1959, and forms the southern boundary of the inner portion of Western Stege Marsh. Establishment of the railroad spur, breakwaters, and dock altered the local hydrology such that sediments began to accrete inboard and outboard of the railroad grade and forming Western Stege Marsh.

2.2.2 Meeker Slough is located on the western edge of the marsh and is the only conduit for tidal exchange from the San Francisco Bay to Western Stege Marsh.

2.2.3 The California Clapper Rail (*Rallus longirostris obsoletus)*, an endangered species, has been observed in Western Stege Marsh.

2.2.4 The coastal terrace prairie contains native grasses and forbs, including a patch of very rare slender wheatgrass (*Elymus trachycaulus*).

2.2.5 Cinders generated by the Stauffer Chemical Company were disposed at various locations at the Site, including Western Stege Marsh, as backfill for utility lines and various locations in the upland areas.

2.2.6 Land uses of the upland portion of the Site include: the Northern Regional Library Facility, the Earthquake Engineering Research Center, the Environmental Engineering and Health Sciences Laboratory, and the Forest Products Laboratory. The Site also includes experimental facilities for the Institute of Transportation Studies and other UC campus-based research in engineering and the natural sciences. Some research space is also leased to private and government entities, including the U.S. Environmental Protection Agency.

2.3 Site History.

2.3.1 The property was part of a land grant from the Spanish Governor of Alta California to Francisco Maria Castro in 1823. The property was later conveyed to Wilhelmina (M.C.C.) Stege and then portions to Edith Stege.

2.3.2 By 1891, the western most portion of the Site was conveyed from Edith Stege to George and Stella Leviston. This portion was later conveyed to William Leviston and then to Stella C. Lovegrove, who created the Inner Harbor subdivision (Exhibit A-3). In 1950, this subdivision was conveyed to the California Cap Company and then to the Regents of the University of California (UC Regents) in 1950.

2.3.3 The northern most portion of the Site was known as the Upper Keystone Blocks Section (Exhibit A-3). Edith Stege conveyed the property in 1903 to R. Lee Barnes, who then sold the property in 1905 to the California Powder Works. In 1906, California Powder Works conveyed the property to E.I. DuPont de Nemours Powder Company (DuPont). DuPont conveyed this property to James Brown, who created the Keystone Business Blocks Subdivision. In 1950 the Contra Costa County Title Company conveyed the property to the California Cap Company, who then sold the property to the UC Regents.

2.3.4 To the south of the Upper Keystone Blocks Section was the Lower Keystone Blocks Section (Exhibit A-3). Edith Stege conveyed this property to R. Lee

Barnes in 1903, who then conveyed the property in 1905 to the California Powder Works. In 1906, California Powder Works conveyed the property to DuPont. DuPont then conveyed the property the California Cap Company in 1907. The California Cap Company conveyed a portion of this property to Stauffer Chemical Company in 1920 and Stauffer Chemical Company conveyed the property back to California Cap Company in 1949. In 1950, the California Cap Company conveyed the property the UC Regents.

2.3.5 The Southeastern Section lies to the south of the Lower Keystone Blocks and is further divided into sections A, B, C and D (Exhibit A-3).

2.3.5.1 Section A is a 6.524-acre portion of the Southeastern Section. M.C.C. Stege conveyed this property to the California Cap Company in 1892. In 1920, the California Cap Company conveyed an undivided one third interest of a 0.813-acres portion of this property to Stauffer Chemical Company. Also in 1920, the California Cap Company conveyed an undivided one third interest of a 0.813 acre portion of this property to the Union Superphosphate Company. In 1949, Stauffer Chemical Company conveyed an undivided two-thirds of a 0.813 portion of the property to California Cap Company. California Cap Company then conveyed this property to the UC Regents in 1950.

2.3.5.2 Section B is a 15.31-acre portion of the Southeastern Section. M.C.C. Stege conveyed the property to the Tonite Powder Company in 1890. In 1891, the Tonite Powder Company conveyed the property to the California Cap Company, who then conveyed the property to the UC Regents in 1950.

2.3.5.3 Section C is a 3.949-acre portion of the Southeastern Section. M.C.C. Stege conveyed the property to the Tonite Powder Company in 1890, and in 1891, the property was conveyed to American Lucol Company. In 1905, American Lucol Company conveyed the property to Richard Hotaling, who then sold the property to B.P. Oliver in 1919. In 1920, the property was conveyed to the California Cap Company, who then conveyed the property the UC Regents in 1950.

2.3.5.4 Section D is the southern most portion of the Site, and is to the north of the existing EBRPD Bay Trail. In 1875, Romaldo Pacheco, Governor, Robert Gardner, Surveyor General, and Controller, of the State Board of Tide Land Commissioners conveyed the property to Wilhelmina C.C. Stege. M.C.C. Stege conveyed the property to William Oliver in 1890, and in 1891 the property was conveyed to the California Cap Company. In 1950, the California Cap Company sold the property the UC Regents.

2.3.6 California Cap Company produced mercury fulminate, blasting caps and shells. Facilities for testing and storing explosives were also present. Production of explosives ceased in 1948.

2.3.7 The Regents of the University of California purchased the Site from California Cap Company in 1950 to accommodate research programs sponsored by the University of California at Berkeley (UC Berkeley).

2.3.8 Stauffer Chemical Company generated pyrite cinders as a byproduct of their sulfuric acid manufacturing operations from approximately 1919 through approximately 1970 at the adjacent Stauffer Chemical Company/Zeneca site. The use of pyrite ore in the production of sulfuric acid ceased in approximately 1963. Sometime during this period, pyrite cinders were deposited at the Site. UC Berkeley constructed roads, utilities and research ponds on, or using the pyrite cinders that were deposited in this area.

2.3.9 On or about September 19, 2001, the San Francisco Bay Regional Water Quality Control Board issued to the University of California Berkeley and Zeneca, Inc. a Site Cleanup Requirements Order No. 01-102. Order No. 01-102 identifies the Site as Meade Street Operable Unit, Subunit 2 and further subdivides Subunit 2 into Subunits 2A and 2B. Subunit 2A consists of the cinder fill area located in the southeastern portion of the upland area of the site and the eastern portion of the Western Stege Marsh. Subunit 2B consists of the remainder of the upland portion of the Site and the western portion of Western Stege Marsh. Zeneca and the UC Berkeley were named as discharges in Subunit 2A and the UC Berkeley was named as the discharger for Subunit 2B. Order No. 01- 102 required technical evaluations and implementation of various remedial measures for soil, groundwater, and sediment contamination that had been identified at the Site. These remedial measures included excavation and backfilling of a portion of the marsh and adjacent upland area, installation of a biologically active permeable barrier wall, and replacement of the eastern storm drain line and outfall. The activities conducted are more fully described in the implementation reports listed in Exhibit G.

2.3.10 Subsequent to the California Environmental Protection Agency designating DTSC as the lead environmental agency for the Site in May 2005, Order No. R2-2005-0055 was adopted in October 2005 by the RWQCB to rescind RWQCB Order No. 01-102.

2.3.11 Various reports were prepared and submitted to the RWQCB pursuant to Order No. 01-102 documenting site investigations and/or previous remediation activities for the Site. Exhibit G includes a list and summary of certain documents produced under the oversight of the RWQCB that describe the work conducted at the Site from 1999 to 2005. (Note: By acknowledging receipt of these reports, DTSC does not intend to imply that it is in agreement with the contents or conclusions set forth in these reports or otherwise approves of them.)

2.4 Hazardous Substances Found at the Site.

2.4.1 Pursuant to section 102 of CERCLA, 42 U.S.C. section 9602, and Health and Safety Code section 25316, a substance is a "hazardous substance" if it is listed in Title 40, Code of Federal Regulations ("CFR"), Section 302.4. The following substances, listed in 40 CFR section 302.4, have been detected in the soil at the Site at levels exceeding hazardous waste criteria: arsenic, copper, lead, mercury, and polychlorinated biphenyls (PCBs). The following substances, listed in 40 CFR section 302.4, have been detected in the groundwater at the Site above Basin Plan requirements: arsenic, beryllium, cadmium, copper, mercury, nickel, carbon tetrachloride, cis-1,2-dichloroethene, tetrachloroethene, trichloroethene, vinyl chloride and PCBs.

2.4.2 Attached hereto as Exhibit B and incorporated herein by this reference is a table setting forth hazardous substances detected in Site soil and the associated hazardous waste criteria concentrations for those substances.

2.5 Health Effects.

2.5.1 Arsenic. Arsenic is listed as a chemical known to the State to cause cancer pursuant to the Safe Drinking Water and Toxic Enforcement Act of 1986. It is a confirmed human carcinogen producing liver tumors. It is a poison by subcutaneous, intramuscular, and intraperitoneal routes, and is an experimental teratogen. It causes human systemic skin and gastrointestinal effects by ingestion. Arsenic causes other experimental reproductive effects.

2.5.2 Beryllium. Beryllium is listed as a chemical known to the State to cause cancer pursuant to the Safe Drinking water and Toxic Enforcement Act of 1986. Beryllium can cause acute beryllium disease by inhalation. Persons can also develop a hypersensitivity or allergy to beryllium which can lead to chronic beryllium disease. This disease can occur long after exposure (10-15 years) to small amounts of either soluble or insoluble forms of beryllium. Both acute and chronic diseases can be fatal. Long periods of exposure to beryllium have been reported to cause cancer in laboratory animals. Some studies of workers reported an increased risk of lung cancer. The U.S. Department of Health and Human Services and the International Agency for Research on Cancer have determined that beryllium and beryllium compounds are human carcinogens. EPA has determined that beryllium is a probable human carcinogen.

2.5.3 Cadmium. Cadmium is listed as a chemical known to the State to cause cancer pursuant to the Safe Drinking water and Toxic Enforcement Act of 1986. Cadmium can cause severe damage to the lungs and death if inhaled at high levels. Ingestion of very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels through inhalation or ingestion can lead to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones.

2.5.4 Carbon Tetrachloride. Carbon tetrachloride is listed as a chemical known to the State to cause cancer pursuant to the Safe Drinking Water and Toxic Enforcement Act of 1986. High exposures via ingestion, inhalation and possibly dermal contact can cause liver, kidney and central nervous system damage. If exposure is very high, the nervous system, including the brain, is affected. Symptoms may include a feeling of intoxication, headaches, dizziness, sleepiness, and nausea and vomiting. These effects may subside if exposure is topped, but in severe cases, coma and death may occur.

2.5.5 Copper. The carcinogenicity of copper has not been adequately studied. However, it causes experimental teratogenic and reproductive effects, and causes human systemic effects by ingestion including nausea and vomiting.

2.5.6 Cis-1, 2-dichloroethene. Cis-1, 2-dichloroethene has anesthetic properties at high concentrations. Humans inhaling high concentrations may display symptoms of nausea, vomiting, and cramps, followed by unconsciousness.

2.5.7 Lead. Lead is listed as a chemical known to the State to cause cancer and reproductive toxicity pursuant to the Safe Drinking Water and Toxic Enforcement Act of 1986. Short-term exposure to lead can cause fatigue, sleep disturbance, headache, aching bones and muscles, constipation, abdominal pains, decreased appetite and reversible kidney damage. Chronic lead exposure can lead to irreversible vascular sclerosis, irreversible brain damage, tubular cell atrophy, interstitial fibrosis, and glomerular sclerosis. Prolonged exposure at high concentrations may result in progressive kidney damage and possibly kidney failure. Anemia is an early sign of lead poisoning. Exposure to lead can produce neurobiological defects in children such as learning disabilities and behavioral problems.

2.5.8 Mercury. Mercury is listed as a chemical known to the State to cause reproductive toxicity pursuant to the Safe Drinking Water and Toxic Enforcement Act of 1986. Highly toxic by skin absorption and inhalation of fume or vapor, absorbed by respiratory and intestinal tracts. Acute effects of exposure to mercury include vomiting, abdominal pain, bloody diarrhea, kidney damage, and death. Chronic effects include inflammation of mouth and gums, excessive salivation, loosening of teeth, kidney damage, muscle tremors, jerky gait, spasms of extremities, personality changes, depression, irritability, and nervousness.

2.5.9 Nickel. Nickel and certain nickel compounds are listed as a chemical known to the State to cause cancer pursuant to the Safe Drinking Water and Toxic Enforcement Act of 1986. Nickel can cause dermatitis, pulmonary asthma, and conjunctivitis.

2.5.10 Polychlorinated Biphenyls (PCBs). PCBs are listed as a chemical known to the State to cause cancer pursuant to the Safe Drinking Water and Toxic Enforcement Act of 1986. PCBs have been shown to cause a number of health effects in animals, including effects on the immune system, reproductive system, nervous system, and endocrine system. People exposed directly to high levels of PCBs through dermal contact, ingestion or inhalation have experienced irritation of the nose and lungs, skin irritations such as severe acne (chloracne) and rashes, and eye irritation. PCBs can also affect the neurological development of children. EPA has found clear evidence that PCBs have significant toxic effects in animals, including effects on the immune system, the reproductive system, the nervous system and the endocrine system.

2.5.11 Tetrachloroethene (Perchloroethene, "PCE"). PCE is listed as a chemical known to the State to cause cancer pursuant to the Safe Drinking Water and Toxic Enforcement Act of 1986. Short-term exposure to PCE through ingestion and inhalation may cause nausea, vomiting, headache, dizziness, drowsiness, and tremors. Skin contact with PCE causes irritation and blistering. Liver and kidney toxicity are long-term effects.

2.5.12 Trichloroethene ("TCE"). TCE is listed as a chemical known to the State to cause cancer pursuant to the Safe Drinking Water and Toxic Enforcement Act of 1986. Acute exposure to TCE causes headache, dizziness, vertigo, tremors, irregular heartbeat, fatigue, nausea, vomiting, and blurred vision. TCE vapors may cause irritation of the eyes, nose, and throat. Long-term effects may include liver and kidney damage.

2.5.13 Vinyl Chloride. Vinyl chloride is listed as a chemical known to the State to cause cancer pursuant to the Safe Drinking Water and Toxic Enforcement Act of 1986. Inhalation of vinyl chloride causes headache, dizziness, abdominal pain, numbness, and tingling of the extremities. Vinyl chloride vapors cause eye irritation and may cause skin irritation. Long-term effects of vinyl chloride exposure include liver damage and liver cancer. There is evidence that vinyl chloride causes mutagenicity.

2.6 Routes of Exposure.

2.6.1 People working at the Site could be exposed to contaminants via dermal contact or via inhalation of volatile or dust-borne contaminants. Excavation of soil in the areas where contamination exists or sediments from the adjacent marsh could expose workers, nearby residents and/or business employees to contamination via dermal contact or via inhalation of contaminants, either from soil or groundwater.

2.6.2 Contaminated groundwater or surface water runoff could migrate to adjacent properties, including the adjacent marsh. Sensitive species may be exposed to contaminants via contact, inhalation, and/or ingestion of contaminated water, sediment and/or plants.

2.7 Public Health and/or Environmental Risk.

2.7.1 The property is currently used for educational and research purposes and open space. The public at risk includes those people who work at, conduct scientific research at or visit the Site, those who excavate into contaminated soil or groundwater, and/or persons who otherwise come into contact with, inhale or ingest contaminated air, soil or groundwater. Other persons who could potentially come into contact with contamination at the Site include recreational users of the San Francisco Bay Trail and adjacent residents of the Marina Bay complex. The Marina Bay complex is approximately 200 feet to the southwest of the Site.

2.7.2 A portion of the Site is located up-gradient from Western Stege Marsh. The potential exists for contamination from the upland areas to discharge via groundwater or surface water runoff into the marsh. Portions of the marsh are also known to contain contaminated sediments. The risk to the environment includes sensitive species (which may include threatened or endangered species) that may reside in these areas.

2.7.3 The coastal terrace prairie is located on the western boundary of the Site. The potential exists for contamination from adjacent upland areas to discharge via surface water runoff into this area. The risk to the environment includes sensitive species that may reside in this area.

III. CONCLUSIONS OF LAW

3.1 Each of the Respondents is a "responsible party" as defined by Health and Safety Code section 25323.5.

3.2 Each of the substances listed in Section 2.4 is a "hazardous substance" as defined in Health and Safety Code section 25316.

3.3 There has been a "release" and/or there is a "threatened release" of hazardous substances listed in Section 2.4 at the Site, as defined in Health and Safety Code section 25320.

3.4 The actual and threatened release of hazardous substances at the Site present the conditions set forth in Health and Safety Code section 25358.3(a).

3.5 Response action is necessary to abate a public nuisance and/or to protect and preserve the public health.

IV. DETERMINATION

4.1 Based on the foregoing findings of fact and conclusions of law, DTSC hereby determines that response action is necessary at the Site because there has been a release and/or there is a threatened release of a hazardous substance presenting the conditions set forth in Health and Safety Code section 25358.3(a).

4.2 Based on the foregoing findings of fact and conclusions of law, DTSC hereby determines that further investigation is required because of the release and/or the threatened release of the hazardous substances at the Site.

V. ORDER

Based on the foregoing FINDINGS, CONCLUSIONS, AND DETERMINATIONS, IT IS HEREBY ORDERED THAT Respondents conduct the following response actions in the manner specified herein, and in accordance with a schedule specified by DTSC as follows:

5.1 All response actions taken pursuant to this Order shall be consistent with the requirements of Chapter 6.8 (commencing with section 25300) of Division 20 of the Health and Safety Code and any other applicable state or federal statutes and regulations.

5.1.1 Site Investigation and Remediation Strategy. The purpose of this Order is to require for the Site: implementation of any appropriate removal actions, completion of a Remedial Investigation (RI), Baseline Human Health and Ecological Risk Assessment, preparation of a Feasibility Study (FS), Remedial Action Plan (RAP) or Removal Action Workplan (RAW), preparation of California Environmental Quality Act (CEQA) documents, and Design and Implementation of the remedial actions approved in the RAP. An overall Site investigation and remediation strategy shall be developed by Respondents in conjunction with DTSC which reflects program goals, objectives, and requirements. Current knowledge of the Site contamination sources, exposure pathways, and receptors shall be used in developing this strategy.

An objective of the Site investigations shall be to identify immediate or potential risks to public health and the environment and prioritize and implement response actions using removal actions and operable units, if appropriate, based on the relative risks at the Site. Respondents and DTSC shall develop and possibly modify Site priorities throughout the course of the investigations. If necessary for the protection of public health and the environment, DTSC will require additional response actions not specified in this Order to be performed as removal actions or separate operable units. Removal actions shall be implemented in accordance with a workplan and implementation schedule submitted by Respondents and approved by DTSC.

For operable unit remedial actions, DTSC will specify the separate and focused remedial phase activities to be conducted as RI/FS, RAP or RAW, Design, and Implementation. The focused activities shall be conducted in accordance with the corresponding remedial phase requirements specified in this Order, but shall only address the area or problem of the operable unit.

5.1.2 Remedial Action Objectives. Based on available information, DTSC has preliminarily determined that the remedial action objectives for the Site shall include:

(a) The reasonably foreseeable future land use of the Site is commercial/educational and open space. Therefore, remedial action objectives for contaminated media shall be developed that are protective of adults and children in a commercial/education scenario and as recreational users of open space.

(b) Western Stege Marsh is a sensitive habitat for the California Clapper Rail, an endangered species. Therefore, remedial action objectives for contaminated media shall be developed that are protective of endangered and threatened species that have been identified at the Site and their habitat.

(c) The coastal terrace prairie is a sensitive habitat for native grasses and forbs. Therefore, remedial action objectives for contaminated media shall be developed that are protective of sensitive species and their habitat.

5.1.3 Removal Actions. Respondents shall undertake removal actions if, during the course of the RI or FS, DTSC determines that they are necessary to mitigate the release of hazardous substances at or emanating from the Site. DTSC may require Respondents to submit a removal action workplan that includes a schedule for implementing the workplan for DTSC's approval. Either DTSC or Respondents may identify the need for removal actions. Respondents shall implement the following removal actions. Workplans for implementing the following removal actions shall be submitted by the specified dates:

(a) Fence and Post.

(1) Within 60 days of the effective date of this Order, Respondents shall install a fence in the area around Building 102 containing mercury contamination in accordance with the specifications attached as Exhibit C. The fence shall secure, at a minimum, the areas specified on the Site map (Exhibit D-1). The existing 4 foot no-climb fence surrounding the southern boundary of Western Stege Marsh (Exhibit D-2) shall be maintained in accordance with the specifications attached as Exhibit C.

(2) Within 60 days of the effective date of this Order, Respondents shall install signs which are visible from the area surrounding the contaminated Site and posted at each route of entry into the Site, including those

routes likely to be used by unauthorized persons. Such routes of entry include: access roads leading to the Site, and facing rivers, creeks, lakes or other waterways which may provide a route of access to the Site. The signs shall be in accordance with the specifications attached as Exhibit E. Signs shall be posted on the fence along the southern boundary of Western Stege Marsh. The signs shall be in accordance with the specifications attached as Exhibit E.

(3) The fence and signs shall be constructed of materials able to withstand the elements and shall be continuously maintained for as long as DTSC determines it to be necessary in order to protect public health and safety and the environment.

5.1.4 Surface Water Monitoring. Respondents previously prepared for the RWQCB the *Final Report, Groundwater, Surface Water, and Sediment Monitoring Plan, Subunit 2, Meade Street Operable Unit, University of California, Berkeley Richmond Field Station Richmond, California (Tasks 2b,3b,4a, and 5a of RWQCB Order No. 01-102), Blasland, Bouck & Lee, Inc., December 3, 2004,* which describes a surface water monitoring plan. Respondents shall immediately continue interim monitoring of surface water and stormwater in Meeker Slough, and stormwater at the outfalls of the eastern and western storm drain systems and the concrete drainage ditch along the western property boundary in accordance with the previously approved plan which is further described in Exhibit F.

5.1.5 Groundwater Monitoring. Respondents previously submitted the *Final Report, Groundwater, Surface Water, and Sediment Monitoring Plan, Subunit 2, Meade Street Operable Unit, University of California, Berkeley Richmond Field Station Richmond, California (Tasks 2b,3b,4a, and 5a of RWQCB Order No. 01-102), Blasland, Bouck & Lee, Inc., December 3, 2004* to the RWQCB. Additional site characterization is being conducted at the adjacent site to the east. Respondents shall consider the information conducted from the adjacent site and submit a revised groundwater monitoring plan for the Site at the same time as the Field Sampling Workplan discussed in Section 5.3.

5.1.6 Site Investigation and Remediation Strategy Meeting. Respondents, including the Project Coordinator (Section 6.1) and Project Engineer/Geologist (Section 6.2), shall meet with DTSC within 30 days from the effective date (and concurrent with the development of the Current Site Conditions Report of this Order to discuss the Site investigation and remediation strategy. These discussions will include prior Site investigations and remedial activities, Site risks and priorities; project planning, phasing and scheduling, further remedial activities, remedial action objectives, remedial technologies, and data quality objectives. Results of the discussions will be included in the Current Conditions Report, Section 5.2.2 of this Order.

5.2 Current Site Conditions. DTSC acknowledges that site activities have occurred in the past as documented in the reports described in Section 2.3.10. Previous removal actions conducted under the oversight of the RWQCB were conducted in phases and encompass different portions of the Site. For these areas, there is no single report that identifies the current site conditions site wide or by phase. Furthermore, additional phases of work identified by the RWQCB still remain to be completed.

5.2.1 The objectives of the Current Conditions Report are to:

(a) Provide historical information regarding previous uses of the site, including the use, storage, disposal, and release of hazardous substances.
(b) Determine the nature and full extent of hazardous substance contamination of air, soil, surface water, and groundwater at the Site.
(c) Identify all actual and potential exposure pathways and routes through environmental media; and
(d) Determine the magnitude and probability of actual or potential harm to public health, safety, or welfare or to the environment posed by the threatened or actual release of hazardous substances at or from the Site.

5.2.2 Current Conditions Report Within 120 days of the effective date of this Order, Respondents shall prepare and submit to DTSC for review and approval a Current Conditions Report that:

(a) summarizes all investigations conducted at the Site to date;
(b) summarizes all removal and remedial actions taken to date;
(c) provides an inventory of chemicals used on the Site (by name and volume) and identifies all pollution sources on the Site, including chemical storage areas, sumps, underground tanks, utility lines, process lines, and related facilities;
(d) identifies surface and subsurface human-made conduits at the Site that may allow contaminants to migrate laterally off the site or vertically into deeper aquifers;
(e) compiles data collected in previous investigations, along with all removal and remedial actions taken to date, to provide a comprehensive summary of current conditions at the Site;
(f) includes figures that:
(1) identifies all sample locations along with the type of chemical analysis (e.g., metals, PCBs, VOCs, etc.) identified in a pie chart for each sample location;
(2) compares sample concentrations to residential, commercial, recreational and/or ecological screening levels (depending on current and anticipated future use of the area) or appropriate background values for surface and samples collected at depth;
(3) identifies all areas that were previously excavated (on a single

map) that can be overlain on the figures prepared for (2) above; and

(4) identifies confirmation sample data for all excavated areas.

(g) identifies all response actions required under the RWQCB's Order that have not been completed;

(h) identifies data gaps taking into account all reasonably foreseeable land uses,

(i) identify potentially suitable remedial technologies and recommendations for treatability studies, if applicable; and

(j) provides historical information regarding previous uses of the Site.

5.3 Field Sampling

5.3.1 Field Sampling Workplan. Within 60 days of the date of DTSC's request, Respondents shall prepare and submit to DTSC for review and approval a detailed Workplan and implementation schedule that addresses data gaps identified in (h) above. The workplan shall include all the sections and address each component listed below.

(a) The Field Sampling Plan, if applicable, shall include:

(1) Sampling objectives, including a brief description of data gaps and how the field sampling plan will address these gaps;

(2) Sample locations, including a map showing these locations, and proposed frequency;

(3) Sample designation or numbering system;

(4) Detailed specification of sampling equipment and procedures;

(5) Sample handling and analysis including preservation methods, shipping requirements and holding times; and

(6) Management plan for wastes generated.

(b) Quality Assurance Project Plan. The plan shall include:

(1) Project organization and responsibilities with respect to sampling and analysis;

(2) Quality assurance objectives for measurement including accuracy, precision, and method detection limits. In selecting analytical methods, Respondents shall consider obtaining detection limits at or below potentially applicable legal requirements or relevant and appropriate standards, such as Maximum Contaminant Levels (MCLs) or Maximum Contaminant Level Goals (MCLGs);

(3) Sampling procedures;

(4) Sample custody procedures and documentation;

(5) Field and laboratory calibration procedures;

(6) Analytical procedures;

(7) Laboratory to be used certified pursuant to Health and Safety Code section 25198;

(8) Specific routine procedures used to assess data (precision, accuracy, and completeness) and response actions;

(9) Reporting procedure for measurement of system performance and data quality;

(10) Data management, data reduction, validation, and reporting. Information shall be accessible to downloading into DTSC's system; and

(11) Internal quality control.

(c) Health and Safety Plan. A site-specific Health and Safety Plan shall be prepared in accordance with federal (Title 29 CFR 1910.120) and state (Title 8 California Code of Regulations,Section 5192) regulations. This plan must include, at a minimum, the following elements:

(1) Site Background/History/Workplan;
(2) Key Personnel and Responsibilities
(3) Job Hazard Analysis/Summary;
(4) Employee Training;
(5) Personal Protection;
(6) Medical Surveillance;
(7) Air Surveillance;
(8) Site Control;
(9) Decontamination;
(10) Contingency Planning;
(11) Confined Space Operations;
(12) Spill Containment;
(13) Sanitation;
(14) Illumination; and
(15) Other applicable requirements based on the work to be performed.

DTSC's *Interim Draft Site Specific Health and Safety Plan Guidance Document for Site Assessment/Investigation, Site Mitigation Projects, Hazardous Waste Site Work Closure, Post Closure, and Operation and Maintenance Activities (DTSC, December 2000)* may be used as a reference tool.

All contractors and all subcontractors shall be given a copy of the Health and Safety Plan prior to entering the Site. Any supplemental health and safety plans prepared by any subcontractor shall also be prepared in accordance with the regulations and guidance identified above. The prime contractor will be responsible for ensuring that all subcontractor supplemental health and safety plans will follow these regulations and guidelines.

(d) Other Activities. A description of any other significant activities, which are appropriate to address data gaps and information needed so that a baseline risk assessment can be prepared, shall be included.

(e) Schedule. A schedule that provides specific time frames and dates for completion of each activity and report conducted or submitted under the Field Sampling Workplan including the schedules for removal actions and operable unit activities.

5.3.2 Field Sampling Implementation. Respondents shall implement the approved field sampling Workplan per the approved schedule found in the Field Sampling Workplan.

5.4 Remedial Investigation (RI) Report. An addendum to the Current Site Conditions Report incorporating the results of the Field Sampling shall be prepared. This report will serve as the Final RI Report for the Site. The RI may be performed as a series of focused RIs, if appropriate, based on Site priorities. The purpose of the RI is to collect data necessary to adequately characterize the Site for the purposes of defining risks to public health and the environment and developing and evaluating effective remedial alternatives for foreseeable land uses. Site characterization may be conducted in one or more phases to focus sampling efforts and increase the efficiency of the investigation. Respondents shall identify the sources of contamination and define the nature, extent, and volume of the contamination. Using this information, the contaminant fate and transport shall be evaluated. The RI Report shall contain:

(a) Site Physical Characteristics. Data on the physical characteristics of the Site and surrounding area shall be collected to the extent necessary to define potential transport pathways and receptor populations and to provide sufficient engineering data for development and screening of remedial action alternatives.

(b) Sources of Contamination. Contamination sources (including heavily contaminated media) shall be defined. The data shall include the source locations, type of contaminant, waste characteristics, and Site features related to contaminant migration and human exposure.

(c) Nature and Extent of Contamination. Contaminants shall be identified and the horizontal and vertical extent of contamination shall be defined in soil, groundwater, surface water, sediment, air, and biota. Spatial and temporal trends and the fate and transport of contamination shall be evaluated.

5.5 Baseline Health and Ecological Risk Assessment. Within 30 days of the submission of the Final RI Report, Respondents shall perform health and ecological (if applicable) risk assessments for the Site that meet the requirements of Health and Safety Code section 25356.1.5(b). Respondents shall submit a Baseline Health and Ecological Risk Assessment Report. The report shall be prepared consistent with U.S. EPA and California Environmental Protection Agency guidance and regulations, including as a minimum: Risk Assessment Guidance for Superfund, Volume 1; Human Health Evaluation Manual, December 1989; Superfund Exposure Assessment Manual, April 1988; Risk Assessment

Guidance for Superfund, Volume 2, Environmental Evaluation Manual, March 1989; Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities (DTSC, September 1993); and all other related or relevant policies, practices and guidelines of the California Environmental Protection Agency and policies, practices and guidelines developed by U.S.EPA pursuant to 40 CFR 300.400 et seq. The Baseline Health and Ecological Risk Assessment Report shall include the following components:

(a) Contaminant Identification. Characterization data shall identify contaminants of concern for the risk assessment process.

(b) Environmental Evaluation. An ecological assessment consisting of:

(1) Identification of sensitive environments and rare, threatened, or endangered species and their habitats; and

(2) As appropriate, ecological investigations to assess the actual or potential effects on the environment and/or develop remediation criteria.

(c) Exposure Assessment. The objectives of an exposure assessment are to identify actual or potential exposure pathways, to characterize the potentially exposed populations that are likely to come into contact with contaminants at the Site, and to determine the extent of the exposure. Exposed populations may include industrial workers, residents, and subgroups that comprise a meaningful portion of the general population, including, but not limited to, infants, children, pregnant women, the elderly, individuals with a history of serious illness, or other subpopulations, that are identifiable as being at greater risk of adverse health effects due to exposure to hazardous substances than the general population.

(d) Toxicity Assessment. Respondents shall evaluate the types of adverse health or environmental effects associated with individual and multiple chemical exposures; the relationship between magnitude of exposures and adverse effects; and related uncertainties such as the weight of evidence for a chemical's potential carcinogenicity in humans.

(e) Risk Characterization. Risk characterization shall include the potential risks of adverse health or environmental effects for each of the exposure scenarios derived in the exposure assessment.

5.6 Interim Screening and Evaluation of Remedial Technologies. If requested by DTSC, Respondents shall submit an interim document which identifies and evaluates potentially suitable remedial technologies and recommendations for treatability studies.

5.7 Treatability Studies. Treatability testing will be performed by Respondents if requested by DTSC to develop data for detailed remedial alternatives. Treatability testing is required to demonstrate the implementability and effectiveness of technologies, unless Respondents can show DTSC that similar data or documentation or information exists. The required deliverables are: a workplan, a sampling and analysis plan, and a treatability evaluation report. To the extent practicable, treatability studies will be proposed and implemented during the latter part of Site characterization.

5.8 Feasibility Study (FS) Report. If, after review and approval of the Remedial Investigation Report and Baseline Health and Ecological Risk Assessment Report, DTSC determines that remedial measures are necessary at the Site, Respondents shall prepare and submit a FS Report to DTSC for review and approval. If a Removal Action Workplan (RAW) is prepared for a subarea or portion thereof (Section 5.10), a stand-alone FS Report may not be required. DTSC shall inform the Respondents whether a FS Report is required. The FS Report shall be submitted no later than 60 days after a request is made in writing by DTSC. The FS Report shall summarize the results of the FS including the following:

(a) Documentation of all treatibility studies conducted.

(b) Development of medium specific or operable unit specific remedial action objectives, including legal requirements and other promulgated standards that are relevant.

(c) Identification of screening of general response actions, remedial technologies, and process options on a medium and/or operable unit specific basis.

(d) Evaluation of alternatives based on the criteria contained in the NCP including:

Threshold Criteria:

(1) Overall protection of human health and the environment.
(2) Compliance with legal requirements and other promulgated standards that are relevant.

Primary Balancing Criteria:

(1) Long-term effectiveness and permanence.
(2) Reduction of toxicity, mobility, or volume through treatment.
(3) Short-term effectiveness.
(4) Implementability based on technical and administrative feasibility.
(5) Cost.

Modifying Criteria:

(1) State and local agency acceptance.
(2) Community acceptance.

(e) Proposed remedial actions.

5.9 California Environmental Quality Act (CEQA). DTSC will comply with CEQA for all activities required by this Order that are projects subject to CEQA. Upon DTSC request, Respondents shall provide DTSC with any information that DTSC deems necessary to facilitate compliance with CEQA. The costs incurred by DTSC in complying with CEQA are response costs and Respondents shall reimburse DTSC for such costs pursuant to Section 6.19.

5.10 Removal Action Workplan (RAW). If DTSC determines a removal action is appropriate, Respondents will prepare and submit no later than 45 days after DTSC's approval of the FS, a draft Removal Action Workplan (RAW) in accordance with Health and Safety Code sections 25323.1 and 25356.1. The Removal Action Workplan will include:

(a) A description of the onsite contamination;
(b) The goals to be achieved by the removal action;
(c) An analysis of the alternative options considered and rejected and the basis for that rejection. This should include a discussion for each alternative which covers its effectiveness, implementability and cost;
(d) Administrative record list;
(e) A description of the techniques and methods to be used in the removal action, including any excavating, storing, handling, transporting, treating, and disposing of material on or off the site;
(f) Sampling and Analysis Plan with corresponding Quality Assurance Plan to confirm the effectiveness of the RAW, if applicable;
(g) A brief overall description of methods that will be employed during the removal action to ensure the health and safety of workers and the public during the removal action. A detailed community air monitoring plan shall be included if requested by DTSC.

In conjunction with DTSC, Respondents shall implement the public review process specified in DTSC's Public Participation Policy and Guidance Manual and Public Participation Plan. DTSC will prepare a response to the public comments received. If required, the Respondents shall submit within fifteen (15) days of the request the information necessary for DTSC to prepare this document.

Following DTSC's finalization of the Responsiveness Summary, DTSC will specify any changes to be made in the RAW. Respondents shall modify the document in accordance with DTSC's specifications and submit a final RAW within 15 days of receipt of DTSC's comments.

If the proposed removal action does not meet the requirements of Health and Safety Code section 25356.1(h), the Respondents shall prepare a Remedial Action Plan (RAP) in accordance with Health and Safety Code section 25356.1(c) for DTSC review and approval.

5.11 Remedial Action Plan (RAP). No later than 60 days after DTSC approval of the FS Report, Respondents shall prepare and submit to DTSC a draft RAP, if applicable. The draft

RAP shall be consistent with the NCP and Health and Safety Code section 25356.1. The draft RAP public review process may be combined with that of any other documents required by CEQA. The draft RAP shall be based on and summarize the approved RI/FS Reports, and shall clearly set forth:

(a) Health and safety risks posed by the conditions at the Site.

(b) The effect of contamination or pollution levels upon present, future, and probable beneficial uses of contaminated, polluted, or threatened resources.

(c) The effect of alternative remedial action measures on the reasonable availability of groundwater resources for present, future, and probable beneficial uses.

(d) Site specific characteristics, including the potential for offsite migration of hazardous substances, the surface or subsurface soil, and the hydrogeologic conditions, as well as preexisting background contamination levels.

(e) Cost-effectiveness of alternative remedial action measures. Land disposal shall not be deemed the most cost-effective measure merely on the basis of lower short-term cost.

(f) The potential environmental impacts of alternative remedial action measures, including, but not limited to, land disposal of the untreated hazardous substances as opposed to treatment of the hazardous substances to remove or reduce their volume, toxicity, or mobility prior to disposal.

(g) A statement of reasons setting forth the basis for the removal and remedial actions selected. The statement shall include an evaluation of each proposed alternative submitted and evaluate the consistency of the removal and remedial actions proposed by the plan with the NCP.

(h) A schedule for implementation of all proposed removal and remedial actions.

In conjunction with DTSC, Respondents shall implement the public review process specified in DTSC's Public Participation Policy and Guidance Manual. DTSC will prepare a response to the public comments received. If required, the Respondents shall submit within fifteen (15) days of the request the information necessary for DTSC to prepare this document

Following DTSC's finalization of the Responsiveness Summary, DTSC will specify any changes to be made in the RAP. Respondents shall modify the document in accordance with DTSC's specifications and submit a final RAP within 15 days of receipt of DTSC's comments.

5.12 Remedial Design (RD). Within 60 days after DTSC approval of the final RAP, Respondents shall submit to DTSC for review and approval a RD describing in detail the technical and operational plans for implementation of the final RAP which includes the following elements, as applicable:

(a) Design criteria, process unit and pipe sizing calculations, process diagrams, and final

plans and specifications for facilities to be constructed.
(b) Description of equipment used to excavate, handle, and transport contaminated material.
(c) A field sampling and laboratory analysis plan addressing sampling during implementation and to confirm achievement of the performance objectives of the RAP.
(d) A transportation plan identifying routes of travel and final destination of wastes generated and disposed.
(e) For groundwater extraction systems: aquifer test results, capture zone calculations, specifications for extraction and performance monitoring wells, and a plan to demonstrate that capture is achieved.
(f) An updated health and safety plan addressing the implementation activities.
(g) Identification of any necessary permits and agreements.
(h) An operation and maintenance plan including any required monitoring.
(i) A detailed schedule for implementation of the remedial action consistent with the schedule contained in the approved RAP including procurement, mobilization, construction phasing, sampling, facility startup, and testing.
(j) A community Air Monitoring Plan.

5.13 Public Participation Plan (Community Relations). Respondents shall work cooperatively with DTSC in providing an opportunity for meaningful public participation in response actions. Any such public participation activities shall be conducted in accordance with Health and Safety Code section 25356.1 and 25358.7 and DTSC's most current Public Participation Policy and Guidance Manual, and shall be subject to DTSC's review and approval.

A baseline community survey was previously completed. Respondents shall assist DTSC in developing a revised Public Participation Plan (PPP) for the Site, which describes how, under this Order, the public and adjoining community will be kept informed of activities conducted at the Site and how Respondents will be responding to inquiries from concerned citizens.

DTSC with assistance of the Respondents shall prepare a revised PPP within 90 days of the effective date of this Order.

Respondents shall implement any of the public participation support activities identified in the PPP, at the request of DTSC. DTSC retains the right to implement any of these activities independently. These activities include, but are not limited to, development and distribution of fact sheets; public meeting preparations; and development and placement of public notices.

5.14 Land Use Covenant. If the approved remedy in the final RAP or final RAW includes land use covenants or land use restrictions, pursuant to California Code of Regulations, title 22, section 67391.1, or if a previous remedial action conducted under the oversight of the RWQCB does not meet unrestricted land use standards and DTSC agrees with the remedy, the current owner(s) of the Site shall sign a land use covenant approved by DTSC within 90 days of

DTSC's approval of the final RAP or DTSC's concurrence in writing of the remedial action approved by the RWQCB.

5.15 Implementation of Final RAP or Final RAW. Upon DTSC approval of the RD or final RAW, Respondents shall implement the final RAP or final RAW in accordance with the approved schedule in the RD or final RW. Within 60 days of completion of field activities, Respondents shall submit an Implementation Report documenting the implementation of the Final RAP and RD or final RAW.

5.16 Operation and Maintenance (O&M). Respondents shall comply with all O&M requirements in accordance with the final RAP and approved RD, final RAW or approved RWQCB plans. Within 30 days of the date of DTSC's request, Respondents shall prepare and submit to DTSC for approval an O&M plan that includes an implementation schedule. Respondents shall implement the plan in accordance with the approved schedule. Respondents shall continue to implement the Wetland Restoration Monitoring Plan found in the Western Stege Marsh Restoration Project Monitoring Plan (Blasland, Bouck & Lee 2004), the Feral Animal Management Program (Blasland, Bouck & Lee 2004), and the Invasive/Exotic Vegetation Management Program (Blasland, Bouck & Lee 2004)..

5.17 Five-Year Review. Respondent shall review and reevaluate the remedial action after a period of five years (unless otherwise specified by DTSC) from the completion of construction and startup, and every 5 years thereafter until such time that DTSC relieves Respondents from this obligation. The review and reevaluation shall be conducted to determine if human health and the environment are being protected by the remedial action. Within thirty 30 calendar days before the end of the time period approved by DTSC to review and reevaluate the remedial action, Respondents shall submit a remedial action review workplan to DTSC for review and approval. Within sixty 60 days of DTSC's approval of the workplan, Respondents shall implement the workplan and shall submit a comprehensive report of the results of the remedial action review. The report shall describe the results of all sample analyses, tests and other data generated or received by Respondents and evaluate the adequacy of the implemented remedy in protecting public health, safety and the environment. As a result of any review performed under this Section, Respondents may be required to perform additional Work or to modify Work previously performed.

5.18 Changes During Implementation of the Final RAP or Final RAW. During the implementation of the final RAP and RD or final RAW, DTSC may specify such additions, modifications, and revisions to the RD or final RAW as DTSC deems necessary to protect public health and safety or the environment or to implement the final RAP or final RAW.

5.19 Stop Work Order. In the event that DTSC determines that any activity (whether or not pursued in compliance with this Order) may pose an imminent or substantial endangerment to the health or safety of people on the Site or in the surrounding area or to the environment, DTSC may order Respondents to stop further implementation of this Order for such period of time needed to abate the endangerment. In the event that DTSC determines that any site activities (whether or not pursued in compliance with this Order) are proceeding without DTSC authorization, DTSC may order Respondents to stop further implementation of this Order or activity for such period of time needed to obtain DTSC authorization, if such authorization is appropriate. Any deadline in this Order directly affected by a Stop Work Order, under this Section, shall be extended for the term of the Stop Work Order.

5.20 Emergency Response Action/Notification. In the event of any action or occurrence (such as a fire, earthquake, explosion, or human exposure to hazardous substances caused by the release or threatened release of a hazardous substance) during the course of this Order, Respondents)shall immediately take all appropriate action to prevent, abate, or minimize such emergency, release, or immediate threat of release and shall immediately notify the Project Manager. Respondents shall take such action in consultation with the Project Manager and in accordance with all applicable provisions of this Order. Within seven days of the onset of such an event, Respondents shall furnish a report to DTSC, signed by Respondents' Project Coordinator, setting forth the events which occurred and the measures taken in the response thereto. In the event that Respondents fail to take appropriate response and DTSC takes the action instead, Respondents shall be liable to DTSC for all costs of the response action. Nothing in this Section shall be deemed to limit any other notification requirement to which Respondents may be subject.

5.21 Discontinuation of Remedial Technology. Any remedial technology employed in implementation of the final RAP or final RAW shall be left in place and operated by Respondents until and except to the extent that DTSC authorizes Respondents in writing to discontinue, move or modify some or all of the remedial technology because Respondents have met the criteria specified in the final RAP or final RAW for its discontinuance, or because the modifications would better achieve the goals of the final RAP or final RAW.

5.22 Financial Assurance. Respondents shall demonstrate to DTSC and maintain financial assurance for operation and maintenance and monitoring. Respondents shall demonstrate financial assurance prior to the time that operation and maintenance activities are initiated and shall maintain it throughout the period of time necessary to complete all required operation and maintenance activities. The financial assurance mechanisms shall meet the requirements of Health and Safety Code Section 25355.2. All financial assurance mechanisms are subject to the review and approval of DTSC.

VI. GENERAL PROVISIONS

6.1 Project Coordinator. Within 10 days from the date the Order is signed by DTSC, Respondents shall submit to DTSC in writing the name, address, and telephone number of a Project Coordinator whose responsibilities will be to receive all notices, comments, approvals, and other communications from DTSC. Respondents shall promptly notify DTSC of any change in the identity of the Project Coordinator. Respondents shall obtain approval from DTSC before the new Project Coordinator performs any work under this Order.

6.1.1 Communication and Coordination Plan (CCP). Within thirty (30) days from the date this Order is signed by DTSC, Respondents shall submit to DTSC for its approval a CCP which specifies the requirements and procedures by which Respondents will communicate and coordinate with one another in carrying out the requirements of this Order.

6.2 Project Engineer/Geologist. The work performed pursuant to this Order shall be under the direction and supervision of a qualified professional engineer or geologist in the State of California, with expertise in hazardous substance site cleanups. Within 15 calendar days from the date this Order is signed by DTSC, Respondents must submit: a) The name and address of the project engineer or geologist chosen by Respondents; and b) in order to demonstrate expertise in hazardous substance cleanup, the résumé of the engineer or geologist, and the statement of qualifications of the consulting firm responsible for the work. Respondents shall promptly notify DTSC of any change in the identity of the Project Engineer/Geologist. Respondents shall obtain approval from DTSC before the new Project Engineer/Geologist performs any work under this Order.

6.3 Monthly Summary Reports. Within 30 days from the date this Order is signed by DTSC, and on a monthly basis thereafter, Respondents shall submit a Monthly Summary Report of its activities under the provisions of this Order. The report shall be received by DTSC by the 15th day of each month and shall describe:

(a) Specific actions taken by or on behalf of Respondents during the previous calendar month;
(b) Actions expected to be undertaken during the current calendar month;
(c) All planned activities for the next month;
(d) Any requirements under this Order that were not completed;
(e) Any problems or anticipated problems in complying with this Order; and

6.4 Quality Assurance/Quality Control (QA/QC). All sampling and analysis conducted by Respondent(s) under this Order shall be performed in accordance with QA/QC procedures submitted by Respondent(s) and approved by DTSC pursuant to this Order.

6.5 Submittals. All submittals and notifications from Respondents required by this Order shall be sent simultaneously to:

Barbara J. Cook, P.E.
Regional Branch Chief

Attention: Lynn Nakashima [two copies and one compact disc]
Site Mitigation Branch
DTSC of Toxic Substances Control
700 Heinz Avenue
Berkeley, CA 94710

Note: The compact disc shall be in searchable portable document format (PDF).

6.6 Communications. All approvals and decisions of DTSC made regarding submittals and notifications will be communicated to Respondents in writing by the Site Mitigation Branch Chief or his/her designee. No informal advice, guidance, suggestions or comments by DTSC regarding reports, plans, specifications, schedules or any other writings by Respondents shall be construed to relieve Respondents of the obligation to obtain such formal approvals as may be required.

6.7 DTSC Review and Approval.

(a) All response actions taken pursuant to this Order shall be subject to the approval of DTSC. Respondents shall submit all deliverables required by this Order to DTSC. Once the deliverables are approved by DTSC, they shall be deemed incorporated into, and where applicable, enforceable under this Order.

(b) If DTSC determines that any report, plan, schedule or other document submitted for approval pursuant to this Order fails to comply with this Order or fails to protect public health or safety or the environment, DTSC may:

(1) Modify the document as deemed necessary and approve the document as modified; or

(2) Return comments to Respondents with recommended changes and a date by which Respondents must submit to DTSC a revised document incorporating the recommended changes.

(c) Any modifications, comments or other directives issued pursuant to (a) above, are incorporated into this Order. Any noncompliance with these modifications or directives shall be deemed a failure or refusal to comply with this Order.

6.8 Compliance with Applicable Laws. Nothing in this Order shall relieve Respondents from complying with all other applicable laws and regulations, including but not limited to compliance with all applicable waste discharge requirements issued by the State Water Resources Control Board or a California Regional Water Quality Control Board. Respondents shall conform all actions required by this Order with all applicable federal, state and local laws and regulations.

6.9 Respondent Liabilities. Nothing in this Order shall constitute or be construed as a satisfaction or release from liability for any conditions or claims arising as a result of past, current or future operations of Respondents. Nothing in this Order is intended or shall be construed to limit the rights of any of the parties with respect to claims arising out of or relating to the deposit or disposal at any other location of substances removed from the Site. Nothing in this Order is intended or shall be construed to limit or preclude DTSC from taking any action authorized by law to protect public health or safety or the environment and recovering the cost thereof. Notwithstanding compliance with the terms of this Order, Respondents may be required to take further actions as are necessary to protect public health and the environment.

6.10 Site Access. Access to the Site and laboratories used for analyses of samples under this Order shall be provided at all reasonable times to employees, contractors, and consultants of DTSC. Nothing in this Section is intended or shall be construed to limit in any way the right of entry or inspection that DTSC or any other agency may otherwise have by operation of any law. DTSC and its authorized representatives shall have the authority to enter and move freely about all property at the Site at all reasonable times for purposes including, but not limited to: inspecting records, operating logs, sampling and analytic data, and contracts relating to this Site; reviewing the progress of Respondents in carrying out the terms of this Order; conducting such tests as DTSC may deem necessary; and verifying the data submitted to DTSC by Respondents.

To the extent the Site or any other property to which access is required for the implementation of this Order is owned or controlled by persons other than Respondents, Respondents shall use best efforts to secure from such persons access for Respondents, as well as DTSC, its representatives, and contractors, as necessary to effectuate this Order. To the extent that any portion of the Site is controlled by tenants of Respondents, Respondents shall use best efforts to secure from such tenants, access for Respondents, as well as for DTSC, its representatives, and contractors, as necessary to effectuate this Order. For purposes of this Section, "best efforts" includes the payment of reasonable sums of money in consideration of access. If any access required to complete the Work is not obtained within forty-five (45) days of the effective date of this Order, or within forty-five (45) days of the date DTSC notifies Respondents in writing that additional access beyond that previously secured is necessary, Respondents shall promptly notify DTSC, and shall include in that notification a summary of the steps Respondents has taken to attempt to obtain access. DTSC may, as it deems appropriate, assist Respondents in obtaining access. Respondents shall reimburse DTSC in obtaining access, including, but not limited to, attorneys fees and the amount of just compensation.

6.11 Site Access for Respondents. The Site owner Respondent shall grant access to other Respondents who are in compliance with this Order for the purpose of conducting activities pursuant to this Order or for activities deemed necessary by DTSC to meet the objectives of this Order.

6.12 Sampling, Data and Document Availability. Respondents shall permit DTSC and its authorized representatives to inspect and copy all sampling, testing, monitoring or other data generated by Respondents or on Respondents' behalf in any way pertaining to work undertaken pursuant to this Order. Respondents shall submit all such data upon the request of DTSC. Copies shall be provided within 7 days of receipt of DTSC's written request. Respondents shall inform DTSC at least 7 days in advance of all field sampling under this Order, and shall allow DTSC and its authorized representatives to take duplicates of any samples collected by Respondents pursuant to this Order. Respondents shall maintain a central depository of the data, reports, and other documents prepared pursuant to this Order.

6.13 Record Retention. All such data, reports and other documents shall be preserved by Respondents for a minimum of ten years after the conclusion of all activities under this Order. If DTSC requests that some or all of these documents be preserved for a longer period of time, Respondents shall either comply with that request or deliver the documents to DTSC, or permit DTSC to copy the documents prior to destruction. Respondents shall notify DTSC in writing at least six months prior to destroying any documents prepared pursuant to this Order.

6.14 Government Liabilities. The State of California shall not be liable for any injuries or damages to persons or property resulting from acts or omissions by Respondents, or related parties specified in Section 6.26, Parties Bound, in carrying out activities pursuant to this Order, nor shall the State of California be held as party to any contract entered into by Respondents or its agents in carrying out activities pursuant to this Order.

6.15 Additional Actions. By issuance of this Order, DTSC does not waive the right to take any further actions authorized by law.

6.16 Extension Requests. If Respondents are unable to perform any activity or submit any document within the time required under this Order, Respondents may, prior to expiration of the time, request an extension of the time in writing. The extension request shall include a justification for the delay. All such requests shall be in advance of the date on which the activity or document is due.

6.17 Extension Approvals. If DTSC determines that good cause exists for an extension, it will grant the request and specify a new schedule in writing. Respondents shall comply with the new schedule incorporated in this Order.

6.18 Liability for Costs. Respondents are liable for all of DTSC's costs that have been incurred in taking response actions at the Site (including costs of overseeing response actions performed by Respondents) and costs to be incurred in the future.

6.19 Payment of Costs. DTSC may bill Respondents for costs incurred in taking response actions at the Site prior to the effective date of this Order. DTSC will bill Respondents quarterly for its response costs incurred after the effective date of this Order. Respondents shall pay DTSC within sixty (60) days of receipt of any DTSC billing. Any billing not paid within sixty (60) days is subject to interest calculated from the date of the billing pursuant to Health and Safety Code section 25360.1. All payments made by Respondents pursuant to this Order shall be by check made payable to "DTSC," and shall bear on the face the project code of the Site (Site 201605) and the Docket number of this Order. Payments shall be sent to:

Department of Toxic Substances Control
Accounting/Cashier
1001 I Street, 21st Floor
P.O. Box 806
Sacramento, California 95812-0806

6.20 Severability. The requirements of this Order are severable, and Respondents shall comply with each and every provision hereof, notwithstanding the effectiveness of any other provision.

6.21 Incorporation of Plans, Schedules and Reports. All plans, schedules, reports, specifications and other documents that are submitted by Respondents pursuant to this Order are incorporated in this Order upon DTSC's approval or as modified pursuant to Section 6.7, DTSC Review and Approval, and shall be implemented by Respondents. Any noncompliance with the documents incorporated in this Order shall be deemed a failure or refusal to comply with this Order.

6.22 Modifications. DTSC reserves the right to unilaterally modify this Order. Any modification to this Order shall be effective upon the date the modification is signed by DTSC unless otherwise indicated and shall be deemed incorporated in this Order.

6.23 Time Periods. Unless otherwise specified, time periods begin from the effective date of this Order and "days" means calendar days.

6.24 Termination and Satisfaction. Except for Respondents obligations under Sections 5.16 Operation and Maintenance (O&M), 5.17 Five-Year Review, 5.22 Financial Assurance, 6.13 Record Retention, 6.18 Liability for Costs, and 6.19 Payment of Costs, Respondents obligations under this Order shall terminate and be deemed satisfied upon Respondents receipt of written notice from DTSC that Respondents have complied with all the terms of this Order.

6.26 Parties Bound. This Order applies to and is binding upon Respondents, and its officers, directors, agents, employees, contractors, consultants, receivers, trustees, successors and assignees, including but not limited to, individuals, partners, and subsidiary and parent corporations. Respondents shall provide a copy of this Order to all contractors, subcontractors, laboratories, and consultants which are retained to conduct any work performed under this Order, within 15 days after the effective date of this Order or the date of retaining their services, whichever is later. Respondents shall condition any such contracts upon satisfactory compliance with this Order. Notwithstanding the terms of any contract, Respondents are responsible for compliance with this Order and for ensuring that its subsidiaries, employees, contractors, consultants, subcontractors, agents and attorneys comply with this Order.

6.27 Change in Ownership. No change in ownership or corporate or partnership status relating to the Site shall in any way alter Respondents' responsibility under this Order. No conveyance of title, easement, or other interest in the Site, or a portion of the Site, shall affect Respondents' obligations under this Order. Unless DTSC agrees that such obligations may be transferred to a third party, Respondents shall be responsible for and liable for any failure to carry out all activities required of Respondents by the terms and conditions of this Order, regardless of Respondents' use of employees, agents, contractors, or consultants to perform any such tasks. Respondents shall provide a copy of this Order to any subsequent owners or successors before ownership rights or stock or assets in a corporate acquisition are transferred.

VII. NOTICE OF INTENT TO COMPLY

7. Not later than fifteen (15) days after the effective date of this Order, Respondents shall provide written notice, in accordance with paragraph 6.5, Submittals of this Order, stating whether or not Respondents will comply with the terms of this Order. If Respondents, or any one of them, do not unequivocally commit to perform all of the requirements of this Order, they, or each so refusing, shall be deemed to have violated this Order and to have failed or refused to comply with this Order. Respondents' written notice shall describe, using facts that exist on or prior to the effective date of this Order, any "sufficient cause" defenses asserted by Respondent(s) under Health and Safety Code sections 25358.3(a) and 25355.5(a)(1)(B) or CERCLA section 107(c)(3), 42 U.S.C. section 9607(c)(3).

VIII. EFFECTIVE DATE

8. This Order is final and effective five days from the date of mailing, which is the date of the cover letter transmitting the Order to you.

IX. PENALTIES FOR NONCOMPLIANCE

9. Each Respondent may be liable for penalties of up to $25,000 for each day out of compliance with any term or condition set forth in this Order and for punitive damages up to three times the amount of any costs incurred by DTSC as a result of Respondents' failure to comply, pursuant to Health and Safety Code sections 25359, 25359.2, 25359.4, and 25367(c). Health and Safety Code section 25359.4.5 provides that a responsible party who complies with this Order, or with another order or agreement concerning the same response actions required by this Order, may seek treble damages from Respondents who fail or refuse to comply with this Order without sufficient cause.

DATE OF ISSUANCE:_____________ ________________________________

Barbara J. Cook, P.E.
Regional Branch Chief
Department of Toxic Substances Control

cc: Site Mitigation Program
Headquarters, Planning & Policy
Office of Legal Counsel

Exhibit A-1
Assessor's Parcel Map
Parcel Numbers 560060008 and 560060007

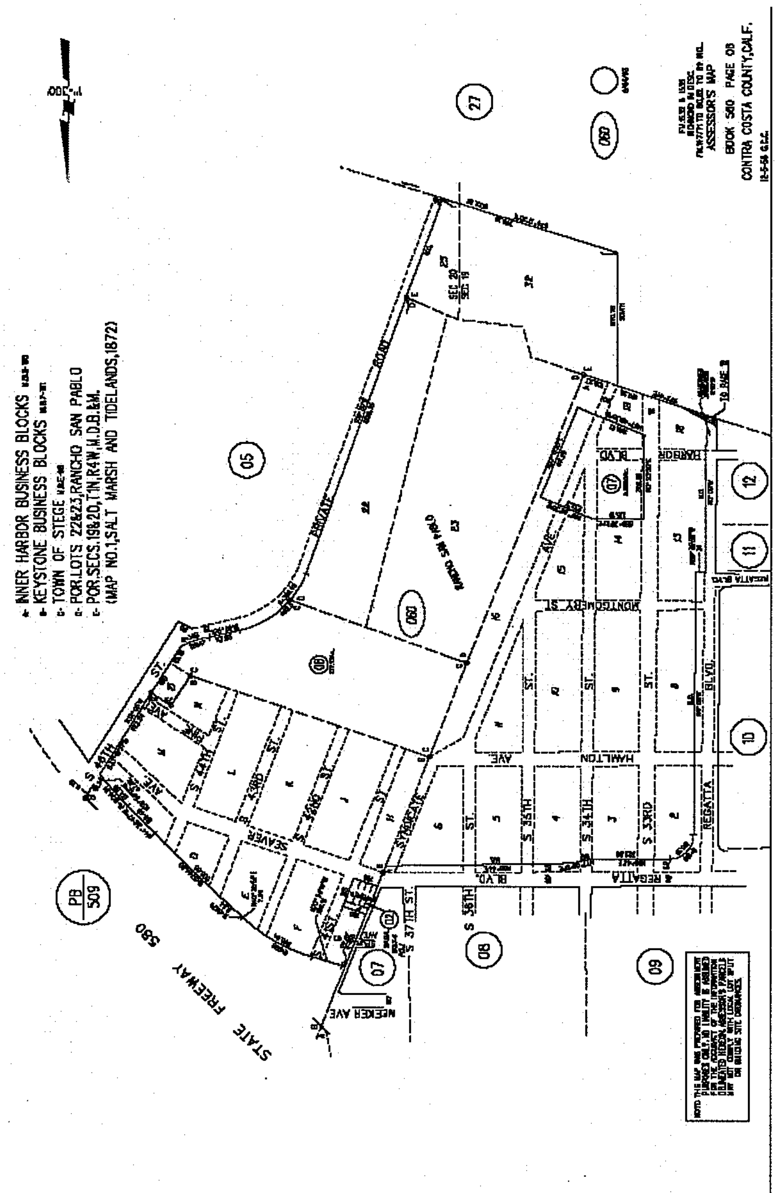


Exhibit A-2
Site Location

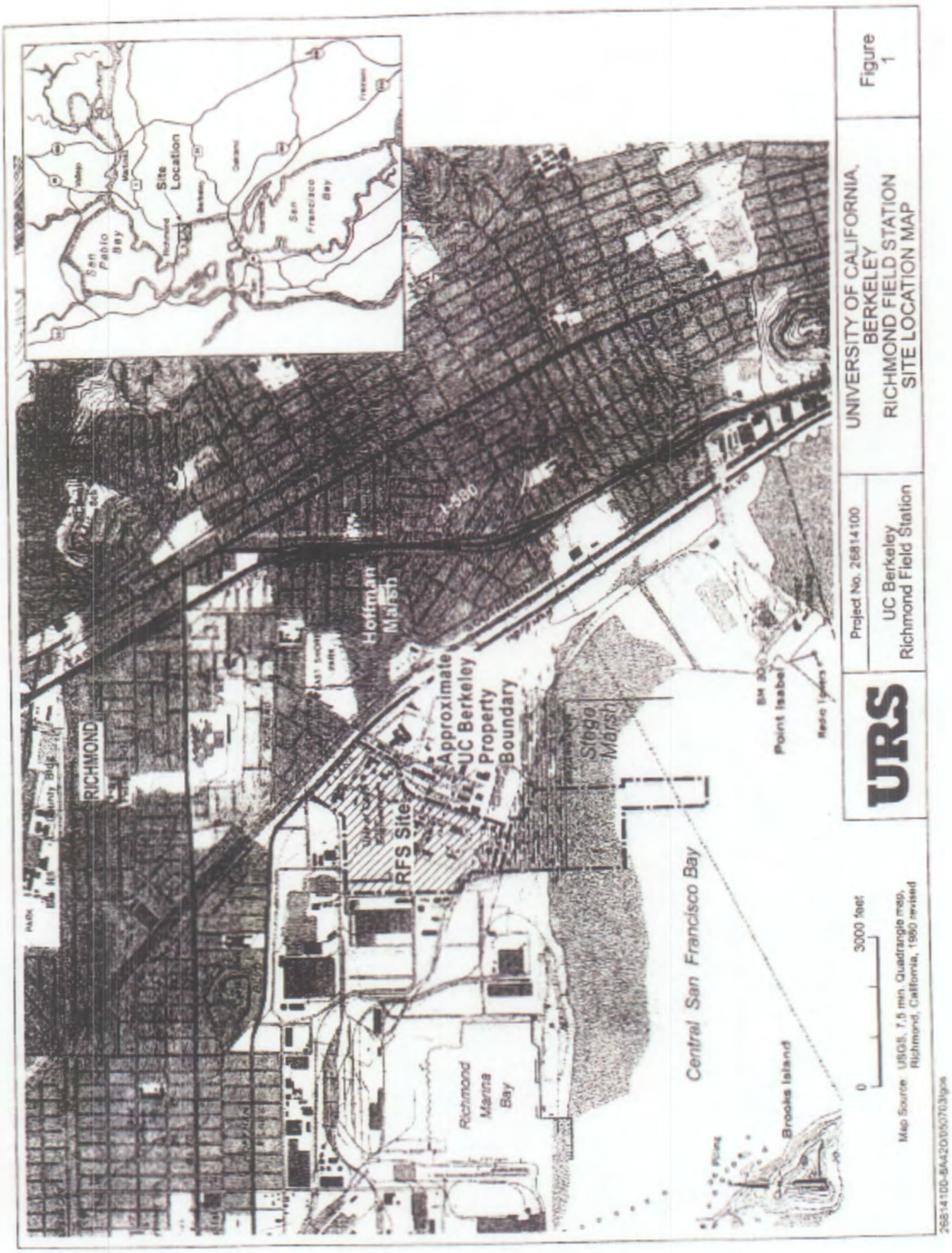
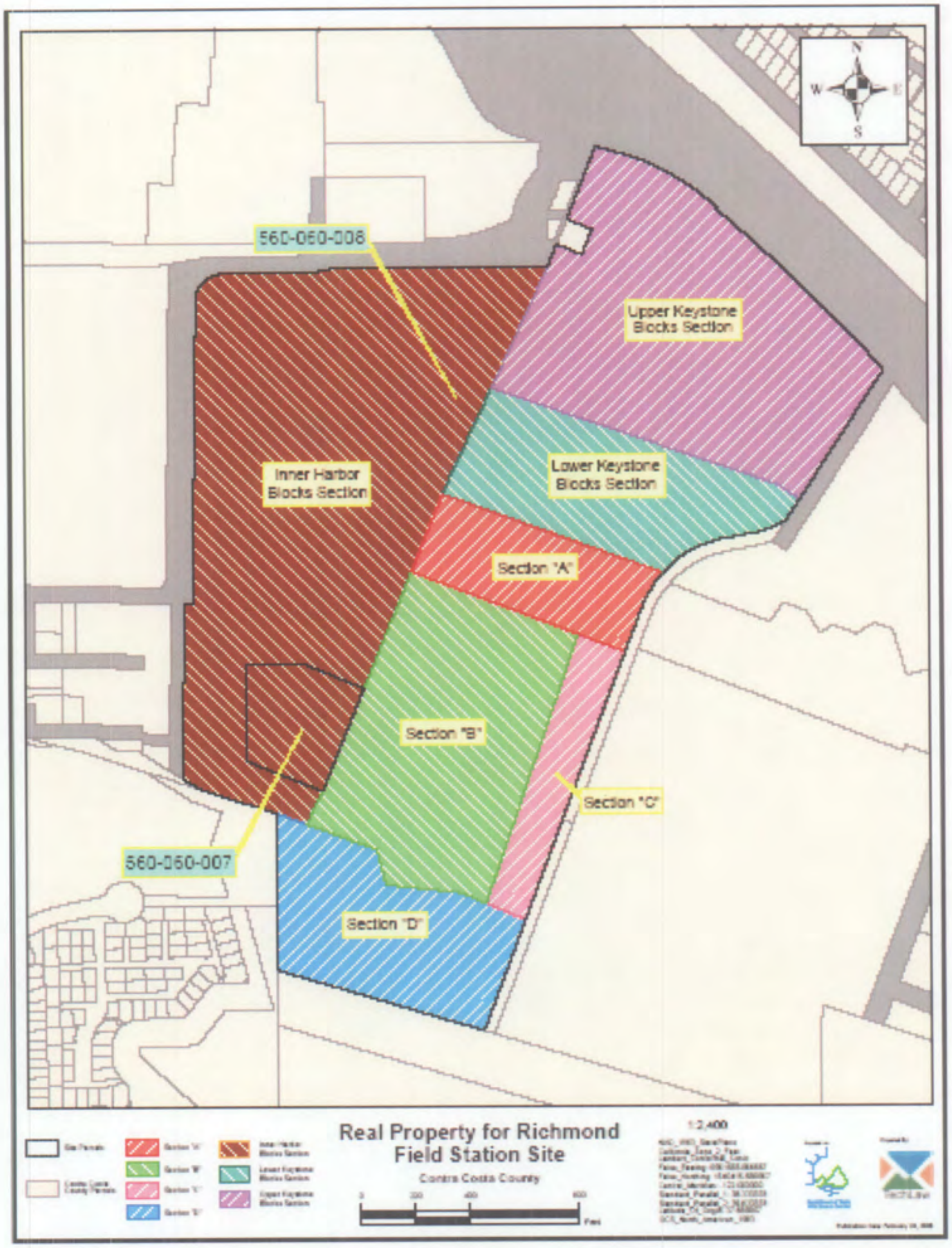


Exhibit A-3
Site History Map



Final RFS Site Investigation and Remediation Order
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EXHIBIT B
SUBSTANCES DETECTED
UC Richmond Field Station Site

Table 1 lists hazardous substances detected in Site soil that require remediation.

Table 1

Substances Detected in Soil	Range of Concentrations in mg/kg.	Hazardous Waste Criteria in mg/kg
Arsenic	Up to 540	500
Cadmium	Up to 437	100
Copper	Up to 3,300	2,500
Lead	Up to 4,000	1,000
Mercury	Up to 260	20
PCBs	Up to 65	50

Table 2 lists hazardous substances detected in Site groundwater above Basin Plan requirements

Table 2

Substances Detected in Groundwater	Range of concentrations in ug/L	Maximum Contaminant Levels
Arsenic	32	10
Beryllium	6.6	4
Cadmium	6.5	5
Copper	4,100	1,300
Mercury	5.9	2
Nickel	780	100
Carbon Tetrachloride	53	5
Cis-1,2-Dichloroethene	10	5
Tetrachloroethene	14	5
Trichloroethene	120	5
Vinyl chloride	3.4	0.5
PCBs	1.3	0.5

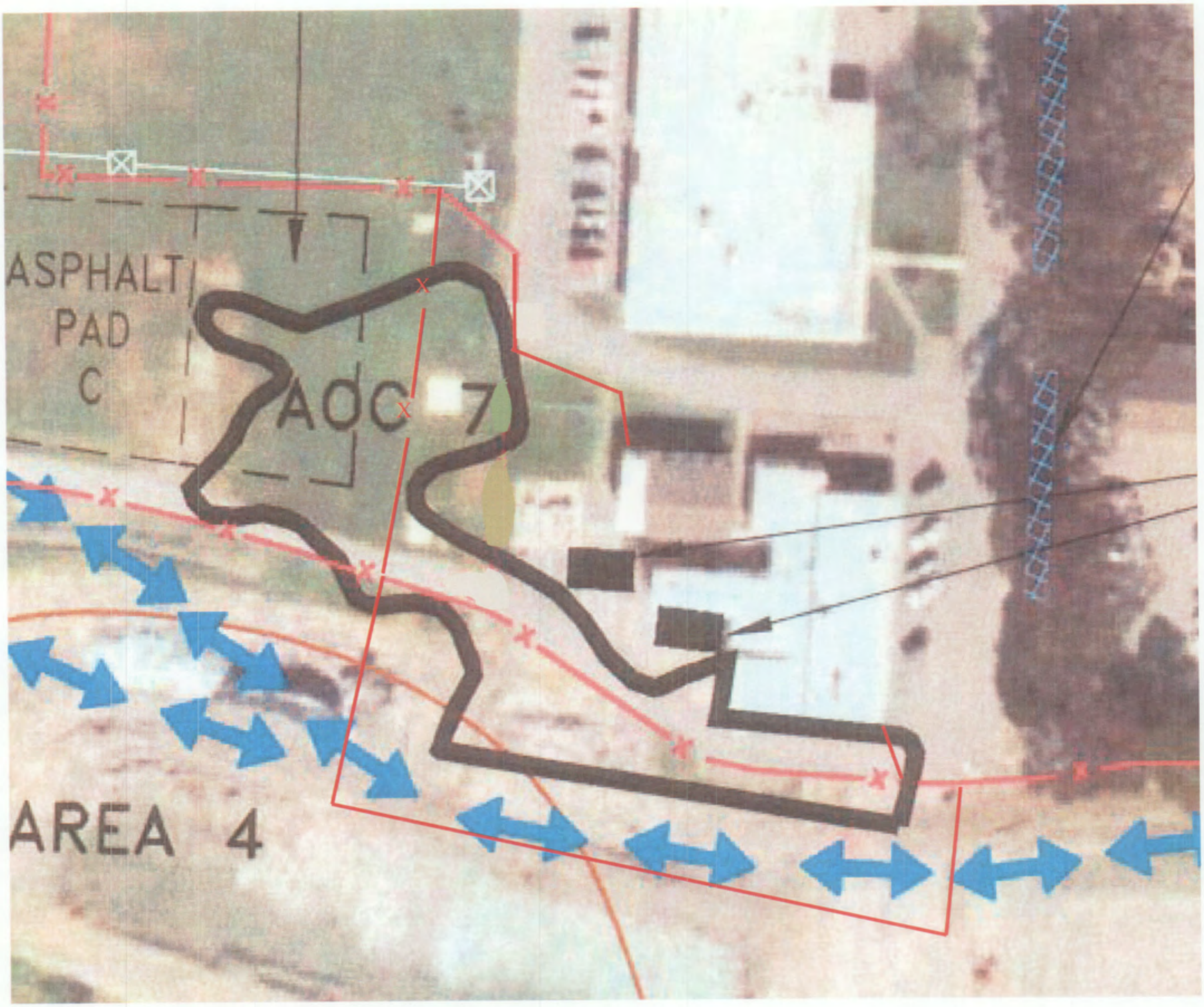
EXHIBIT C
STANDARD FENCE SPECIFICATIONS

The fence shall be a standard chain link fence with a height of six feet. The fence shall be similar in construction and material to the main line fences located on the site. In general, replacement fencing shall consist of a minimum of 11-gauge, woven into an approximately two-inch mesh. The fencing should have a knuckled finish on the top and bottom edges. The posts are to be made of galvanized metal and shall be placed no more than fifteen feet apart. Any access gates are to be of the same material as the fence. Gates shall be secured with a padlock unless alternative measures approved by DTSC are in place to prevent access to unauthorized personnel.

The 4-foot no-climb fence shall be made of 10 gauge galvanized wrapped wire. An 8-guage top wire shall be added in high use areas to further stiffen the fence. The fence shall be installed using pressure treated "peeler core" posts or steel T-Bar posts if wood is not suitable. T-Bar posts shall be driven to at least 2 feet below ground surface, while "peeler core" posts shall be driven to four feet. Corner and end posts shall be Schedule 40 steel pipe with 3-inch nominal diameter. Brace posts shall be Schedule 40 steel pipe with 1.315 –inch outside diameter. Fabric ties shall be 11-guage galvanized steel wire. When necessary, concrete footings 12 inches in diameter and 2 feet deep shall be installed at the fence posts.

Exhibit D-1
Area to Be Fenced

Note: existing fencing designated by "x"s. Temporary fencing is shown as a solid red line (approximate locations).



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15Sept2006

Exhibit D-2
Area to be Fenced

EXHIBIT E
SIGN SPECIFICATIONS

Signs shall be posted with lettering legible from a distance of at least 25 feet which states, "Caution: Hazardous Substance Area, Unauthorized Persons Keep Out", in English. The signs shall include the name of the Department and the telephone number 510-540-2122. The Department also recommends that the Respondents attach "do not enter" international symbol signs at appropriate intervals to the fence to prevent injury to individuals who cannot read the sign. Signs along the 4-foot no climb fence shall meet East Bay Regional Park District requirements and shall state, "Resource Protection Area, Keep Out". These signs shall be placed at a minimum of every 250 feet.

The signs shall be visible from the area surrounding the contaminated area and posted at each route of entry into the Site, including those routes likely to be used by unauthorized persons, access roads leading to the Site, and facing rivers, creeks, lakes or other waterways where appropriate.

The fence and signs shall be continuously maintained to minimize the risk of unauthorized entry. The signs shall be of a material which resists the elements and shall be replaced when necessary.

Exhibit F
Surface-Water and Sediment Monitoring Program

A semi-annual monitoring program will be conducted for a minimum of five years, depending on the results of the five-year review.

The surface-water and sediment samples from the eastern portion of West Stege Marsh, as well as the Meeker Slough sample from below the EBRPD Bay Trail bridge (locations SED 101 through SED 103 and SW101 through SW104) will be collected during an outgoing tide.

The stormwater samples from the storm drain outfalls, concrete ditch, and upper Meeker Slough (locations SW105 through SW108) will be collected during the first fall rainfall event producing surface runoff (i.e., the "first flush"). An additional sample will be collected from the outfalls in the spring (late in the rainy season in March or April).

Sample collection and analysis will follow the methods identified in the *Final Report, Groundwater, Surface Water, and Sediment Monitoring Plan, Subunit 2, Meade Street Operable Unit, University of California, Berkeley Richmond Field Station Richmond, California (Tasks 2b,3b,4a, and 5a of RWQCB Order No. 01-102), Blasland, Bouck & Lee, Inc., December 3, 2004.*

EXHIBIT G

PREVIOUS SITE DOCUMENTATION

1. University of California, Berkeley Richmond Field Station, Field Sampling and Analysis Plan and Tiered Risk Evaluation, URS Corp., December 10, 1999.
Sampling plan to identify potential sources, delineate the extent of COPCs, and perform a risk evaluation based on the results of the sampling program.

2. Conceptual Remediation and Risk Management Plan, Upland Portion of the Zeneca Inc. Richmond Facility. Richmond, California, LFR. November 15, 2000.
With respect to this Site, the plan describes the remedial measures that will be implemented to neutralize excavated cinders, installation of a biologically active permeable barrier (BAPB), and installation of a temporary cap to prevent direct exposure to affected soils placed on the former Zeneca site.

3. Treatability Study Report, Zeneca Inc. Richmond Facility, Richmond, California, LFR, December 8, 2000.
This report discusses the results of bench-scale experiments for (1) neutralizing the acid-generating cinders and the acid-affected soil and groundwater, and (2) ability of a Biologically Active Permeable Barrier (BAPB) to immobilize and reduce concentrations of dissolved inorganic contaminants.

4. Field Sampling and Analyses Results, University of California, Berkeley Richmond Field Station/Stege Marsh, URS Corp., December 2000.
Report discusses the results of the field sampling investigation and results of the risk screening evaluation. Includes identification of potential onsite and offsite sources of COPCs.

5. Conceptual Remediation and Risk Management Plan for Upland Portion of Subunit 2A, Meade Street Operable Unit, Richmond California, LFR December 17, 2001.
The Conceptual Remedial Plan includes the following components: removal of cinders from Subunit 2A (UC Richmond Field Station); treatment of those cinders on Subunit 1 (Former Zeneca site) and subsequent placement and capping of the treated cinders in a designated area on Subunit 1; extension of the biologically active permeable barrier onto Subunit 2A; preparation of a soil management plan; and preparation of a health and safety plan. The soil management plan would be developed to monitor the long-term effectiveness of the proposed remedial plan and to ensure that potential future risks at the former Zeneca site are managed appropriately.

6. Biological Assessment of Remediation. Meade Street Operable Unit, Richmond California LFR. December 20, 2001
The Biologic Assessment (BA) was prepared to facilitate review of potential impacts on threatened or endangered species (California red-legged frog, California clapper rail and salt marsh harvest mouse) pursuant to Section 7 of the Endangered Species Act, as amended, from the remediation of the Former Zeneca site and the UC Richmond Field Station Site. The BA was requested by the US Army Corps of Engineers (ACOE) pursuant to 33 CFR Section 325.2(a). Following completion of the BA, U.S. Fish and Wildlife initiated a Section 7 consultation with ACOE. The BA states that the remediation project would not cause any direct affects to listed species, but has the potential for non-lethal direct affects to the California clapper rail during remedy implementation. The BA also proposed measures to avoid or minimize those effects.

7. Remedial Design Details, Upland Remediation, Meade Street Operable Unit LFR, January 31, 2002.
Remedial design details for the former Zeneca Site (Subunit 1) and portions of the UC Richmond Field Station and East Bay Regional Park District properties (Subunit 2A). Design details relevant to this Site includes performance-based design drawings and technical specifications for the removal of cinders from Subunit 2A, treatment of those cinders on Subunit 1, and subsequent placement and capping of the treated cinders in designated areas on Subunit 1. Also includes the extension of the BAPB to be installed on Subunit 1 west onto Subunit 2A, and replacement of the sanitary and storm drain system.

8. Biologically Active Permeable Barrier (BAPB) Design and Treatability Study Report, Meade Street Operable Unit, Richmond, California, LFR September 26, 2002.
This report documents the final results of the biologically active permeable barrier (BAPB) tests which evaluated biologically mediated reduction of sulfate and dissolved metal removal in longer-term BAPB experiments (224 days). The report also contains BAPB design considerations based upon the treatability studies conducted.

9. Implementation Report for Upland Remediation, Subunit 1 and Subunit 2A, Meade Street Operable Unit, Richmond, California. LFR, October 3, 2003)
With respect to the Site, this report documents excavation of cinders and sediments from Subunit 2A; treatment of cinders with crushed limestone; excavation of a mixture of alum waste and cinders and conditioning with cement kiln dust; conditioning of West Stege Marsh cinder and/or mercury-affected sediments with cement; excavation and treatment of mercury-affected cinders

with powdered activated carbon and limestone; backfilling of certain excavated areas; placement of alum waste material, marsh sediments not contaminated with cinders but that did contain metals, and mercury-affected cinders onto Subunit 1. Installation of the biologically active permeable barrier was also completed on the upland portion of Subunit 2A.

10. Human Health and Ecological Tiered Risk Evaluation, University of California, Berkeley, Richmond Field Station/Stege Marsh, URS Corp., November 2001. The report presents the findings of a multi-tiered risk assessment that was conducted to evaluate the potential risks to human health and the environment posed by chemicals of potential concern. Also includes the development of site-specific target levels (SSTLs) for soil and groundwater.

11. Results of Additional Soil and Groundwater Investigations and Groundwater Monitoring Plan, Upland Portion of Subunit 2A, Richmond Field Station, Richmond, California (URS Corp. November 2001)
This report discusses for the Upland Portion of Subunit 2A, the field activities involving the collection of soil, sediment and groundwater samples; results of sampling activities; and conclusions and recommendations for additional characterization. The report also includes a ground water monitoring plan for the upland area of Subunit 2A.

12. Phase 1 Remedial Design Details – Addendum Subunit 2A Meade Street Operable unit Richmond Field Station, Richmond, California (Tasks 2D and 3D, RWQCB Order No. 01-102), URS Corp., August 16, 2002. Describes the results of additional investigations conducted within Subunit 2A, proposes remedial action objectives and excavation, treatment and disposal plan for cinders and sediment for Subunit 2A, and installation of a slurry wall along a portion of the boundary between Subunit 1 and 2.

13. Phase 1 Remedial Design Details – Addendum 2 Mercury Treatability Study Subunit 2A Meade Street Operable Unit Richmond Field Station, Richmond, California (Tasks 2D and 3D), URS Corp., November 6, 2002.
Describes supplemental information on the results of a treatability study performed for sediment and cinders containing elevated concentrations of mercury.

14. Conceptual Remedial Action Plan, Marsh Portion of Subunit 2B, Richmond Field Station, Richmond, California (Tasks 5B, RWQCB Order No. 01-102), URS Corp., December 17, 2002
Presents a conceptual remedial action plan for the cleanup of the portion of Western Stege Marsh located in Subunit 2B, Meade Street Operable Unit, and

includes the results of environmental field investigations, compilation of sampling data collected to date, and identification of areas requiring remedial action.

15. Remedial Action Plan, Phase 2 Subunits 2A and 2B, Marsh, Meade Street Operable Unit, University of California Berkeley, Richmond Field Station, Richmond, California (Task 5C, RWQCB Order No. 01-102), URS Corp, April 15, 2003.
Contains the remedial design details for the 2003 cleanup activities for the portion of Subunit 2A that was not completed as part of the Phase I work conducted in 2002, and portions of Subunit 2B.

16. Richmond Field Station Remediation Project Initial Study, California Environmental Quality Act, URS Corp., May 28, 2003
Notice of Intent to adopt a Mitigated Negative Declaration and Initial Study Checklist. The proposed project is to remediate known contaminated soil and sediments at the Richmond Field Station property and Western Stege Marsh.

17. Remedial Action Plan – Phase 3 Upland Portion of Subunit 2B Meade Street Operable Unit, University of California Berkeley, Richmond Field Station, Richmond, California (Task 4B and 4C, RWQCB Order No. 01-102), BBL, July 13, 2004.
This report describes the Phase 3 remedial activities to be conducted in 2004. The areas include excavation of six upland areas, and additional excavation and grading in the Subunit 2 portion of West Stege Marsh.

18. Final Implementation Report, Phase 1 – Subunit 2A, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station, Richmond (Tasks 2E and 3E, RWQCB Order No. 01-102), URS Corporation, September 4, 2003.
Describes remedial action conducted in 2002. Areas include Area 1, eastern portion of Area 2 and Area 3.

19. Feral Animal Management Program, BBL, January 2004.
This plan details a program to address potential impacts of predation on the California clapper rail that may occur due to remediation and restoration of wetlands areas at the Site. The program is required as a condition of the Army Corps of Engineers Nation Wide Permit 38.

20. Invasive/Exotic Vegetation Management Plan, BBL, January 2004.
This plan presents an invasive/exotic vegetation management program that is required as a condition of the Army Corps of Engineers Nation Wide Permit 38.

21. Western Stege Marsh Restoration Monitoring Plan, BBL, August 2004.

The Western Stege Marsh Restoration Project (WSMRP) site consists of areas remediated during Phases 1 and 2 of the RFS remediation. The plan contains a monitoring plan to document post-remediation conditions.

22. Final Implementation Report Phase 2 – Subunit 2A & 2B, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station, Richmond (Tasks 2E, 3E, and 5D, RWQCB Order No. 01-102), URS Corp., December 3, 2004.
Describes remedial activities conducted in Area 4 and sanitary sewer line, miscellaneous Upland soil with cinders, western portions of area 2 (subunit 2A Marsh), area M3 of Subunit 2B Marsh located adjacent to Area 2, and area M1a of subunit 2B Marsh (PCB impacted area located at western storm drain outfall).

23. Draft Technical Report, Conceptual Remedial Action Plan – Addendum Marsh Portion of Subunit 2B, Richmond Field Station, University of California Berkeley, Richmond, California, BBL, June 3, 2005.
This report is an addendum to the Conceptual Remedial Action Plan, Marsh portion of Subunit 2B, Richmond Field Station, Richmond, California, URS 2002 and presents a conceptual approach to developing the Remedial Action Plan for remediation activities proposed in the western portion of Stege Marsh.

ATTACHMENT B
ADMINISTRATIVE RECORD LIST

Administrative Record List

The following is a non-exclusive list of records, documents, and other communications relied upon in the development of the Richmond Bay Campus Removal Action Workplan. The list is divided into the following sections: (1) statues, regulations, guidance documents, and regulatory directives; (2) reports and work plans; (3) correspondence including letters, notifications, and interviews; and (4) supporting references. The documents are listed in chronological order within each section.

Statutes, Regulations, Guidance, and Regulatory Directives:

Date: 1975
Type: Guidance
Title: Polychlorinated Biphenyls (PCBs), NIOSH Current Intelligence Bulletin 7.
Author: Lloyd, R.J.W, R.M. Moore, B.S. Woolf, and H.P. Stein.

Date: March 17, 1982
Type: Regulation
Title: BAAQMD Rules and Regulations, Regulation 11, Hazardous Pollutants Rule 1, Lead.
Author: BAAQMD

Date: October 1988
Type: Guidance
Title: Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA
Author: U. S. EPA

Date: September 1986
Type: Statute
Title: The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as Amended by the Superfund Amendments and Reauthorization Act of 1986
Author: U.S. Congress

Date: 1989
Type: Guidance
Title: Transport and Fate of Contaminants in the Subsurface. Center for Environmental Research Information, Cincinnati, Ohio.
Author: U. S. EPA

Date: December 1989
Type: Guidance
Title: Risk Assessment Guidance for Superfund (RAGS). Volume I, Human Health Evaluation Manual (Part A), Interim Final. Office of Emergency and Remedial Response (OERR). Washington, DC. EPA/540/1-89/002.
Author: U.S. EPA

Date: December 1989
Type: Regulation
Title: Title 14, California Code of Regulations, Chapter 3, Guidelines for Implementation of the California Environmental Quality Act
Author: State of California

Date: March 8, 1990
Type: Regulation
Title: 40 Code of Federal Regulations Part 300, National Oil and Hazardous Substances Pollution Contingency Plan
Author: U.S. Government

Date: December 1990
Type: Regulation
Title: BAAQMD Rules and Regulations, Regulation 6
Author: BAAQMD

Date: 1990
Type: Guidance
Title: Region 9 Laboratory Documentation Requirements for Data Validation. Document Control No. 9QA-07-90.
Author: U.S. EPA, Region 9

Date: March 1991
Type: Guidance
Title: Risk Assessment Guidance for Superfund: Vol. I- Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors, Interim Final, OSWER Directive 9285.6-03
Author: U.S. EPA, Office of Solid Waste and Emergency Response

Date: December 1991
Type: Guidance
Title: Risk Assessment Guidance for Superfund: Volume 1- Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals) Interim, Publication 9285.7-0lB
Author: U.S. EPA, Office of Solid Waste and Emergency Response

Date: June 1992
Type: Statute
Title: Porter-Cologne Water Quality Control Act
Author: State Water Resources Control Board

Date: March 1993
Type: Guidance
Title: California Storm Water Best Management Practice Handbooks
Author: Storm Water Quality Task Force

Date: July 1993
Type: Regulations
Title: 40 Code of Federal Regulations, Parts 300 to 399, National Oil and Hazardous Substances Pollution Contingency Plan
Author: U. S. Government

Date: 1994
Type: Guidance
Title: Preliminary Endangerment Assessment Guidance Manual (A Guidance Manual for Evaluating Hazardous Substance Release Sites)
Author: DTSC

Date: 1994
Type: Guidance
Title: Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. EPA540/R-94/013
Author: U.S. EPA, Office of Emergency and Remedial Response

Date: 1994
Type: Guidance
Title: Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA 540/R-94/012.
Author: U.S. EPA, Office of Emergency and Remedial Response

Date: 1996
Type: Guidance
Title: Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities
Author: DTSC

Date: 1996
Type: Guidance
Title: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. SW-846, Third Edition
Author: U.S. EPA, Office of Solid Waste and Emergency Response

Date: August 1997
Type: Guidance
Title: Exposure Factors Handbook, EP A/600/P-97 /002Fa
Author: U.S. EPA

Date: July 1998
Type: Guidance
Title: Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons." Office of Research and Development. Washington, DC. EPA/600/R-93/089.
Author: U.S. EPA

Date: April 1998
Type: Guidance
Title: Ambient Concentrations of Toxic Chemicals in Sediments." Prepared by T. Gandesbery and F. Hetzel.
Author: San Francisco Bay Regional Water Quality Control Board (RWQCB)

Date: September 23, 1998
Type: Guidance Memorandum
Title: Removal Action Workplans (RAWs)
Author: DTSC

Date: 1998
Type: Guidance
Title: EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, External Review Draft Final, EPA QA/R-5.
Author: U.S. EPA

Date: October 1998
Type: Guidance
Title: Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA
Author: U.S. EPA

Date: June 1999 (Second Printing)
Type: Guidance
Title: Preliminary Endangerment Assessment Guidance Manual
Author: DTSC

Date: May 2000
Type: Guidance
Title: Technical Support Document for the Determination of Acute Reference Exposure Levels for Airborne Toxicants
Author: Cal/EPA OEHHA

Date: May 2000
Type: Guidance
Title: Draft Staff Report – Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines
Author: RWQCB

Date: July 2000
Type: Guidance
Title: A Guide to Developing and Documenting Cost Estimates During the Feasibility Study, EPA 504-R-00-002
Author: U.S. EPA, Office of Solid Waste and Emergency Response.

Date: July 1, 2001
Type: Regulation
Title: 40 Code of Federal Regulation Part 761 Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce and Use Prohibitions
Author: U.S. Government

Date: September 19, 2001
Type: Order
Title: Order 01-102, Site Cleanup Requirements for University of California and Zeneca, Inc. Meade Street Operable Unit, Subunit 2.
Author: RWQCB

Date: October 2001
Type: Guidance
Title: DTSC Public Participation Manual, Chapter 3
Author: DTSC

Date: October 2001
Type: Guidance
Title: Information Advisory- Clean Imported Fill Material
Author: DTSC

Date: December 2001
Type: Guidance
Title: Transportation Plan- Preparation Guidance for Site Remediation, Interim Final
Author: DTSC

Date: December 2002
Type: Guidance
Title: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4024
Author: U.S. EPA

Date: December 2002
Type: Guidance
Title: Guidance for Quality Assurance Project Plans. Document Number EPA QA/G-5.
Author: U.S. EPA

Date: December 5, 2003
Type: Regulatory Directive
Title: Human Health Toxicity Values in Superfund Risk Assessments. Memorandum from Michael B. Cook, Director, to Superfund National Policy Managers, Regions 1-10. Office of Solid Waste and Emergency Response Directive 9285.7-53.
Author: U.S. EPA

Date: January 2004
Type: Guidance
Title: Guidance for Monitoring at Hazardous Waste Sites: Framework for Monitoring Plan and Development and Implementation." Office of Solid Waste and Emergency Response Directive 9355.4-28.
Author: U.S. EPA

Date: July 2004
Type: Guidance
Title: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)
Author: U.S. EPA

Date: October 2004
Type: Guidance
Title: Region 9 Preliminary Remediation Goal Table.
Author: U.S. EPA

Date: 2004
Type: Guidance
Title: U.S. EPA's Johnson and Ettinger Model Updated by the Human and Ecological Risk Division of the California Environmental Protection Agency
Author: Cal-EPA

Date: January 1, 2005
Type: Statute
Title: California Public Resources Code, Division 13
Author: State of California

Date: January 2005
Guidance
Title: Chemical Specific Toxicity Factors, Risk Assessment Information System
Author: Department of Energy, Office of Environmental Management and the Oak Ridge Operations Office

Date: January 2005
Type: Guidance
Title: Preliminary Remediation Goals Table, Region 9
Author: U.S. EPA

Date: January 2005
Type: Guidance
Title: Use of California Human Health Screening Levels (CHHSLs) in Evaluation of Contaminated Properties
Author: Cal-EPA

Date: February 2005
Type: Guidance
Title: Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels
Author: Cal/EPA OEHHA

Date: January 2005
Type: Guidance
Title: Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil
Author: Cal/EPA Office of Environmental Health Hazard Assessment (Cal/EPA OEHHA), DTSC

Date: May 2005
Type: Guidance
Title: Technical Support Document for Describing Available Cancer Potency Factors
Author: Cal/EPA OEHHA

Date: October 2005
Type: Guidance
Title: Human Health Risk Assessment (HHRA) Note Number I
Author: DTSC

Date: November 2005
Type: Guidance
Title: Polychlorinated Biphenyl (PCB) Site Revitalization Guidance Under the Toxic Substances Control Act.
Author: U.S. EPA

Date: February 2006
Type: Guidance
Title: Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA/240/B-06/001.
Author: U.S. EPA

Date: June 30, 2006
Type: Regulation
Title: Title 4, Health and Safety, Chapter 414-4.809, Wells- Abandoned
Author: Contra Costa County

Date: July 11, 2006
Type: Regulation
Title: Title 14, California Code of Regulations, Chapter 3, Guidelines for Implementation of the California Environmental Quality Act
Author: State of California

Date: August 1, 2006
Type: Guidance
Title: Mercury in San Francisco Bay Proposed Basin Plan Amendment and Staff Report for Revised Total Maximum Daily Load (TMDL) and Proposed Mercury Water Quality Objectives
Author: RWQCB

Date: 2006
Type: Regulation
Title: California Code of Regulations, Title 8, Division I, Chapter 4, Subchapter 7, General Industry Safety Orders
Author: State of California

Date: 2006
Type: Regulations
Title: California Code of Regulations, Title 22, Division 4 and 4.5, Volume 29A
Author: State of California

Date: 2006
Type: Statutes
Title: California Health and Safety Code, Division 20, Chapters 6.5 and 6.8
Author: State of California

Date: 2006
Type: Guidance
Title: Integrated Risk Information System
Author: U.S. EPA

Date: 2006
Type: Order
Title: Site Investigation and Remediation Order, Health and Safety Code Sections 25355.5(a)(1)(B), 25358.3(a), 58009 and 58010. Docket No. I/SE-RAO 06/07-004. In the Matter of University of California Richmond Field Station, 1301 South 46th Street, Richmond, CA 94804.
Author: DTSC

Date: 2006
Type: Order
Title: Site Investigation and Remediation Order, Health and Safety Code Sections 25355.5(a)(1)(B), 25358.3(a), 58009 and 58010. Docket No. I/SE-RAO 06/07-005. In the Matter of Zeneca Site, aka: Stauffer Chemical Site, 1390 South 49th Street, Richmond, CA.
Author: DTSC

Date: August 1, 2006
Type: Guidance
Title: Mercury in San Francisco Bay Proposed Basin Plan Amendment and Staff Report for Revised Total Maximum Daily Load (TMDL) and Proposed Mercury Water Quality Objectives.
Author: RWQCB

Date: November 2007
Type: Guidance
Title: Screening for Environmental Concerns at Site with Contaminated Soil and Groundwater, Interim Final
Author: San Francisco Bay Regional Water Quality Control Board

Date: 2008
Type: Guidance
Title: Maximum Contaminant Levels and Regulatory Dates for Drinking Water U.S EPA vs. California, November 2008.
Author: California Department of Public Health (CDPH)

Date: May 2008
Type: Guidance
Title: Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater.
Author: RWQCB

Date: 2009
Type: Guidance
Title: HERD HHRA Note 2 (interim): Remedial Goals for Dioxins and Dioxin-like Compounds for Consideration at California Hazardous Waste Sites.
Author: DTSC

Date: 2009
Type: Regulatory Directive
Title: National Primary Drinking Water Regulations - List of Contaminants and their MCLs.
Author: U.S. EPA

Date: July 1, 2009
Type: Guidance
Title: Use of the Northern and Southern California Polynuclear Aromatic Hydrocarbon (PAH) Studies in the Manufactured Gas Plant Site Cleanup Process.
Author: DTSC

Date: September 2009
Type: Guidance
Title: Revised California Human Health Screening Levels for Lead. Integrated Risk Assessment Branch, Cal/EPA OEHHA, Cal/EPA.
Author: Cal/EPA OEHHA

Date: 2010
Type: Regulation
Title: Cal. Health and Safety Code §§25368-25368.8, Article 6.3, Technology Demonstration Program
Author: State of California

Date: May 2010
Type: Guidance
Title: ProUCL Version 4.1.00 Technical Guide (Draft). EPA/600/R-07/041. Prepared by A. Singh, N. Armbya, and A.K. Singh. Office of Research and Development. Washington, DC.
Author: U.S. EPA

Date: June 9, 2011
Type: Guidance
Title: Screening Level Human Health Risk Assessments. Office of Human and Ecological Risk (HERO). Human Health Risk Assessment (HHRA) Note Number 4.
Author: DTSC

Date: October 2011
Type: Guidance
Title: Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance)
Author: DTSC

Date: November 2012
Type: Guidance
Title: Regional Screening Levels for Chemical Contaminants at Superfund Sites.
Author: U.S. EPA

Date: May 21, 2013
Type: Guidance
Title: DTSC recommended methodology for use of U.S. EPA Regional Screening Levels (RSLs) in the Human Health Risk Assessment process at hazardous waste sites and permitted facilities. Office of Human and Ecological Risk (HERO). Human Health Risk Assessment (HHRA) Note Number 3.
Author: DTSC

Date: August 20, 2013
Type: Guidance
Title: Air Toxics Hot Spots Program Technical Support Document for the Derivation of Noncancer Reference Exposure Levels
Author: Cal/EPA OEHHA

Date: 2013
Type: Regulations
Title: 42 USC., Chapter 82, §6901-6991 [i], Solid Waste Disposal
Author: U.S. Congress

Date: 2013
Type: Regulations
Title: CCR tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100, TTLCs and STLCs for Classification of Water
Author: State of California

Date: 2013
Type: Regulations
Title: CCR tit. 22, §§ 66261.3(a)(2)(C)or (a)(2)(F),66261.22(a)(3) and (a)(4), 66261.24(a)(2) – (a)(8), and 66261.101, Definition of Non-RCRA, State Regulated Hazardous Waste
Author: State of California

Date: 2013
Type: Regulations
Title: CCR tit. 27, §§ 20210, 20220 and 20230, Definition of designated, Nonhazardous Waste and Inert Waste
Author: State of California

Date: 2013
Type: Regulations
Title: 15 U.S.C §§ 2602, 40 CFR 761.3, 40 CFR §761.61(a)(4)(i), Toxic Substance Control Act
Author: U.S. Congress

Date: 2013
Type: Regulations
Title: Cal. Water Code § 13240, Water Quality Control Plan Chapters 2 and 3
Author: RWQCB, San Francisco Bay Region

Date: 2013
Type: Regulations
Title: 40 CFR §131.38(b)(1), (2), California Toxics Rule
Author: State of California

Date: 2013
Type: Resolution
Title: Cal. Water Code § 13140, 13240, 13245
Author: SWRCB

Date: 2013
Type: Regulations
Title: 16 USC 1531 et seq.; 50 CFR Part 200; 50 CFR Part 402, Endangered Species Act
Author: U.S. Congress

Date: 2013
Type: Regulations
Title: FGC Div. 3, Chapter 1.5, Section 2050 et seq.; FGC Div. 4, §3005 (a); §3511; §3513, California Endangered Species Act
Author: California Department of Fish and Game

Date: 2013
Type: Regulations
Title: Cal. Fish and Game Code § 3511, Prohibits Take of Fully Protected Birds
Author: California Department of Fish and Game

Date: 2013
Type: Regulations
Title: 16 USC §46; 36 CFR §65, National Archaeological and Historic Preservation Act
Author: U.S. Congress

Date: 2013
Type: Regulations
Title: Cal. Civil Code § 1471, Land Use Restrictions
Author: State of California

Date: 2013
Type: Regulations
Title: CCR,tit. 22, §67391.1, Land Use Controls
Author: State of California

Date: 2013
Type: Regulations
Title: Cal. Health & Safety Code §25355.2, Financial Assurance Requirement
Author: State of California

Date: 2013
Type: Regulations
Title: CCR tit. 22, §§ 66262.10(a), and 66262.11, Hazardous Waste Determination
Author: State of California

Date: 2013
Type: Regulations
Title: CCR tit. 22, § 66264.13(a) and (b), Hazardous Waste Profiling
Author: State of California

Date: 2013
Type: Regulations
Title: CCR tit. 22 §66264.251, Waste Pile Design and Operation
Author: State of California

Date: 2013
Type: Regulations
Title: CCR tit. 22, § 66264.258(a) and (b), Waste Pile Closure
Author: State of California

Date: 2013
Type: Regulations
Title: Cal. Health & Safety Code §25123.3, Soil Stockpiling, Non-RCRA Hazardous Waste
Author: State of California

Date: 2013
Type: Regulations
Title: Cal. Health & Safety Code §25358.9 and §25356.1, Regulatory Oversight of Soil Excavation and Handling
Author: State of California

Date: 2013
Type: Regulations
Title: CCR Title 8 §5192 and 40 CFR §1910.120, Health and Safety of Construction Workers
Author: State of California

Date: 2013
Type: Regulations
Title: 40 CFR §761.65(c)(9), Toxic Substances Control Act
Author: U.S. Congress

Date: 2013
Type: Regulations
Title: BAAQMD Regulation 6-1-302, Air Emissions Requirements
Author: BAAQMD

Date: 2013
Type: Regulations
Title: 40 CFR §122.44(k)(2) and (4), Clean Water Act Stormwater Discharge
Author: U.S. Congress

Date: 2013
Type: Regulations
Title: CCR Title 11 §§15000-15387 et seq., California Environmental Quality Act
Author: State of California

Date: 2013
Type: Regulations
Title: 49 CFR §§171.2(f), 171.2 (g), 172.300, 172.301, 172.302, 172.303, 172.304, 172.312, 172.400 and 172.504, Generation, Transport, and Disposal
Author: U.S. Congress

Date: 2013
Type: Regulations
Title: Cal. Health and Safety Code §§25100-25166.5, 25179.1-.12 (land disposal restrictions ("LDRs")), §§25244-25244.24 (waste reduction and recycling); 22 CCR §§66260.10-66262.43, 66264.1-.172, 66265.16-.199; 66268.10-.44, .105-.113 (LDRs + treatment standards), Generation, Transport, and Disposal
Author: State of California

Date: 2013
Type: Regulations
Title: 42 U.S.C. §§ 300(f)-300(j) 40 CFR § 144.12, Safe Drinking Water Act Underground Injection Requirements
Author: U.S. Congress

Date: 2013
Type: Regulations
Title: CCR, tit. 22 §§ 66264.171, 66264.172,66264.173, 66264.174, 66264.175, 66264.178, Hazardous Waste Container Requirements
Author: State of California

Date: 2013
Type: Regulations
Title: CCR tit. 22, Chapter 14, Article 6, §§66264.90-66264.10, Water Quality Monitoring and Response Programs
Author: State of California

Date: 2014
Type: Guidance
Title: US EPA Region IX Regional Screening Levels for Industrial Air.
Author: U.S. EPA

Reports and Work Plans:

Date: September 8, 1983
Type: Report
Title: NPL Site Narrative for Liquid Gold Oil Corp, Richmond, California. Federal Register Notice.
Author: U.S. EPA

Date: 1987
Type: Report
Title: Hydrogeologic Assessment of the Engineering Geosciences Well Field at the Richmond Field Station, Contra Costa County, California.
Author: Pouch, Gregory W.

Date: August 1989
Type: Report
Title: Environmental Assessment of University of California Richmond Field Station. Richmond, California.
Author: Ensco Environmental Services, Inc (EES)

Date: April 6, 1990
Type: Report
Title: Environmental Assessment for the Proposed EPA Region 9 Laboratory at the University of California's Richmond Field Station.
Author: Jonas & Stokes Associates, Inc.

Date: May 21, 1990
Type: Report
Title: Draft Environmental Soil Sampling and Analysis Plan for Construction of EPA Laboratory at the University of California Richmond Field Station, Richmond, California.
Author: Jonas & Associates, Inc.

Date: May 21, 1990
Type: Report
Title: Removal Site Evaluation of Mercury in Soil and Groundwater at Former Mercury Fulminate Facility Richmond Field Station, Richmond, California.
Author: Jonas & Associates, Inc.

Date: February 22, 1991
Type: Report
Title: Preliminary Risk Assessment, University of California Richmond Field Station, Richmond, California.
Author: Jonas & Associates, Inc.

Date: 1993
Type: Report
Title: Supplemental Site Subsurface Investigation at Zeneca's Agricultural Chemical Facility, Richmond, California.
Author: Woodward-Clyde

Date: June 21, 1993
Type: Report
Title: EPA Superfund Record of Decision: Liquid Gold Oil Corp., EPA ID: CAT000646208, OU01, Richmond, California.
Author: U.S. EPA

Date: April 1998
Type: Report
Title: Ambient Concentrations of Toxic Chemicals in Sediments
Author: RWQCB

Date: December 10, 1999
Type: Report
Title: Final Field Sampling and Analysis Plan and Tiered Risk Evaluation, University of California, Berkeley, Richmond Field Station.
Author: URS Corporation (URS)

Date: December 2000
Type: Report
Title: Field Sampling and Analysis Results, University of California Berkeley, Richmond Field Station/Stege Marsh.
Author: URS

Date: November 21, 2001
Type: Report
Title: Human Health and Ecological Tiered Risk Evaluation, University of California, Berkeley, Richmond Field Station/Stege Marsh, Richmond, California.
Author: URS

Date: November 21, 2001
Type: Report
Title: Results of Additional Soil and Groundwater Investigations and Groundwater Monitoring Plan, Upland Portion of Subunit 2A, Richmond Field Station, Richmond, California (Tasks 2A and 2B, RWQCB Order No. 01-102).
Author: URS

Date: November 21, 2001
Type: Report
Title: Results of Additional Soil and Groundwater Investigations and Surface Water Monitoring Plan, Marsh Portion of Subunit 2A, Richmond Field Station, Richmond, California (Tasks 3A and 3B, RWQCB Order No. 01-102).
Author: URS

Date: February 28, 2002
Type: Work Plan
Title: Workplan for Additional Sediment Sampling and Surface Water Monitoring, Marsh Portion of Subunit 2B, Richmond Field Station, Richmond, California (Task 5A, RWQCB Order No. 01-102).
Author: URS

Date: February 28, 2002
Type: Work Plan
Title: Workplan for Additional Soil and Groundwater Investigation, Upland Portion of Subunit 2B, Richmond Field Station, Richmond, California (Task 4A, RWQCB Order No. 01-102).
Author: URS

Date: June 7, 2002
Type: Report
Title: Background Levels of Polycylic Aromatic Hydrocarbons in Northern California Surface Soil.
Author: Environ Corporation, Entrix, IRIS Environmental, and Env America

Date: August 16, 2002
Type: Report
Title: Remedial Design Details – Addendum, Subunit 2A, Meade Street Operable Unit, Richmond Field Station, Richmond, California (Tasks 2D and 3D, RWQCB Order No. 01-102).
Author: URS

Date: October 31, 2002
Type: Report
Title: Results of Additional Soil and Groundwater Investigations, Upland Portion of Subunit 2B, Richmond Field Station, Richmond, California (Task 4B, RWQCB Order No. 01-102).
Author: URS

Date: November 6, 2002
Type: Report
Title: Remedial Design Details – Addendum 2, Mercury Treatability Study Results, Subunit 2A, Operable Unit, Richmond Field Station, Richmond, California (Tasks 2D and 3D, RWQCB Order No. 01-102).
Author: URS

Date: December 17, 2002
Type: Report
Title: Conceptual Remedial Action Plan, Marsh Portion of Subunit 2B, Richmond Field Station, Richmond, California (Task 5B, RWQCB Order No. 01-102).
Author: URS

Date: April 15, 2003
Type: Report
Title: Remedial Action Plan, Phase 2 Subunits 2A and 2B Marsh, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station (Task 4C, RWQCB Order No. 01-102.
Author: URS

Date: May 28, 2003
Type: Report
Title: Richmond Field Station Remediation Project, Initial Study, California Environmental Quality Act.
Author: URS

Date: July 25, 2003
Type: Report
Title: Richmond Field Station Remediation Project, Biological Assessment Report at the University of California Berkeley's Richmond Field Station in California.
Author: BBL

Date: September 4, 2003
Type: Report
Title: Implementation Report, Phase 1 Subunit 2A, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station (Tasks 2E and 3E, RWQCB Order No. 01-102).
Author: URS

Date: January 2004
Type: Report
Title: Invasive/Exotic Vegetation Management Program, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Blasland, Bouck & Lee, Inc. (BBL)

Date: July 13, 2004
Type: Report
Title: Remedial Action Plan, Phase 3 Upland Portion of Subunit 2B, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station (Tasks 4B and 4C, RWQCB Order No. 01-102).
Author: URS

Date: August 2004
Type: Report
Title: Western Stege Marsh Restoration Project Monitoring Plan, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: BBL

Date: December 3, 2004
Type: Report
Title: Groundwater, Surface Water, and Sediment Monitoring Plan, Subunit 2, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: BBL

Date: December 3, 2004
Type: Report
Title: Implementation Report, Phase 2 Subunit 2A and 2B, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station (Tasks 2E, 3E, and 5D, RWQCB Order No. 01-102).
Author: URS

Date: May 12, 2005
Type: Report
Title: Current Conditions Report, Lot 1, 1200 South 47th Street, Campus Bay, Richmond, California.
Author: LFR, Inc. (LFR)

Date: June 3, 2005
Type: Report
Title: Draft Technical Report, Conceptual Remedial Action Plan - Addendum, Marsh Portion of Subunit 2B, Richmond Field Station, University of California Berkeley, Richmond, California.
Author: URS

Date: June 16, 2005
Type: Report
Title: Implementation Report, Phase 3 Upland Portion of Subunit 2B, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station (Task 4D, RWQCB Order No. 01-102).
Author: URS

Date: June 24, 2005
Type: Report
Title: Current Conditions Report, Lot 2, 1200 South 47th Street, Campus Bay, Richmond, California.
Author: LFR

Date: July 29, 2005
Type: Report
Title: Current Conditions Report, Lot 3, 1200 South 47th Street, Campus Bay, Richmond, California.
Author: LFR

Date: August 2005
Type: Report
Title: Western Stege Marsh Restoration Project Year 1 Monitoring Report, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: BBL

Date: August 2005
Type: Report
Title: Western Stege Marsh Restoration Project Year 1 Monitoring Report, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech, Inc. (Tetra Tech, formerly Tetra Tech EM Inc.)

Date: September 2005
Type: Report
Title: Second Five-Year Review Report, Liquid Gold Site, Richmond, California.
Author: Environmental Resource Management

Date: December 8, 2005
Type: Report
Title: Revised Technical Specifications for Well Destructions, University of California Berkeley, Richmond Field Station.
Author: Stellar Environmental Solutions (Stellar)

Date: 2006
Type: Report
Title: Provisional Joint Health Statement Summary, The Zeneca and UC Richmond Field Station Sites.
Author: Contra Costa County Health Services and California Department of Health Services

Date: March 8, 2006
Type: Report
Title: Well Closure Documentation Report, University of California Berkeley, Richmond Field Station.
Author: Stellar

Date: October 31, 2006
Type: Report
Title: Health and Safety Plan Addendum, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: November 2006
Type:
Title: Fact Sheet, DTSC Oversees Pilot Study at Bio-Rad Laboratories, Regatta Boulevard, Richmond, California.
Author: DTSC

Date: November 2, 2006
Type: Report
Title: Field Implementation Plan for Surface Water, Stormwater and Sediment Monitoring, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: December 18, 2006
Type: Report
Title: Surface Water, Sediment, and Stormwater Sampling Summary Report, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: 2007
Type: Report
Title: Envirostor Public Profile Report.
Author: DTSC

Date: February 2, 2007
Type: Report
Title: Draft Final Remedial Investigation Report Lot 3, Campus Bay 1200 South 47th Street, Richmond, California.
Author: LFR

Date: February 7, 2007
Type: Report
Title: Interim Soil Management Plan for the Upland and Transition Areas, University of California, Berkeley, Richmond Field Station.
Author: Tetra Tech

Date: May 16, 2007
Type: Report
Title: Pyrite Cinder-Containing Soil Management Procedures. Prepared by Greg Haet, Associate Director, University of California, Office of Environment, Health and Safety.
Author: UC Berkeley

Date: July 23, 2007
Type: Report
Title: Technical Memorandum: Background Concentrations of Arsenic in Soil at Campus Bay, Campus Bay Site, Richmond, California.
Author: Erler & Kalinowski, Inc. (EKI)

Date: August 10, 2007
Type: Report
Title: Botanical Survey Report.
Author: URS

Date: August 15, 2007
Type: Report
Title: Evaluation of Exposure to Contaminants at the University of California, Berkeley, Richmond Field Station, 1301 South 46th Street (Public Comment Draft).
Author: CDPH

Date: August 24, 2007
Type: Report
Title: Memorandum for a Time-Critical Removal Action at the Former Forest Products Laboratory Wood Treatment Laboratory, University of California Berkeley, Richmond Field Station.
Author: Tetra Tech

Date: September 2007
Type: Report
Title: 2-Page Summary, "Results of a Draft Public Health Evaluation about Contaminants at the UC Richmond Field Station."
Author: Contra Costa County Health Services Department

Date: September 20, 2007
Type: Report
Title: Soil Confirmation and Perimeter Air Monitoring Plan, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: University of California, Berkeley (UC Berkeley)

Date: January 8, 2008
Type: Report
Title: Year 2 Monitoring Report for the Western Stege Marsh Restoration Project. University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: March 14, 2008
Type: Report
Title: Implementation Summary Report for a Time-Critical Removal Action at the Forest Products Laboratory Wood Treatment Laboratory, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: April 30, 2008
Type: Report
Title: Revised Human Health Risk Assessment and Calculation of Site-Specific Goals for Lots 1, 2, and 3. Campus Bay Site, Richmond, California.
Author: EKI

Date: July 11, 2008
Type: Report
Title: Memorandum for a Time-Critical Removal Action at Two Campfire Locations in the Western Transition Area, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: August 22, 2008
Type: Report
Title: Indoor Air Monitoring Report, University of California, Berkeley, Richmond Field Station, Richmond California.
Author: Tetra Tech

Date: November 21, 2008
Type: Report
Title: Current Conditions Report, University of California, Berkeley, Richmond Field Station, Richmond California.
Author: Tetra Tech

Date: March 16, 2009
Type: Report
Title: Public Health Assessment Evaluation of Exposure to Contaminants from the Zeneca/Campus Bay Site, 1200 South 47th Street, Richmond, Contra Costa Country, California, EPA Facility ID: CAD009123456.
Author: Agency for Toxic Substances and Disease Registry (ATSDR)

Date: March 19, 2009
Type: Report
Title: Year 3 Monitoring Report for the Western Stege Marsh Restoration Project. University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: April 2009
Type: Report
Title: Public Participation Plan, Richmond Southeast Shoreline Area, Richmond, California." Prepared by Yvette LaDuke, Public Participation Specialist, DTSC.
Author: DTSC

Date: May 14, 2009
Type: Report
Title: Human Health Risk Evaluation for Marsh Volunteers, PCA 95060.
Author: DTSC

Date: May 26, 2009
Type: Report
Title: Final Implementation Summary Report for a Time-Critical Removal Action at Two Subareas in the Western Transition Area, University of California Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: June 22, 2009
Type: Work Plan
Title: Workplan for Evaluation of Pre-Construction Conditions in Soil, Meade By-Pass Roadway, Richmond, California.
Author: PES Environmental, Inc.

Date: August 12, 2009
Type: Report
Title: Year 4 Monitoring Report for the Western Stege Marsh Restoration Project.
Author: Tetra Tech

Date: November 2, 2009
Type: Report
Title: Results of Evaluation of Pre-Construction Conditions in Soil, Meade By-Pass Roadway, Richmond, California.
Author: PES Environmental, Inc.

Date: December 2009
Type: Report
Title: Western Stege Marsh Restoration Project: Vegetation Monitoring Report – 2009.
Author: May & Associates, Inc.

Date: December 23, 2009
Type: Report
Title: Technical Memorandum: Geotechnical Memorandum - Hydrogen Fuel Station Limited Geotechnical Investigation.
Author: Nichols Consulting Engineers, Chtd.

Date: March 17, 2010
Type: Report
Title: Final Release, Public Health Assessment Evaluation of Exposure to Contaminants at the University of California, Berkeley, Richmond Field Station, 1301 South 46th Street, Richmond, Contra Costa Country, California, EPA Facility ID: CAD980673628. Prepared by the California Department of Public Health. Published for public comment on July 28, 2008.
Author: ATSDR

Date: June 2, 2010
Type: Work Plan
Title: Final Field Sampling Workplan, Appendix A, Quality Assurance Project Plan, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: June 2, 2010
Type: Work Plan
Title: Final Field Sampling Workplan, Appendix B, Health and Safety Plan, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: June 2, 2010
Type: Work Plan
Title: Final Phase I Groundwater Sampling, Field Sampling Workplan, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: September 21, 2010
Type: Report
Title: Five-Year Review Report, Third Five-Year Review for Liquid Gold Oil Corporation Site, Richmond, California, September 2010.
Author: U.S. EPA

Date: September 30, 2010
Type: Report
Title: Year 5 Monitoring Report for the Western Stege Marsh Restoration Project. University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: March 25, 2011
Type: Report
Title: Proposed Continued Groundwater Monitoring Locations, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: July 2011
Type: Report
Title: Radiological Confirmatory Action Plan, Volume I Radiological Sampling and Survey Plan. Prepared for UC Berkeley Capital Projects, Richmond Field Station Buildings B102 and B110.
Author: New World Environmental

Date: August 19, 2011
Type: Report
Title: Final Technical Memorandum for Well Destructions, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: August 22, 2011
Type: Report
Title: Final, Revision 1, Phase I Groundwater Sampling Results, Technical Memorandum, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: August 31, 2011
Type: Work Plan
Title: Soil Gas Investigation Work Plan Describing Sampling Along the Campus Bay and the University of California Richmond Field Station Property Border, Richmond, California.
Author: Terraphase Engineering Inc. (Terraphase)

Date: September 12, 2011
Type: Report
Title: Final Phase II Field Sampling Plan, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: November 18, 2011
Type: Report
Title: Technical Memorandum, University of California Richmond Field Station Biologically Active Permeable Barrier Groundwater Sampling Results.
Author: Terraphase

Date: November 30, 2011
Type: Report
Title: Soil Gas Sampling Results, Campus Bay and University of California Richmond Field Station Property Boundary, Richmond, California.
Author: Terraphase

Date: March 2013
Type: Work Plan
Title: Removal Action Work Plan for the Pistol Range, Stege Property, Richmond, California." Prepared for Union Pacific Railroad Company.
Author: CH2MHill

Date: January 20, 2012
Type: Report
Title: Draft Technical Memorandum for Well Closures, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: February 1, 2012
Type: Work Plan
Title: Field Sampling Work Plan to conduct additional groundwater investigations within and in the vicinity of the BAPB at the University of California Berkeley, Richmond Field Station, Richmond, California.
Author: Terraphase

Date: February 1, 2012
Type: Report
Title: Final, Revision 1, Phase I April 2011 Groundwater Sampling Results, Technical Memorandum, Revision 1, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: February 29, 2012
Type: Report
Title: Final Phase I October 2011 Groundwater Sampling Results, Technical Memorandum, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: March 6, 2012
Type: Report
Title: Wetland Determination, Western Stege Marsh, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: March 16, 2012
Type: Report
Title: Proposed Continued Groundwater Monitoring, April 2012, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: June 11, 2012
Type: Report
Title: Final Phase II Sampling Results, Technical Memorandum, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: June 11, 2012
Type: Report
Title: Final Technical Memorandum for Well Closures, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: September 10, 2012
Type: Report
Title: Pilot Study Summary Report for the In Situ Treatment of Volatile Organic Compounds in Groundwater, 2011 Injections, Lot 1, Former Zeneca Facility, Campus Bay Project, Richmond, California.
Author: Arcadis

Date: September 10, 2012
Type: Report
Title: Final Phase III Field Sampling Plan, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: November 16, 2012
Type: Report
Title: Response to DTSC Comments Regarding the November 30, 2011 "Soil Gas Sampling Results, Campus Bay and University of California Richmond Field Station Property Boundary, Richmond, California."
Author: Terraphase

Date: November 18, 2012
Type: Report
Title: Final Status Survey Report for UC Berkeley Capital Projects, Richmond Field Station, Buildings B102 and B110.
Author: New World Environmental Inc.

Date: December 12, 2012
Type: Report
Title: Final Phase I November 2010 through April 2012 Groundwater Sampling Results, Technical Memorandum, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: January 9, 2013
Type: Report
Title: Draft Site Characterization Report, Proposed Richmond Bay Campus, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: January 23, 2013 (revision to original submitted October 22, 2012)
Type: Work Plan
Title: Storm Water Pollution Prevention Plan for the Stockpiling of CRT Soil at the Richmond Field Station, Richmond, California
Author: 4LEAF, Inc.

Date: March 5, 2013
Type: Work Plan
Title: Notification of Piezometer Abandonment and Installation, and Scope of Work, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: Tetra Tech

Date: May 28, 2013
Type: Report
Title: Final Site Characterization Report, Proposed Richmond Bay Campus, Research, Education, and Support Area and Groundwater with the Richmond Field Station Site.
Author: Tetra Tech

Correspondence including letters, notifications, and interviews:

Date: April 1973
Type: Notification
Title: *Sanitary Engineering Research Laboratory News Quarterly*. Volume XXIII, No. 2. Richmond, California.
Author: UC Berkeley

Date: 1974
Type: Interview
Title: The Sanitary Engineering Research Laboratory: Administration, Research, and Consultation, 1950-1972—An Interview Conducted by Malca Chall. Regional Oral History Office, UC, Berkeley.
Author: McGauhey, P.H.

Date: March 22, 1991
Type: Letter
Title: Letter from John Wise, EPA, to Daniel Boggan, UC Berkeley, regarding Richmond Field Station site conditions and risk posed to workers in planned Region IX laboratory.
Author: U.S. EPA

Date: June 12, 2000
Type: Interview
Title: Interview regarding RFS Operational History. Between Anna Moore, Environment, Health & Safety, UC Berkeley; and Larry Bell, RFS Operations Staff.
Author: UC Berkeley

Date: June 13, 2000
Type: Interview
Title: Interview regarding RFS Operational History. Between Anna Moore, Environment, Health & Safety, UC Berkeley; and Stewart Foster and John Potter, Researchers, Richmond Field Station.
Author: UC Berkeley

Date: June 7, 2001
Type: Interview
Title: Interview regarding RFS Operational History. Between Anna Moore, Environment, Health & Safety, UC Berkeley; and Dana Krauter, RFS Operations Staff, Richmond Field Station.
Author: UC Berkeley

Date: March 19, 2002
Type: Letter
Title: Letter from Tina Low, RWQCB, to Lee Erikson, Zeneca, Inc. regarding "Water Quality Certification for Cleanup Activities at Zeneca Richmond Facility, City of Richmond, Contra Costa County."
Author: RWQCB

Date: November 1, 2002
Type: Response to Comments
Title: Response to Comments on Human Health and Ecological Tiered Risk Evaluation, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: URS

Date: June 2003
Type: Letter
Title: Nationwide Permit 38 Modification Request (ACOE File No. 25417S), Western Stege Marsh Remediation and Restoration Project, Richmond, California.
Author: BBL

Date: June 26, 2003
Type: Letter
Title: Letter from Diane Mims, BBL, to Bob Batha, San Francisco Bay Conservation and Development Commission, regarding a Revision to Permit No. M01-52, Western Stege Marsh Remediation and Restoration Project, Richmond, California.
Author: BBL

Date: June 27, 2003
Type: Letter
Title: Letter from Steven McAdam, BCDC, to Diane Mims, BBL, regarding Amendment No. Two to BCDC Permit No. M01-52(b), Western Stege Marsh Remediation and Restoration Project, Richmond, California.
Author: San Francisco Bay Conservation and Development Commission (BCDC)

Date: July 16, 2003
Type: Letter
Title: Letter from Edward Denton, UC Berkeley, Capital Projects, to Chancellor Berdahl, UC Berkeley regarding "Project and Environmental Approval for the Richmond Field Station Remediation Project, SCH #2003052124."
Author: UC Berkeley

Date: July 24, 2003
Type: Letter
Title: Letter from Diane Mims, BBL, to Michelle Levenson, BCDC, regarding "Additional Information Requested to Complete Revision to Permit No. M01-52 for the UC Berkeley RFS Remediation Project at Stege Marsh."
Author: BBL

Date: September 4, 2003
Type: Letter
Title: Letter from Edward Wylie, Department of the Army, to Mike Hryciw, UC Berkeley, Capital Projects, regarding File Number 28135S - Western Stege Marsh Remediation and Restoration.
Author: Department of the Army, San Francisco District, Corp of Engineers.

Date: August 19, 2005
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding purple ooze seeping from the grassy area in front of Building 484.
Author: DTSC

Date: September 27, 2006
Type: Letter
Title: Letter from Greg Haet, University of California EH&S, to Barbara Cook, DTSC, proposing Greg Haet from UC Berkeley Environment Health, & Safety as the Project Coordinator for work performed pursuant to the DTSC Order, "UC Site Investigation and Remediation Order, Section 6.1."
Author: UC Berkeley

Date: September 27, 2006
Type: Letter
Title: Letter from Greg Haet, University of California Environment Health, & Safety, to Barbara Cook, DTSC, proposing John Bosche from Tetra Tech EMI as the Project Engineer/Geologist for work performed pursuant to the DTSC Order, "University of California (UC) Site Investigation and Remediation Order, Section 6.2."
Author: UC Berkeley

Date: October 5, 2006
Type: Letter
Title: Letter from William Marsh, Law Office of John D. Edgcomb, to Barbara Cook, DTSC, regarding concurrence with the UC's letters identifying Greg Haet as the Project Coordinator and John Bosche from Tetra Tech EMI as the Project Engineer/Geologist for work performed pursuant to the DTSC Order.
Author: Law Office of John D. Edgcomb.

Date: November 14, 2006
Type: Interview
Title: Interview regarding RFS Operational History. Between Scott Shackleton, Karl Hans, Larry Bell, and Greg Haet, UC Berkeley; and Julia Vetromile and Leslie Lundgren, Tetra Tech EM Inc.
Author: UC Berkeley

Date: December 21, 2006
Type: Interview
Title: Interview regarding RFS Operational History. Between Karl Hans, Environment Health, & Safety, RFS and Rick Alcarez, former RFS employee, Greg Haet and Karl Hans of RFS; Lynn Nakashima of DTSC; Gene Barry of 4LEAF, Inc.; and Julia Vetromile of Tetra Tech EM Inc.
Author: UC Berkeley

Date: February 16, 2007
Type:
Title: Information on site operations, chemicals, and radioactive material use provided by Karl Hans, University of California, Berkeley Office of EH&S.
Author: UC Berkeley

Date: March 15, 2007
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding comments on the Draft Interim Soil Management Plan for the Upland and Transition Areas for the University of California, Berkeley, Richmond Field Station.
Author: DTSC

Date: May 25, 2007
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the "Pyrite Cinder-Containing Soil Management Procedures," outlined in a letter from Greg Haet dated May 16, 2007.
Author: DTSC

Date: September 2007
Type: Notification
Title: Notice of Public Comment Period, Administrative Record, Time Critical Removal Action, University of California Berkeley, Richmond Field Station, October 1, 2007 to October 30, 2007.
Author: DTSC

Date: September 17, 2007
Type: Notification
Title: California Environmental Quality Act Notice of Exemption for the "Time-Critical Removal Action at the Former Forest Products Laboratory Wood Treatment Laboratory, University of California Berkeley, Richmond Field Station."
Author: DTSC

Date: September 17, 2007
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the "Final Memorandum for a Time-Critical Removal Action at the Former Forest Products Laboratory Wood Treatment Laboratory, University of California, Berkeley, Richmond Field Station, Richmond, California."
Author: DTSC

Date: September 21, 2007
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the "Soil Confirmation and Perimeter Air Monitoring Plan to be implemented as part of the Final Memorandum for a Time-Critical Removal Action at the Former Forest Products Laboratory Wood Treatment Laboratory, University of California, Berkeley, Richmond Field Station, Richmond, California."
Author: DTSC

Date: September 24, 2007
Type: Letter
Title: Letter from Catherine Koshland, UC Berkeley, to Tracy Barreau, California Department of Public Health, regarding "UC Comments on the Draft RFS Public Health Assessment."
Author: UC Berkeley

Date: October 1, 2007
Type: Letter
Title: Letter to Doug Mosteller, Cherokee Simeon Venture I, LLC, from Barbara Cook, DTSC, Concurring on the Recommendation of 16 mg/kg Arsenic as a Good Estimator of the Upper Range of the Ambient Distribution of Arsenic at the Campus Bay Site.
Author: DTSC

Date: October 23, 2007
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the MSRI soil as acceptable backfill material in the Former Forest Products Laboratory Wood Treatment Laboratory Area Time Critical Removal Action.
Author: DTSC

Date: April 9, 2008
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the "Implementation Summary Report for the Time-Critical Removal Action at the Former Forest Products Laboratory Wood Treatment Laboratory, University of California, Berkeley, Richmond Field Station, Richmond, California."
Author: DTSC

Date: September 25, 2008
Type: Notification
Title: California Environmental Quality Act Notice of Exemption for the "Time-Critical Removal Action at Two Campfire Locations in the Western Transition Area, University of California Berkeley, Richmond Field Station."
Author: DTSC

Date: September 25, 2008
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the "Final Memorandum for a Time-Critical Removal Action at Two Campfire Locations in the Western Transition Area, University of California, Berkeley, Richmond Field Station, Richmond, California."
Author: DTSC

Date: September 28, 2008
Type: Notification
Title: Notice of Public Comment Period, Time Critical Removal Action, University of California Berkeley, Richmond Field Station, September 28, 2008 to October 28, 2008.
Author: DTSC

Date: December 29, 2008
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the "Final Current Conditions Report."
Author: DTSC

Date: May 26, 2009
Type: Letter
Title: Letter report regarding "Sampling Results for March 2, 2009 Stormwater within the Western Stege Marsh. University of California, Berkeley, Richmond Field Station, Richmond, California."
Author: Tetra Tech

Date: May 29, 2009
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the "Final Implementation Summary Report for a Time-Critical Removal Action at Two Subareas in the Western Transition Area."
Author: DTSC

Date: June 5, 2009
Type:
Title: Consent Agreement between The Regents of the University of California and Zeneca Inc. regarding Summary of Violations.
Author: DTSC

Date: December 7, 2009
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Allen Wolken, Richmond Community Redevelopment Agency, regarding approval of the PES Environmental, Inc. "Results of Evaluation of Pre-Construction Conditions in Soil, Meade By-Pass Roadway, Richmond, California."
Author: DTSC

Date: December 15, 2009
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding comments on the "Year 4 Monitoring Report for the Western Stege Marsh Restoration Project, Berkeley, Richmond Field Station, Richmond, California."
Author: DTSC

Date: December 17, 2009
Type: Notificaton
Title: Notice of Public Comment Period, Time Critical Removal Action, Zeneca/Former Stauffer Chemical Site, 1391 South 49th Street, Richmond, California; Public Comment Period: December 17, 2009 – January 29, 2010.
Author: DTSC

Date: May 26, 2010
Type: Letter
Title: Letter from Barbara Cook, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval contingent upon changes of the "Final Phase I Groundwater Sampling Field Sampling Workplan; Appendix A, Quality Assurance Project Plan; and Appendix B, Health and Safety Plan, University of California, Berkeley, Richmond Field Station."
Author: DTSC

Date: November 24, 2010
Type: Response to Comments
Title: Response to DTSC Comments on the "Letter Work Plan to Evaluate Groundwater in Select Areas at the University of California Richmond Field Station, Richmond, California.
Author: Arcadis

Date: November 29, 2010
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to William Marsh, Edgcomb Law Group, regarding approval of the response to comments on the "Letter Work Plan to Evaluate Groundwater in Select Areas at the University of California Richmond Field Station, Richmond, California."
Author: DTSC

Date: March 11, 2011
Type: Letter
Title: Letter from Ronald Goloubow, Arcadis, and Daren Roth, Arcadis, to Barbara Cook, DTSC, regarding "Transmittal of Groundwater Data Collected in Select Areas at the University of California Richmond Field Station, Richmond, California."
Author: Arcadis

Date: March 29, 2011
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the Proposed Continued Groundwater Monitoring Locations.
Author: DTSC

Date: July 27, 2011
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding the Year 5 Monitoring Report Response to Comments.
Author: DTSC

Date: September 12, 2011
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Andrew Romolo, Terraphase Engineering, Inc. regarding approval of the "Soil Gas Investigation Work Plan Describing Sampling Along the Campus Bay and the University of California Richmond Field Station Property Border, Richmond, California."
Author: DTSC

Date: September 12, 2011
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the Final Technical Memorandum for Well Destructions.
Author: DTSC

Date: October 5, 2011
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the Final Phase II Field Sampling Plan.
Author: DTSC

Date: October 14, 2011
Type: Letter
Title: Letter from Greg Haet, University of California Environment Health, & Safety, to Lynn Nakashima, DTSC. "Final Disposal Memorandum for Investigation Derived Waste from the Phase I Field Sampling Workplan Groundwater Investigation, University of California, Berkeley, Richmond Field Station, California."
Author: UC Berkeley

Date: November 16, 2011
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the Final, Revision I, Phase I Groundwater Sampling Results Technical Memorandum.
Author: DTSC

Date: November 16, 2011
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding the Final Disposal Memorandum for Investigation Derived Waste from the Phase I Field Sampling Workplan Groundwater Investigation, University of California, Berkeley, Richmond Field Station, California.
Author: DTSC

Date: December 2, 2011
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to William Marsh, Edgcomb Law Group, regarding comments on the Terraphase "Technical Memorandum for the University of California Richmond Field Station Biologically Active Permeable Barrier Groundwater Sampling Results."
Author: DTSC

Date: January 1, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the Final Phase II October 2011 Groundwater Sampling Results Technical Memorandum.
Author: DTSC

Date: January 6, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding DTSC's review of the Request to Amend UC Berkeley Radioactive Material License No. 1333 Notice of Intent to Vacate and Decommission Buildings 102 and 111 at Richmond Field Station.
Author: DTSC

Date: January 19, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to William Marsh, Edgcomb Law Group, regarding comments on the Terraphase "Soil Gas Sampling Results, Campus Bay and University of California Richmond Field Station Property Boundary, Richmond, California."
Author: DTSC

Date: February 22, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to William Marsh, Edgcomb Law Group, regarding comments on the Terraphase "Field Sampling Work Plan to conduct additional groundwater investigations within and in the vicinity of the BAPB at the University of California, Richmond Field Station, Richmond, California."
Author: DTSC

Date: March 8, 2012
Type: Response to Comments
Title: Response to DTSC Comments Regarding the "Field Sampling Work Plan to conduct additional groundwater investigations within and in the vicinity of the BAPB at the University of California Berkeley, Richmond Field Station, Richmond, California."
Author: Terraphase

Date: March 10, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the Final, Revision 1, Phase I April 2011 Groundwater Sampling Results Technical Memorandum, University of California, Berkeley.
Author: DTSC

Date: March 15, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the Final Phase II October 2011 Groundwater Sampling Results Technical Memorandum.
Author: DTSC

Date: March 20, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to Jenifer Beatty, Arcadis US, Inc., regarding approval of and comments on the Terraphase "Field Sampling Work Plan to conduct additional groundwater investigations within and in the vicinity of the BAPB at the University of California, Richmond Field Station, Richmond, California."
Author: DTSC

Date: March 23, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding comments on the Technical Memorandum for Well Closures, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: DTSC

Date: July 5, 2012
Type:
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the amended Technical Memorandum for Well Closures, University of California, Berkeley, Richmond Field Station, Richmond, California.
Author: DTSC

Date: July 19, 2012
Type: Response to Comments
Title: Response to Department of Toxic Substances Control Comments Regarding the "Revised TCE Risk Evaluation," and "Revised TCE Risk Evaluation." Campus Bay Site, Richmond, California.
Author: Terraphase

Date: August 2, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the Final Phase II Sampling Results Technical Memorandum.
Author: DTSC

Date: August 3, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the Phase III Field Sampling Plan.
Author: DTSC

Date: October 17, 2012
Type:
Title: Draft Notes, University of California, Richmond Field Station, Meeting on Proposed LBNL and UCB Development of Richmond Field Station, October 9, 2012
Author: Tetra Tech

Date: November 16, 2012
Type: Response to Comments
Title: Response to Department of Toxic Substances Control Comments Regarding the November 30, 2011 "Soil Gas Sampling Results, Campus Bay and University of California Richmond Field Station Property Boundary, Richmond, California."
Author: Terraphase

Date: December 4, 2012
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding the Responses to DTSC comments on the Draft Phase I November 2010 through April 2012 Groundwater Sampling Results Technical Memorandum.
Author: DTSC

Date: January 4, 2013
Type: Notification
Title: Notice of Preparation, Draft Environmental Impact Report, Richmond Bay Campus 2013 Long Range Development Plan and Phase 1 Development, Richmond Bay Campus, Richmond Field Station, Contra Costa.
Author: Ernest Orlando Lawrence Berkeley National Laboratory.

Date: January 24, 2013
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Jeff Philliber, Lawrence Berkeley National Laboratory regarding Richmond Bay Campus 2013 Long Range Development Plan and Phase I Development Notice of Preparation, Draft Environmental Impact Report.
Author: DTSC

Date: March 8, 2013
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding review and comments on "Notification of Piezometer Abandonment and Installation, and Scope of Work, University of California, Berkeley, Richmond Field Station, Richmond, California."
Author: DTSC

Date: May 2, 2013
Type: Letter
Title: Letter from Lynn Nakashima, DTSC, and Mark Vest, DTSC, to Greg Haet, University of California Environment Health, & Safety, regarding approval of the Final Site Characterization Report and Responses to Comments on the Draft.
Author: DTSC

Supporting References:

Date: 1910
Type: Reference
Title: *American Archaeology and Ethnology*. Volume 7, No. 5. UC Publications.
Author: Nelson

Date: 1998
Type: Reference
Title: Adsorption of Metals by Geomedia. Academic Press, San Diego, California.
Author: Everett, Jenne A. (Editor)

Date: 2000
Type: Reference
Title: Profile of General Demographic Characteristics. 2000 Census of Population and Housing, California.
Author: U.S. Census Bureau

Date: 2002
Type: Reference
Title: Allocation of PCB Sources at a Scrap Metal Yard. *American Bar Association Section on Energy, Energy, and Resources Science Newsletter.*
Author: Lowenbach, W.A.

Date: 2006
Type: Reference
Title: The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds. Toxicol. Sci. (October 2006) 93(2): 223-241.
Author: van den Berg, M, L.S. Birnbaum, M. Denison, M. De Vito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, N. Walker, and R.E. Peterson.

Date: 2010
Type: Reference
Title: Profile of General Demographic Characteristics. 2010 Census of Population and Housing, California.
Author: U.S. Census Bureau

ATTACHMENT C
SOIL MANAGEMENT PLAN

Final

Soil Management Plan

Removal Action Workplan, Attachment C

Richmond Bay Campus, Richmond, California

Research, Education, and Support Area within the Former Richmond Field Station

Prepared for:

University of California, Berkeley

July 18, 2014

Prepared by

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ACRONYMS AND ABBREVIATIONS

AST	Above ground storage tank
BAP(EQ)	Benzo(a)pyrene equivalent
bgs	Below ground surface
Cal/EPA	California Environmental Protection Agency
CCC	California Cap Company
CCR	Current Conditions Report
CFR	Code of Federal Regulations
COC	Chemical of concern
CY	Cubic yard
DTSC	Department of Toxic Substances Control
EH&S	Office of Environment, Health & Safety
EPA	U.S. Environmental Protection Agency
FPL WTL	Forest Products Laboratory Wood Treatment Lab
FSW	Field Sampling Workplan
GIS	Geographic information system
HMX	Octahydor-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HSP	Health and Safety Plan
IDW	Investigation-derived waste
LBNL	Ernest Orlando Lawrence Berkeley National Laboratory
LBP	Lead-based paint
LRDP	Long Range Development Plan
LUC	Land use control
MCL	Maximum contaminant level
MFA	Mercury Fulminate Area
mg/kg	Milligrams per kilogram
NOI	Notice of Intent
NOS	Land use designation identified in the LRDP as Natural Open Space, which applies to areas that UC plans to protect from development and maintain in their natural condition
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyl
PPE	Personal protective equipment
QSD	Qualified SWPPP Developer
QSP	Qualified SWPPP Preparer

ACRONYMS AND ABBREVIATIONS (Continued)

RAW	Removal Action Workplan
RBC	Richmond Bay Campus
RES	Land use designation identified in the LRDP as Research, Education, and Support, which applies to areas that are either currently developed with facilities that would remain in their present form or be expanded, or that would be developed with new facilities
RFS	Richmond Field Station
RFS Site Investigation and Remediation Order	DTSC Site Investigation and Remediation Order. Docket No. IS/E-RAO 06/07-004 for the former RFS Site
RWQCB	San Francisco Bay Regional Water Quality Control Board
SAP	Sampling and analysis plan
SCR	Site Characterization Report
SMP	Soil Management Plan
SOP	Standard operating procedure
SVOC	Semivolatile organic compounds
SWPPP	Stormwater pollution prevention plan
TCE	Trichloroethylene
TCRA	Time-critical removal action
TPH	Total petroleum hydrocarbons
TSCA	Toxic Substance Control Act
UC	University of California
UCL	Upper confidence limit
URS	URS Corporation
UST	Underground storage tank
VOC	Volatile organic compound
Zeneca Order	DTSC Site Investigation and Remediation Order. Docket No. IS/E-RAO 06/07-005 for the former Zeneca Site

1.0 INTRODUCTION AND PURPOSE

On May 15, 2014, The Regents of the University of California (UC) approved establishment of a new major research campus on properties it owns in Richmond, California, composed of portions of the Former Richmond Field Station (RFS) and the Regatta Property located west of the RFS. The Richmond Bay Campus (RBC) will provide for the development of additional facilities for UC Berkeley and the Ernest Orlando Lawrence Berkeley National Laboratory (LBNL) for academic teaching, applied research, and collaborations with private industry focused on energy, environment, and health. The RBC Long Range Development Plan (LRDP) identifies two land use designations to form the pattern of development at the RBC: (1) Research, Education, and Support (RES) and (2) Natural Open Space (NOS). The RES land use applies to areas that are either currently developed with facilities that would remain in their present form or be expanded, or that would be developed with new facilities (UC 2014). The NOS land use applies to areas that UC plans to protect from development and maintain in their natural condition. The location of the RBC and areas identified as RES and NOS land uses are shown on Figure C-1.

UC Berkeley has been conducting investigation and cleanup actions at the Former RFS under the oversight of the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC), in compliance with the Site Investigation and Remediation Order, Docket No. IS/E-RAO 06/07-004, dated September 15, 2006 (RFS Site Investigation and Remediation Order, Attachment A). The RFS Site Investigation and Remediation Order provides for the investigation and cleanup of 96 acres of upland and 13 acres of tidal marsh and transition habitat within the Former RFS. UC Berkeley has prepared a Removal Action Workplan (RAW), and this accompanying Soil Management Plan (SMP), under Health and Safety Code Section 25356.1(h)(1) and in compliance with the RFS Site Investigation and Remediation Order. For the purposes of this RAW, the property defined under the RFS Site Investigation and Remediation Order is referred to as the "Former RFS Site" or "Site." The Former RFS Site does not encompass the entire RFS; two outboard parcels are not included in the RFS Site Investigation and Remediation Order. The Regatta Property portion of the RBC is not included in the RFS Site Investigation and Remediation Order or Former RFS Site; and therefore is not subject to the SMP. Figure C-2 shows the Former RFS Site in relation to the RBC, Regatta Property, and outboard parcels.

The RAW establishes the remedial goals and final remedy for the RES and groundwater at the portions of RBC within the Former RFS Site. The remainder of the Former RFS site consisting of areas designated for NOS is not addressed by the RAW. Continued investigation within the NOS of the Former RFS Site will continue under the RFS Site Investigation and Remediation Order. The Former RFS Site, including the RES and NOS, is shown on Figure C-3.

The RAW identifies specific actions to be conducted within the RES at the Former RFS Site as follows:

<u>Soil Remedy</u>

- Excavation of polychlorinated biphenyl (PCB)–impacted soils at the Building 112 and Building 150 Transformer Areas and three areas within the Corporation Yard with total PCB concentrations exceeding the remedial goal (1 milligram per kilogram [mg/kg]).

- Excavation of mercury-impacted soil at the Mercury Fulminate Area (MFA) with concentrations exceeding the remedial goal (275 mg/kg).

- Excavation of benzo(a)pyrene equivalent (BAP[EQ])-impacted soil with concentrations exceeding the remedial goal (0.4 mg/kg) and dioxin-impacted soil with concentrations greater than the remedial goal (1.6.4E-05 mg/kg) at the Corporation Yard.

- Management of cinders encountered during soil excavations.

- Implementation of site-wide land use controls (LUC) consisting of deed restrictions identifying the future use of the Site as commercial only, and mandating that future site soil disturbance or soil movement be conducted under the SMP.

- Implementation of the SMP which provides a framework for excavation and soil management, in conjunction with redevelopment or construction projects for chemicals in soil exceeding Criteria I or II levels within the RES.

Groundwater Remedy

- Monitoring natural attenuation of groundwater with carbon tetrachloride concentrations exceeding the remedial goal (2.63 micrograms per liter) at the western edge of the Coastal Terrace Prairie.

- Continuing groundwater monitoring at the Former RFS Site

- Treatment and monitoring of contaminants in groundwater originating from the former Zeneca Site, including trichloroethylene (TCE) and its breakdown components, under the DTSC Site Investigation and Remediation Order for the former Zeneca Site (IS/E-RAO 06/07-005) (Zeneca Order)

- Implementation of site-wide LUCs consisting of deed restrictions prohibiting groundwater extraction for purposes other than groundwater monitoring/treatment or construction dewatering.

This SMP supports the implementation of LUCs by providing a framework to prohibit uncontrolled soil excavation or disturbance activities which may expose workers or visitors to unsafe exposures to environmental contaminants. The objective of this SMP is to ensure that soil disturbance activities do not adversely impact human health or the environment and that the soils are handled, stored and disposed of, or reused onsite in accordance with applicable laws, regulations, and UC policies. The SMP ensures that soils disturbed during future construction, redevelopment, or maintenance projects will be sampled and managed to ensure that no uncontrolled exposures to, or releases of contaminants within the RES occur (Figure C-1). This SMP becomes effective once the RAW and SMP are finalized.

1.1 SCOPE

All activities conducted in the RES of the Former RFS Site impacting surface cover conditions, surface soil, or subsurface soil are subject to the direct oversight of UC Office of Environment, Health & Safety (EH&S), and are subject to all state and federal soil disposal requirements.

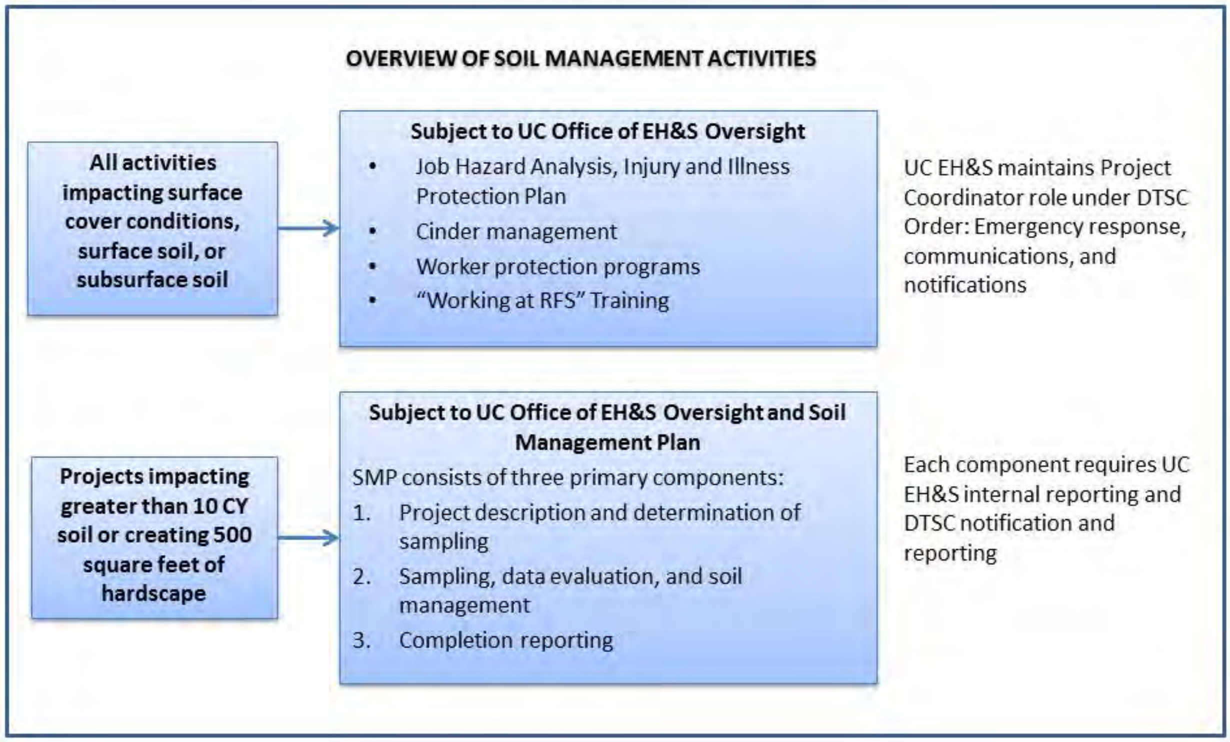
EH&S provides the following services for UC activities at the RBC:

- Emergency Response – the EH&S Dedicated Spill Response Team is trained and equipped to address the majority of chemical spills and releases on campus. Team members serve as the liaison to the Richmond Fire Department Hazardous Materials Team and obtain specialized assistance from outside responders as necessary.
- Environmental Protection – programs include acutely hazardous materials management program, campus resources for environmental protection, construction coordination, construction resources, drain disposal restrictions (water quality), environmental management systems, groundwater quality, outdoor air quality, spare the air, surface water quality, and wastewater quality.
- Hazardous Materials – programs include biohazardous waste management, chemical exchange program, compressed gas cylinders, controlled substances disposal, hazardous material management resources, hazardous materials shipping, hazardous waste program, PCBs, and potentially explosive chemicals.
- Health & Safety – programs include asbestos safety, biosafety program, chemical hygiene plan, chemical inventory program, confined space, controlled substances used in research, dedicated spill response team, department safety coordinator program, field safety, hazard communication, hearing conservation, indoor air quality, industrial equipment, industrial safety, injury and illness prevention program, job safety analysis library, material safety data sheets, respiratory protection, sanitation program, standard operating procedures (SOP), toxic gas program, and training (all EH&S). The Health & Safety program includes oversight and approval of any subsurface soil disturbance activities, including utility clearance and cinder management, if present.
- Radiation Safety – programs include radiation safety forms and additional resources, radiation safety training, radiation surveys, radiation use authorization, and radioactive waste management.

In addition to conforming to the EH&S programs above, projects impacting greater than or equal to 10 cubic yards (CY) of in situ soil, or any projects resulting in a new hardscape surface of greater than 500 square feet, are subject to this SMP, which presents an evaluation of sampling requirements, reporting, and DTSC notification. Soil disturbance activities impacting less than 10 CY of in situ soil or less than 500 square feet of hardscape surface are not subject to the requirements of the SMP; however, they will be managed directly by EH&S through its existing programs listed above. If any condition arises that may pose an imminent or substantial endangerment to public health or safety or the environment, DTSC will be notified and a determination will be made whether the SMP is applicable or some other action needs to be taken.

The provisions of the SMP consist of three primary components: (1) project description and determination of sampling; (2) sampling, data evaluation, and soil management action; and (3) completion reporting. Implementation of the SMP will be conducted on a site-specific basis, following the DTSC notification and reviews presented in the SMP. The SMP also provides prescriptive approaches for implementing each component without seeking DTSC-approval for each step; however, DTSC notification requirements will still be met.

An overview of soil management activities is presented below.



1.2 APPROACH

The SMP provides a systematic process intended to ensure that future projects impacting surface and subsurface soils will not result in uncontrolled exposures to or releases of contaminants. This SMP outlines the process required for safe management of soil activities with specific document submittals to DTSC. The SMP also allows for self-implementation of soil sampling and management actions, coupled with DTSC notification, provided UC follows the prescribed protocols outlined in Section 3.0 through 6.0 of this SMP. The prescribed protocols are not intended as sampling requirements for all projects; instead, they serve as a starting point for sampling protocols and analyses. UC may elect to select alternative methods for soil sampling and management for any project, in which case UC will request and receive approval from DTSC.

This SMP outlines protocols to be followed for soil sampling, data analyses, soil management actions or disposal practices; and final reporting. EH&S will notify DTSC through the submittal of SMP checklist forms. Soil sampling will be based on site-specific strategies, or may follow the prescribed sampling density, depths, and chemicals of concern (COC), which are determined based on the proposed footprint and location of the project. Soil management actions and disposal requirements are based on comparison of soil sample results to screening criteria described herein and various waste acceptance criteria, and final reporting is conducted through preparation of a completion report that will also be provided to DTSC once the project has been completed. Soil may be disposed of at permitted landfills following federal and state hazardous waste laws and regulations, and would be subject to review by DTSC's enforcement program.

The three primary components of the SMP and an overview of the process are presented below and on the SMP Decision Framework diagram on the following page.

1. Project Description and Determination of Sampling. The first component of the SMP process is the determination by EH&S if the project is subject to the SMP requirements. Projects subject to SMP requirements are any construction, redevelopment, renovation, subsurface or utility repairs, grading, landscaping activities impacting at least 10 CY of soil, or any resulting in a hardscape cover more than 500 square feet.

   Projects impacting soils less than 10 CY or 500 square feet of hardscape surface are considered *de minimis* projects and will not be subject to SMP requirements; these impacted soil volumes are expected to result in less than one small roll-off bin of soil. The intent of *de minimis* projects is to not expend unnecessary sampling and administrative costs for small projects already under the oversight of UC EH&S as described in Section 1.1. Examples of *de minimis* projects are presented in Section 3.1.

   For projects subject to the SMP requirements, EH&S will provide a project description and determination of sampling by submitting *SMP Form A, Project Overview* (Exhibit C1) to DTSC prior to initiation of the project. EH&S will complete SMP Form A for *de minimis* projects to ensure proper administrative recordkeeping as well as documenting the rationale for the *de minimis* determination.

2. Sampling Design, Data Evaluation, and Soil Management Actions. The SMP provides sampling protocols for projects requiring sampling in the previous step. Sampling protocols consist of the number of sampling locations per defined area (density), sampling intervals (depths), and analytical requirements. The protocols are based on the size of the proposed soil disturbance (horizontal and vertical); COCs are based on the history of the area (former operations or previous sampling data). Sampling protocols may follow the prescriptive protocols presented, or be conducted on a site-specific basis. The SMP requires submittal of the sampling strategy to DTSC prior to sampling.

   Analytical data will be compared to numerical screening criteria presented in the SMP (Table C-1). Soil with chemical concentrations less than Category I criteria is suitable for reuse within the project area described in SMP Form A. Soil with chemical concentrations below Category II criteria may be managed on site within the SMP project area – management on site consists of being covered with 2 feet of soil having concentrations less than the Category I criteria, or used as fill beneath hardscaped surfaces such as roadways, parking areas, or building structures, thereby eliminating the direct exposure pathway to potential receptors. EH&S will request DTSC concurrence for any proposed deviations from the prescriptive soil management protocols. Soil will remain within the SMP project area, unless UC requests project-specific approval from DTSC.

   Category I and II screening criteria include conditions protective of commercial workers, maintenance workers, construction workers, on-site visitors, and off-site receptors; Category I screening criteria are based on the lowest of the calculated risk-based concentrations, unless background, ambient, or Toxic Substance Control Act (TSCA) criterion are available, in which case the alternate values are selected. Category I criteria for TPH constituents are based on the RWQCB ESL. Category II criteria are based on 10 times the Category I criteria, with exceptions noted on Table C-1.

For each SMP project, site-specific conditions will be considered when selecting a remedial goal for a cleanup action. Category I or II screening criteria may be selected as remedial goals for a cleanup action within an SMP project area. However, a different remedial goal may be selected based on the appropriate receptors. The SMP is intended to protect all current and future receptors, however, for example, if the SMP project is known to not consist of a utility corridor, then the maintenance worker need not be considered if it is more stringent than the risk-based concentrations for the other receptors.

Soil with chemical concentrations exceeding Category II criteria will be considered for off-site disposal, or may be managed on site with DTSC approval. UC will prepare internal documentation of soil management actions, including an on-site management plan or an excavation plan if appropriate. If soil cannot be managed according to the prescribed requirements specified in this SMP, for example if there are significant building constraints or limitations, UC will request approval of an alternative soil management approach from DTSC.

Notification to DTSC and documentation of this information is provided in *SMP Form B, Sampling, Data Evaluation, and Soil Management Action* (Exhibit C1). SMP Form B will be submitted to DTSC at three stages: (1) prior to sampling, with a sampling strategy memorandum as an attachment; (2) following sampling, with a data summary report as an attachment; and (3) prior to implementation of a soil management action, if required.

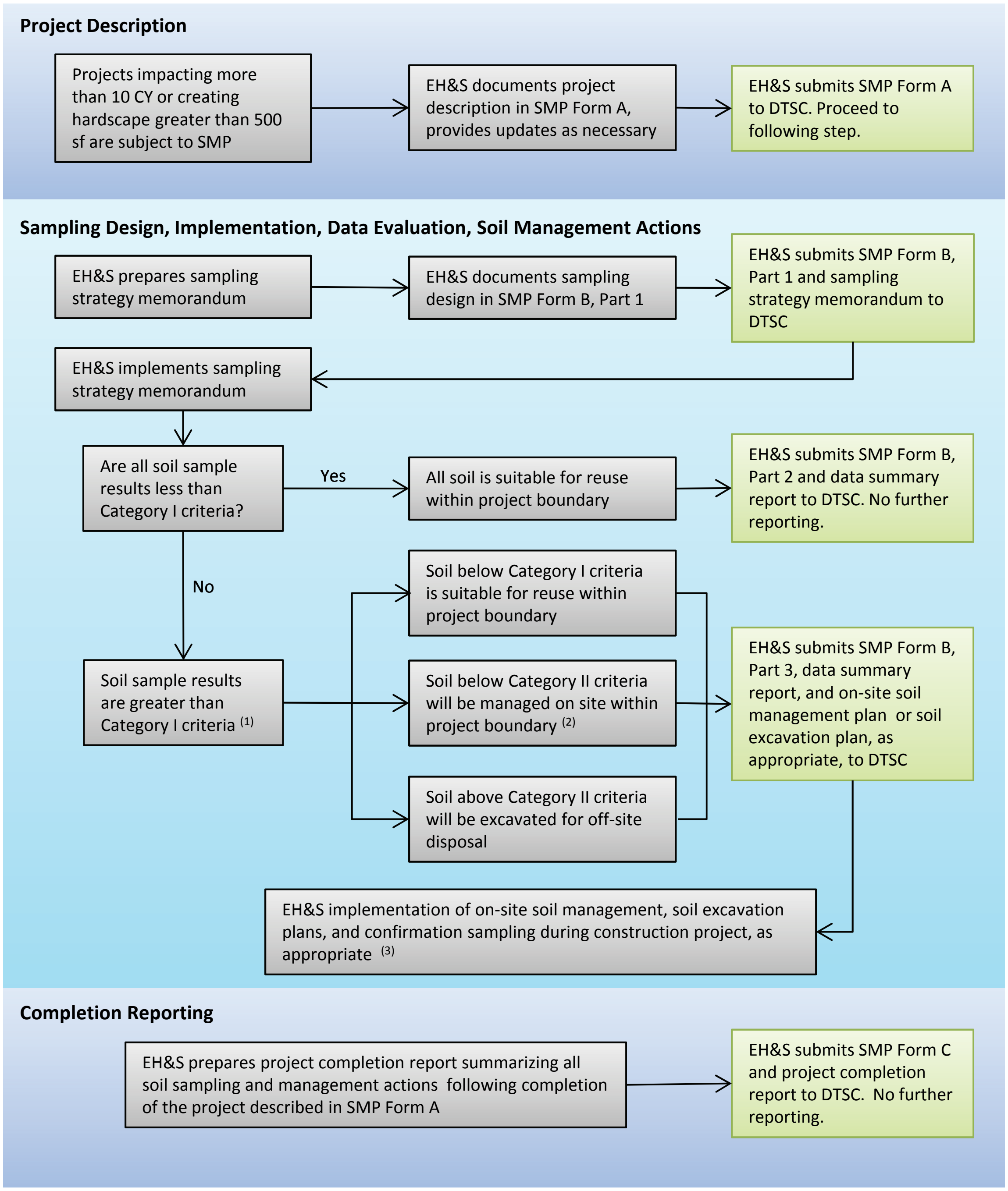
If soils have concentrations less than Category I criteria, SMP activities and documentation will be considered complete following submission of SMP Form B with the data summary report.

For projects involving soil with concentrations greater than Category I, additional soil management actions such as on-site management or excavation will be required; in this case SMP Form B will be submitted to DTSC prior to implementation of a soil excavation or on-site management plan (and will include the soil excavation or on-site management plan as an attachment).

3. Completion Reporting. For projects where soil management actions are required, UC will prepare a report summarizing the sampling design, data results and evaluation, soil management actions, and final site conditions following project completion.

   Notification to DTSC and documentation of this information will be provided in *SMP Form C, Completion Reporting* (Exhibit C1), which will include the completion report as an attachment. SMP Form C and the completion report will be provided following completion of all construction activities to ensure documentation of final soil management.

SMP Decision Framework



Notes

1. Any soil may be moved off-site for reuse or disposal at an appropriate waste facility at any point within the process, with prior notification to DTSC.
2. Managed on site consists of being covered with 2 feet of soil with concentrations below Category I criteria; being used as fill beneath hardscaped surfaces such as roadways, parking areas, or building structures; or any placement eliminating the direct exposure pathway to potential receptors.
3. Confirmation sampling or any additional characterization sampling may be conducted throughout the project duration.

1.3 DOCUMENTATION AND SMP UPDATES

Compliance with SMP requirements will be documented through EH&S submitting SMP Forms A, B, and C and associated documentation to DTSC. DTSC may require changes to sampling plans based on their review of the SMP Forms. Documentation requirements are as follows:

- Initial notification of projects subject to the SMP consists of EH&S submitting SMP Form A to DTSC, along with a project map. Projects not recommended for sampling will conclude with DTSC concurrence with SMP Form A. Examples include projects with sufficient existing sampling information, or projects being conducted entirely within clean fill.
- If sampling is required, EH&S will submit SMP Form B, Part 1 to DTSC, along with a sampling strategy memorandum describing the sampling strategy.
- Following sampling, EH&S will submit SMP Form B, Part 2 to DTSC. Documentation for projects with soils having concentrations less than Category I criteria will conclude with EH&S submitting SMP Form B and an attached data summary report to DTSC. For projects with soils having concentrations greater than Category I criteria, EH&S will submit SMP Form B, an attached data summary report, and a recommendation to conduct remedial action.
- For projects with soils having concentrations greater than Category I criteria, EH&S will submit SMP Form B, Part 3 to DTSC, along with either a soil excavation plan or on-site management plan, depending on the soil management strategy selected.
- Following completion of the soil management action, documentation for an SMP project will conclude with EH&S submitting SMP Form C and a completion report to DTSC.

UC will maintain records of all completed SMP Forms A, B, and C, in addition to required attachments supporting the sampling design, data evaluation, and soil management decisions copies of the records will be available to the public and will be maintained in the administrative office at Building 478 and EH&S offices.

UC will conduct annual reviews of the SMP to evaluate screening criteria, protocols, and sampling requirements to ensure they continue to meet the intended purpose of the SMP. Suggested improvements or changes to the SMP will be proposed to DTSC for review and approval, and documented formally as a part of the 5-year review process of the RAW, or more frequently if justified. Copies of completed SMP Forms A, B, and C will also be included as a part of the 5-year review of the RAW.

1.4 COMMUNITY NOTIFICATION PROCESS

Community members will be notified of SMP activities similar to current notification practices. EH&S will use following methods of communication:

- Regularly scheduled town hall meetings for staff and tenants at RBC

- Posting of SMP Forms A, B, and C and required documentation on the RFS environmental website (http://www.rfs-env.berkeley.edu/index.html, or equivalent address) prior to soil disturbance
- Routine email communications to staff at RBC
- Hard copies of primary documents, and SMP Forms A, B, and C and required documentation will be available for review in a reading room in Building 478
- DTSC work notices
- Posting of SMP Forms A, B, and C and required documentation to DTSC's Envirostor database

In addition, a spreadsheet tracking all SMP projects will be available to the public via the RFS environmental website.

Notification practices will be reviewed on an annual basis and modified if deemed necessary.

1.5 Roles and Responsibilities

The roles and responsibilities for implementing the SMP are provided below.

Name and Affiliation	Role	Responsibility
UC, EH&S	Project Coordinator	Directs environmental health and safety compliance of the SMP. Receives notices, comments, approvals, and related communications from DTSC. Reports to and interacts with the DTSC for all SMP tasks. Signatory to SMP Forms A, B, C.
UC, EH&S	Project Geologist	Reviews all technical documents for technical accuracy and adherence with California laws and regulations.
UC, EH&S	Project Civil Engineer	Reviews all design and management plans for technical accuracy and adherence with California laws and regulations.
DTSC	Remedial Project Manager	Reviews environmental health and safety compliance of the SMP. Signatory to 5-year RAW review process including updated SMP, if appropriate. Receives notices, comments, and related communications from UC. Interacts with UC for all SMP tasks. Reviews all submittals and notifications to DTSC for quality and completeness.

1.6 SMP Content

This SMP is organized consistent with the three primary elements discussed in the approach above. SMP text, tables, and figures provide the required background information and technical information necessary to identify the sampling protocols, data evaluation, soil management action, and completion reporting. The exhibits provide supporting information and reference materials for the implementation of the SMP. A summary of the SMP content is presented below.

- Section 1.0 – Introduction. Presents an overview of SMP purpose, scope, approach, protocols for soil management notifications and SMP document updates, roles and responsibilities, and SMP content.

- Section 2.0 – Background. Presents the current and historical land use activities, previous sampling and remedial activities, and summary of COCs. Introduces the geographic delineation of SMP Areas to assist with the review of background information and determination of sampling design.
- Section 3.0 – Project Description and Determination of Sampling. Describes projects subject to the SMP, including small projects which may not require sampling to large projects which will implement the prescriptive sampling requirements of the SMP, or will require consultation with DTSC. Includes description of the information to be presented in SMP Form A.
- Section 4.0 – Sampling Design, Data Evaluation, and Soil Management. Provides specific protocols to implement the SMP sampling requirements. Provides the sampling frequency and recommended analytes based on previous sampling results and background of the applicable SMP Areas, as referenced in Section 2.0. Identifies the sampling density and sampling depths based on the horizontal and vertical extent of the planned soil disturbance activities. Provides Category I and II criteria for the characterization of soil, and resulting soil management action options. Identifies internal documentation requirements as well as a description of the information to be presented in SMP Form B.
- Section 5.0 – Implementation of Soil Management Actions. Presents protocols and management practices that will be implemented during the soil management actions.
- Section 6.0 – Project Completion Reporting. Presents a description of the reporting requirements necessary for the completion report and a description of the information to be presented in SMP Form C.
- Section 7.0 – References. Lists sources referenced within the SMP.

The SMP also includes two exhibits essential to the implementation of the SMP:

- Exhibit C1: SMP Forms A, B and C provide templates for documentation of notification requirements and EH&S approval of SMP activities.
- Exhibit C2: The Sampling and Analysis Plan (SAP) provides sampling protocols, policies, and procedures for implementing the sampling conducted under the SMP.

2.0 BACKGROUND

This section presents the current and historical land use activities, previous sampling and remedial activities, and summary of COCs in the RES. It introduces the geographic delineation of SMP Areas to assist with the review of background information and proposed sampling design criteria.

The summary of known conditions provided in this section is intended to provide an overview only. Specific information about historical sources, remediation activities, nature and extent of known contamination, and fate and transport of contaminants are available in the following reference documents:

- Final RAW (Tetra Tech 2014)
- Final Site Characterization Report (SCR) (Tetra Tech 2013)
- Final Current Conditions Report ([CCR] Tetra Tech 2008a)

2.1 CURRENT AND HISTORICAL ACTIVITIES

This section discusses the history of the Former RFS and provides an overview of current and historical land use and features. Current physical features, including buildings, are shown on Figure C-4. The historical potential source areas from former industrial operations are shown on Figure C-5. Further details, as well as historical aerial photographs, are in the CCR (Tetra Tech 2008a).

The RES has been subject to numerous land alterations through its history of development, including creation of ditches and culverts to channel storm drainage; placement of fill in the upland areas; and construction of buildings and utilities.

2.1.1 Current Land Use

The Former RFS is an academic teaching and research facility for UC Berkeley that has been used primarily for large-scale engineering research since 1950. Teaching and research facilities are available for public health investigations, civil engineering, mechanical engineering, transportation, fine arts, ergonomics, and occupational and environmental health. With more than 500,000 assignable square feet of research space, the Former RFS accommodates a range of space-intensive activities—including the UC Berkeley Northern Regional Library Facility, the Asbestos Information Center, some of the world’s largest earthquake shaking tables, the Geosciences Well Field, sophisticated test facilities for advanced transportation research, and a robotics laboratory. The Former RFS also provides for a variety of smaller-scale engineering research projects not conducted on the central UC Berkeley campus. No sources of contamination have been identified as a result of research activities, with the exception of the Former Forest Product Laboratory Wood Treatment Laboratory (FPL WTL), for which a time-critical removal action (TCRA) was conducted and the small area of total petroleum hydrocarbon (TPH)-affected soil associated with leaks from the Earthquake Engineering hydraulic lines at Building 484. The UC Regents also lease space to non-UC Berkeley tenants. Current tenants include the U.S. Environmental Protection Agency (EPA) Region 9 Laboratory; Schlumberger, Inc.; The Watershed Project; Marine Advanced Research; Cybertran; and Stratacor, Inc. In

1989, UC management estimated that 250 to 300 people worked at the RFS (Ensco Environmental Services, Inc. 1989). Staffing in 2013 is approximately 300 people.

Portions of the Former RFS and the Regatta Property located west of the Former RFS make up the current RBC. The RBC consolidates the biosciences programs of the LBNL, and provides for the development of additional facilities for both LBNL and UC Berkeley for academic teaching and research focused on energy, environment, and health. The RBC, LRDP (UC 2014) identifies the developable portion of the new campus as the RES and the remainder as NOS Area. An LRDP is defined by statute (Public Resources Code 21080.09) as a “physical development and land use plan to meet the academic and institutional objectives for a particular campus or medical center of public higher education.” The RBC LRDP will guide growth and development of the campus through year 2050.

2.1.2 Historic Uses

Prior to settlement of the East Bay plain by the Spanish beginning in 1772, Native Americans used the area for fishing and harvesting shellfish. In the late 1800s, portions of the property were sold, and chemical and explosives industries moved into the area. Between the 1880s and 1948, several companies, including the California Cap Company (CCC), manufactured explosives at the RES (see RAW Figure 2-3). The CCC plant hosted several operations, including manufacturing explosives (primarily mercury fulminate), shells, and blasting caps; testing explosives; and storing explosives (URS Corporation [URS] 1999).

Two small companies, the U.S. Briquette Company and the Pacific Cartridge Company, are presumed to have operated on a portion of the RES. Both companies are shown on the 1912 and 1916 Sanborn maps, although the U.S. Briquette Company was noted as “not in operation” as of January 1912. Neither company is listed on the 1930 Sanborn map. No additional information is available about either facility. By 1920, the CCC was the only remaining explosives manufacturer on site.

The chief constituent of the explosive manufactured by the CCC was a nitrocellulose (guncotton) base called “tonite.” Manufacture of the explosive included production of mercury fulminate, a whitish-gray solid with the chemical formula $Hg(ONC)_2$, a key ingredient in blasting caps. The former mercury fulminate facility was in the southeastern portion of the RES (see RAW Figure 2-4). Other former facilities associated with the CCC included the former CCC shell manufacturing areas in the southern portion of the RES; the blasting cap manufacturing area in the central portion of the RES; an explosives test pit area in the northeast portion of the RES; and two explosive storage areas, both southwest of the former explosives test pit area (URS 1999).

According to an article published in the July 1922 edition of the CCC newspaper, The Detonator, the manufacturing plant consisted of approximately 150 buildings, including administration buildings, a shell and metal drawing unit, a wire drawing unit, the blasting cap line unit, an electric blasting cap unit, and fulminate nitrating and recovery units. A tram line, evident on Sanborn maps and historical photographs, was present between these buildings (see RAW Figure 2-5). It appears from the photograph that the tram line was a rail system with a horse-drawn cart that moved supplies and other goods around the property. The entire CCC facility covered approximately 30 acres, with an additional 30 acres of trees surrounding the facility.

2.2 PREVIOUS INVESTIGATIONS AND REMEDIATION

This section summarizes previous investigations and remediation activities within the RES and RFS-wide groundwater. Section 2.2.1 briefly summarizes investigations that were conducted in the RES prior to the Field Sampling Workplan (FSW) that was prepared by UC Berkeley and approved by DTSC in 2010. Section 2.2.2 summarizes FSW Phases I, II, and III investigation activities and sampling results from 2010 through 2012. Section 2.2.3 summarizes previous cleanup actions that have been conducted in portions of the RES between 2002 and 2004 as well as two TCRAs.

2.2.1 Pre-FSW Investigations

Investigations conducted between 1981 and 2008 involved collection of soil and groundwater samples in a variety of locations within the RES. Soil samples were generally analyzed for metals, PCBs, polycyclic aromatic hydrocarbons (PAH), semivolatile organic compounds (SVOC), or pesticides (Tetra Tech 2013). The investigations conducted prior to 2010 focused on potential source areas (see RAW Figure 2-3), and identified areas requiring further investigation. The data collected during these investigations is summarized in the CCR (Tetra Tech 2008a) and SCR (Tetra Tech 2013).

2.2.2 FSW Investigations

UC Berkeley completed FSW Phases I, II, and III data gap investigations between 2010 and 2012. The FSW addresses data gaps identified in the CCR that warranted additional characterization or evaluation at RFS (Tetra Tech 2008a). The majority of the FSW soil investigations occurred within the RES. The scope of the FSW groundwater investigation covered the entire Former RFS.

The purpose of the FSW investigation was to close previously-identified data gaps, and to identify any immediate or potential risks to public health and the environment. Results are briefly summarized below and are described in detail in the SCR (Tetra Tech 2013).

2.2.3 Previous Cleanup Actions

Remedial activities occurred in three phases beginning in 2002. Remedial Phases 1 through 3 were completed in 2002, 2003, and 2004, respectively, under oversight of the San Francisco Bay Regional Quality Control Board (RWQCB). A TCRA occurred near the FPL WTL in fall 2007 to remove arsenic-contaminated soils; the results are summarized in the TCRA Implementation Report (Tetra Tech 2008b). A second TCRA was conducted south of the RES in fall 2008 to excavate soil associated with ash piles with elevated levels of PCBs; the results are summarized in the TCRA Implementation Report (Tetra Tech 2009). The TCRAs were completed under DTSC oversight. Figure C-5 shows locations of the previously remediated areas. Table C-2 briefly summarizes these remediation activities.

2.3 CHEMICALS OF CONCERN

The results of the historical and FSW investigations indicate that elevated concentrations of certain metals, PAHs, and PCBs occur in RES soils, and soil sampling for these constituents is recommended throughout the RES. Other potential contaminants more limited in RES soils include dioxins, TPH, and volatile organic compounds (VOC); these contaminants are recommended for analysis in select locations of the RES.

Based on the historical use of explosives, explosives constituents are also recommended for sampling and analysis in select locations in the RES; however, explosives constituents have not been detected in previous soil sampling in the RES above Category I criteria.

For the purposes of this discussion, "elevated" concentrations in soil refers to soil concentrations above the screening criteria used in the SCR. Soil screening criteria used in the SCR include:

- Calculated human health risk-based concentrations for future commercial workers for metals, VOCs, SVOCs, pesticides, PCBs, and explosives (Tetra Tech 2013);
- The background value for arsenic (16 mg/kg) as established for the adjacent Campus Bay site and approved by DTSC for the Former RFS Site (Erler & Kalinowski, Inc. 2007; DTSC 2007);
- The ambient value for carcinogenic PAHs, as represented by BAP (EQ), which is equal to the 95th percentile Upper Confidence Limit (UCL) of the mean BAP (EQ) values of the ambient surface soil dataset from urban environments in Northern California of 0.4 mg/kg (DTSC 2009, Environ Corporation and others 2002);
- TSCA cleanup criteria for total PCBs in soil, high occupancy areas with no conditions (1 mg/kg) (EPA 2005); and
- Commercial environmental screening levels for TPH constituents (RWQCB 2013).

The SCR also identified two VOCs in groundwater (TCE and carbon tetrachloride) which have been detected above the calculated human health vapor intrusion risk-based concentrations for future commercial workers (Tetra Tech 2013). While these VOCs are not COCs in soil, future soil disturbance activities which occur in areas where the groundwater concentration exceeds vapor intrusion risk-based concentrations must take into consideration proper countermeasures to ensure protection of future commercial workers.

Metals

Arsenic concentrations above background levels in soils are the result of historical placement of pyrite cinders as fill material in the RES. Pyrite cinders, such as those used in production of sulfuric acid at the former Stauffer production areas, are produced from ore that is composed mostly of iron sulfide but may also contain other metal sulfides, such as arsenopyrite, and concentrations of arsenic and other metals are often found above background levels in pyrite cinders. Other possible sources of arsenic include the historic use of arsenic containing herbicides on railways and the use of arsenic wood preservatives at the former FPL WTL. A removal action conducted at FPL WTL in 2007 removed arsenic contamination above background levels in the area of the research laboratory.

Potential sources of lead at RES include (1) historic emissions from automobiles, (2) a component of metals used in manufacture of shells and blasting caps, (3) pyrite cinders used as fill throughout RES, and (4) leaded paint from former or existing buildings. Some elevated concentrations of lead are in isolated areas of RES soils, perhaps attributable to the "nugget effect" that can occur when lead-based paint chips into soil.

Mercury is present at elevated concentrations in RES soils primarily due to historical activities associated with manufacturing explosives. The former CCC historically used elemental or liquid mercury in the MFA. This form of mercury can volatilize into the atmosphere from soil, sediment, or water. Drawings of the mercury fulminate production plant show an open structure (presumably for ventilation) and air stack which could have contributed to aerial deposition of mercury in the areas surrounding the mercury fulminate plant in the central meadow. Drawings also identify storage tanks rinsate areas in the MFA. Movement of the blasting caps around the facility via the tram system could have tracked mercury away from the mercury fulminate plant. As part of the remedy for the RES, UC has proposed a soil removal action in the MFA where concentrations of mercury elevated above the commercial risk-based concentration are present.

PAHs

PAHs in the RES are likely a result of burning carbon-containing compounds (including at the former waste incinerator near Building 120 and the former Field Laboratory), aerial industrial emissions from surrounding industrial facilities, and gasoline and diesel exhaust from regional roadways and railyards. An assessment of the soil data obtained from RES soils, mostly in the Corporation Yard, indicates that concentrations of PAHs decrease with depth; where PAHs are present, concentrations of PAHs are elevated above screening criteria in surface soils (0 to 0.5 feet below ground surface [bgs]), but are typically less than screening criteria at deeper depths (2 to 2.5 feet bgs), and non-detect below 2 to 2.5 feet bgs.

PCBs

PCBs are biopersistent organic chemicals that were used for many purposed from the initial commercial use in 1929 to when use was banned by EPA in 1979, including heat transfer fluids for gas turbines, hydraulic fluids for vacuum pumps, fire retardants, and plasticizers in adhesives, textiles, surface coatings, sealants, printing, and carbonless copy paper (Lloyd and others 1975). Aroclors-1248, -1254, and -1260 are commonly found in the RES, and are likely associated with hydraulic fluids and dielectrical fluids in capacitors and transformers. A release of PCBs to surface soils from a spill would have migrated little from its original release point, as PCBs sorb strongly to soil. This model is supported by the sampling data obtained during the FSW Phase II investigation, which sampled near former PCB-containing transformers. Where PCB contamination was detected, elevated concentrations of PCBs were limited to a small area, both horizontally and vertically, confirmed through step-out sampling.

PCBs have also been detected at low concentrations (below screening criteria) in surficial soils within the RES, most of which may not be attributed to a spill but possibly to aerial deposition from surrounding industrial facilities, including the PG&E facility northwest of the RES. As part of the removal action for the RES, UC will remove soils with total PCB concentrations greater than 1 mg/kg. The areas identified for PCB removal are located at two transformer areas and the Corporation Yard.

Dioxins

Dioxins in the environment are the result of burning chlorine-based chemical compounds with hydrocarbons, such as stack emissions from the incineration of municipal refuse and certain chemical wastes, or exhaust from automobiles powered by leaded gasoline. The former waste incinerator at Building 120 may be a potential historical source of dioxins; soil samples collected for dioxin analysis near the former incinerator location indicate that dioxin concentrations in that area exceed the commercial risk-based concentration in surficial soil, but concentrations decrease as sample depth increases.

VOCs

Although RES soils have not been found to contain concentrations of VOCs exceeding screening criteria, groundwater results indicate that TCE and carbon tetrachloride exceed groundwater screening criteria.

Groundwater impacted with elevated levels of TCE exceeding the commercial vapor intrusion risk-based concentration and the California and federal maximum contaminant levels (MCL) has migrated onto the Site from the adjacent former Zeneca Site. UC concludes that TCE and related breakdown products originated from legacy industrial activities at the former Zeneca Site, based on (1) the measured groundwater gradient from the former Zeneca Site to the Site, (2) known historical TCE sources and groundwater contamination at the upgradient former Zeneca Site, and (3) lack of measured or identified TCE sources within the Site. The remedy for contaminants in groundwater originating from the former Zeneca Site, including TCE and its breakdown components, is subject to the Zeneca Order.

Carbon tetrachloride was detected at piezometer location CTP (located in the upland meadows) at concentrations exceeding the commercial vapor intrusion risk-based concentration and California MCL during the FSW Phase I investigation. Carbon tetrachloride has also been detected at some of the piezometer locations downgradient of location CTP at concentrations exceeding the California MCL. No source of carbon tetrachloride has been identified in the immediate area or upgradient of the piezometer CTP.

TPH

Low concentrations of TPH compounds in soil may originate from small diesel spills from equipment, from above ground storage tanks (AST) or former underground storage tanks (UST), from incomplete combustion of petroleum from nearby automobiles and industrial uses, or as a carrier in herbicides. No spills were observed at any of the ASTs still in place, and all USTs have been removed and administratively closed. Soil sample results indicate that the Earthquake Engineering hydraulic lines at Building 484 have leaked, and soil excavation within this area is proposed to be completed as a maintenance activity. TPH contamination may be present near and around the Earthquake Engineering hydraulic lines.

Explosives

Between the late 1800s and 1948, the CCC and other smaller companies, manufactured blasting caps, shells, and explosives on the property. The chief constituent of the explosive used by the

CCC was a nitrocellulose (guncotton) base called “tonite,” the manufacturing of which included the production of mercury fulminate. Documentation indicates that nitrocellulose and mercury fulminate were the primary explosives used in manufacturing explosives on the property, however, other explosives such as octahydor-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), cyclotrimethylenetrinitramine, or 2,4,6-trinitrotoluene may have been employed. Historical documents indicate that explosives were tested and stored in the north-central portion of the property (RAW Figure 2-3). Soil data to date indicates that HMX may have been used, as it was detected at a low level in one sample collected near the explosive storage area at a concentration of 0.37 mg/kg, five orders of magnitude below the commercial risk-based concentration.

2.4 Soil Management Plan Areas

In order to determine the analytical requirements and density of sampling required for the SMP, the RES was divided into 25 SMP Areas. SMP Areas were created by reviewing historical activities, results of sampling conducted to date, contaminants previously detected, and removal actions conducted to date. Areas with similar site histories and uses that were adjacent were placed into the same SMP Area. Figure C-3 presents the 25 SMP Areas, and Table C-2 presents a summary of the characteristics considered for each SMP Area, including historical and current activities, previous cleanups, potential for pyrite cinders, and whether a groundwater concentration exceeds the commercial vapor intrusion risk-based concentration. EH&S will review Table C-3 annually to incorporate data from sampling conducted following the publication of this SMP.

3.0 PROJECT DESCRIPTION AND DETERMINATION OF SAMPLING

This section describes types of projects subject to the SMP, spanning from small projects that may not require sampling to large projects which will implement the full range of sampling and soil management requirements presented in this SMP.

3.1 TYPES OF WORK

The LRDP for the RBC includes redevelopment and construction of new buildings and support infrastructure within the RES which are anticipated to require large-scale soil disturbance. Routine maintenance and repair activities which require small-scale soil disturbance will also be required in the RES on an ongoing basis, independent of redevelopment under the LRDP.

The SMP will be implemented for all future projects conducted within the RFS portions of the RES that impact greater than or equal to 10 CY of in-situ surface or subsurface soils or result in a hardscaped surface of greater than 500 square feet. Examples of typical soil disturbance activities that are subject to the SMP include the following:

- Building construction
- Road construction
- Sidewalk construction
- Parking lot construction
- Major underground utilities construction associated with a project
- Significant landscaping activities

Soil disturbance activities that impact less than 10 CY of soil or less than 500 square feet of hardscape surface are not subject to the prescriptive requirements outlined in this SMP. These *de minimis* projects will be managed and overseen by UC EH&S as discussed in Section 1.1. Larger projects may not be identified as *de minimis* projects to avoid prescriptive sampling measures. For *de minimis* projects, EH&S will prepare SMP Form A to document the rationale for the *de minimis* determination. UC will notify DTSC and the community of *de minimis* activities consistent with current notifications provided to DTSC and the RBC community (e.g., work notices, posting of documents to DTSC's Envirostor database, regularly scheduled town hall meetings for RBC workers and tenants). Typical *de minimis* projects that will not be subject to the SMP include the following:

- Minor sidewalk or utility repairs
- Landscaping activities such as tree, shrub, or weed removal
- Installation of fence posts or signage
- Roadway asphalt repair
- Installation of soil boreholes and monitoring wells

All soil disturbance activities with the RES are subject to review and approval by EH&S. Soil disturbance activities within the RES subject to the SMP require written EH&S notification and approval, which is initiated through the completion of *SMP Form A, Project Overview*, included in Exhibit C1. The extent of the EH&S approval process and supporting documentation will depend on the nature, size, and complexity of the project, as well as location of the project within the RES. A spreadsheet tracking all SMP projects will be available to the public via the RFS environmental website.

The requirements of the SMP will be based on the scale and location of the proposed activity. All soil disturbance activities will require EH&S approval of the activity prior to soil disturbance, and projects subject to the SMP will require EH&S approval of SMP Form A. EH&S will provide SMP Form A to DTSC at least 14 days prior to the start of work or as soon as practicable during the next working day if the 14 days advance notification is not possible, such as for emergency repairs or other time-critical projects. In cases where pre-approval cannot be attained for projects requiring SMP Form A, such as for emergency repairs, EH&S will notify DTSC by telephone within 24 hours of the start of the activity, and SMP Form A will be completed within 48 hours. Notification to all other appropriate agencies will also be provided as required by law.

3.2 Potential Impacts to Groundwater Piezometer Network

The RAW for the RES and Site-wide groundwater includes ongoing sampling at piezometers located throughout the RES. Efforts should be made to minimize any impacts to existing piezometers from a proposed soil disturbance activity. In the event that an activity impacts a piezometer, the piezometer must be properly destroyed and abandoned per Contra Costa County Environmental Health Department guidelines and a permit must be obtained; UC will notify DTSC to propose a new piezometer location. All existing piezometer locations are shown on Figure C-5.

3.3 Sampling Requirements

Soil disturbance projects under the scope of this SMP are subject to the prescriptive sampling requirements discussed in Section 4.0. If UC proposes an alternative sampling plan which does not specifically follow the prescriptive requirements, EH&S will notify DTSC for review and approval of the proposed sampling plan.

3.4 Documentation

EH&S will document EH&S approval and DTSC notification of projects subject to the SMP through the completion and submission of SMP Form A, Project Overview.

Instructions for Completing SMP Form A, Project Overview	
1. Tracking No., Revision No., and Date	Provide unique tracking number, revision number, and date of latest revision.
2. Project Name	Provide unique project name.
3. Description	Include details necessary to implement SMP. Include specific location, description of activities impacting soil, estimate of total soil disturbance in cubic yards. Attach map indicating project location.

Instructions for Completing SMP Form A, Project Overview (Continued)	
4. Points of Contact	Provide EH&S point of contact, facilities point of contact, or any other UC or other third party responsible for implementation of SMP requirements.
5. Estimated Schedule	Identify estimated schedule of entire project through completion. Update as necessary.
6. DTSC Work Notice Requirements	EH&S must provide DTSC a 14-day notice regarding projects involving excavation, drilling, or sampling for the purpose of collecting environmental samples or addressing soil management. DTSC issues a Work Notice to a community distribution list.
7. Impacts to Piezometer Network	Consult with SMP Figure C-5 to ensure project does not impact an existing piezometer, or propose replacement location to DTSC if necessary.
8. Radiological Status	Indicate if radioactive materials have been used within the project area. If yes, contact UC Berkeley's Radiological Safety Program to determine the radiological status and protocols necessary prior to proceding (http://www.ehs.berkeley.edu/rs.html).
9. Total Volume of Soil Excavation Planned (in CY)	Calculate the total in-situ volume of soil that is planned for excavation.
10. *De Minimis* Status	Indicate if the project is exempt from SMP prescriptive requirements based on the volume of excavation or size of hardscaped area affected. Projects impacting less than 10 cubic yards of in-situ soil or 500 feet of hardscaped area are exempt from the SMP prescriptive requirements. EH&S will document the rationale for *de minimis* determinations in the SMP Form A.
11. Form A EH&S and Facilities Management, UC Berkeley College of Engineering Approval	Form A must be signed and dated by EH&S staff responsible for implementation of SMP activities. Signature indicates review and approval of Items 1 through 6. Signature indicates that proper additional documentation necessary is included within EH&S files. EH&S will provide Completed SMP Form A to DTSC.

SMP Form A, which will include the project location map, will be completed by EH&S and submitted to DTSC and posted on the RFS Environmental website prior to any soil disturbance activities. SMP Form A will be updated and provided to DTSC if the project scope or conditions change, for example if the project area or estimated soil volume increases or the schedule has been revised. If after 6 months the project has not proceeded to the next step, the information on SMP Form A will be reviewed and updated as necessary. EH&S will maintain within UC files any additional internal documentation necessary in support of the information presented in SMP Form A. Supplemental documentation, if prepared, will be provided to DTSC or be available upon request from DTSC.

4.0 SAMPLING, DATA EVALUATION, AND SOIL MANAGEMENT ACTIONS

This section outlines the objectives and basis for projects subject to sampling under the SMP. Projects will be evaluated to determine the scope of sampling and analysis to be conducted prior to initiating earthwork activities.

The sampling protocols will be established on a site-specfic basis, or may follow the prescribed protocols (number of sampling locations, sample depth, sample intervals), and chemical analyses presented in Section 4.1. Soil sampling will be conducted following the protocols outlined in Exhibit C2, SAP. Soil sampling data will be evaluated per the guidelines in Section 4.2 to determine the appropriate soil management action determination presented in Section 4.3. Section 4.3 presents the planning documents necessary to manage soil in place or for off-site disposal. All sampling approaches will be submitted to DTSC prior to implementation.

4.1 PRESCRIPTIVE SAMPLING DESIGN

The sampling design is based on the location, footprint, and depth of the proposed soil disturbance. The prescriptive sampling designs presented below may be used in the event that a site-specific sampling strategy is not recommended by UC EH&S or DTSC.

Sampling Density and Recommended Analytes

Sampling design is initiated by identifying the SMP Area(s) impacted by the project through comparison to Figure C-6. Table C-3 presents the recommended sampling density and analytical requirements for each of the SMP Areas delineated on Figure C-6.

Samples will generally be collected in a grid pattern to provide representative lateral coverage over the project area. Three categories of sampling density have been defined (low, medium, and high) as described below. The recommended sampling density for each SMP Area is a function of historical activity in the area and the results of previous investigations. Sample locations must be documented on scaled figure with appropriate landmarks or buildings identified. The required sample density for each SMP Area is specified in Table C-3.

- Low density sampling requires sampling on a 125 foot grid spacing (one sample location per 15,625 square feet) – applicable in SMP Areas where no historical industrial activities occurred;
- Medium density sampling requires sampling on a 100 foot grid spacing (one sample location per 10,000 square feet) – applicable in SMP Areas where some historical industrial activities occurred, or an adjacent SMP Area has had a high level of historical industrial activities;
- High density sampling requires sampling on a 75 foot grid spacing (one sample location per 5,625 square feet) – applicable in SMP Areas where a high level of historical industrial activities occurred.

There is no minimum number of sample locations required for each project; however, if a 95 UCL is to be calculated, as described in Section 4.2.2, a minimum of ten samples will be collected.

Known site conditions within the project area will be considered when developing the sampling design, to determine if any additional sampling is needed, or if sampling locations should be moved to characterize certain areas of the project to meet the intent of this SMP. Factors to be considered include:

- Existing buildings, utilities and site features (current and any which will be demolished by a proposed project);
- Former buildings, remediated areas, and known pyrite cinder areas, as shown on Figure C-5;
- Historical soil sample locations, sample depths, and sample analysis results, as presented in the Final SCR (Tetra Tech 2013). Historical sampling information may be used to supplement the sampling design; and
- Recent sampling data, if available.

Sampling Depth and Intervals

Samples will be collected in 0.5-foot depth intervals every 2 feet starting at the surface and extending to a depth of 2.5 feet below the depth of planned soil disturbance. This will allow documentation of potential residual soil contamination beneath the excavation. If the depth of the planned soil disturbance varies within the project area, the sampling design should be adjusted to provide representative coverage for the variable depths or by sampling subareas separately. Soil samples will be collected by hand or advanced through hand-auger techniques up to 5 feet bgs. Sampling methodologies will be conducted according the SAP.

Samples may also be collected at depths greater than 2.5 feet below the proposed excavation depth as part of characterization sampling; these samples will be held in the laboratory and analyzed in the case that concentrations from samples from 2.5 feet below the proposed excavation depth exceed criteria. Similarly, samples may be collected outside of the proposed excavation boundary and held in the laboratory, and analyzed in the case that concentrations from samples at the edge of the proposed excavation exceed criteria. Samples being held pending analysis will only be analyzed if the holding time has not expired. In cases where the holding time is exceeded, an additional sample would be collected at the edge of the final excavation to confirm that the criteria are not exceeded.

EH&S will determine the need for professional land-surveying for sampling locations on a project-by-project basis. For all other projects, hand-held devices using global positioning systems will be used to record sampling locations and will be tracked in the geographic information system (GIS) database.

Soil Sampling for Lead Based Paint Around Existing Buildings

Paints applied to the exterior of buildings constructed prior to 1993 are likely to have contained lead (DTSC 2006). Lead-based paint (LBP) may be present in the immediate vicinity of these buildings as a result of weathering, or past renovation activities resulting in deposition of LBP fragments to surface soil. Lead in soil from LBP from exterior paint is generally present only in the immediate vicinity of the building and in the top few inches of surface soil. LBP is generally not present where the building perimeter is hardscaped, such that paint chips are carried away by rain or wind, and does not accumulate.

Sampling for LBP-impacted soil will be conducted where the planned project boundary includes a building constructed prior to 1993.

Area of Potential Groundwater Concern

TCE and carbon tetrachloride concentrations exceed commercial vapor intrusion risk-based concentrations in portions of the RES, as discussed in Section 2.3. Table C-2 identifies the four SMP areas where groundwater concentrations exceed the commercial vapor intrusion risk-based concentrations, indicating that indoor air concentrations of those VOCs may be present at levels posing risk to potential commercial receptors (Tetra Tech 2013). The selected remedy for groundwater at the Former RFS includes an ongoing groundwater monitoring program and implementation of the groundwater remedy for the adjacent former Zeneca site, which consists of treatment and ongoing monitoring. The groundwater remedy also includes monitored natural attenuation with a contingency for active treatment to address the carbon tetrachloride contamination in the northwest part of the RES (SMP Area 15).

If a soil disturbance project (1) consists of the construction of a new building or (2) extends deep enough to contact groundwater, and (3) is located in a SMP Area where groundwater results exceed the commercial vapor intrusion risk-based concentrations for VOCs identified in Table C-1, then EH&S will consult DTSC before creating a sampling plan. Because VOC concentrations in groundwater are expected to change over time, site-specific evaluation is needed to determine if additional sampling protocols or worker protection precautions will be required, based on the project location. Given the ongoing nature of the groundwater monitoring programs, EH&S will consult the most current groundwater data available. A prescriptive approach for addressing potential groundwater concerns in the SMP is not appropriate.

If there is a concern regarding groundwater contamination along newly created-preferential pathways as a result of a new construction project (for example a deep utility corridor), then engineering parameters, such as impervious linings, will be developed under the project-specific design plan.

UC will evaluate potential impacts to groundwater in the event that a project involves the construction of a swale or permeable landscaping intended for the management of stormwater.

4.2 DATA EVALUATION

Soil sample data will be evaluated to confirm that the data set is complete, and data quality is acceptable. Data acceptance criteria and data validation protocols are provided in Exhibit C2, SAP. Deviations from the sampling design, such as change in sample location, or analytical results which do not meet data quality criteria, will be evaluated to determine whether additional sampling is required.

4.2.1 Screening Criteria

Soil sampling data will be compared to two soil screening criteria to determine the management action that needs to be taken: (1) Category I criteria represent the most protective risk-based concentration (or background, ambient, or regulatory criteria, if available) and are protective of all future workers and visitors to the RES; and (2) Category II (On-Site Management) criteria represent the maximum concentration of chemicals in soil which may be managed in place within the SMP project area described in SMP Form A with a cover to prevent exposure to commercial workers or visitors. Category I and II criteria are presented in Table C-1.

Category I criteria are based on the lowest of the calculated risk-based concentrations (of the commercial worker, construction worker, maintenance worker, and off-site receptor [inhalation only]), unless background, ambient, or TSCA criterion are available, in which case the alternate values are selected. Category II criteria are generally based on the equivalent of one order of magnitude greater than the Category I criteria, with exceptions identified in Table C-1. Screening criteria will be reviewed at least annually during periods when projects are occurring, in addition to the evaluation of remedy implementation that will occur as part of the five-year review process.

4.2.2 Determination of Soil Management Action

A comparison of the maximum sample result or the calculated 95 UCL (if available) to the Category I and II criteria will be used to determine how to manage the project soil. UC will determine the appropriate soil management actions for sampled project soil using the following decision matrix:

Comparison of Soil Concentrations to Screening Criteria [1, 2]	Soil Management Action
Maximum soil concentration or 95 UCL concentration does not exceed Category I criteria	No action; suitable for commercial reuse within the SMP project area.
Maximum soil concentration or 95 UCL concentration exceeds Category I criteria but does not exceed Category II criteria	Soil may be managed in place within the SMP project area with appropriate cover. Appropriate cover consists of hardscape (roadway, parking lot, sidewalk, or building) or a minimum of 2 feet of soil with concentrations less than Category I criteria, or as approved by DTSC.
Maximum soil concentration or 95 UCL concentration exceeds Category II criteria	Soil will be evaluated for off-site disposal, or DTSC will be contacted if proposed to be managed in place.

<u>Delineation of Soil Exceeding Criteria</u>

Additional soil samples may be collected in order to delineate the lateral and vertical extent of soil contamination exceeding Category I or II criteria in order to reduce the amount of soil that is planned for excavation or management in place. The sampling grid size for additional delineation sampling will be no less than twice the frequency of the original sampling. If significant excavation activities are already planned for the proposed project, additional sampling may be conducted during excavation activities rather than prior to excavation.

If the project soil concentrations are less than the Category I criteria, then the project may proceed without specific soil management practices, as outlined in the table above. Soil generated from the project must remain within the project boundaries described in SMP Form A unless DTSC has provided approval otherwise. The sampling results will be documented in a summary report and submitted by EH&S to DTSC with SMP Form B.

If soil is less than Category II criteria, then soil can either be managed in place within the SMP project area described in SMP Form A or excavated and managed through placement beneath 2 feet of soil below Category I criteria, or beneath a hardscaped surface, such as a roadway, sidewalk, parking, or building foundation, to prevent exposure of commercial workers and visitors to soil. Soil with concentrations exceeding Category II criteria will be excavated to a depth of 2 feet below the planned soil disturbance, effectively eliminating the direct contact exposure pathway, unless DTSC is contacted for approval to manage the soil in place. Soil excavated from a SMP project area will remain within the same SMP project area unless it is disposed of off-site; if UC proposes to use the excavated soils in other portions of the RES, UC will contact DTSC for approval. The sampling results will be documented in a summary report and submitted by EH&S to DTSC with SMP Form B following project completion, as described in Section 6.0, Completion Reporting.

Soils exceeding Category II criteria will be transported off site to an appropriate disposal facility. Any deviations from the specified soil management requirements will be discussed with DTSC. Only soil which meets the DTSC Information Advisory, Clean Imported Fill Material requirements (DTSC 2001) may be managed without DTSC oversight or land use controls.

If the COC is PCBs (Aroclors), the soil will continue to be excavated until concentrations of total PCBs are less than or equal to 1 mg/kg. DTSC and EPA will be consulted on a case-by-case basis if soils with total PCB concentrations greater than 1 mg/kg are present below 10 feet bgs to determine if excavation below that depth is appropriate.

4.3 SOIL MANAGEMENT ACTIONS

Soil management will be conducted based on the criteria described in Section 4.2.

4.3.1 On-Site Management Plan

Soils exceeding Category I criteria, but less than Category II criteria, may be managed within the SMP project area described in SMP Form A, provided there is acceptable cover to eliminate the potential exposure pathway of human contact with the soil. Human receptors in the RES are commercial workers, construction workers, maintenance workers, and any on-site visitors. Category I criteria are protective of exposure to chemicals by off-site receptors via the inhalation pathway.

Acceptable covers include:

- A minimum of 2 feet of soil with chemical concentrations below Category I criteria; the overlying soil may not be breached. Prevention of breaches to the soil will be stipulated in the on-site management plan and managed by EH&S. In the event that the cover is breached, the breached area would be subject to renewed SMP requirements.
- Concrete building foundations and slabs with continuous coverage, which is laid directly over the soil or base rock layer above soil that will prevent contact with the soil;
- Asphalt or concrete pavement (and accompanying base rock) with continuous coverage, which is laid directly over the soil that exceeds the criteria.

A physical horizontal and vertical demarcation layer, such as geosynthetic fabric or snow fencing, will be placed over areas where soils exceeding Category I criteria, but are less than Category II criteria, are excavated or left in place and covered with an acceptable cover; the demarcation layer will be placed below the acceptable cover. Demarcation will not be required in the event that at least 2 feet of in-situ Category I soil (to be left in place) already covers Category II soil.

The on-site management plan will document the following:

- Summary of the proposed soil disturbance work, including location and depths of soil disturbance
- Data evaluation that supports the decision that the soil within the project area can be managed-in-place in accordance with the SMP
- Text and associated analytical results describing the cover or the materials to eliminate direct contact exposure pathway to commercial workers and visitors
- Figure showing the proposed cover area, material, and thickness

The on-site management plan will serve as the basis for the soil management action to be conducted during construction activities. The locations of covered soils will be documented in the closure reports for each SMP project, as well as in a centralized GIS database. The depth, cover material (if applicable), and management date of each of the excavated or covered areas will also be documented in the closure report for the SMP project and in the GIS metadata.

4.3.2 Soil Excavation Plan

Soil that exceeds Category II criteria will be excavated to a depth of 2 feet below the depth of project soil disturbance, or EH&S will consult with DTSC if other soil management actions are proposed. The area will be backfilled such that at least 2 feet of clean fill, or a permanent hardscaped surface, is placed above soil remaining in the excavation which exceeds Category I or Category II criteria. If site circumstances justify leaving the soil in place, UC will contact DTSC for approval.

A physical horizontal and vertical demarcation layer, such as geosynthetic fabric or snow fencing, will be placed over areas where soils exceeding Category II criteria have not been excavated. The demarcation layer will be covered with soil below Category I criteria.

The excavation plan will document the following:

- Summary of the proposed soil disturbance work, including location and depths of soil disturbance
- Data evaluation that supports the decision that the soil within the project area containing concentrations greater than the Category II criteria will be excavated for off-site disposal
- Text describing the placement and source of the imported clean fill or Category I soil, if applicable, to eliminate the direct contact exposure pathway to commercial workers and visitors
- Figure showing previous sampling locations and the proposed excavation and depths
- Description of how the excavated soil will be stockpiled, profiled and transported off-site for disposal
- Confirmation sampling plan

The excavation plan will serve as the basis for the soil management action to be conducted during excavation activities. The locations of excavated soils will be documented in the closure reports for each SMP project, as well as in a centralized GIS database. The boundaries of the covered areas will be determined using a hand-held GPS device and incorporated into a site-wide figure showing movement of soils. The depth and excavation date of each of the excavated areas will also be documented in the closure report for the SMP project and in the metadata of the GIS figure.

4.4 DOCUMENTATION

EH&S approval of the sampling design, data evaluation, and soil management will be documented through the completion of SMP Form B, Sampling Design, Data Evaluation, and Soil Management Parts 1, 2, and 3 (Exhibit C1), and required supporting documentation. Whether or not EH&S elects to follow the prescriptive protocols or site-specific sampling, the sampling will be outlined in a sampling strategy memorandum provided to DTSC with SMP Form B, Part 1. EH&S will submit a data summary report with SMP Form B, Part 2, documenting the results of the sampling activities. If SMP Form B, Part 3 is required, EH&S will submit the soil management or excavation plan with sufficient detail, including the selection of remedial goals and the proposed actions. Instructions for completing SMP Form B and supplemental documents are presented below.

Instructions for Completing SMP Form B, Sampling, Data Evaluation, Soil Management	
1. Sampling Design	
a. SMP Areas Affected	Consult SMP Figure C-6 to identify SMP areas affected by project.
b. Sampling Density	Consult SMP Figure C-6 and Table C-3 to determine the number of sampling locations.
c. Chemicals of Concern	Consult SMP Table C-3 to identify soil analytical requirements. Include a summary of existing data within the sampling strategy memorandum.
d. Sampling Depth	Consult SMP Section 4.1 to identify required total sampling depth and intervals.
e. Project is within area of groundwater above screening criteria	Consult SMP Table C-2 to determine if project is within SMP area with potential for groundwater contamination or vapor intrusion. If so, consult with current groundwater monitoring program.
f. Sampling design meets all SMP prescriptive requirements	Evaluate if proposed sampling meets the prescriptive requirements outlined in SMP. If not, indicate if DTSC concurrence has been received on the site-specific sampling strategy.
2. Data Evaluation (Post-Sampling)	
a. Sampling Design Completed	Confirm all samples were collected and analyzed according to sampling design in Item 1.
b. Sample Results below Category I	Consult SMP Table C-1 for soil categorization criteria. If results do not exceed Category I criteria, EH&S submits SMP Form B with attached data summary report to DTSC. No further soil management actions are required. Category I soils are suitable for commercial use, and can be managed within the SMP project area. Soil excavated from a SMP project area will remain within the same SMP project area unless it is disposed of off-site; if UC proposes to use the excavated soils in other portions of the RES, UC will contact DTSC for approval.
c. Soil Exceeding Category I is Defined Vertically and Laterally	If sample results exceed Category I criteria, then soil management is required, and the boundaries of contaminants exceeding criteria must be defined. If the project requires excavation, additional sampling may be conducted during or following excavation activities.
d. Soil Less Than Category II Criteria	If sample results are less than Category II criteria, soil may be managed on site within the SMP project area according to SMP Section 4.3, and an on-site management plan is required. If sample results are above Criteria II criteria, off-site disposal is required unless DTSC provides approval for on-site management. Review and approval of the plans is included in the item below. EH&S will submit SMP Form B to DTSC following project completion reporting discussed in Section 6.0.
3. Soil Management Action	
a. On-Site Management Plan Meets SMP Requirements	Consult SMP Section 4.3 regarding on-site management plan requirements. DTSC must be notified if deviations result in not adhering to the intent of the prescriptive portions of the SMP, for example, if sampling depths or frequencies are less than described in Section 4.1.
b. Excavation Plan Meets SMP Requirements	Consult SMP Section 4.3 regarding excavation plan requirements. DTSC must be notified of deviations which result in not adhering to the intent of the prescription portions of the SMP, for example if soils above Criteria II remain in place or the proposed cover does not meet the criteria presented in Section 4.2.1.
4. SMP Form B EH&S Approval	Form B must be signed and dated by EH&S staff responsible for implementation of SMP. Signature indicates review and approval of Items 1, 2, and 3. Signature indicates that proper additional documentation necessary is included within EH&S files. Completed Form B must be provided to DTSC.
5. References Used to Complete Form	Include names and dates of documents used to complete form.

EH&S will maintain within UC files additional internal documentation necessary in support of the information presented in SMP Form B. If SMP Form B has not been approved or no activities have occurred for 1 year, the information contained in the form must be reviewed and updated as necessary prior to work occurring in the project area. Supporting documentation will be available upon request from DTSC.

The following documents will be submitted as attachments to SMP Form B, as appropriate.

SMP Form B, Part 1 Sampling Design will document the planned sampling design. Prior to conducting sampling, a sampling strategy memorandum will be submitted as an attachment to DTSC with Part 1 of SMP Form B completed, which will include the following:

- Summary of the proposed soil disturbance work, including location and depths of soil disturbance
- Identification of the SMP Areas affected by the project area and corresponding sampling density and required analytes
- Description of the proposed sampling locations, sampling depths, sample identification scheme, and sample collection methodology
- Figures depicting project area, depths of proposed soil disturbance, and sampling locations, drawn to scale

SMP Form B, Part 2 Data Evaluation will document the sampling results. Following completion of sampling, if soil concentrations are less than the Category I criteria (no action required), EH&S will submit a data summary report with SMP Form B to DTSC and include:

- Summary of soil sampling conducted in accordance with the sampling design
- Summary of soil sampling location, depths, sample identification and analytical results compared to soil criteria
- Laboratory analytical reports
- Soil data evaluation results, including data completeness, and data quality

Documentation will be completed for these projects with the submittal of SMP Form B, Part 2.

For all other projects, where soil concentrations are greater than the Category I criteria, SMP Form B, Part 3 Soil Management Action will also be required, along with a soil excavation plan or on-site management plan with the components listed in Section 4.3; these documents will be submitted to DTSC prior to conducting the soil management action.

5.0 IMPLEMENTATION OF SOIL MANAGEMENT ACTIONS

This section describes management practices that will be employed whenever applicable during implementation of projects subject to the requirements of the SMP.

5.1 PRE-EXCAVATION ACTIVITIES

Pre-construction activities for any SMP project may include (1) permitting and notification, (2) health and safety, (3) stormwater pollution prevention plan (SWPPP) development and implementation, (4) utility clearance, (5) clearing and grubbing, (6) groundwater water level measurement, (7) piezometer abandonment and replacement, (8) building demolition and abatement, and (9) implementation of grassland protection measures. Determination of the need for each activity will be determined by EH&S.

5.1.1 Permitting and Notification

The following permits and notifications will be required to perform any soil disturbance activity subject to the requirements of the SMP:

- EH&S will approve contractor personnel and subcontracts for access consistent with UC Berkeley policies
- DTSC notification at least 14 days in advance of field work
- RFS on-site worker and employee notifications
- Amend the existing Notice of Intent (NOI) and SWPPP or create a new NOI and SWPPP in compliance with the Construction General Permit and upload to the California State Water Resources Control Board SMARTS database
- Well abandonment and well installation permits for piezometers planned for abandonment and installation from Contra Costa County Environmental Health.

5.1.2 Health and Safety

All personnel entering the project control area which encompasses the excavation area and support areas, will read and comply with the requirements set forth in a site-specific Health and Safety Plan (HSP) prepared by the contractor. All contractors will be responsible for operating in accordance with the most current requirements of Title 8, California Code of Regulations, Section 5192 (8 California Code of Regulations 5192) and Title 29, Code of Federal Regulations (CFR), Section 1910.120 (29 CFR 1910.120), Standards for Hazardous Waste Operations and Emergency Response. Onsite personnel will be responsible for operating in accordance with all applicable regulations of the Occupational Safety and Health Administration outlined in 8 California Code of Regulations General Industry and Construction Safety Orders and 29 CFR 1910 and 29 CFR 1926, Construction Industry Standards, as well as other applicable federal, state and local laws and regulations. All personnel working at the site shall have reviewed and signed the HSP, and a safety meeting shall be conducted at the beginning of each work day to review potential site hazards and safe working procedures.

In the case that an excavation is greater than 4 feet deep, the contractor will be required to submit to EH&S a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazards of caving ground during the excavation, as appropriate. The proposed plan will comply with the State of California Construction Safety Orders and Title 24 of the California Code of Regulations. If the detailed plan varies from such shoring system standards, it shall be prepared by a registered civil or structural engineer.

5.1.3 Storm Water Pollution Prevention Plan Compliance

The current SWPPP that was developed for stockpiling of clean soils in the RES will be modified to incorporate information about excavation activities in the RES (4LEAF, Inc 2013), or a new SWPPP will be completed. The SWPPP will outline the Best Management Practices that shall be used to prevent erosion or runoff of soil, silts, gravel, non-stormwater discharges, hazardous chemicals, or other materials that are prohibited by the General Construction Permit from being discharged from the project boundaries. The SWPPP will include specific references to regulatory guidelines and applicable UC SOPs.

5.1.4 Utility Clearance

Prior to mobilization for any soil disturbance activity impacting soils greater than 2 feet bgs, underground utilities must be cleared and marked with UC facility management and utility locator. UC facility management will be consulted to first check for the presence of known utility lines in the vicinity of the proposed excavation area, based on existing utility maps, available information and a site walk. An underground utility survey will be conducted by a utility location contractor. It should be noted that existing utility location data at the facility may be incomplete: not all lines are identified on a map, and accuracy of identified utility line locations are limited. Plastic utility lines without metal tracer wire may be present. Underground pipes or utilities will be identified using hand-held detection devices, and utilities will be marked on the ground with indications (standard colors, letters, and numbers) of the assumed type of utility. This information will be provided to the EH&S for approval to excavate, prior to excavation activities. Regardless of utility clearance activities, all soil sampling to 5 feet will be conducted with hand auger equipment.

5.1.5 Ground Clearance and Grubbing

Prior to excavation, large debris, fencing and large vegetation (trees/shrub) will be cleared from the area to be excavated, either manually or using heavy equipment. Small trees/shrubs may be left in place for removal by heavy equipment during excavation. Water shall be applied to the soil surface to mitigate potential dust generation during all intrusive activities.

5.1.6 Groundwater Level Measurement

Groundwater in the RES varies from 3 to 16 feet bgs. For excavation activities disturbing soil to depths greater than 3 feet bgs, the depth to groundwater will be measured in the piezometers in the vicinity; ideally, measurement will be collected from three piezometers surrounding the area, within a time period of few hours. The potentiometric surface elevation of the shallow groundwater at the proposed excavation site calculated using this information, will assist the field team to determine at which depth groundwater is likely to occur while excavating or disturbing soils.

5.1.7 Piezometer Abandonment and Replacement

If a piezometer is located within the project footprint and cannot be maintained following the project, the existing piezometer will be abandoned properly prior to the excavation of the area. The groundwater data to date will be reviewed and EH&S will determine whether a replacement piezometer should be installed. The abandonment of the existing piezometer, and a location of a replacement piezometer, if applicable, will be proposed to DTSC for review and approval prior to abandoning the impacted piezometer. The existing piezometer will be abandoned and the replacement piezometer will be installed according to Contra Costa County Environmental Health regulations. The replacement piezometer location and elevation will be surveyed by a licensed surveyor. The replacement piezometer will be developed to accommodate use for future monitoring activities.

5.1.8 Hazardous Material Abatement

As part of hazardous material abatement for building demolition projects, a number of programs will be followed regarding the survey, abatement, and mitigation of the potential presence of hazardous materials related to LBP, asbestos or asbestos-containing materials, PCB-containing caulking, or the application of pesticides at building foundations.

Soil containing hazardous material identified in the survey will be removed as directed by EH&S. The removal activity may be conducted in conjunction with the building demolition work, following relevant health and safety procedures for the work.

5.1.9 Implementation of Grassland Protection Measures

Prior to construction activities near the grasslands, the core prairie area will be marked at a minimum with temporary fencing and signage, consistent with the recommendations in the RBC Coastal Terrace Prairie Management Plan (UC 2014, Appendix G). Temporary construction fencing in the vicinity of the grassland portion of the NOS shall consist, at minimum, of steel t-posts and 4 feet tall red plastic netting.

5.1.10 Implementation of Archeological Resource Protection Measures

To protect archaeological artifacts potentially present in subsurface soils, all subsurface activities, including the possible identification and recovery of archaeological artifacts, would be conducted in accordance with the applicable RBC health and safety plans to ensure protection from known and potential hazards. In addition, consistent with DTSC protocols for addressing archaeological artifacts in contact with contaminated media, UC would work directly with DTSC and the appropriate trustee organization for each artifact on a case-by-case basis to ensure proper treatment of the artifacts.

5.2 Excavation Activities

The following subsections describe management practices that will be implemented as applicable when excavating contaminated soil. The excavation process may include: (1) excavation of contaminated soil, (2) pyrite cinder management, (3) erosion and dust control, (4) decontamination, (5) confirmation sampling, and (6) contaminated soil management. Applicable excavations include:

- Excavation to remove soil containing chemical concentrations greater than Category I criteria, but less than Category II criteria (for potential use below an acceptable cover within the SMP project area described in SMP Form A)
- Excavation to remove soil containing chemical concentrations greater than Category II criteria (for off-site disposal)

Implementation practices for excavation activities conducted (1) to geotechnically or structurally prepare a project footprint for construction; or (2) within project footprints that have been pre-characterized as containing soil with concentrations less than Category I criteria (and thus no soil management action is required) are not included in this SMP, and will be described within the project-specific construction documents.

5.2.1 Excavation

Excavation activities will be conducted when characterization soil sampling results (based on the 95 UCL concentrations, or the maximum concentration if less than ten samples are collected) are greater than Category I or II criteria, per the soil management options described in Section 4.0. Characterization sampling will be conducted prior to excavation. During excavation, soils will be visually observed for unusual soils such as pyrite cinders, petroleum stains, or alum mud; if observed, excavation will be stopped until the identified soil is managed by EH&S staff.

Excavation will be conducted in a safe manner with proper sloping of sidewalls. Excavation will not extend below groundwater level. Workers will not be allowed to enter the excavation when it is deeper than 4 feet, unless the excavation is properly shored or sloped. All identified utilities in the excavation footprint will be deenergized or disconnected prior to any excavation.

5.2.2 Confirmation Sampling

To determine the final depth and width of the excavation, confirmation soil samples will be collected from the bottoms and sidewalls of the excavations to evaluate if sufficient soil impacted with concentrations of chemicals exceeding Category I or II criteria has been removed. Confirmation samples will initially be analyzed for all analytes specified in the prescriptive sampling plan (Table C-3). All sampling and analysis activities will be conducted consistent with the protocols identified in the SAP (Exhibit C2).

Confirmation samples will be collected at the same grid spacing as indicated on Figure C-6 (low, medium, or high density). Sampling required for each of the grid spacing categories consists of the following:

- Low – 125 foot grid spacing (one sample location per 15,625 square feet) – applicable in SMP Areas where no historical industrial activities occurred;

- Medium – 100 foot grid spacing (one sample location per 10,000 square feet) – applicable in SMP Areas where some historical industrial activities occurred, or an adjacent SMP Area has had a high level of historical industrial activities; and
- High – 75 foot grid spacing (one sample location per 5,625 square feet) – applicable in SMP Areas where a high level of historical industrial activities occurred.

At least one confirmation sample will be collected at the base of each excavation and one sidewall sample will be collected from each excavation sidewall. If chemicals are present in confirmation samples (based on the 95 UCL concentrations, or the maximum concentration if less than ten samples are collected) at a concentration exceeding the Category I or Category II criteria (depending on the remediation criteria), then the excavation will be expanded either laterally for sidewall samples or vertically for bottom samples.

For sidewall samples that exceed the criteria, the excavation will be expanded approximately 5 feet laterally, and then resampled. For bottom confirmation samples that exceed the criteria, the excavation will be expanded approximately 1 foot vertically, with the provision that excavation will not extend to such depth as to extend into standing groundwater. The distance to expand an excavation laterally and vertically may be adjusted based on site-specific or project-specific conditions. The excavation and confirmation sampling process will repeat until sample results are below the appropriate criteria, or unless DTSC has approved adequate excavation has been conducted. EH&S will contact DTSC for concurrence if there are proposed deviations from this approach.

The horizontal location and depth of each confirmation sample will be accurately recorded on the as-built plans and all final confirmation sample results will be recorded for presentation in the Completion Report, which will accompany SMP Form C.

Continuous observation of soil will be required as it is excavated to observe the soil for indications of potential contamination such as pyrite cinders or unusual debris. If workers observe unusual debris, EH&S will be notified prior to proceeding with excavation in the area. If pyrite cinders are observed, the soil will be managed as described below.

5.2.3 Cinder Management

Cinder management applies to the management of pyrite cinders and soils impacted by pyrite cinders during any soil disturbance activity, regardless of the size of the expected soil disturbance. Cinder management is based on and is consistent with the previous cinder management strategy implemented at Former RFS, as documented in the *Pyrite Cinder-Containing Soil Management Procedures* (UC Berkeley 2007) and *Regulatory Status of Soils Excavated During Replacement of Old Sewer Lines* (DTSC 1993).

EH&S or EH&S-trained personnel will conduct inspections during excavation where cinders are expected during the following activities:

- Building construction earthwork
- Drainage pipe or culvert installation

- Sewer or water main installation or removal
- Road work where excavation is required as part of drainage or road base installation
- Building renovation work that involves the types of underground utility work discussed above

EH&S does not expect that direct oversight and inspections will be necessary during smaller projects, including:

- Tree planting and removal
- Minor landscaping projects not intended to impact subsurface soils such as routine maintenance, weed control, and plantings
- Small irrigation line work and repairs
- Emergency utility work

During soil disturbance activities that are not conducted to remove contaminated soil, excavated soils, including those mixed with cinders, may be deposited back into the original excavation, assuming that there is no complete exposure pathway identified. Exposure pathways are eliminated if cinders are placed beneath 2 feet of native or clean fill, or a hardscaped feature such as a roadway, parking lot, or building foundation. Cinders will not be placed back into the original excavation if the highest measured groundwater is within 5 feet of the bottom of the excavation and placed no closer than 2 feet to the surface. If cinders are excavated from an excavation less than 2 feet deep, cinders cannot be replaced in that excavation. To the extent that no removal of cinders from the project area is involved and that all material can be placed back into the excavation, EH&S will likely not perform cinder sampling.

During soil disturbance activities that are conducted to remove contaminated soil, cinders will be removed from the excavation if they are within the original excavation footprint.

Displaced soil suspected of, or known to contain cinders, which cannot be placed back into the excavation will be assessed to determine if it exhibits a characteristic specified in Identification and Listing of Hazardous Waste, Chapter 11, Title 22, California Code of Regulations. EH&S will sample the material and determine the proper method of disposal. While sample results are pending, the material will be stored in covered stockpiles, covered bins, or drums. If the displaced soil is determined to be a hazardous waste, it will be managed in accordance with all California and Federal hazardous waste laws and regulations. If the presence of cinders has not been confirmed, then soil characterized as having concentrations below Category I criteria may be reused within the SMP project area. Soil characterized as having concentrations below Category II criteria can be managed in place within the SMP project area described in SMP Form A. Soil management in place generally consists of placement of soil beneath 2 feet of clean fill, under a roadway or parking lot, or building foundation, as defined in Section 4.3.1.

EH&S will track areas where cinders are encapsulated in a GIS-based map to ensure that the cinder material remains isolated. Any cinders-contaminated soil discovered during small excavations that is not managed in place will be sampled for management and disposal and results will be reported in writing to DTSC.

5.2.4 Erosion, Dust Control, and Air Monitoring

All excavated soils will be managed to prevent dust, spills to the ground or water, disposal into drains, and exposure risk to people or the environment. Excavation, transportation, and handling of all soil must result in no visible dust at the fence line of the excavation. Any soil material proposed to be placed as fill, whether from an offsite source or onsite source, will be kept covered or moist to facilitate eventual compaction and to control dust during earthwork operations. A water truck, water tank, or hydrant will be available to supply water in sufficient quantity on the job site while earthwork operations are underway. Sufficient water will be applied to suppress dust while exercising care to avoid generating runoff to any area outside the project boundary. Dust control measures will be implemented, as appropriate and necessary, beginning with site mobilization and continuing during all phases of the construction activities. Water will not be applied if there is a possibility of spreading contaminated soil or leaching contaminants from the soil, or if it results in hazardous working conditions.

Erosion and Dust Control

Contractors will not be allowed to stockpile material containing or suspected to contain hazardous waste or contamination unless covered and protected from rain or wind erosion for the duration of the construction project. Stockpiles of material containing hazardous waste or contamination will be placed on plastic sheeting of adequate thickness to contain the soils, and will not be placed in areas potentially affected by surface run-on or run-off. Contaminated and clean soils material will not be allowed to enter storm drains, inlets, or waters of the State. The plastic sheeting used to cover the soil must be anchored to the ground and weighted as necessary to securely and completely cover the stockpiled soil to prevent wind-blown dust from being generated. All stockpiled soil must be managed in accordance with the requirements outlined in the SWPPP and Section 5.1.4 of the RAW. EH&S will review and approve the project-specific SWPPP prior to submittal to the State Water Board. EH&S or EH&S-trained personnel will conduct inspections during work where soil is disturbed, including:

- Building construction earthwork
- Excavation of contaminated soil
- Loading and transportation of soil
- Drainage pipe or culvert installation
- Sewer or water main installation or removal
- Road work where excavation is required as part of drainage or road base installation

The construction general permit, if applicable to the project, requires that all SWPPP-related inspections must be performed by a Qualified SWPPP Practitioner (QSP) or Developer (QSD). The QSP or QSD can delegate other trained staff to perform some of the inspections on their behalf but the QSD or QSP must do some of the inspections since they have to certify the inspections.

EH&S does not typically require direct oversight and inspections for smaller projects, including:

- Tree planting and removal
- Landscaping projects impacting less than 10 CY
- Small irrigation line work and repairs
- Soil sampling and piezometer installation
- Emergency utility work

If the excavation is to be conducted when rain is possible, the site work must be carefully executed to contain potentially contaminated surface water, groundwater in excavations, muddy soils within the project area, and prevent off-site tracking of sediment and soils to adjoining roads.

Air Monitoring

Exposure monitoring and air sampling will be evaluated for each SMP project to monitor possible airborne levels of contaminants down-wind from any excavation and stockpile areas, and ensure that all on- and off-site workers are protected. The monitoring will help assure that excavation activities do not pose unacceptable concentrations to project personnel or any down-wind human receptors.

Prior to beginning construction for a project, a description of the conditions under which air monitoring would take place, the general approach that would be used by EH&S to develop action levels, a general description of the air monitoring equipment expected to be employed, and a citation to any appropriate health and safety plans.

Pertinent project information to decide if a project requires air monitoring include:

- Project size and location
- Nature of project and potential to generate airborne particulates or dust
- Contaminant concentrations
- Proximity to potential on-site and off-site receptors

Should air monitoring be required for a project, action levels will be developed using available soil sampling data to determine the chemicals of potential concern for the project, the potential concentration of the chemicals in dust, and acceptable concentrations in dust (including risk-based concentration). The potential concentrations of chemicals in dust will then be compared to the acceptable concentrations and action levels will be established. It is anticipated that only large projects or projects in areas with elevated soil concentrations would require perimeter dust monitoring using real-time aerosol monitors (such as the MIE Personal Data

Rams) equipped with data loggers to provide immediate information for the total dust levels present. Should analyte-specific monitoring be required (such as for mercury vapors), equipment and additional action level criteria will be included in the project construction plans or a separate air monitoring plan.

5.2.5 Decontamination

An exclusion zone will be established around the project's excavation area. Access to and from the exclusion zone by personnel and equipment will be controlled to mitigate site risks and prevent the spread of contamination. Decontamination procedures for workers will be established in the HSP.

A lined decontamination pad appropriately sized for storage and treatment of all anticipated rinse water will be placed just outside the exclusion zone and near the excavation area. The pad should be sized to collect decontamination water and overspray. Collection and removal of the decontamination water and precipitation captured in the decontamination pad will be conducted utilizing sumps, dikes, ditches, and holding tanks as required. The pad design will depend on the size and duration of the project. For smaller projects, a lined bermed area with water collection to drums via a sump pump at the low end is sufficient. The decontamination pad design will be approved by EH&S prior to construction.

All wastes including liquid wastes and non-hazardous or hazardous contaminated soils will be managed to prevent uncontrolled releases outside of the project area. Contaminated material handling and storage is discussed in Section 5.2.6.

All vehicles exiting the site will be inspected to be free of mud on tires, wheel wells, undercarriage and other exposed surfaces outside the covered truck bed or roll-off bin. Vehicles will be cleaned as necessary prior to leaving the decontamination area.

5.2.6 Waste Handling and Storage

Wastes generated during excavation and investigation will include hazardous and nonhazardous soil, decontamination water, and other investigation-derived waste (IDW). Wastes will be handled and stored according to the protocols below and all state and federal laws. Storage containers will be in good condition and constructed of materials that are compatible with the material to be stored. Storage of IDW and soil stockpiles will not be allowed on coastal terrace prairie grasslands, or anywhere in the NOS. Each container will be clearly labeled with an identification number and a written log will be kept to track the source of contaminated material in each temporary storage container. Samples of soils and liquids will be collected and analyzed for contaminated material in conformance with state and federal criteria as well as to the requirements of the treatment or landfill facility, as further described in Section 5.3.1 below.

Hazardous Soils

Soil with chemical concentrations known to be TSCA waste, Resource Conservation and Recovery Act hazardous waste, or California hazardous waste, based on results from prior sampling or EH&S knowledge, will be stockpiled separately from soils with unknown chemical concentrations, or concentrations less than hazardous waste criteria.

For temporary storage of contaminated soil or hazardous soil remediation waste storage, securely covered stockpiles, drums, or metal containers will be utilized. Drums and other metal containers must be appropriately labeled per all applicable legal requirements.

Stockpiles will be constructed to isolate stored contaminated material from the environment. Stockpiles will be placed on and covered with a chemically resistant geomembrane liner free of holes and other damage. Stockpiles will be managed in compliance with Section 5.1.4 of the RAW and the applicable SWPPP as modified for the soil management action, to prevent pollutants from being discharged from the project boundaries.

Roll-off bins used to temporarily store contaminated material will be water-tight. A cover will be placed over the bins to prevent precipitation from contacting the stored material. Excavated soil containing pyrite cinder must be segregated and stored in covered bins, drums, or other suitable container.

Nonhazardous Soils Waste

Excavations and investigations may generate nonhazardous soil waste. Soils that are considered potentially contaminated will be segregated from nonhazardous waste and clean soils until characterized. Soils with chemical analysis results that do not exceed state or federal hazardous waste criteria concentrations are considered nonhazardous soils only if approved by EH&S.

Nonhazardous soils may be used on-site consistent with the provisions of the SMP, or may be removed from the property only if directed and approved by EH&S.

Waste Water

Liquid collected from personnel and equipment decontamination operations will be temporarily stored in drums or other suitable containers. Water from heavy equipment decontamination, excavations and stockpile areas will be temporarily stored in tanks, drums, or other suitable containers. Stored wastewater containers will be appropriately labeled per all applicable legal requirements.

Aqueous waste will be analyzed per the requirements of the SWPPP and project COCs. If analytical test results show that the water is not contaminated and within limits for onsite discharge then it will be disposed of on-site per the SWPPP. Waste water not suitable for on-site disposal will be managed consistent with Section 5.3.1.

5.3 POST-EXCAVATION ACTIVITIES

Post-excavation activities include waste classification and transportation, and site restoration.

5.3.1 Waste Classification, Transportation, and Disposal

Wastes and their expected waste classifications anticipated to be generated during excavation will include the following:

Type of Waste	Expected Waste Classification
Soil containing chemical concentrations less than hazardous waste criteria	Nonhazardous solid waste
Soil containing chemical concentrations greater than hazardous waste criteria	Hazardous solid waste
Soil containing PCB concentrations greater than 1 mg/kg	TSCA solid waste
Aqueous wastes from decontamination water and any surface water contained onsite	Nonhazardous or hazardous liquid waste (pending waste characterization results)
IDW (PPE and disposable sampling equipment)	Nonhazardous solid waste or hazardous solid waste, consistent with soil or aqueous waste determinations

Waste Classification

Waste codes applicable to each hazardous waste stream will be identified based on the requirements in 40 CFR 261 and California Title 22 California Code of Regulation 66261, and any other applicable state law or regulation. All applicable treatment standards in 40 CFR 268 and state land disposal restrictions will be identified and a determination will be made as to whether or not the waste meets or exceeds the standards. Wastes with total PCB concentrations greater than 1 mg/kg will be disposed of off-site at an appropriate facility for TSCA waste. Waste profiles, analyses, classification and treatment standards will be according to the requirements of receiving facility and will be reviewed and approved by EH&S prior to any waste disposal activities.

Existing data for the excavated soil may be sufficient to meet disposal facility profiling requirements. If, however, the selected disposal facilities require additional profiling, or if EH&S elects to conduct additional waste profiling, samples will be collected from the excavated soil and analyzed for the constituents specified by the selected disposal facilities.

To characterize soil for disposal, waste characterization samples will be collected to adequately meet the representativeness and variability goals identified in SW-846 Chapter 9. Waste characterization sampling will be proposed on a case-by-case basis, to allow for incorporation of site conditions, SMP sampling results, and waste stream volumes.

Analytical criteria are dependent on the requirements of the receiving facility; therefore, the receiving facility will be consulted prior to analysis of the samples. Additional tests may be needed based on the results of the initial tests. Once characterized, the waste will be classified and disposed according to federal and state regulations.

A waste acceptance letter will be obtained from each selected disposal facility. Waste profile sample results and documentation will be included in the Completion Report, which will accompany SMP Form C.

Waste Transportation

Manifests will be used for transporting hazardous wastes as required by 40 CFR 263 and applicable state law or regulation. Transportation will comply with all requirements in the

Department of Transportation referenced regulations in the 49 CFR series. Manifests and waste profiles will be reviewed and approved by EH&S prior to any waste transportation activities. Land disposal restriction notifications will be prepared as required by 40 CFR 268 and any applicable state law or regulation for each shipment of hazardous waste and will be reviewed and approved by EH&S. Hazardous waste manifests will be prepared for each shipment of waste shipped offsite using instructions in 40 CFR 761, Sections .207 and .208 and all other applicable requirements. Soil waste will be removed from the site in compliance with all U. S. Department of Transportation regulations and will be covered to prevent soil loss during transport.

Waste Disposal

No soils will be removed from the site for offsite disposal without EH&S permission. Soils designated for off-site soil disposal will first be sampled according to the requirements of the potential receiving facility and in compliance with all state and federal waste classification requirements. All contaminated nonhazardous or hazardous soil waste will be disposed at an appropriately permitted landfill or treatment facility. Personal protective equipment (PPE) and disposable sampling equipment will be disposed of offsite as hazardous or nonhazardous waste.

5.3.2 Site Restoration

Excavations will be backfilled as soon possible after all contaminated materials have been removed and confirmation test results have been evaluated by EH&S. As discussed in Section 4.3.1, before placing backfill, a demarcation layer will be placed along the bottom and sides of the excavation, if soil exceeding Category I criteria is to be left-in-place, to indicate the extent to which soil was excavated and backfilled. If UC construction specifications apply, soil will be spread, moisture conditioned, and compacted in 8- to 12-inch thick loose lifts to 95 percent relative compaction or greater relative to the modified proctor standard (American Society for Testing and Materials D1557).

Backfill Material

All fill material, imported or otherwise, will be entirely free of refuse and any other deleterious material. If UC construction specifications apply, a testing laboratory or the project geotechnical engineer will be retained to certify that all fill has been spread, compacted, and tested to meet the compaction standards established for the project.

As discussed in Section 5.2.6, soil with concentrations of COCs below Category I criteria may be used as backfill in the same excavation, or at another location within the RES with DTSC approval.

Other sources of imported clean fill are also permitted at the RBC. In order to minimize the potential of introducing contaminated fill material, documentation will be verified that the fill source is appropriate. Potential sources of imported fill will be sampled as recommended in the Cal/EPA DTSC Information Advisory, Clean Imported Fill Material (DTSC 2001). Fill documentation will include detailed information on the previous use of the land from where the fill is taken, whether an environmental site assessment was performed and its findings, and the results of analytical testing performed. If such documentation is not available or is inadequate, samples of the fill material will be chemically analyzed. Analytical methods required for the fill material will be based on the source of the fill and knowledge of the prior land use. The number of samples per volume of imported fill will be determined according to the table in the "Waste Characterization" section above.

Analytical results of potential imported fill will be compared to the following criteria to determine if the fill can be imported and used:

- Category I criteria (Table C-1)
- Total threshold limit concentrations (Title 22 of the California Code of Regulations)

EH&S personnel will review fill documentation before approving acceptance of fill soil, and will notify DTSC before any soil is imported for use. EH&S will provide written notification, all analytical results, and location and history of source area to DTSC, as part of the documentation included in SMP Form C.

6.0 COMPLETION REPORTING

Completion reporting is conducted for all projects requiring soil excavation or on-site management. Completion reporting will document all portions of the SMP relevant to proper sampling and management of soils.

Projects with soils exceeding Category I criteria will require an on-site management or excavation plan per Section 4.3 and will also require documentation of all activities following completion of the soil disturbance project. Documentation of project completion will be addressed through SMP Form C, Completion Report (Exhibit C1) and within a final project completion report. Instructions for completing SMP Form C are presented below. Geologic or engineering plans, specifications, drawings, and reports contained in the Completion Report will be prepared by, or under the direct supervision of, a California professional geologist or civil engineer, as appropriate, who will review and sign all such documents indicating responsibility for their content. If UC elects to select alternative methods for soil sampling and management for a project, EH&S will prepare a detailed completion summary report for submittal to DTSC for concurrence in lieu of SMP Forms and attachments. If SMP Form C has not been approved or no activities have occurred for 1 year, the information contained in the form will be reviewed and updated as necessary prior to submittal of the completion report.

Instructions for SMP Form C, Completion Report	
1. Summary of Completed Construction Project	Provide description of the completed construction project, with specific attention to final surface grade, including asphalt, concrete, landscaped areas, or building footings. The intent is to describe any possible exposure pathways to Category II soils, if applicable.
2. Dates of On-Site Project Work	Provide the dates of each step of the project conducted on-site (sampling, soil management actions, soil disposal)
3. Summary of Completed Soil Management Actions	Provide description of any on-site or excavation soil management activities completed.
4. On-Site Management Plan Implemented	Confirm that the on-site management plan was implemented according to SMP Form B, Item 3a, if applicable. Include any deviations from the plan, if appropriate.
5. Soil Excavation Plan Implemented	Confirm that the excavation plan was implemented according to SMP Form B, Item 3b, if applicable. Include any deviations from the plan, if appropriate.
6. Project Completion Report Meets SMP Requirements	Final confirmation that all soil sampling and management activities were completed according to the SMP requirements. Attach completion report which discusses soil sampling design, sampling results, data evaluation, soil management practices, and final construction project completion, and includes a reference list.
7. SMP Form C EH&S Approval	Form C must be signed and dated by EH&S staff responsible for implementation of SMP. Signature indicates review and approval of Items 1 through 4. Signature indicates that proper additional documentation necessary is included within EH&S files. EH&S will provide SMP Form C to DTSC.

In addition to SMP Form C, EH&S will prepare a completion report to provide to DTSC. As discussed in Section 1.4, UC will post completion reports on the RFS Environmental website, and DTSC will post completion reports to DTSC's Envirostor website for the former RFS. The completion report will include the following information documenting the soil management action completion:

- Summary of previous soil sampling, analytical results, and data evaluation
- Summary of soil management strategies and actions conducted
- Summary of the soil excavation work, including location and depths of excavation activities
- Discussion of any deviations from the soil excavation or on-site management plan
- Text describing the final cover or the materials to eliminate direct contact exposure pathway to commercial workers and visitors
- Figures indicating all sampling locations, Criteria I or II exceedances, final excavation areas, and cover area, material, and thickness, if appropriate
- Summary of disposition of excavated soil (off-site disposal or on-site management)
- Summary of all confirmation sample results
- Summary of backfill, final grade, and final project description
- Copies of signed hazardous waste manifest and bill of ladings

7.0 REFERENCES

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EXHIBITS

EXHIBIT C1 Soil Management Plan Forms A, B, C

Richmond Bay Campus

Soil Management Plan
Project Approval Checklist

University of California

SMP FORM A: PROJECT OVERVIEW			
1. Tracking No, Revision No. and Date:	*If after 6 months the project has not proceeded to the next step, the information on this form must be reviewed and updated as necessary.*		
2. Project Name:			
3. Description:	*Attach figure identifying project location*		
4. Points of Contact:	Name:	Position:	
	Email:	Phone:	
5. Estimated Schedule:			
6. DTSC Work Notice Requirements	Yes ☐	No ☐	If Yes, notify DTSC 14 days prior to activity
7. Impacts to Piezometer Network	Yes ☐	No ☐	Piezometer ID: If Yes, notify DTSC
8. Radiological Status			
Have radioactive materials been used within the project area?	Yes ☐	No ☒	
If yes, have buildings within the project area been properly decontaminated, decommissioned, and cleared by CDPH?	Yes ☐	No ☐	If No, contact CDPH; do not investigate project area until it is cleared by CDPH
9. Total Volume of Soil Excavation Planned (in CY)			
10. *De Minimis* Status	Project exempt from SMP prescriptive requirements based on volume (< 10 CY or 500 square feet of hardscape)? Yes ☐ No ☐		
11. SMP Form A Approval			
a. Greg Haet, Project Coordinator, EH&S	(Signature, Date)		
b. Scott Shackleton, Facilities Management, UCB, College of Engineering	(Signature, Date)		
c. Professional Civil Engineer or Geologist	(Name, Signature, Date, Stamp)		

SMP FORM B: SAMPLING, DATA EVALUATION, SOIL MANAGEMENT ACTION

Project Name: ____

Tracking Number: ___________________ Revision Number: ______________________

Date Submitted to DTSC: ______________________

EH&S Point of Contact: ______________________

If this form has not been approved or no activities have occurred for 1 year, the information contained herein must be reviewed and updated as necessary prior to work occurring in the project area.

1. Sampling Design (attach Sampling Strategy Memorandum)	
a. SMP Areas Affected	*Consult SMP Figure 6*
b. Sampling Density and Planned Number of Sample Locations	*Consult SMP Figure 6*
c. Chemicals of Concern and Summary of Existing Data	*Consult SMP Tables 1 and 2, and the most current groundwater report* *Include data summary in sampling strategy memorandum*
d. Sampling Depths and Intervals	*Consult SMP Section 4.1*
e. Project is within area of GW above screening criteria	Yes ☐ No ☒ *Consult SMP Table 1* If Yes, consult RAW, notify DTSC
f. Sampling design meets all SMP prescriptive requirements	Yes ☐ No ☐ If No, DTSC concurrence received? Yes ☐ No ☐
2. Data Evaluation (Post-Sampling) (attach Data Summary Report)	
a. Sampling Design Implemented	Yes ☐ No ☐ If No, describe deviations:
b. Sample Results Meet Category I	Yes ☐ No ☐ *Consult SMP Table 3* If Yes, submit summary report with SMP Form B If sample results indicate unanticipated contamination or discovery, notify DTSC
c. Soil Exceeding Category I is Defined Vertically and Laterally	Yes ☐ No ☐ NA ☐ If No, consult sampling requirements or defer to excavation confirmation sampling
d. Soil Meets Category II Criteria	Yes ☐ No ☐ NA ☐ Soil proposed for on-site management requires plan Soil above Category II criteria requires excavation plan
3. Soil Management Action (attach On-Site Management or Soil Excavation Plan)	
a. On-Site Management Plan Meets SMP Requirements	Yes ☐ No ☐ *Consult SMP Section 4.3* If No, provide explanation or contact DTSC:
b. Excavation Plan Meets SMP Requirements	Yes ☐ No ☐ *Consult SMP Section 4.3* If No, provide explanation or contact DTSC:

SMP FORM B: SAMPLING, DATA EVALUATION, SOIL MANAGEMENT ACTION

Project Name: ____

Tracking Number: ____________________ Revision Number: ______________________

Date Submitted to DTSC: ______________________

EH&S Point of Contact: ______________________

If this form has not been approved or no activities have occurred for 1 year, the information contained herein must be reviewed and updated as necessary prior to work occurring in the project area.

4. SMP Form B Approval a. Greg Haet, Project Coordinator, EH&S	(Signature, Date)
b. Scott Shackleton, Facilities Management, UCB, College of Engineering	(Signature, Date)
c. Professional Civil Engineer or Geologist	(Name, Signature, Date, Stamp)
5. References Used to Complete Form	*Include names and dates of documents*

SMP FORM C: COMPLETION REPORT

Project Name: ____

Tracking Number: ________________________ Revision Number: ________

Date Submitted to DTSC: _______________________

EH&S Point of Contact: ____

If this form has not been approved or no activities have occurred for 1 year, the information contained herein must be reviewed and updated as necessary prior to work occurring in the project area.

1. Summary of Completed Construction Project, Including Project Date (attach Completion Report)	
2. Dates of On-Site Project Work	
3. Summary of Completed Soil Management Actions	
4. On-Site Management Plan Implemented	Yes ☐ No ☐ NA ☐ If No, describe deviations:
5. Soil Excavation Plan Implemented	Yes ☐ No ☐ NA ☐ If No, describe deviations:
6. Project Completion Report Meets SMP Requirements	Yes ☐ No ☐ If No, contact DTSC
7. SMP Form C Approval a. Greg Haet, Project Coordinator, EH&S	(Signature, Date)
b. Scott Shackleton, Facilities Management, UCB, College of Engineering	(Signature, Date)
c. Professional Civil Engineer or Geologist	(Name, Signature, Date, Stamp)

EXHIBIT C2 Sampling and Analysis Plan

Final

Sampling and Analysis Plan for the Soil Management Plan Removal Action Workplan, Exhibit C2

Richmond Bay Campus, Richmond, California

Research, Education, and Support Area within the Former Richmond Field Station

July 18, 2014

Prepared for

Office of Environment, Health & Safety
University of California, Berkeley
317 University Hall No. 1150
Berkeley, California 94720

Prepared by

TETRA TECH, INC.
1999 Harrison Street, Suite 500
Oakland, California 94612

CONTENTS

Tables

ACRONYMS AND ABBREVIATIONS

CAS	Chemical Abstracts Service
CCC	California Cap Company
CHSSL	California Human Health Screening Levels
COC	Chemical of concern
CPT	Cone penetrometer
DTSC	Department of Toxic Substances Control
EH&S	Environmental Health & Safety
EPA	Environmental Protection Agency
IDW	Investigation-derived waste
LCS	Laboratory control sample
LRDP	Long Range Development Plan
mg/kg	Milligram per kilogram
MS	Matrix spike
MSD	Matrix spike duplicate
ng/kg	Nanograms per kilogram
PAH	Polycyclic aromatic hydrocarbons
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PCB	Polychlorinated biphenyl
QA	Quality assurance
QC	Quality control
RAW	Remedial action work plan
RBC	Richmond Bay Campus
RES	Research, Education, and Support
RFS	Richmond Field Station
RPD	Relative percent difference
SAP	Sampling and analysis plan
SMP	Soil Management Plan
Tetra Tech	Tetra Tech EM Inc. (1996-2012): currently Tetra Tech, Inc.
TPH	Total petroleum hydrocarbons
UC	University of California
UC Berkeley	University of California, Berkeley
VOC	Volatile organic compound

EXECUTIVE SUMMARY

This sampling and analysis plan (SAP) is one element of the Soil Management Plan (SMP) for the Richmond Bay Campus (RBC). The SMP is an appendix to the Removal Action Workplan, but is also intended to serve as a stand-alone document to guide management of future environmental actions conducted at the "Research, Education, and Support" (RES) Area of the RBC. The SMP establishes management requirements for areas at RBC to ensure that soil disturbance activities do not adversely impact human health or the environment and that the soils are handled, stored and disposed of, or reused onsite in accordance with applicable laws, regulations, and University of California policies. The SAP addresses the quality assurance (QA) and quality control (QC) aspects of the field, laboratory, and data reporting efforts associated with the proposed activates to address the data gaps. The success of an environmental data collection effort depends on the quality of the data collected and used to make decisions. The intent of this SAP is to establish protocols for assuring quality data collection and criteria for determining the quality of resultant data.

- **Section 1.0 – Project Description:** This section gives a brief overview of the history of the site, a description of the current conditions at the RBC. For more information about past or current conditions at the site, please refer to the Site Characterization Report, Proposed RBC, Richmond, California (Tetra Tech EM Inc. (1996-2012): currently Tetra Tech, Inc. 2013). The second subsection describes the project objective, and the third contains a table summarizing roles and responsibilities of Environmental Health & Safety decision makers.

- **Section 2.0 – Sampling Design:** This section outlines the sampling evaluation process and sampling plan requirements for sampling projects within the RES Area.

- **Section 3.0 – Sampling Procedures:** This section presents specific procedures for various soil sampling methods.

  - Subsection 3.1 – Hand Auger: This subsection describes procedures for soil sample collection using a hand auger.
  - Subsection 3.2 – Drilling Methods: This subsection provides describes procedures for soil sample collection using drilling methods.

- **Section 4.0 – Analytical Procedures:** Section 4.0 describes the laboratory methods that may be used at the RES area for measurements and analysis. These methods are the same as those approved by the Environmental Protection Agency (EPA) unless otherwise documented.

  - Subsection 4.1 – Laboratory Methods: This subsection provides a summary of the EPA-approved laboratory analytical methods that will be used for the analysis of RBC samples.
  - Subsection 4.2 – Quantitation Limits: Analytical laboratories will be required to ensure that quantitation limits are sufficiently low to allow comparison to the risk based concentration screening criteria.
  - Subsection 4.3 – Laboratory Selection: This subsection presents the criteria to be considered when evaluating contract laboratories.

- **Section 5.0 – Quality Assurance Objectives:** Section 5.0 defines the specific QA and QC activities that will be applied to ensure that the environmental data collected are of the type and quality needed.
  - Subsection 5.1 – Data Quality Objective Process: This subsection describes the overall QA objective for collecting data that will provide results that are usable for their intended purpose.
  - Subsection 5.2 – Quality Assurance Objectives for Measurement Data: This subsection addresses the level of QC effort and objectives for sensitivity; accuracy and precision; and representativeness, completeness, and comparability of data.
  - Subsection 5.3 – Field Quality Control Samples: This subsection indicates the quality control samples that will be collected and analyzed for this project.
- **Section 6.0 – Sample Custody:** This section describes sample handling procedures including sample identification, labeling, documentation, and chain-of-custody forms. It also discusses proper practices for packing and shipping samples to laboratories. Equipment decontamination and management of investigation derived waste are also briefly described.
- **Section 7.0 – Data Reduction, Validation, and Reporting:** This section describes the methods used for verifying and validating data in the field, laboratory, and office.
- **Section 8.0 – Data Assessment Procedures:** This section describes the evaluation of the data to determine whether data objectives have been met.
- **Section 9.0 – References:** This section lists site reports, scientific reference materials, and regulatory guidance and standards cited throughout the document.

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) is one element of the Soil Management Plan (SMP), which is intended to guide management of future environmental actions conducted at the Research, Education, and Support (RES) Area of the Richmond Bay Campus (RBC). The SAP addresses the quality assurance (QA) and quality control (QC) aspects of the field, laboratory, and data reporting efforts associated with the future proposed construction activities. The success of an environmental data collection effort depends on the quality of the data collected and used to make decisions. The intent of this SAP is to establish protocols for assuring quality data collection and criteria for determining the quality of resultant data.

1.1 BACKGROUND

The former Richmond Field Station (RFS) is an academic teaching and research facility, located at 1301 South 46th Street, Richmond, California, along the eastern shoreline of the Richmond Inner Harbor of the San Francisco Bay and northwest of Point Isabel, approximately 6 miles northwest of the University of California (UC) Berkeley Central Campus. The SMP and SAP focus on the portions of the former RFS which the proposed RBC designates as developable under the Long Range Development Plan (LRDP), identified as the RES Area. The RES Area consists of 82.5 acres within the former RFS. The RES Area occupies portions of the upland area and Transition Area. The proposed LRDP also designates a portion of the RBC preserved as Natural Open Space Area (26.5 acres). This Natural Open Space Area is not a part of the SMP.

Between the 1880s and 1948 and prior to UC ownership, the California Cap Company (CCC) operated facilities on portions of the RFS property for the manufacturing of blasting caps, shells, and explosives. Two small companies, the U.S. Briquette Company and the Pacific Cartridge Company, are presumed to have operated on a portion of the RFS property. By 1920, the CCC was the only remaining explosives manufacturer on site.

In October 1950, the CCC property was purchased by UC with the agreement that the CCC would remove all hazardous materials from the property. However, subsequent site observations and testing revealed the presence of hazardous materials on RFS. For example, several explosions reportedly occurred between 1950 and 1953 during a controlled burn for clearing. These explosions likely were associated with residual chemicals used by the CCC. Previous investigations in the test pit and explosive storage area found a single detection of explosives at a concentration close to the detection limit (URS Corporation 2000).

The former RFS was initially established by UC Berkeley for large-scale engineering research that required significant space and resources that were not available on UC Berkeley’s central campus in downtown Berkeley. In addition to UC Berkeley-related operations, the UC Regents have leased space to non-UC Berkeley tenants. Complete environmental site conditions are presented in the Draft Site Characterization Report for the Proposed RBC (Tetra Tech EM Inc. (1996-2012): currently Tetra Tech, Inc. [Tetra Tech] 2013).

1.2 PROJECT OBJECTIVE

The SMP provides a systematic process intended to ensure that future projects in the RES area impacting subsurface soils will not result in uncontrolled exposures to unknown or unidentified contaminants. The SMP prescribes protocols for Department of Toxic Substances Control (DTSC) notification; soil sampling, data analyses, soil management or disposal practices; and final reporting. DTSC notification is conducted through the submittal of SMP checklist forms throughout the process. Soil sampling is based on prescribed sampling frequency, depths, and chemicals of concern which are determined based on the size and location of the project. Soil management and disposal practices are based on comparison of soil sample results to screening criteria, and final reporting is conducted through submittal of a completion report once the project has been completed.

All soil disturbance activities within the RES Area require Office of Environment, Health & Safety (EH&S) notification. This notification will be provided in the form of a three-part Project Approval Checklist (SMP Forms A, B and C). This SAP establishes protocols for assuring quality data collection and criteria for determining the quality of resultant data in support of *SMP Form B, Sampling Design, Data Evaluation, and Soil Management.*

1.3 PROJECT ORGANIZATION AND RESPONSIBILITIES

The roles and responsibilities of the RBC project team members with respect to sampling and analysis are provided in Table C2-1. Principal decision makers are further defined in the accompanying SMP.

TABLE C2-1: KEY PERSONNEL

Organization	Role	Responsibilities
UC, EH&S	Project Coordinator	Directs environmental health and safety compliance of the SMP. Receives notices, comments, approvals, and related communications from DTSC. Reports to and interacts with the DTSC for all SMP tasks. Signatory to SMP Forms A, B, C.
UC, EH&S	Project Geologist	Reviews all documents for technical accuracy.
DTSC	Remedial Project Manager	Reviews environmental health and safety compliance of the SMP. Signatory to 5-year remedial action work plan (RAW) review process including updated SMP, if appropriate. Receives notices, comments, and related communications from UC. Interacts with UC for all SMP tasks. Reviews all submittals and notifications to DTSC for quality and completeness.
Project-by-Project Basis	Field team Leader	Responsible for directing day-to-day field activities conducted by subcontractor personnel. Verifies that field sampling and measurement procedures follow the sampling planning document. Provides project manager with regular reports on status of field activities.
Laboratory	Project Manager	Responsible for delivering analytical services that meet requirements of SAP. Reviews chains of custody to understand analytical requirements. Works with project chemist to confirm sample delivery schedules. Reviews laboratory data package before submittal.

2.0 SAMPLING DESIGN

This section outlines the sampling evaluation process and sampling plan requirements for sampling projects within the RES Area. Based on knowledge of the location and depth of the proposed soil disturbance activity, identify the soil sampling and analysis needed to evaluate the soil within the footprint of the proposed project. Projects which are not exempted from sampling, as discussed in Section 3.4 of the SMP, require collection, analysis and evaluation of additional soil chemical data in order to determine the appropriate soil management decision and action. EH&S must approve the sampling design (Form B) prior to implementation.

General

Sampling Design will be project-specific, depending on the geographical location, size, and depth of soil to be disturbed by the proposed project. As a first step, identify the SMP Area(s) (see SMP Figure C-6 and Table C-2) corresponding to the proposed project area. The minimum soil sample location density and chemicals of concern (COC) for each of the 25 SMP Areas are listed in Table C-3 of the SMP.

Soil Sampling Methodology

Soil samples should be collected in accordance with the methods found in Section 6.0 of this SAP.

Analytical Requirements

Analytical requirements for soil are summarized on Table C-3 of the SMP and will vary depending on the location of the project within the RES Area. Soil samples should be analyzed in accordance with the methods designated in Table C2-2.

Design Documentation

Sampling Design must be documented with sufficient detail for reviewer to (1) understand the project geographical area within the RES Area and depths of proposed soil disturbance, including project figure; (2) to check that the proposed sampling locations, depths and analysis meet the requirements of the SMP; and (3) the Sampling Design adequately takes into account known conditions within the project area, such as presence of existing buildings, remediated areas, or prior soil sample data. Section 4.1 of the SMP details the Sample Design process. The Sampling Design shall be approved by EH&S on Form B of Checklist prior to embarking on the field sampling effort.

3.0 SAMPLING PROCEDURES

The following sections describe methods for collecting soil samples. Samples will be collected for analysis of volatile organic compounds (VOC) and total petroleum hydrocarbons (TPH)-gasoline using an EnCore sampler. For all other analytical parameters, samples will be collected in sleeves or jars (Table C2-2).

3.1 HAND AUGER

A hand auger equipped with extensions and a "T" handle is used to obtain samples from a depth of up to 6 feet. If necessary, a shovel may be used to excavate the topsoil to reach the desired subsoil level. If topsoil is removed, its thickness should be recorded. Samples obtained using a hand auger are disturbed in their collection, so that determining the exact depth at which samples are obtained is difficult. The hand auger is screwed into the soil at an angle of 45 to 90 degrees from horizontal. When the entire auger blade has penetrated soil, the auger is removed from the soil by lifting it straight up without turning it, if possible. If the desired sampling depth has not been reached, the soil is removed from the auger and deposited onto plastic sheeting. This procedure is repeated until the desired depth is reached and the soil sample is obtained. The auger is then removed from the boring, and the soil sample is collected directly from the auger into an appropriate sample container.

All soil samples collected from less than 5 feet will be collected through hand auger equipment to ensure safety from unidentified utility lines.

3.2 DRILLING METHODS

Primary drilling methods expected to be of potential use at the RBC site include traditional auger drilling, direct-push methods, and potentially some type of small sonic drilling tools. Because of the proximity of the site to buildings and workers, the preferred methods will generally be direct-push methods because they are agile and create less of a disturbance, and are mobile and can be moved easily and quickly based on field sampling results.

3.2.1 Direct Push

Direct-push platforms have gained widespread acceptance in the environmental industry over the past decade because of their versatility, relatively low cost, and mobility. Using the weight of the truck in combination with a hydraulic ram or hammer, a tool string is pushed into the ground. All borehole locations must be advanced by hand auger equipment up to 5 feet before use of direct push techniques.

The two major classes of direct-push platforms are cone penetrometer (CPT) and percussion hammer systems. The distinction between these units is that CPT units advance the tool string by applying a hydraulic ram against the weight or mass of the vehicle alone, while percussion hammer units add a hammer to the hydraulic ram to compensate for their lower mass. These platforms share the same principle of operation, similar tools, and a number of advantages and limitations. They differ in scale, application, and to some extent the types of instruments and tools that have been developed for each. For these reasons, CPT and percussion hammer platforms fill different niches in the environmental field. CPT rigs can generally push to greater depths and push larger-diameter rods; they allow sampling from depths that are inaccessible using percussion hammer rigs. Percussion hammer rigs are generally smaller, more portable, and require less training to use; they allow samples to be collected from places, including inside of buildings that are inaccessible to a CPT rig. Although they are sometimes limited in the depths to which they can penetrate, some of the smaller percussion hammer units as well as smaller CPT rigs can be anchored to the ground using earth augers to add to the reaction mass of the vehicle alone.

Because of their methods of operation, direct-push systems provide some unique advantages when collecting soil and soil-gas samples. In particular, direct-push systems are quicker and more mobile than traditional drill rigs. Sampling and data collection are faster, reducing the time needed to complete an investigation and increasing the number of sample points that can be collected during the investigation. Soil sampling systems have been developed in response to a need to collect samples of unconsolidated material from a range of depths, without generating large volumes of cuttings. Direct-push soil samplers also allow investigators to collect soil samples from a specific depth, with minimal disturbance to soil stratigraphy.

3.2.2 Hollow-Stem Auger

Hollow-stem augers are readily available and are recommended for penetrating unconsolidated materials when direct-push applications are not appropriate. Auger rigs are light and maneuverable. Each section or flight is typically 5 feet in length. A head is attached to the first flight, and cuttings are rotated to the surface as the borehole is advanced. A pilot bit (or center bit) can be held at the base of the first flight with drill rods to prevent cuttings from entering. When the bit is removed, formation samples can be obtained through the auger using split-spoon or thin-wall samplers.

3.3 OTHER

If a construction footprint at the RBC site includes an existing monitoring well, it will be necessary to move the well and collect a groundwater sample from the new well. For groundwater well installation and sampling, refer to Appendix A of the Field Sampling Workplan (Tetra Tech 2010).

4.0 ANALYTICAL PROCEDURES

The following sections the analytical methods and laboratory selection criteria for samples collected for the RES area.

4.1 ANALYTICAL METHODS

The COCs in the RES area are metals, polycyclic aromatic hydrocarbons (PAH), and polychlorinated biphenyls (PCB). In addition, VOCs, TPH, and dioxins may need to be investigated. SMP Form B will indicate the appropriate analyses for each investigation. Table C2-2 specifies the analytical methods, maximum holding time, sample containers, and preservation for the possible chemicals to be investigated in the RES area.

4.2 QUANTITATION LIMITS

To ensure risk based screening criteria are met, analytical laboratories will be required to ensure quantitation limits are sufficiently low to allow comparison to the screening criteria. Table C2-3 lists the chemical, risk based concentration screening criteria, and required laboratory quantitation limit. If the laboratory reporting limit for a given chemical is not sufficiently low to allow comparison to the risk based screening criteria, a further discussion of that chemical with DTSC is required, or alternative methods should be pursued.

TABLE C2-2: ANALYTICAL REQUIREMENTS TABLE

Matrix	Analytical Group	Analytical Method	Containers	Sample Volume	Preservation Requirements	Maximum Holding Time (preparation / analysis)
All RES areas						
Soil	Metals	SW-846 EPA 6010/7471	8 ounce glass jar or sleeve	5 grams	Cool, 4+/- 2˚C	180 days (28 days mercury)
Soil	PAHs	SW-846 EPA 8270-SIM		30 grams	Cool, 4+/- 2˚C	14 days/40 days
Soil	PCBs	SW-846 EPA 8082		30 grams	Cool, 4+/- 2˚C	14 days/40 days
Potential analyses						
Soil	VOCs	SW-846 EPA 5035/8260	EnCore sampler	5 grams	Cool, 4 °C ± 2	48 hours to preserve/14 days
Soil	Dioxins	SW-846 EPA 8280	4 ounce glass jar or sleeve	30 grams	Cool, 4 °C ± 2	30 days
Soil	TPH-purgeables	SW-846 EPA 5035/8015	EnCore sampler	5 grams	Cool, 4 °C ± 2	48 hours to preserve/14 days
Soil	TPH-extractables	SW-846 8015	4 ounce glass jar or sleeve	30 grams	Cool, 4 °C ± 2	14 days/40 days

Notes:

EPA Environmental Protection Agency

TABLE C2-3: REQUIRED LABORATORY QUANTITATION LIMITS AND QC CRITERIA

Total Metals (EPA 6010/7471)

Chemical	CAS Number	Risk Based Concentration Screening Criteria (mg/kg)	Required Laboratory Quantitation Limit (mg/kg)	MS/MSD %Recovery	MS/MSD Relative Percent Difference	Laboratory Control Sample %Recovery	Duplicate Relative Percent Difference
Aluminum	7429-90-5	75,000	35,000	75 - 125	20	85 - 115	20
Antimony	7440-36-0	30.4	15	75 - 125	20	85 - 115	20
Arsenic	7440-38-2	16.0[1]	10	75 - 125	20	85 - 115	20
Barium	7440-39-3	14,900	7,500	75 - 125	20	85 - 115	20
Beryllium	7440-41-7	150	75	75 - 125	20	85 - 115	20
Cadmium	7440-43-9	77.8	35	75 - 125	20	85 - 115	20
Chromium	7440-47-3	100,000	50,000	75 - 125	20	85 - 115	20
Cobalt	7440-48-4	22.7	11	75 - 125	20	85 - 115	20
Copper	7440-50-8	3,040	1,500	75 - 125	20	85 - 115	20
Iron	7439-89-6	53,200	27,000	75 - 125	20	85 - 115	20
Lead	7439-92-1	80	40	75 - 125	20	85 - 115	20
Mercury	7439-97-6	22.8	11	80 - 120	20	85 - 115	20
Manganese	7439-96-5	1,780	900	75 - 125	20	85 - 115	20
Molybdenum	7439-98-7	380	190	75 - 125	20	85 - 115	20
Nickel	7440-02-0	1,410	700	75 - 125	20	85 - 115	20
Selenium	7782-49-2	380	190	75 - 125	20	85 - 115	20
Silver	7440-22-4	380	190	75 - 125	20	85 - 115	20
Thallium	7440-28-0	0.76	0.50	75 - 125	20	85 - 115	20
Vanadium	7440-62-2	380	190	75 - 125	20	85 - 115	20
Zinc	7440-66-6	22,800	11,000	75 - 125	20	85 - 115	20

Notes:

1	Background
CAS	Chemical Abstracts Service
mg/kg	Milligram per kilogram
MS	Matrix spike
MSD	Matrix spike duplicate
QC	Quality control

TABLE C2-3: REQUIRED LABORATORY QUANTITATION LIMITS AND QC CRITERIA (CONTINUED)

Polycyclic Aromatic Hydrocarbons (EPA 8270-SIM)

Chemical	CAS Number	Risk Based Concentration Screening Criteria (mg/kg)	Required Laboratory Quantitation Limit (mg/kg)	MS/MS % Recovery	MS/MSD Relative Percent Difference	Laboratory Control Sample % Recovery	Surrogate % Recovery
Naphthalene	91-20-3	3.57	1.8	45 - 115	40	50 - 115	-
Acenaphthene	83-32-9	3,270	1,600	45 - 115	40	50 - 115	-
Acenaphthylene	208-96-8	3,270	1,600	45 - 115	40	50 - 115	-
Fluorene	86-73-7	80	40	45 - 115	40	50 - 115	-
Phenanthrene	85-01-8	2,180	1,100	45 - 115	40	50 - 115	-
Anthracene	120-12-7	16,400	8,200	45 - 115	40	50 - 115	-
Fluoranthene	206-44-0	2,180	1,100	45 - 115	40	50 - 115	-
Pyrene	129-00-0	1,640	820	45 - 115	40	50 - 115	-
Benzo(a)anthracene	56-55-3	0.0854	0.04	45 - 115	40	50 - 115	-
Chrysene	218-01-9	0.854	0.40	45 - 115	40	50 - 115	-
Benzo(b)fluoranthene	205-99-2	0.0854	0.04	45 - 115	40	50 - 115	-
Benzo(k)fluoranthene	207-08-9	0.0854	0.04	45 - 115	40	50 - 115	-
Benzo(a)pyrene	50-32-8	0.014	0.007	45 - 115	40	50 - 115	-
Indeno(1,2,3-cd)pyrene	193-39-5	0.0854	0.04	45 - 115	40	50 - 115	-
Dibenzo(a,h)anthracene	53-70-3	0.059	0.03	45 - 115	40	50 - 115	-
Benzo(g,h,i)perylene	191-24-2	1,640	820	45 - 115	40	50 - 115	-
1-Methylnaphthalene	90-12-0	14.8	7.4	45 - 115	40	50 - 115	-
2-Methylnaphthalene	91-57-6	218	110	45 - 115	40	50 - 115	-
2-Fluorobiphenyl	-	-	-	-	-	-	50 – 110
Terphenyl-d14	-	-	-	-	-	-	50 – 135

TABLE C2-3: REQUIRED LABORATORY QUANTITATION LIMITS AND QC CRITERIA (CONTINUED)

Polycyclic Aromatic Hydrocarbons (EPA 8270-SIM) (Continued)

Chemical	CAS Number	Risk Based Concentration Screening Criteria (mg/kg)	Required Laboratory Quantitation Limit (mg/kg)	MS/MSD % Recovery	MS/MSD Relative Percent Difference	Laboratory Control Sample % Recovery	Surrogate % Recovery
2,4,6,-Tribomophenol	-	-	-	-	-	-	40 – 125
2-Fluorophenol	-	-	-	-	-	-	20 – 110
Nitrobenzene-d5	-	-	-	-	-	-	40 - 110

Table C2-3: Required Laboratory Quantitation Limits and QC Criteria (Continued)

Polychlorinated Biphenyls (EPA 8082)

Analyte	CAS Number	Risk Based Concentration Screening Criteria (mg/kg)	Required Laboratory Quantitation Limit (mg/kg)	MS/MSD % Recovery	MS/MSD Relative Percent Difference	Laboratory Control Sample % Recovery	Surrogate % Recovery
PCB-1242	53469-21-9	0.215	0.10	60 - 130	30	60 - 130	60 - 125
PCB-1248	12672-29-6	0.215	0.10	60 - 130	30	60 - 130	60 - 125
PCB-1254	11097-69-1	0.215	0.10	60 - 130	30	60 - 130	60 - 125
PCB-1260	11096-82-5	0.215	0.10	60 - 130	30	60 - 130	60 - 125

TABLE C2-3: REQUIRED LABORATORY QUANTITATION LIMITS AND QC CRITERIA (CONTINUED)

Volatile Organic Compounds (EPA 8260B)

Chemical	CAS Number	Risk Based Concentration Screening Criteria (mg/kg)	Required Laboratory Quantitation Limit (mg/kg)	MS/MSD % Recovery	MS/MSD Relative Percent Difference	Laboratory Control Sample % Recovery	Surrogate % Recovery
1,1,1-Trichloroethane	71-55-6	-	-	65 – 130	40	70 - 125	-
1,1,1,2-Tetrachloroethane	630-20-6	-	-	65 - 130	40	70 - 125	-
1,1,2,2-Tetrachloroethane	79-34-5	-	-	65 – 130	40	70 - 125	-
1,1,2-Trichloroethane	79-00-5	-	-	65 - 130	40	70 - 125	-
1,2,3-Trichloropropane	96-18-4	-	-	65 – 130	40	70 - 125	-
1,1-Dichloroethane	75-34-3	-	-	65 - 130	40	70 - 125	-
1,1-Dichloroethene	75-35-4	-	-	65 – 130	40	70 - 125	-
1,2-Dibromo-3-chloropropane	96-12-8	-	-	65 - 130	40	70 - 125	-
1,2-Dibromoethane	106-93-4	-	-	65 – 130	40	70 - 125	-
1,2-Dichloroethane	107-06-2	-	-	65 - 130	40	70 - 125	-
1,2-Dichloropropane	78-87-5	0.924	0.46	65 – 130	40	70 - 125	-
2-Butanone	78-93-3	-	-	65 - 130	40	70 - 125	-
2-Hexanone	591-78-6	-	-	65 – 130	40	70 - 125	-
Acetone	67-64-1	48,900	24,000	65 - 130	40	70 - 125	-
Benzene	71-43-2	0.30	0.15	65 – 130	40	70 - 125	-
Bromodichloromethane	75-27-4	-	-	65 - 130	40	70 - 125	-
Bromoform	75-25-2	-	-	65 – 130	40	70 - 125	-
Bromomethane	74-83-9	-	-	65 - 130	40	70 - 125	-
Carbon disulfide	75-15-0	-	-	65 – 130	40	70 - 125	-
Carbon tetrachloride	56-23-5	-	-	65 - 130	40	70 - 125	-

TABLE C2-3: REQUIRED LABORATORY QUANTITATION LIMITS AND QC CRITERIA (CONTINUED)

Volatile Organic Compounds (EPA 8260B) (Continued)

Chemical	CAS Number	Risk Based Concentration Screening Criteria (mg/kg)	Required Laboratory Quantitation Limit (mg/kg)	MS/MSD % Recovery	MS/MSD Relative Percent Difference	Laboratory Control Sample % Recovery	Surrogate % Recovery
Chlorobenzene	108-90-7	-	-	65 – 130	40	70 - 125	-
Chloroethane	75-00-3	-	-	65 - 130	40	70 - 125	-
Chloroform	67-66-3	-	-	65 – 130	40	70 - 125	-
Chloromethane	74-87-3	-	-	65 - 130	40	70 - 125	-
cis-1,2-Dichloroethene	156-59-2	-	-	65 – 130	40	70 - 125	-
cis-1,3-Dichloropropene	10061-01-5	-	-	65 - 130	40	70 - 125	-
Dibromochloromethane	124-48-1	-	-	65 – 130	40	70 - 125	-
Dibromomethane	74-95-3	-	-	65 - 130	40	70 - 125	-
Dichlorodifluoromethane	75-71-8	-	-	65 – 130	40	70 - 125	-
Ethylbenzene	100-41-4	5.23	2.5	65 - 130	40	70 - 125	-
Methylene chloride	75-09-2	-	-	65 – 130	40	70 - 125	-
Methyl tert-Butyl Ether	1634-04-4	-	-	65 - 130	40	70 - 125	-
Tetrachloroethene	127-18-4	-	-	65 – 130	40	70 - 125	-
Toluene	108-88-3	1,110	550	65 - 130	40	70 - 125	-
trans-1,2-Dichloroethene	156-60-5	-	-	65 – 130	40	70 - 125	-
trans-1,3-Dichloropropene	10061-02-6	-	-	65 - 130	40	70 - 125	-
Trichloroethene	79-01-6	0.884	0.44	65 – 130	40	70 - 125	-
Trichlorofluoromethane	75-69-4	-	-	65 - 130	40	70 - 125	-
Vinyl chloride	75-01-4	-	-	65 – 130	40	70 - 125	-
o-Xylenes	95-47-6	684	340	65 - 130	40	70 - 125	-
m/p-Xylenes	6777-61-2	585	300	65 – 130	40	70 - 125	-
1,2-Dichlorethane-d4	-	-	-	-	-	-	70 – 120

TABLE C2-3: REQUIRED LABORATORY QUANTITATION LIMITS AND QC CRITERIA (CONTINUED)

Volatile Organic Compounds (EPA 8260B) (Continued)

Chemical	CAS Number	Risk Based Concentration Screening Criteria (mg/kg)	Required Laboratory Quantitation Limit (mg/kg)	MS/MSD % Recovery	MS/MSD Relative Percent Difference	Laboratory Control Sample % Recovery	Surrogate % Recovery
4-Bromofluorobenzene	-	-	-	-	-	-	75 – 120
Dibromofluoromethane	-	-	-	-	-	-	85 – 115
Toluene-d8	-	-	-	-	-	-	85 - 120

TABLE C2-3: REQUIRED LABORATORY QUANTITATION LIMITS AND QC CRITERIA (CONTINUED)

Total Petroleum Hydrocarbons (EPA 8015)

Chemical	CAS Number	Environmental Screening Level (mg/kg)	Required Laboratory Quantitation Limit (mg/kg)	MS/MSD %Recovery	MS/MSD Relative Percent Difference	Laboratory Control Sample %Recovery	Surrogate %Recovery
TPH-puregeables							
Gasoline	86290-81-5	420	210	70 – 130	40	75 – 125	-
Bromofluorobenzene	-	-	-	-	-	-	70 - 140
TPH-extractables							
Diesel (C10-C24)	68334-30-5	500	250	65 – 140	40	75 – 125	-
Motor Oil (C24-C36)	NA	2,500	1,250	65 – 140	40	75 - 125	-
Bromobenzene	-	-	-	-	-	-	50 - 150
Hexacosane	-	-	-	-	-	-	50 - 150

Source:

California Regional Water Quality Control Board. 2013. "February 2013 Update to Environmental Screening Levels." February. Available on-line at: http://www.waterboards.ca.gov/rwqcb2/water_issues/programs/esl.shtml

TABLE C2-3: REQUIRED LABORATORY QUANTITATION LIMITS AND QC CRITERIA (CONTINUED)

Dioxins/Furans (EPA 8290)

Chemical	CAS Number	Toxicity Equivalence Factor	CHSSL (ng/kg)	Required Laboratory Quantitation Limit (ng/kg)	Laboratory Control Sample %Recovery	Surrogate %Recovery
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	1.0	19	19	70 - 130	-
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4	1.0	-	19	70 - 130	-
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6	0.10	-	1.9	70 - 130	-
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7	0.10	-	1.9	70 - 130	-
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3	0.10	-	1.9	70 - 130	-
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9	0.01	-	0.19	70 - 130	-
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9	0.0003	-	0.0057	70 - 130	-
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	0.10	-	1.9	70 - 130	-
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6	0.03	-	0.57	70 - 130	-
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4	0.30	-	5.7	70 - 130	-
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9	0.10	-	1.9	70 - 130	-
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9	0.10	-	1.9	70 - 130	-
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9	0.10	-	1.9	70 - 130	-
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5	0.10	-	1.9	70 - 130	-
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4	0.01	-	0.19	70 - 130	-
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7	0.01	-	0.19	70 - 130	-
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	39001-02-0	0.0003	-	0.0057	70 - 130	-
Total Tetrachlorodibenzo-p-dioxin (TCDD)	41903-57-5	-	-	-	-	-

TABLE C2-3: REQUIRED LABORATORY QUANTITATION LIMITS AND QC CRITERIA (CONTINUED)

Dioxins/Furans (EPA 8290) (Continued)

Chemical	CAS Number	Toxicity Equivalence Factor	CHSSL (ng/kg)	Required Laboratory Quantitation Limit (ng/kg)	Laboratory Control Sample %Recovery	Surrogate %Recovery
Total Pentachlorodibenzo-p-dioxin (PeCDD)	36088-22-9	-	-	-	-	-
Total Hexachlorodibenzo-p-dioxin (HxCDD)	34465-46-8	-	-	-	-	-
Total Heptachlorodibenzo-p-dioxin (HpCDD)	37871-00-4	-	-	-	-	-
13C 2,3,7,8,-TCDF	-	-	-	-	-	40 – 135
37C 1,2,3,7,8-TCDD	-	-	-	-	-	40 - 135

Notes:

CHSSL California Human Health Screening Levels
ng/kg Nanograms per kilogram

4.3 SELECTION OF ANALYTICAL LABORATORIES

The following criteria will be considered when evaluating contract laboratories:

- Quality assurance and quality control documents governing laboratory operations
- Status of laboratory certification and the most recent laboratory audit conducted
- Initial demonstration of proficiency results for all analysts on all methods performed
- Availability of technical support regarding methods to be used
- Standard operating procedures for the desired analyses
- Method detection limits and quantitation limits for the desired analyses
- Laboratory past performance on performance evaluation samples

Additional criteria to be considered include:

- Laboratory capacity for the desired analyses
- Costs per analysis or batch of analyses
- Typical turn-around times for the type of analytical work requested
- Method development/optimization protocol

The source of analytical services to be provided will in part be determined by the project-specific intended use of the resulting data and specific requirements and constraints such as quick turnaround of data. The project-specific chain of custody will identify the laboratories that have been selected to provide analytical services.

The laboratory performing analytical analyses for samples collected from the RES area shall have current certification from the California Department of Health Services Environmental Protections Laboratory Accreditation Program to perform Hazardous Materials analysis for each method specified in this SAP.

5.0 QUALITY ASSURANCE OBJECTIVES

The intent of this SAP is to establish protocols for assuring quality data collection and criteria for determining the quality of resultant data. Data collection, reporting requirements, and analytical protocols are established to meet the needs of the SMP. The SAP emphasizes the use of proven, validated, and EPA-approved sampling methods and analytical methods such as Test Methods for Evaluating Solid Waste (SW-846) (EPA 1996). The following subsections define the specific QA and QC activities that will be applied to ensure that the environmental data collected are of the type and quality needed. In addition, Form B of the SMP is critical for the collection and use of environmental data.

5.1 DATA QUALITY OBJECTIVE PROCESS

All projects will be evaluated to determine the scope of sampling and analysis which may be required prior to initiating earthwork activities. Sampling design shall be reviewed and approved by EH&S prior to the sampling event. Soil sampling data collected from the project area will be evaluated to determine the appropriate soil management decision.

Form B is used to track project status for fulfilling the requirements for Sampling, Data Evaluation, and Soil Management steps. The Sampling Design must be approved by EH&S prior to initiating sampling. EH&S approval signature on Form B documents that the soil sampling is complete, the data has been evaluated, and the soil management decision for the project is approved. The project may proceed once EH&S approval of the soil management decision is documented.

5.2 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and data reporting that will provide results that are usable for their intended purpose. This section addresses the level of QC effort and the specific QA objectives for sensitivity, accuracy, precision, representativeness, completeness, and comparability of data. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, preventive maintenance of field equipment, and corrective action are described in other sections of this SAP. Form B will identify the numbers of samples that will be collected, and Table C2-3 identified the types of field and laboratory QC samples that will be required.

Analytical data will be evaluated for compliance with QC limits (Table C2-3). Typically, when analytical data do not meet the QC limits, corrective action must be initiated or the data will be qualified or rejected. Corrective action includes stopping the analysis; examining instrument performance, sample preparation, and analysis information; recalibrating instruments; re-preparing and reanalyzing samples; and informing the appropriate project staff member of the problem.

The following subsections address the level of QC effort and objectives for sensitivity; accuracy and precision; and representativeness, completeness, and comparability of data.

5.2.1 Sensitivity

The QA objective for sensitivity is generally expressed in the form of the method quantitation limit for the analytical method selected. Table C2-3 provides the concentrations of concern for contaminants known or suspected to be present at the sampling location based on risk-based criteria. The laboratory contracted for work under the SMP must be able to meet these quantitation limits. Quantitation limits reflect the influences of the sample matrix on method sensitivity and are typically higher than detection limits. Quantitation limits provide a reliable indication of the amount of material needed to produce an instrument response that can be routinely identified and reliably quantified when applying a particular analytical method to real environmental samples.

5.2.2 Precision and Accuracy

Precision and accuracy will be evaluated quantitatively by collecting the QC samples listed in Table C2-3. Section 7.3 describes field QC samples in detail. The sections below describe how each of the precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters will be assessed.

5.2.2.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Usually, combined field and laboratory precision is evaluated by collecting and analyzing field replicates and then calculating the variance between the samples, typically as a relative percent difference (RPD):

$$RPD = \frac{|A-B|}{(A+B)/2} \ x \ 100\%$$

where:

A	=	First duplicate concentration
B	=	Second duplicate concentration

Laboratory analytical precision is evaluated by analyzing laboratory replicates or a MS and MSD. The results of the analysis of each MS/MSD and sample duplicate pairs will be used to calculate an RPD for evaluating precision. See Table C2-3 for MS/MSD RPD criteria.

5.2.2.2 Accuracy

Sample spiking will be conducted to evaluate laboratory accuracy. This includes analysis of the MS and MSD samples, laboratory control samples (LCS) or blank spikes, surrogate standards, and method blanks. MS and MSD samples will be prepared and analyzed at a frequency of 5 percent. LCS or blank spikes are also analyzed at a frequency of 5 percent. Surrogate standards, where available, are added to every sample analyzed for organic constituents. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

$$\text{Percent Recovery} = \frac{S - C}{T} \; x \; 100$$

where:

S	=	Measured spike sample concentration
C	=	Sample concentration
T	=	True or actual concentration of the spike

Results that fall outside the project-specific accuracy goals will be further evaluated on the basis of the results of other QC samples. See Table C2-3 for spike recovery criteria.

5.2.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that depends on the proper design of the sampling program and proper laboratory protocol. The sampling network for each investigation will be designed to provide data that are representative of environmental conditions. During development of the SMP, consideration was given to past waste disposal practices, existing analytical data, current and former on-site physical setting and processes, and other relevant information.

Representativeness can also be affected by the time, place, and manner in which the samples are collected. The SMP identifies specific methods (i.e. grid frequency and prior investigation data) for achieving and demonstrating the representativeness of the samples to be collected.

Representativeness will also be satisfied by ensuring that this SAP and the Form B are followed, samples are collected in accordance with the appropriate DTSC guidance, proper analytical procedures are followed, and holding times of the samples are not exceeded in the laboratory.

5.2.4 Completeness

Completeness is a measure of the percentage of data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when none of the QC criteria that affect data usability is exceeded. When all data validation is completed, the percent completeness value may be calculated by dividing the number of useable sample results by the total number of sample results.

Completeness will also be evaluated as part of the data quality assessment process (EPA 2006). The degree of completeness will be calculated by dividing the number of useable sample results by the total number of number of sample results. This evaluation will help determine whether there are any limitations on the decisions to be made based on the data collected. A minimum of 95% completeness per matrix type will be required for usable data.

5.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

5.3 Field Quality Control Samples

Field QC samples will be collected and analyzed to assess the quality of data generated from sampling activities. Table C2-4 presents QC samples to be collected and analyzed for RES area projects. These samples may include trip blanks, equipment rinsate blanks, field replicates, and field split samples as described below:

- **Trip blanks** are used to assess the potential for sample contamination during handling, shipment, and storage. One trip blank is usually included within every shipping cooler of liquid samples to be analyzed for VOCs. Trip blanks are sample bottles filled by the analytical laboratory with organic-free water. The trip blanks are sealed and transported to the field; kept with empty sample bottles and then with the investigative samples throughout the field effort; and returned to the laboratory for analysis with the investigative samples. Trip blanks are never opened in the field.

- **Equipment rinsate blanks** are collected when sampling equipment is used. These blanks assess the cleanliness of sampling equipment and the effectiveness of equipment decontamination. Equipment rinsate blanks are typically collected for each type of decontaminated sampling equipment. Equipment rinsate blanks are collected by pouring analyte-free water over surfaces of cleaned sampling equipment that contact sample media. Equipment rinsate blanks are collected after sampling equipment has been decontaminated but prior to being reused for sampling.

- **Source blanks** are collected from the water used for the final decontamination rinse of equipment. They are used to assess contamination in the water used for decontamination. One source blank is collected from each source of water used for decontamination.

- **Field replicate samples** are independent samples collected as close as possible in space and time to the original investigative sample. Collection of soil replicates are decided based on the data objectives for each site. Immediately following collection of the original sample, the field duplicate sample is collected using the same collection method. Care should be taken to collect the field duplicate sample as close to the location of the original sample as possible. Field duplicate samples can measure how sampling and field procedures influence the precision of an environmental measurement. They can also provide information on the heterogeneity of a sampling location.

- **Temperature blanks** are used to assess the temperature of the samples upon arrival at the laboratory. A sample container is filled with distilled water and placed each cooler. Upon arrival at the laboratory, the temperature of the water is measured. The temperature blank is not analyzed.

- **Field split samples** are usually a set of two or more samples taken from a larger homogenized sample. Field split samples may be collected to monitor how closely laboratories are meeting project-specific QA objectives. The larger sample is usually collected from a single sampling location, but can also be a composite sample. Field split samples can be sent to two or more laboratories and are used to provide comparison data between the laboratories.

TABLE C2-4: QC SAMPLES FOR PRECISION AND ACCURACY

QC Type	QA Sample Type	Precision / Accuracy	Default Frequency
Field QC	Field Replicates	Precision	1 every 10 soil or sediment samples
	Equipment Rinsate	Accuracy	1 per day per type of non-disposable sampling equipment
	Source Water Blank	Accuracy	1 per source of decontamination water
	Trip Blanks	Accuracy	1 per shipping container containing volatile samples
	Temperature Blanks	Accuracy	1 per shipping container
Laboratory QC	Method Blanks	Accuracy	1 per every batch of samples, type of matrix, or 20 samples (whichever is more frequent)
Laboratory QC	MS/MSD Percent Recovery	Precision	1 per every 20 samples
	Laboratory Replicates (blind)	Precision	1 per every 20 samples
	LCS or Blank Spikes Percent Recovery	Accuracy	1 per every batch of samples, type of matrix, or 20 samples (whichever is more frequent)
	Surrogate Standard Percent Recovery	Accuracy	Every sample for organic analysis by gas chromatography

Source:
EPA. 2005 Uniform Federal Policy for Quality Assurance Project Plans. Part 2B, Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities. EPA 505-B-04-900B.

6.0 SAMPLE CUSTODY

The sections below describe sample handling procedures, including sample identification and labeling, documentation, chain of custody, and shipping. Procedures for equipment decontamination and management of investigation derived waste are also briefly described below.

6.1 SAMPLE IDENTIFICATION

A unique sample identification number will be assigned to each sample collected during the various RES investigations. The sample numbering system allows each sample to be uniquely identified and provides a means of tracking the sample from collection through analysis.

6.2 SAMPLE LABELS

A sample label will be affixed to all sample containers. The label will be completed with the following information, written in indelible ink:

- Project name and location
- Sample identification number
- Date and time of sample collection
- Preservative used
- Sample collector's initials
- Analysis required

After it is labeled, each sample will be refrigerated or placed in a cooler that contains wet ice to maintain the sample temperature at or below 4 ±2°C.

6.3 SAMPLE DOCUMENTATION

Documentation during sampling is essential to ensure proper sample identification. Sampling personnel will adhere to the following general guidelines for maintaining field documentation:

- Documentation will be completed in permanent black ink.
- All entries will be legible.
- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout.
- Unused portions of pages will be crossed out, and each page will be signed and dated.

The field team leader is responsible for ensuring that sampling activities are properly documented.

6.4 CHAIN OF CUSTODY

Standard sample custody procedures will be conducted to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Chain-of-custody procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The chain-of-custody record also will be used to document all samples collected and the analysis requested. Information that the field personnel will record on the chain-of-custody record includes:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample identification number
- Date and time of collection
- Number and type of containers filled
- Analyses requested
- Preservatives used (if applicable)
- Filtering (if applicable)
- Sample designation (i.e. grab or composite)
- Sample media
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Air bill number (if applicable)
- Project contact and phone number

Unused lines on the chain-of-custody record will be crossed out. Field personnel will sign chain-of-custody records that are initiated in the field, and the air bill number will be recorded. The record will be placed in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed air bills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the chain-of-custody record and the air bill will be retained and filed by field personnel before the containers are shipped.

Laboratory chain of custody begins when samples are received and ends when samples are discarded. Laboratories analyzing samples must follow custody procedures at least as stringent as are required by the EPA Contract Laboratory Program statements of work (EPA 2003, 2004). The laboratory should designate a specific individual as the sample custodian. The custodian will receive all incoming samples, sign the accompanying custody forms, and retain copies of the forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the samples, including the persons who delivered the samples, the date and time they were received, condition of the sample at the time it was received (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification numbers, and any unique laboratory identification numbers for the samples. When the sample transfer process is complete, the custodian is responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory will provide a secure storage area for all samples. Access to this area will be restricted to authorized personnel. The custodian will ensure that samples that require special handling, including samples that are heat- or light-sensitive, radioactive, or have other unusual physical characteristics, will be properly stored and maintained prior to analysis.

6.5 Sample Shipment

The following procedures will be implemented when collected samples are shipped:

- The chain-of-custody records will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the shipping container. The air bill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.
- The shipping container will be closed and taped shut with strapping tape around both ends. If the shipping container has a drain, it will be taped shut both inside and outside of the shipping container.
- Signed and dated custody seals will be placed on the front and side of each shipping container. Wide clear tape will be placed over the seals to prevent accidental breakage.
- The chain-of-custody record will be transported within the taped sealed shipping container. When the shipping container is received at the analytical laboratory, laboratory personnel will open the shipping container and sign the chain-of-custody record to document transfer of samples.

Multiple shipping containers may be sent in one shipment to the laboratory. The outside of the shipping container will be marked to indicate the number of shipping containers in the shipment.

6.6 DECONTAMINATION PROCEDURES

All reusable equipment will be decontaminated according to the following procedures. All reusable sampling tools will be decontaminated before sampling begins and between sample locations. Reusable sampling tools will be decontaminated by scrubbing in a solution of potable water and nonphosphate detergent (Alconox or Liquinox). The tools will then be double-rinsed with distilled water. Sampling tools that are not used immediately after decontamination will be allowed to air dry and wrapped in plastic.

6.7 MANAGEMENT OF IDW

All soils and debris generated from soil borings and well installations, and water from well purging and decontamination will be contained as investigation-derived waste (IDW). The soil or water will be placed in 55-gallon drums, labeled, and stored on a concrete containment pad in a fenced or secured location at the RBC. Samples will be collected from the drums for characterization of the waste. The results of the sample will dictate the exact disposal requirements. The drums will then be shipped off site to the appropriate facility.

Personal protective equipment and miscellaneous waste from sampling (paper towels, aluminum foil, and plastic sheeting) will be placed in large garbage bags, sealed, and disposed of in facility trash receptacles as solid waste, or disposed of at a proper off-site facility to prevent exposure to unauthorized personnel, as appropriate.

7.0 DATA REDUCTION, VALIDATION, AND REPORTING

The following section describes the methods used for verifying and validating data.

7.1 FIELD DATA VERIFICATION

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data are obtained.

Data values that are significantly different from the population are called "outliers." A systematic effort will be made to identify any outliers or errors before field personnel report the data. Outliers can result from improper sampling or measurement methodology, data transcription errors, calculation errors, or natural causes. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in sampling, measurement, transcription, or calculation will be clearly identified in project reports.

7.2 LABORATORY DATA VERIFICATION

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected.

7.3 LABORATORY DATA VALIDATION

Data validation is a systematic process for reviewing and qualifying data against a set of criteria to determine whether they are adequate for their intended use. Reviewing and evaluating all analytical data for their PARCC parameters verifies adequacy. EH&S will indicate the level of validation required for the data. Criteria for data qualification during the cursory and full review are derived from EPA guidelines (EPA 2008, 2010), the SAP, SMP, sampling planning document, and associated analytical methods. General requirements for cursory and full validation are listed below.

7.3.1 Cursory Data Validation

Cursory review of the analytical reports includes evaluating the following parameters, as applicable: holding times, initial and continuing calibrations, laboratory and field blanks, accuracy, laboratory precision, and analytical and matrix performance. An overall assessment of the data will also be conducted. Cursory data validation is the default review for SMP-related project sampling.

7.3.2 Full Data Validation

Full review includes all the elements of a cursory review as presented above, and the following additional items, as applicable:

- Method compliance, instrument performance check samples, cleanup performance, system performance check samples, system performance, inductively coupled plasma or atomic emission spectroscopy interference check samples, and overall assessment of the data
- Target analyte identification
- Analyte quantitation
- Detection and quantitation limit verification

Full data validation may be selected on a project-by-project basis, if determined to be necessary by UC EH&S staff.

8.0 DATA ASSESSMENT PROCEDURES

After environmental data have been reviewed, verified, and validated, the data must be further evaluated to determine whether data objectives have been met. This section describes these procedures.

UC will systematically assess data quality and data usability. This assessment will include the following elements:

- A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives.
- A review of project-specific data quality indicators for PARCC parameters and quantitation limits to determine if acceptance criteria have been met.
- A review of project-specific objectives to evaluate whether they have been achieved by the data collected.
- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared with a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

Deviations from the Sampling Design (Form B), such as change in sample location, or analytical results which do not meet data quality criteria, will be evaluated to determine whether additional sampling is required. Once the data set is deemed acceptable per project sampling design, the soil sample results will be compared to the SMP Category I and Category II criteria to determine if a soil management action is required.

9.0 REFERENCES

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FIGURES

LEGEND

Property Boundary
134.0 acres

Natural Open Space
25.0 acres

Research, Education & Support
107.6 acres

Potential Road Alignment through Natural Open Space*
0.8 acres

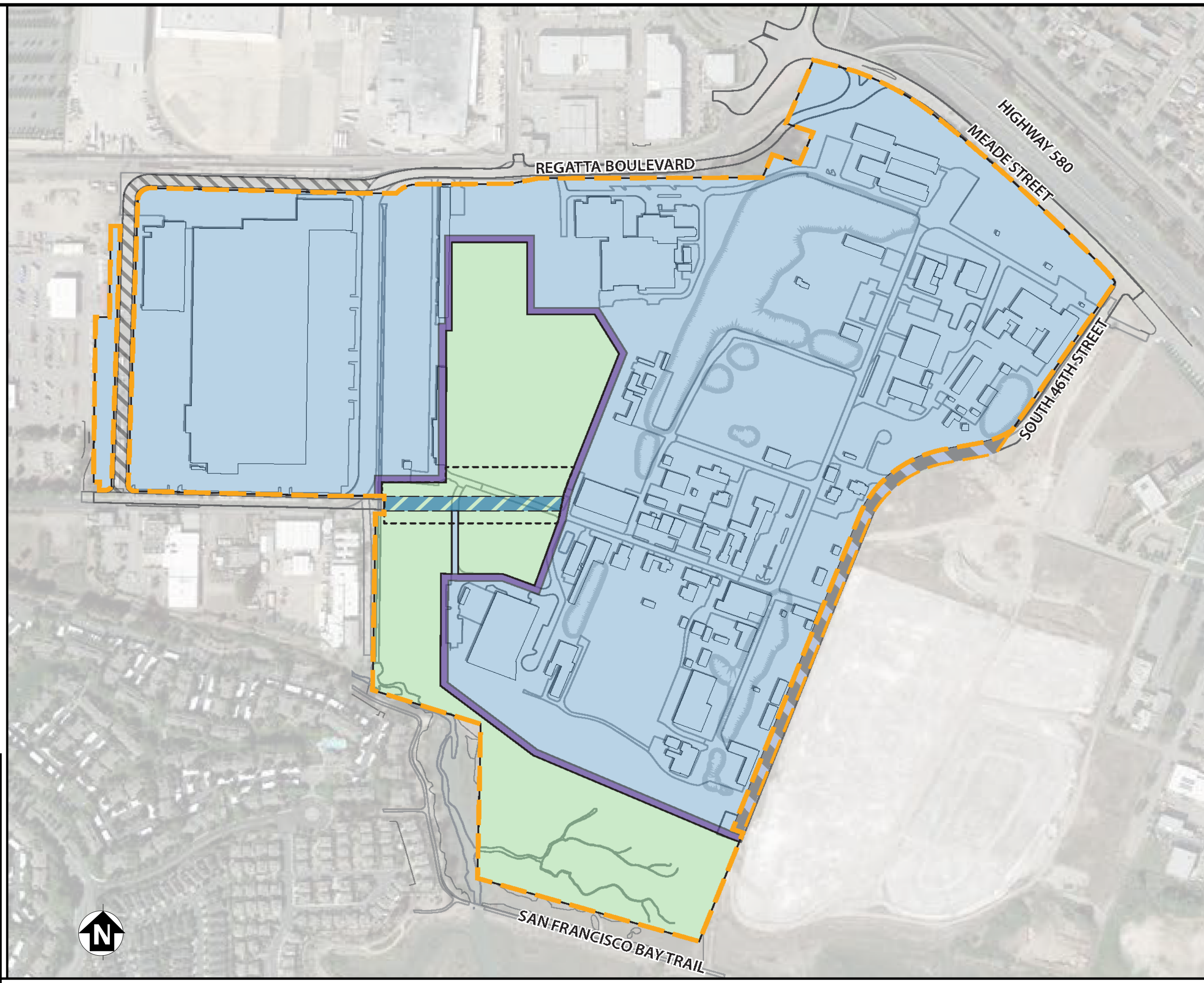
Zone of Potential Road Alignment through Natural Open Space

Private Road: 1/3 UC Undivided Interest
0.6 acres

25' Buffer Zone

City of Richmond Realigned Regatta Boulevard

* NOTE: The potential road alignment is illustrative. A road with similar dimensions may be aligned differently but will fall within the Zone of Potential Road Alignment through Natural Open Space.

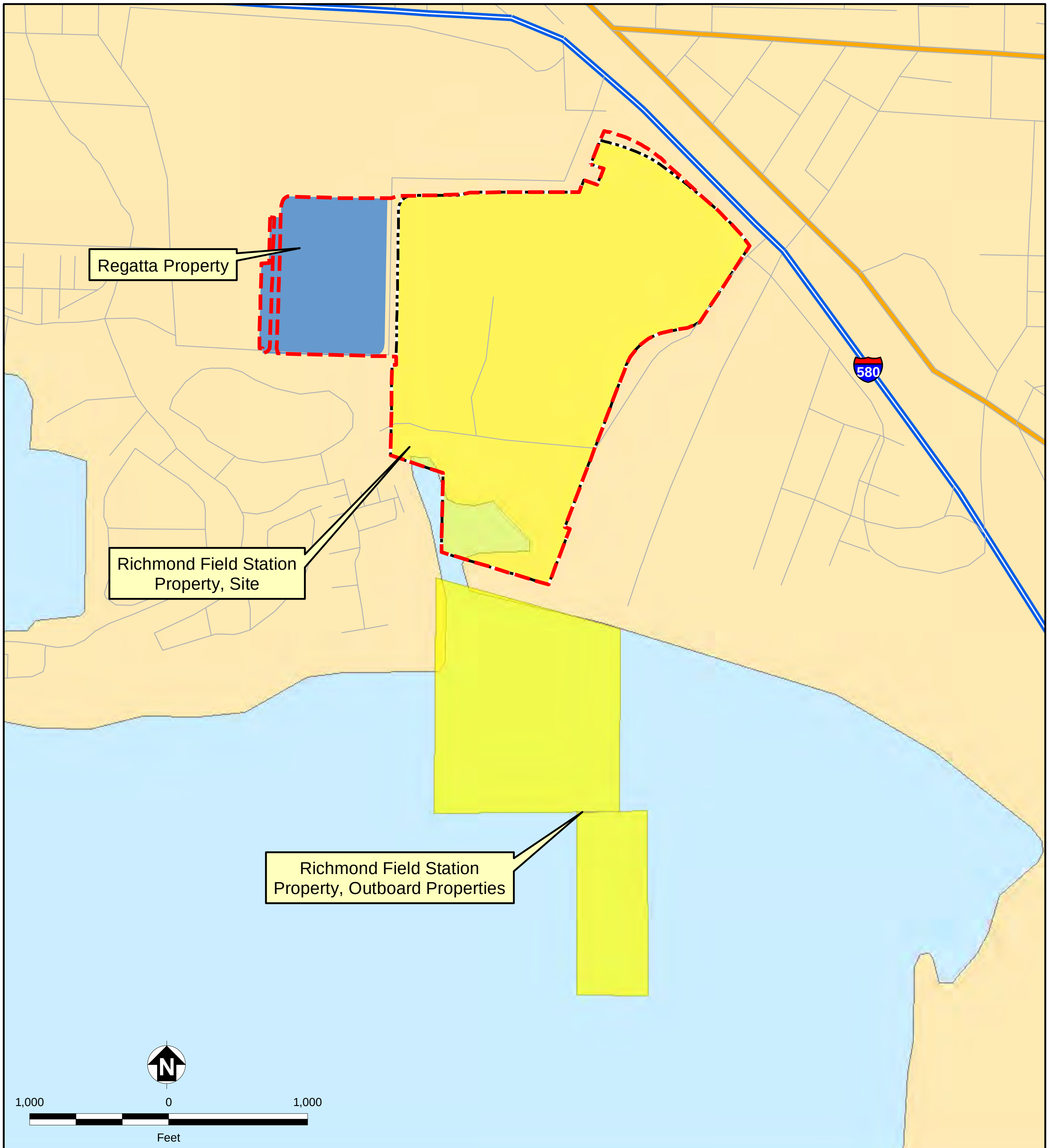


TETRA TECH

Richmond Bay Campus

FIGURE C-1
RICHMOND BAY CAMPUS LOCATION MAP

Soil Management Plan



Richmond Field Station Property

Portion of RFS Property Subject to DTSC order, Defined as "Site"

Regatta Property

Richmond Bay Campus Property Boundary

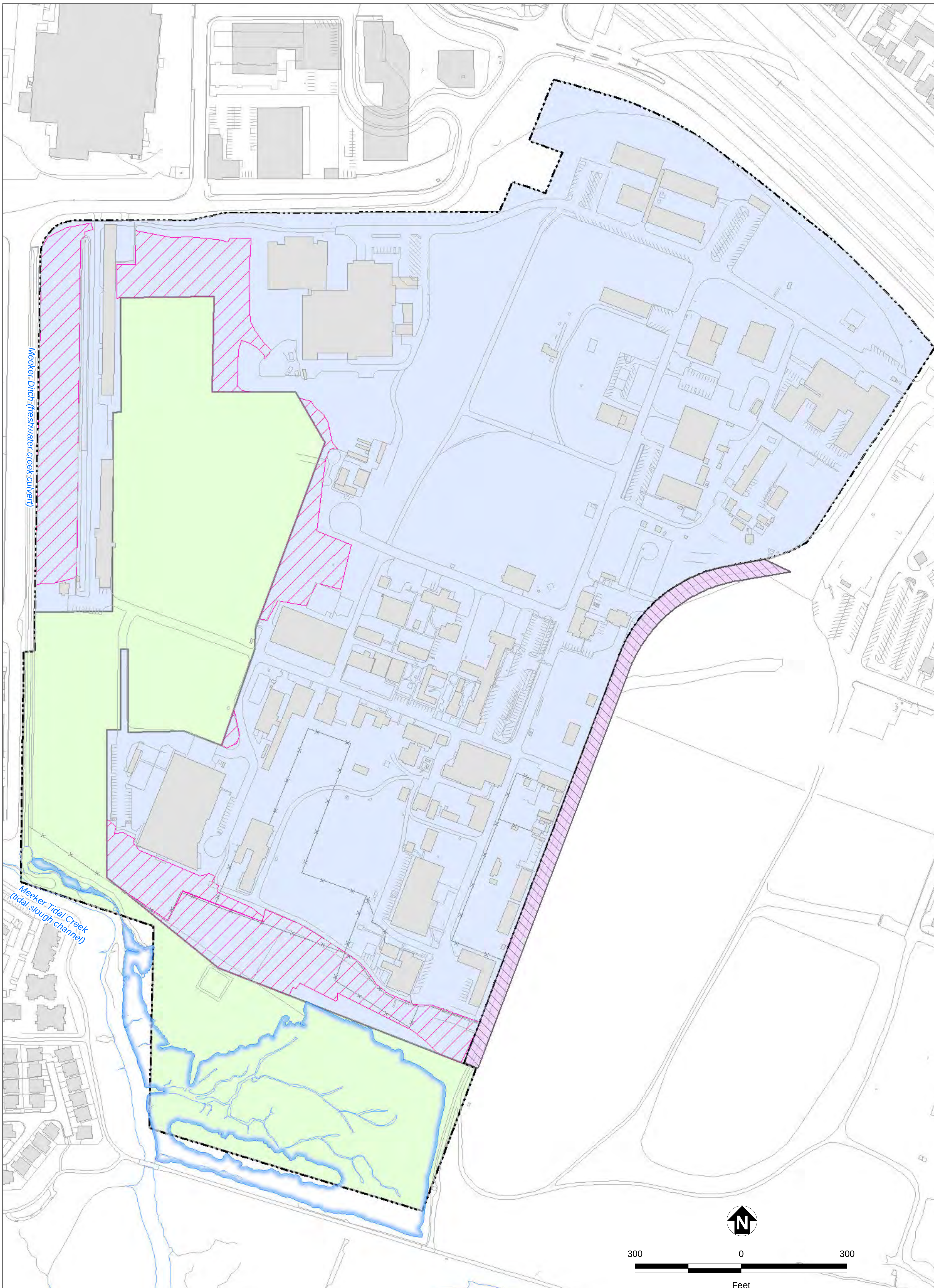
Notes:
DTSC Department of Toxic Substances Control
RFS Richmond Field Station

TETRA TECH

Richmond Bay Campus

FIGURE C-2
UNIVERSITY OF CALIFORNIA PROPERTIES

Soil Management Plan



- Research, Education & Support Area
- Natural Open Space
- The portion of South 46th Street owned by UC and Zeneca under a 1/3 and 2/3 shared interest is subject to the RAW
- Habitat within RES Area
- Existing Building
- Portion of RFS Property Subject to DTSC order, Defined as "Site"
- Roads and Other Landscape Features
- Marsh Boundary

Note:
DTSC Department of Toxic Substances Control
RAW Removal Action Workplan
RES Research, Education, & Support
RFS Richmond Field Station
UC University of California

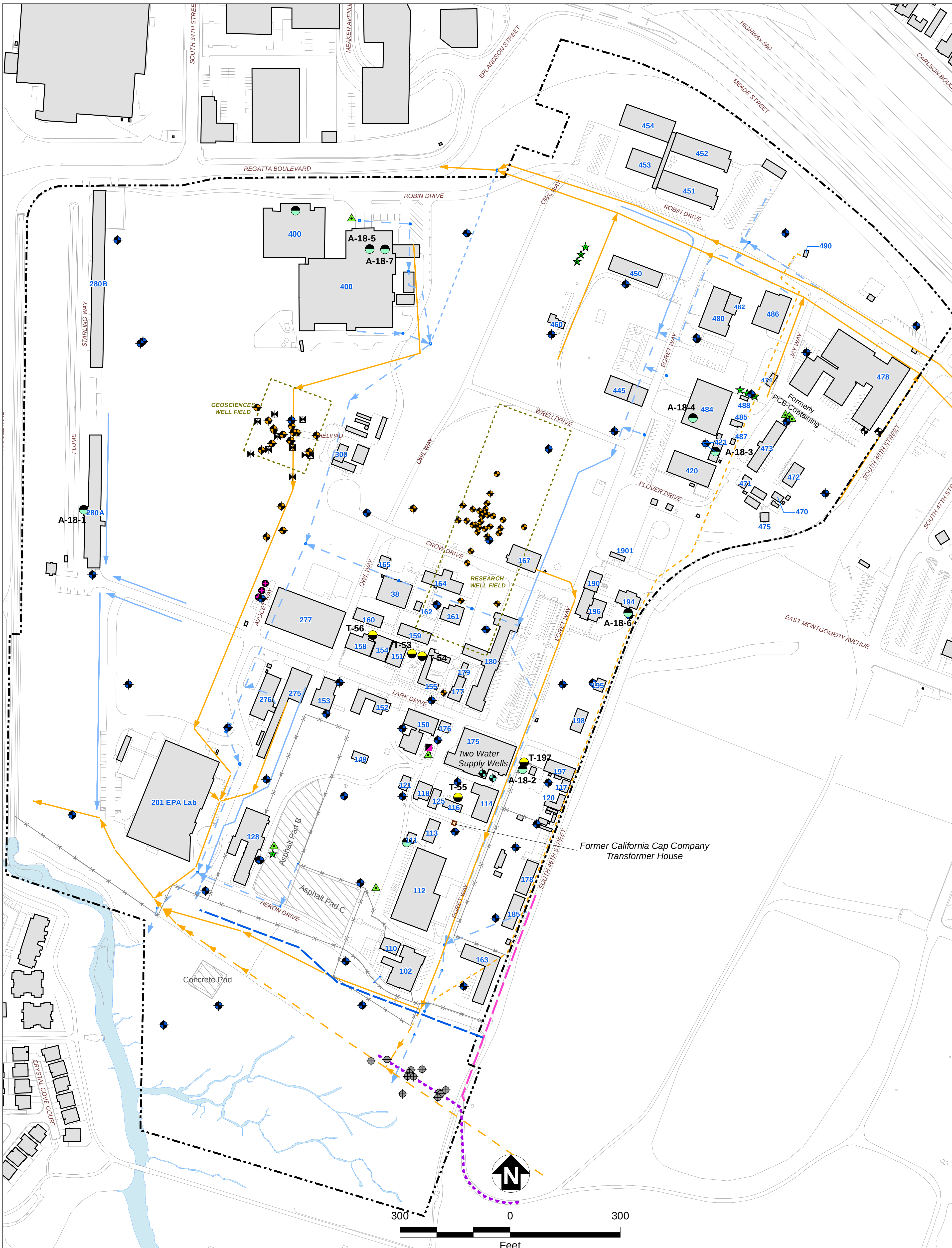
TETRA TECH

Richmond Bay Campus

FIGURE C-3
RESEARCH, EDUCATION AND SUPPORT AREA AND NATURAL OPEN SPACE WITHIN SITE BOUNDARY

Soil Management Plan

2013-11-22 V:\Misc_GIS\Richmond_Field_Station\Projects\SMP\Layouts\RES Area and Natural Open Space within RFS Boundary.mxd TtEMI-OAK yashekia.evans.



Existing Building (Building Numbers Shown in Blue)
Surface Water
Asphalt/Concrete Pads
Well Field Boundary
Portion of RFS Property Subject to DTSC order, Defined as "Site"
Fenceline
Biologically Active Permeable Barrier
Former Seawall (Approximate)
Slurry Wall

Sanitary Sewer Lines:
Existing Sewer Line
Removed Sewer Line
Abandoned Sewer Line

Aboveground Storage Tank (AST)
Former Underground Storage Tank (UST)

Transformer Locations:
Pad-Supported, Non PCB-Containing
Pad-Supported, Former PCB-Containing (Removed)
Pole-Mounted, Non PCB-Containing
Pole-Mounted, Former PCB-Containing (Removed)

Storm Drain Lines:
Open Swale
Underground Culvert
Underground Culvert, Abandoned (Grouted at Manholes)

Open Well (Not in Use)
Closed Well (Pressure Grouted)
Open Piezometer
Open Geosciences Well
BAPB Wells on RFS Property
Zeneca Wells on RFS Property

Note:

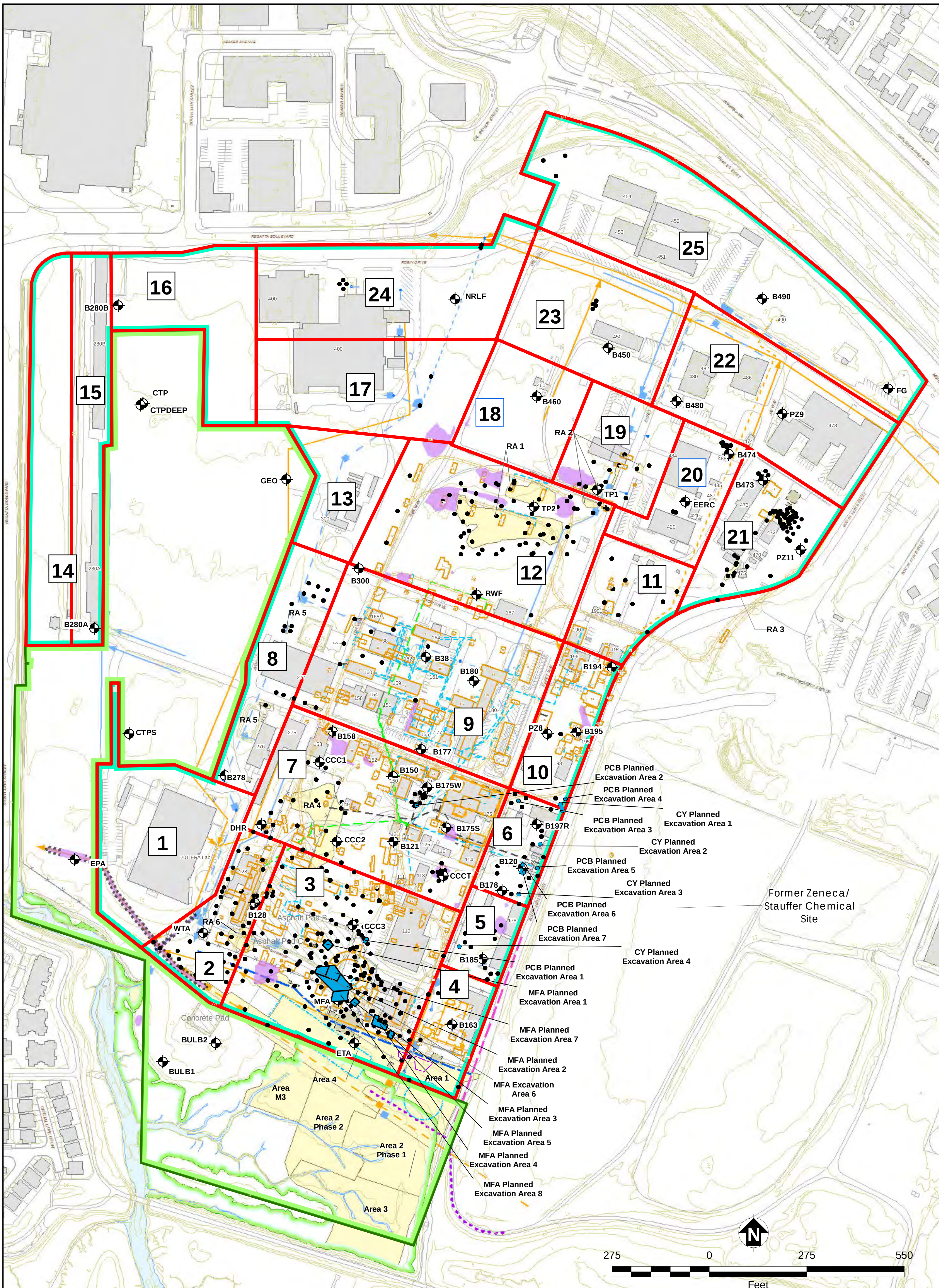
BAPB	Biologically Active Permeable Barrier
DTSC	Department of Toxic Substances Control
EBRPD	East Bay Reagional Parks District
EPA	Evironmental Protection Agency
PCB	Polychlorinated biphenyls
RFS	Richmond Field Station

TETRA TECH

Richmond Bay Campus

FIGURE C-4
PHYSICAL FEATURES

Soil Management Plan



RES Area within the Site Boundary
Natural Open Space Area
Planned Excavation Areas
Existing Building
Removed or Relocated Building (RFS)
Remediated Areas
Surface Water
Asphalt/Concrete Pad
Marsh Boundary
Known Pyrite Cinders Area
Suspect Pyrite Cinders (Presence Not Verified)
SMP Area Boundaries and identifiers
Elevation Contour (US Survey Feet NAVD88) April 2008 - Source: Contra Costa County
Former SERL Pond

Roads or Other Landscape Feature
Biologically Active Permeable Barrier Wall
Former Seawall (Approximate)
Slurry Wall

Sanitary Sewer Lines:
- Existing Sewer Line
- Removed Sewer Line
- Abandoned Sewer Line

Storm Drain Lines:
- Open Swale
- Underground Culvert
- Underground Culvert, Abandoned (Grouted at Manholes)

Former California Cap Company Facilities/Building
Former Pacific Cartridge Company Building
Former U.S. Briquette Company Building
Former California Cap Company Tramway

Former California Cap Company Utilities:
- Natural Gas Line
- Fuel Line
- Hydraulic Line

Soil Sampling Location
Piezometer Location

Notes: Only currently existing samples are shown on this figure. Samples removed through excavation are not shown here.

CY	Corporation Yard
MFA	Mercury Fulminate Area
PCB	Polychlorinated biphenyl
RA	Remediation Area
RES	Research, Education & Support
RFS	Richmond Field Station
SMP	Soil Management Plan
SERL	Sanitary Engineering Research Laboratory

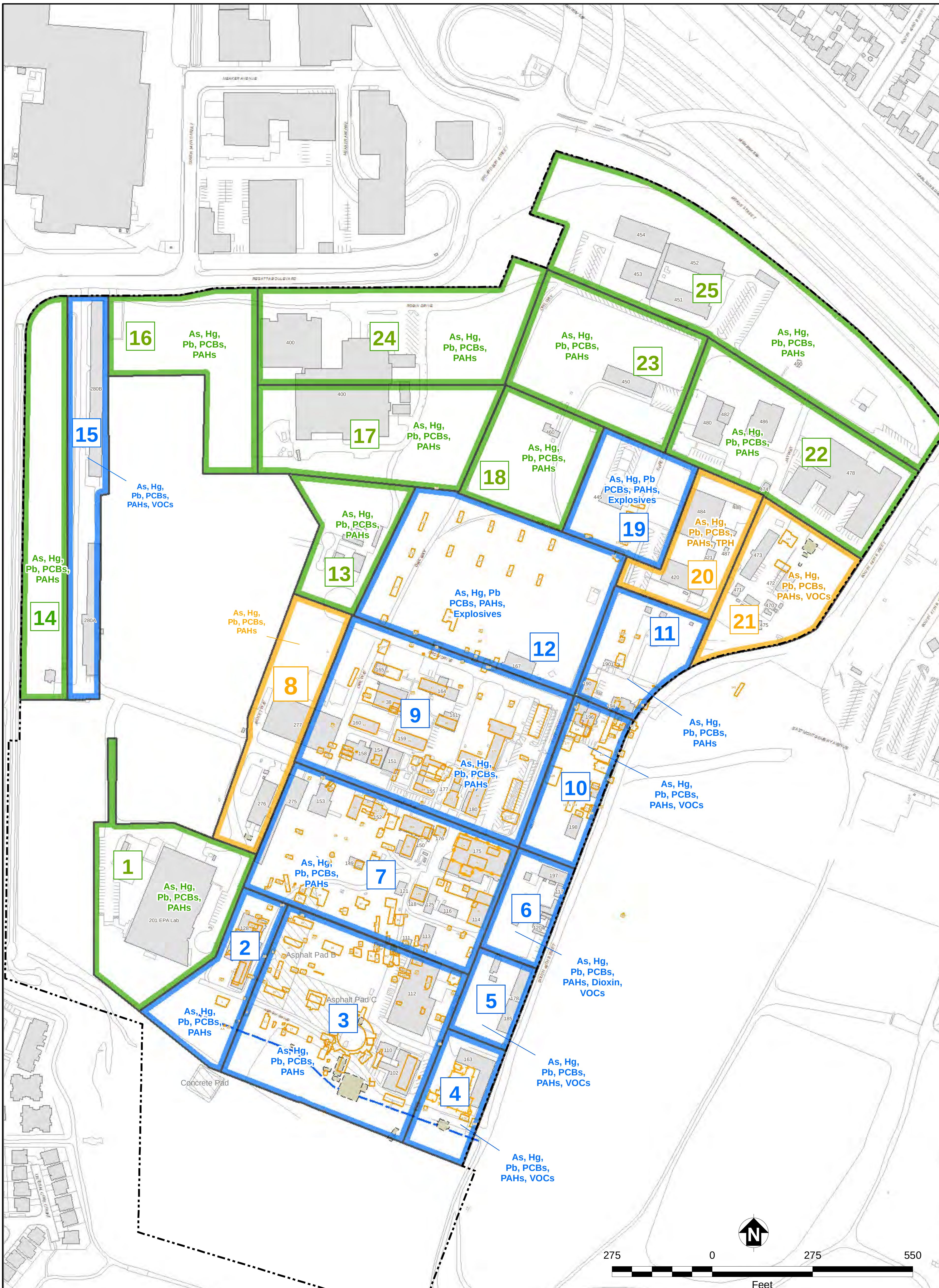
TETRA TECH

Richmond Bay Campus

FIGURE C-5
SOIL MANAGEMENT PLAN AREAS

Soil Management Plan

7/15/2014 V:\Misc_GIS\Richmond_Field_Station\Projects\SMP\Layouts\SMP Plan Areas.mxd TtEMI-OAK yashekia.evans



Existing Building
Removed or Relocated Building
Asphalt/Concrete Pad
Former Seawall (Approximate)
Approximate Site Boundary
Roads or Other Landscape Feature
Former California Cap Company Facilities/Building

SMP Area Boundaries and Identifiers with Density Protocol

1 Low Density Sampling Area
0 Medium Density Sampling Area
2 High Density Sampling Area

Notes:

As	Arsenic
Hg	Mercury
PAH	Polycyclic aromatic hydrocarbons
Pb	Lead
PCB	Polychlorinated biphenyl
SMP	Soil Management Plan
TPH	Total petroleum hydrocarbons
VOC	Volatile organic compound

TETRA TECH

Richmond Bay Campus

FIGURE C-6
SOIL MANAGEMENT PLAN AREAS SAMPLING DENSITIES AND RECOMMENDED ANALYTES

Soil Management Plan

7/15/2014 V:\Misc_GIS\Richmond_Field_Station\Projects\SMP\Layouts\SMP Plan Areas Sampling Densities and COCs.mxd TtEMI-OAK yashekia.evans

TABLES

Table C-1: Category I and II Criteria

Chemical [3]	Risk-Based Concentrations [1,2] Commercial Worker	Construction Worker	Maintenance Worker	Off-Site Receptor (Inhalation)	Other Criteria	Category I Criteria [4]	Category II On-Site Management Criteria [5]
Metals							
Aluminum	100000	**20300**	100000	6860000	--	20300	100000
Antimony	367	**109**	2720	--	--	109	1090
Arsenic	**0.224**	1.58	1.58	745	16 [6]	16 [6,7]	16 [6,7]
Barium	100000	**2110**	52600	686000	--	2110	100000
Beryllium	1760	**29.0**	128	1330	--	29.0	290
Boron	100000	**33600**	100000	27400000	--	33600	100000
Cadmium	1000	**68.1**	73.0	762	--	68.1	681
Chromium	**100000**	100000	100000	--	--	100000	100000
Cobalt	273	**19.9**	34.1	356	--	19.9	199
Copper	36700	**10900**	100000	--	--	10900	100000
Iron	**100000**	100000	100000	--	--	100000	100000
Lead [7,8]	**320**	320	320	--	320 [7,8]	320 [7,8]	800 [7,8]
Manganese	20500	**212**	5300	68600	--	212	2120
Mercury [9]	275	**77.0**	1920	412000	--	77.0	275
Molybdenum	4590	**1360**	34000	--	--	1360	13600
Nickel	14900	**60.6**	1180	12300	--	60.6	606
Selenium	4590	**1340**	33500	27400000	--	1340	13400
Silver	4590	**1360**	34000	--	--	1360	13600
Thallium	9.17	**2.72**	68.0	--	--	2.72	27.2
Vanadium	4590	**1360**	34000	--	--	1360	13600
Zinc	100000	**81600**	100000	--	--	81600	100000
VOCs							
1,2-Dichloropropane	4.41	71.0	83.7	**0.993**	--	0.993	9.93
Acetone	**100000**	100000	100000	475000	--	100000	100000
Benzene	1.44	27.9	27.9	**0.320**	--	0.320	3.20
Ethylbenzene	24	393	393	**5.94**	--	5.94	59.4
m,p-Xylene	2510	2350	58700	**614**	--	614	6140
o-Xylene	2950	2730	68100	**725**	--	725	7250
Toluene	5230	3830	95700	**1440**	--	1440	14400
Trichloroethylene	5.72	15.8	93.7	**1.03**	--	1.03	10.3

Table C-1: Category I and II Criteria

Chemical [3]	Risk-Based Concentrations [1,2] Commercial Worker	Construction Worker	Maintenance Worker	Off-Site Receptor (Inhalation)	Other Criteria	Category I Criteria [4]	Category II On-Site Management Criteria [5]
SVOCs							
BAP (EQ) [10]	**0.145**	0.963	0.963	1150	0.4 [11]	0.4 [11]	1.45
1-Methylnaphthalene	**36.4**	243	243	--	--	36.4	364
2-Methylnaphthalene	1510	**403**	10100	--	--	403	4030
4-Methylphenol	47800	**13000**	100000	823000000	--	13000	100000
Acenaphthene	22600	**6050**	100000	--	--	6050	60500
Acenaphthylene	22600	**6050**	100000	--	--	6050	60500
Anthracene	100000	**30200**	100000	--	--	30200	100000
Benzo(a)anthracene	**0.880**	5.87	5.87	11500	--	0.880	8.80
Benzo(a)pyrene	**0.145**	0.963	0.963	1150	--	0.145	1.45
Benzo(b)fluoranthene	**0.88**	5.87	5.87	11500	--	0.880	8.80
Benzo(g,h,i)perylene	11300	**3020**	75600	--	--	3020	30200
Benzo(k)fluoranthene	**0.880**	5.87	5.87	11500	--	0.880	8.80
bis(2-Ethylhexyl)phthalat	**95.5**	647	647	1330000	--	95.5	955
Chrysene	**8.80**	58.7	58.7	115000	--	8.80	88.0
Dibenz(a,h)anthracene	**0.145**	0.963	0.963	2670	--	0.145	1.45
di-n-Butylphthalate	47800	**13000**	100000	--	--	13000	100000
Fluoranthene	15100	**4030**	100000	--	--	4030	40300
Fluorene	15100	**4030**	100000	--	--	4030	40300
Indeno(1,2,3-cd)pyrene	**0.880**	5.87	5.87	11500	--	0.880	8.80
Naphthalene	18.0	450	450	**3.57**	--	3.57	35.7
Phenanthrene	15100	**4030**	100000	--	--	4030	40300
Pyrene	11300	**3020**	75600	--	--	3020	30200
PCBs							
Aroclor-1242	**0.528**	3.50	3.50	5620	1 [12]	1 [12]	1 [12]
Aroclor-1248	**0.528**	3.50	3.50	5620	1 [12]	1 [12]	1 [12]
Aroclor-1254	**0.528**	2.02	3.50	5620	1 [12]	1 [12]	1 [12]
Aroclor-1260	**0.528**	3.50	3.50	5620	1 [12]	1 [12]	1 [12]
Total PCBs [13]	**1.58**	9.03	10.5	16900	1 [12]	1 [12]	1 [12]
Pesticides							
4,4'-DDD	**7.59**	52.8	52.8	46400	--	7.59	75.9
4,4'-DDE	**5.36**	37.3	37.3	33000	--	5.36	53.6
4,4'-DDT	**5.36**	37.3	37.3	33000	--	5.36	53.6

Table C-1: Category I and II Criteria

Chemical [3]	Risk-Based Concentrations [1,2] Commercial Worker	Construction Worker	Maintenance Worker	Off-Site Receptor (Inhalation)	Other Criteria	Category I Criteria [4]	Category II On-Site Management Criteria [5]
Pesticides (continued)							
Aldrin	**0.107**	0.745	0.745	654	--	0.107	1.07
alpha-BHC	**0.289**	2.01	2.01	1780	--	0.289	2.89
alpha-Chlordane	**1.40**	9.76	9.76	9420	--	1.40	14.0
beta-BHC	**1.01**	7.04	7.04	6040	--	1.01	10.1
Carbazole	**145**	934	934	291000	--	145	1450
Chlordane	**1.40**	9.76	9.76	9420	--	1.40	14.0
delta-BHC	**0.289**	2.01	2.01	1780	--	0.289	2.89
Dieldrin	**0.114**	0.792	0.792	696	--	0.114	1.14
Endosulfan I	3910	**1100**	27500	--	--	1100	11000
Endosulfan II	3910	**1100**	27500	--	--	1100	11000
Endosulfan sulfate	3910	**1100**	27500	--	--	1100	11000
Endrin	195	**54.9**	1370	--	--	54.9	549
Endrin aldehyde	195	**54.9**	1370	--	--	54.9	549
gamma-BHC (Lindane)	**1.66**	11.5	11.5	10300	--	1.66	16.6
gamma-Chlordane	**1.40**	9.76	9.76	9420	--	1.40	14.0
Heptachlor	**0.405**	2.82	2.82	2460	--	0.405	4.05
Heptachlor epoxide	**0.200**	1.39	1.39	1230	--	0.200	2.00
Mirex	**0.101**	0.704	0.704	628	--	0.101	1.01
Pentachlorophenol	**1.86**	12.2	12.2	628000	--	1.86	18.6
Dioxin							
Dioxin TEQ [14]	**0.0000164**	0.000116	0.000116	0.0843	--	0.0000164	0.000164
Explosives							
HMX	23900	**6500**	100000	--	--	6500	65000
TPH							
Diesel range organics	--	--	--	--	500 [15]	500 [15]	500 [15]
Gasoline range organics	--	--	--	--	500 [15]	500 [15]	500 [15]
Motor oil range organics	--	--	--	--	2500 [15]	2500 [15]	2500 [15]

Notes:
All values are in mg/kg.

Table C-1: Category I and II Criteria

Notes (continued):

1 Risk-based concentrations are calculated in Appendix C of the Site Characterization Report (Tetra Tech 2013a). Risk-based concentrations are shown with 3 significant figures, except where the default value of 100,00 mg/kg applies (where calculated value exceeds 100,000 mg/kg). Risk-based concentrations shown are the minimum values between the cancer and noncancer multi-pathway risk-based concentrations. For the off-site receptor, the values shown are the minimum values between the cancer and noncancer inhalation pathway risk-based concentrations calculated for the unrestricted use scenario.

2 Bold values indicate the lowest of the risk-based concentrations for all potential future receptors.

3 All chemicals detected at the site are included in this table. If a chemical is detected in the future that is not included in the table, risk-based concentrations will be calculated for it, and DTSC will be consulted.

4 Category I criteria are based on the lowest of the calculated risk-based concentrations, unless background, ambient, or TSCA criterion are available, in which case the alternate values are selected and noted within this table. Category I criteria for TPH constituents are based on the RWQCB ESL.

5 Category II criteria are based on 10 times the Category I criteria, unless otherwise noted. In cases where 10 times the Category I criteria is greater than 100,000 mg/kg, the default value of 100,000 mg/kg is used.

6 The background level for arsenic (16 mg/kg) was established for the adjacent Campus Bay Site and approved by DTSC for the former RFS Site (Erler & Kalinowski, Inc. 2007; DTSC 2007). The arsenic criteria is a not to exceed value, except in cases where arsenic is associated with cinders in soil (see note 7).

7 If lead or arsenic is associated with cinders, manage on site per Section 5.2.3 of the SMP. If not associated with cinders, investigate further, determine if source is present, and dispose of off-site.

8 A risk-based concentration was not calculated for lead. Rather, the industrial CHHSL of 320 mg/kg (Cal/EPA OEHHA 2009) was used for the commercial, construction, and maintenance worker scenarios. The Category II lead value is based on industrial RSL from EPA (2012).

9 The toxicity criteria for mercuric chloride was used as a surrogate for mercury to calculate the risk-based concentration.

10 The toxicity criteria for benzo(a)pyrene was used as a surrogate for BAP (EQ) to calculate the risk-based concentration.

11 The ambient level for BAP (EQ) (0.4 mg/kg) is based on the 95 UCL concentration of the ambient dataset for BaP (EQ) in surface soils in Northern California (DTSC 2009; Environ Corporation and others 2002).

12 The other criterion is based on the TSCA High Occupancy, no further conditions threshold criterion for total PCBs from EPA (2005). The TSCA criterion is a not-to-exceed value.

13 PCB COCs include Aroclor-1248, Aroclor-1254, and Aroclor-1260. The receptor-specific risk-based concentration for total PCBs is the sum of the individual risk-based concentrations for the three COCs. The TSCA criteria for Aroclors of 1 mg/kg is applicable for total PCBs (the sum of all detected individual Aroclors in a particular sample).

14 The toxicity criteria for 2,3,7,8-TCDD was used as a surrogate for Dioxin TEQ to calculate the risk-based concentration.

15 Criteria for TPH constituents are based on the RWQCB ESL (RWQCB 2013).

--	Not applicable	DTSC	California Department of Toxic Substances Control
95 UCL	95th percentile Upper Confidence Limit of the arithmetic mean	EPA	U.S. Environmental Protection Agency
BAP (EQ)	Benzo(a)pyrene equivalent	ESL	Environmental Screening Level
BHC	Hexachlorocyclohexane	HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
Cal/EPA	California Environmental Protection Ageny	mg/kg	Milligrams per kilogram
CHHSL	California human health screening level	OEHHA	Office of Environmental Health Hazard Assessment
COC	Chemical of concern	PCB	Polychlorinated biphenyl
DDD	Dichlorodiphenyldichloroethane	RBC	Risk-based concentration
DDE	Dichlorodiphenyldichloroethylene	RSL	Regional Screeing Level
DDT	Dichlorodiphenyltrichloroethane	RWQCB	California Regional Water Quality Control Board

Table C-1: Category I and II Criteria

Notes (continued):

SMP	Soil management plan	TPH	Total petroleum hydrocarbons
SVOC	Semivolatile organic compound	TSCA	Toxic Substances Control Act
TCDD	Tetrachlorodibenzo-p-dioxin	VOC	Volatile organic compound
TEQ	Toxic equivalency quotient		

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Tetra Tech. 2013. Site Characterization Report, Research, Education, and Support Area and Groundwater within the Richmond Field Station Site. May 28.

Table C-2: Summary of SMP Areas and Historical Activities

SMP Area	Historical Activities	UC Berkeley Activities [1]	Previous Cleanups [2]	Depth of Completed Cleanup (ft bgs)	COC of Completed Cleanup	Report Reference for Cleanup	Known Pyrite Cinders?	Commercial Vapor Intrusion RBC Exceedance in GW
1	--	--	--	--	--		Y	N
2	CCC, Shell Manufacturing, Pyrite Cinder Disposal	B128	Area 4 - Phase 2 RA 6 (AOC U6) - Phase 3	1 - 1.5 [3] 2 - 5	Pyrite Cinders, Hg Hg, PCBs	URS 2004 URS 2005	Y	N
3	CCC, MFA, Pyrite Cinder Disposal	B102, B112	Area 4 - Phase 2 RA 4 (AOC U4) - Phase 3 RA 6 (AOC U6) - Phase 3	1 - 5 [3] 1 2 - 5	Pyrite Cinders, Hg As, Cr, Cu, Pb, Hg Hg, PCBs	URS 2004 URS 2005	Y	N
4	CCC, Briquette, Pyrite Cinder Disposal	B163	Area 1 - Phase 1	11	Pyrite Cinders, Hg	URS 2003b	N	N
5	CCC	--	--	--	--		Y	Y [4]
6	CCC	B120 chemical and petroleum product storage, maintenance equipment storage, incinerator, UST (removed)	--	--	--		Y	Y [5]
7	CCC, Pacific Cartridge Company	B118, B125, B275, UST (removed)	RA 4 (AOC U4) - Phase 3	1	As, Cr, Cu, Pb, Hg	URS 2005	Y	N
8	--	B276, B277	RA 5 (AOC U8) - Phase 3	2	PCBs	URS 2005	N	N
9	CCC	B151, B158, B165, B277, UST (Removed)	--	--	--	--	N	N
10	CCC	AST	--	--	--	--	Y	N
11	CCC	--	--	--	--	--	N	N
12	CCC, Explosives Storage Area	B167	RA 1 (AOC U1) - Phase 3 RA 2 (AOC U2) - Phase 3	1 1 - 3 [6]	As, Cu, Pb As, Cu	URS 2005	Y	N
13	--	B300	--	--	--	--	N	N
14	--	--	--	--	--	--	N	N
15	--	B280A, B280B, AST	--	--	--	--	N	Y [5]
16	--	--	--	--	--	--	N	N
17	--	--	--	--	--	--	Y	N
18	--	B460	--	--	--	--	N	N
19	CCC, Explosives Test Pit	--	RA 2 (AOC U2) - Phase 3	1 - 3 [6]	As, Cu	URS 2005	Y	N
20	--	B420, B421, B484, AST, B421 hydraulic oil spill	--	--	--	--	N	N
21	--	FPL WTL (B470-B473)	RA 3 (AOC U3) - Phase 3 FPL WTL TCRA	1 2 - 3.5	As, Cu As	URS 2005 Tetra Tech 2008c	N	Y [4]
22	--	FPL (B474, B478, B480)	--	--	--	--	N	N
23	--	B450, AST	--	--	--	--	N	N
24	--	--	--	--	--	--	N	N
25	--	--	--	--	--	--	N	N

Table C-2: Summary of SMP Areas and Historical Activities

Notes:

1 See Section 1.1.4.1 of the CCR (Tetra Tech 2008d) for a description of research activities associated with each building. Tranformers are present in SMP Areas 2, 3, 7, 8, 20, 21, and 24. All transformers have been investigated. Remediation activities are planned to remove PCB contamination near the B112 and B150 transformers in SMP Areas 3 and 7. PCB levels at all other transformers do not require remediation.

2 Cleanups planned for mercury in SMP Area 3, and for PCBs in SMP Areas 3 and 7.

3 Depth indicated is the range of depths of the remediated area within the SMP Area.

4 TCE groundwater concentration exceeds site-specific goal of 270 µg/L established by DTSC for the Campus Bay site (EKI 2008; Terraphase 2012).

5 Carbon tetrachloride groundwater concentration exceeds commercial RBC of 2.63 µg/L (Tetra Tech 2013).

6 A wooden vault approximately six foot by six foot by six feet deep containing cinders was discovered during the remedial action. The structure and cinders were removed.

Acronyms:

--	None/not applicable	N	No
µg/L	Micrograms per liter	MFA	Mercury Fulminate Area
AOC	Area of concern	Pb	Lead
As	Arsenic	PCB	Polychlorinated biphenyl
AST	Aboveground storage tank	RA	Remedial area
CCC	California Cap Company	RBC	Risk-based concentration
Cr	Chromium	SMP	Soil management plan
COC	Chemical of concern	TCE	Trichloroethene
Cu	Copper	TCRA	Time-critical removal action
DTSC	Department of Toxic Substances Control	Terraphase	Terraphase Engineering, Inc.
EKI	Erler & Kalinowski, Inc.	Tetra Tech	Tetra Tech, Inc. (formerly Tetra Tech EM Inc.)
FPL WTP	Forest Products Products Laboratory Wood Treatment Laboratory	UC	University of California
ft bgs	Feet below ground surface	URS	URS Corporation
GW	Groundwater	UST	Underground storage tank
Hg	Mercury	Y	Yes

References:

EKI. 2008. "Revised Human Health Risk Assessment and Calculation of Site-Specific Goals for Lots 1, 2, and 3. Campus Bay Site, Richmond, California." April 30.

Terraphase. 2012. "Response to Department of Toxic Substances Control Comments Regarding the 'Revised TCE Risk Evaluation.' Campus Bay Site, Richmond, California." July 19.

Tetra Tech. 2008c. "Implementation Summary Report for a Time-Critical Removal Action at the Forest Products Laboratory Wood Treatment Laboratory." March 14.

Tetra Tech. 2008d. "Current Conditions Report, University of California, Berkeley, Richmond Field Station, Richmond California." November 21.

Tetra Tech. 2013. "Draft Site Characterization Report, Proposed Richmond Bay Campus, University of California, Berkeley, Richmond Field Station, Richmond, California." January 9.

URS. 2003b. "Implementation Report, Phase 1 Subunit 2A, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station." September 4.

URS. 2004. "Implementation Report, Phase 2 Subunit 2A and 2B, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station." December 3.

URS. 2005. "Implementation Report, Phase 3 Upland Portion of Subunit 2B, Meade Street Operable Unit, University of California, Berkeley, Richmond Field Station." June 16.

Table C-3: Recommended Soil Sampling Density and Analysis for Sampling Design

SMP Area [1]	Sampling Density [2]	Recommended Analytes [3]: As, Hg, Pb, PCBs, PAHs	TPH	Dioxins	Explosives	VOCs
1	Low	X	--	--	--	--
2	High	X	--	--	--	--
3	High	X	--	--	--	--
4	High	X	--	--	--	X
5	High	X	--	--	--	X
6	High	X	--	X	--	X
7	High	X	--	--	--	--
8	Medium	X	--	--	--	--
9	High	X	--	--	--	--
10	High	X	--	--	--	X
11	High	X	--	--	--	--
12	High	X	--	--	X	--
13	Low	X	--	--	--	--
14	Low	X	--	--	--	--
15	High	X	--	--	--	X
16	Low	X	--	--	--	--
17	Low	X	--	--	--	--
18	Low	X	--	--	--	--
19	High	X	--	--	X	--
20	Medium	X	X	--	--	--
21	Medium	X [4]	--	--	--	X
22	Low	X [4]	--	--	--	--
23	Low	X	--	--	--	--
24	Low	X	--	--	--	--
25	Low	X	--	--	--	--

Notes:

1 See Figure 6 for location of SMP Areas.

2 Low, medium, and high sampling densities correspond to those defined in Section 4.1 of the SMP.
Low = 1 sample location per 15,625 square feet of project area (125 foot grid spacing)
Medium = 1 sample location per 10,000 square feet of project area (100 foot grid spacing)
High = 1 sample location per 5,625 square feet of project area (75 foot grid spacing)

3 Existing sample results will be evaluated when selecting analytes at each sampling location.

4 Soil containing concentrations of arsenic in this SMP Area exceeding commercial RBCs may be associated with the FPL WTL and should be considered for off-site disposal.

Acronyms:

--	None/not applicable	PCB	Polychlorinated biphenyl
As	Arsenic	RBC	Risk-based concentration
FPL WTP	Forest Products Products Laboratory Wood Treatment Laboratory	SMP	Soil management plan
Hg	Mercury	TPH	Total petroleum hydrocarbons
PAH	Polycyclic aromatic hydrocarbons	VOC	Volatile organic compounds
Pb	Lead		

ATTACHMENT D
AIR MONITORING PLAN

Perimeter Air Monitoring Plan

for the

Removal Action Workplan Activities

Richmond Bay Campus

FINAL

Prepared for

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Submitted: July 18, 2014

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1.0 INTRODUCTION

4LEAF, Inc. (4LEAF) has prepared this perimeter air monitoring plan (the "Plan") for the University of California, Berkeley (UC Berkeley) Office of Environment, Health and Safety (EH&S) in accordance with the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC), Site Investigation and Remediation Order, Docket No. ISE-RAO 06/07-004, dated September 15, 2006. This Plan outlines the air monitoring procedures for conducting the Removal Action Workplan (RAW) for the Research, Education, and Support (RES) Area and Groundwater within the Richmond Bay Campus (RBC) in Richmond, California (see Figure D-1).

The air monitoring procedures were developed to protect RBC workers and off-site communities from exposure to chemicals of potential concern (COPCs) and to evaluate adequacy of dust control methods being applied by the contractor selected to implement the RAW. As described in the RAW, excavation activities will be performed in four areas at RBC:

- Former Mercury Fulminate Area (MFA)
- Building 112 area
- Building 150 area
- RBC Corporation Yard

2.0 AIR MONITORING

Air monitoring will be performed during all soil disturbance and excavation activities performed under the RAW. Based on the known COPCs, real-time dust monitoring and mercury vapor monitoring will be performed during excavation activities to be performed in the former MFA and real-time dust monitoring will be performed during excavation activities to be performed in the Building 112 area, Building 150 area, and RBC Corporation Yard.

2.1 Real-time Perimeter Dust Monitoring

There is the possibility that minor amounts of dust will be released into the air during excavation activities. Dust emissions will be minimized by spraying water on excavation-equipment buckets during excavation and dumping to eliminate visible dust. In addition, excavated soils will be placed and stored in covered roll-off bins or in covered soil stockpiles to minimize wind-borne dust prior to transporting the soil off site.

Air monitoring will be performed at the fenced perimeter of the various excavation areas to verify that dust control measures are adequate. Real-time air monitoring of total dust will be performed using real-time aerosol monitors [MIE Personal Data Rams (PDR)] with data loggers to provide immediate information for the total dust levels present. The lower detection limit for the operating range of the PDR is 0.001 milligrams per cubic meters (mg/m^3). The particle size maximum range of response for the PDR is 0.1 to 10 micro meters (μm). The PDRs will be set to automatically log dust levels over 5-minute periods and will be visually checked approximately every hour during the work day and the value manually recorded in the field logs by an on-site UC Berkeley representative to verify equipment operation and compliance with the target action levels. The data will be downloaded into a computer daily and will be posted on the RBC Environmental Website (http://rfs.berkeley.edu) within one week.

The PDRs will be calibrated daily according to the manufacturer's requirements and maintained in good working conditions. Spare batteries and one spare PDR unit will be maintained on site in the event a unit malfunctions during the work day. Dust measurements will be recorded upwind of the excavation area at the start of work in the morning and after lunch break at mid-day to determine ambient dust concentrations for that day.

The PDRs will be positioned along excavation fence lines at locations most likely to be in the direction of off-site dust migration from each excavation area depending on the identified wind direction on the day and time of work (see Figures D-2 and D-3). Two PDRs will be placed at a height of five feet on fences in the downwind direction of the excavation area to monitor for dust being generated in the excavation and one PDR will be placed upwind of the excavation to measure ambient dust concentrations.

Wind speed and direction will be continuously monitored using a portable calibrated wind sock. Wind speed will also be measured every hour using a hand-held anemometer and the readings recorded in the daily field notes. The contractor will be notified verbally (and documented in the daily field notes) to stop work if real-time dust monitoring shows that perimeter action levels for dust are exceeded or if sustained wind speeds exceed 15 miles per hour (mph) (sustained for 15 minutes).

UC Berkeley has calculated the following action levels for fugitive dust concentrations for the perimeter (or fence line) of each excavation area:

- Former MFA - 34 $\mu g/m^3$ dust concentration (in addition to the daily measured ambient dust levels).

- Building 112 area - 50 $\mu g/m^3$ dust concentration (in addition to the daily measured ambient dust levels).

- Building 150 area - 50 $\mu g/m^3$ dust concentration (in addition to the daily measured ambient dust levels).

- Corporation Yard area - 16 $\mu g/m^3$ dust concentration (in addition to the daily measured ambient dust levels).

The perimeter dust action levels are protective of the most sensitive off-site receptors including children, elderly, and the ill. These perimeter dust action levels were established using the following methodology:

- *Determination of chemicals of potential concern (COPCs).* Chemicals detected in soils during previous site investigation activities were reviewed to determine those chemicals that are present in soils at concentrations exceeding the lowest of the risk-based concentration (RBCs) criteria and could be potentially associated with an adverse health risk if released into the air as dust. The RBCs are published in Appendix C of the Site Characterization Report (Tetra Tech 2013). Based on this review, the following chemicals of potential concern (COPC) were identified for each excavation area as exceeding the lowest of their respective RBC.

- ✓ Former MFA: arsenic, cadmium, lead, mercury, and thallium.
- ✓ Building 112 area: Aroclor-1248 and Aroclor-1254.
- ✓ Building 150 area: Aroclor-1260.
- ✓ Corporation Yard area: arsenic, copper, lead, benzo(a) pyrene, dieldrin, and dioxins (as 2,3,7,8-TCDD).

- *Calculation of COPC Concentrations in Dust.* A hypothetical worst-case dust concentration that an individual located outside of the excavation area could be exposed to was calculated for each COPC by assuming all dust released from the excavation contained the maximum concentrations of the COPCs found during previous site investigations. This adds conservatism to the calculated allowable dust concentration since the majority of soils in each proposed excavation area contains the COPCs at much lower concentrations than the maximum concentration. The California Ambient Air Quality Standard (CAAQS) PM_{10} standard of 50 micrograms per cubic meter ($\mu g/m^3$) was used as the benchmark dust concentration. The maximum soil concentration for each COPC was converted to mg of COPC per mg of dust, and then multiplied by the PM_{10} standard to determine the worst-case COPC concentration in dust. For example, the maximum soil concentration of Aroclor-1254 in the Corporation Yard area is 110 mg/kg. If total dust concentrations were equivalent to the PM_{10} standard, the calculated worst-case Aroclor-1254 concentration in dust would be 0.0055 $\mu g/m^3$ (110 mg/kg x 0.000001 kg/mg x 50 $\mu g/m^3$ = 0.0055 $\mu g/m^3$).

- *Determination of Acceptable Concentration in Dust.* A hierarchy approach was used to identify the appropriate regulatory or risk-based concentrations for comparison to the calculated worst-case COPC concentrations in dust. The maximum detected soil concentrations for the COPCs detected in each excavation area are listed in Table 1. The Bay Area Air Quality Management District (BAAQMD) regulatory levels were consulted first because they included a value for lead. The California Office of Environmental Health Hazard Assessment (OEHHA) reference exposure levels (RELs) for inhalation were then consulted, which included chronic RELs for arsenic and cadmium and the acute REL for copper. The chronic RELs are concentrations or doses at or below which adverse health effects are not likely to occur. They are designed to protect the individuals who live or work in the vicinity of emissions of these substances. Chronic RELs are intended to protect individuals with low susceptibility for chemical injury as well as identifiable sensitive subpopulations (high-risk individuals) from adverse health effects (OEHHA 2000). The acceptable COPC concentrations in dust were calculated for the remaining COPCs.

  Note: The OEHHA REL table lists acute, 8-hour and chronic RELs for mercury, which are based on exposure to elemental mercury (OEHHA, 2013), and are utilized in monitoring mercury vapor exposures (see Section 2.2 of this document). However, particulate mercury is much less bioavailable than organic vapor from elemental mercury (ATSDR, 1999). As such, a risk-based concentration was derived for assessing potential chronic exposure to particulate mercury in lieu of using the OEHHA RELs for elemental mercury.

- *Calculation of Risk-based Acceptable COPC Concentrations in Dust.* The acceptable risk-based COPC concentrations in dust were calculated using a target risk of 1 x 10^{-6} for carcinogenic compounds and a target hazard quotient (HQ) of 1 for non-carcinogenic compounds. Exposures with risks less than the target levels are not considered significant. For carcinogenic compounds, the target risk was divided by the inhalation unit risk (IUR)[1] for each COPC to determine an acceptable COPC concentration in dust. To continue with the Aroclor-1254 example from above, the target risk was divided by the IUR for Aroclor-1254 of 0.00057 (m^3/µg), resulting in an acceptable Aroclor-1254 concentration in dust of 0.0018 µg/m^3 (1 x 10^{-6} / 0.00057 (m^3/µg) = 0.0018 µg/m^3). For non-carcinogenic compounds, the target HQ was multiplied by the reference dose concentration (RfC)[2] for each COPC to determine an acceptable COPC concentration in dust. For example, the target HQ was multiplied by the mercury RfC (0.3 µg/m^3), which resulted in an acceptable mercury concentration in dust of 0.3 µg/m^3 (1 x 0.3 µg/m^3 = 0.3 µg/m^3). Because the risk-based acceptable COPC concentrations in dust were calculated using toxicity data (i.e., IURs and RfCs) derived from chronic exposure studies, the risk-based acceptable concentrations are protective of chronic exposure to COPCs.

- *Comparison of Worst-case COPC Concentrations in Dust to Acceptable COPC Concentrations in Dust.* The calculated worst-case COPC concentrations in dust were compared to the acceptable COPC concentrations. This comparison was made to determine if exposure to dust at the PM_{10} standard of 50 µg/m^3 could result in an unacceptable exposure to COPCs for offsite receptors. As shown in Table 1, the worst-case COPC concentrations in dust exceed their respective acceptable COPC concentrations in dust for the following constituents:

  - ✓ Cadmium and mercury in soils in the MFA.
  - ✓ Aroclor-1254 and dioxis (as 2,3,7,8-TCDD) in soils in the Corporation Yard area.

  This indicates the PM_{10} standard of 50 µg/m^3 should be lowered in these areas to reduce exposure to COPCs via dust inhalation.

- *Calculation of Action Levels for Total Dust*. The acceptable COPC concentrations in dust were used for cadmium and mercury in the MFA, and for Aroclor-1254 and dioxins (as 2,3,7,8-TCDD) in the Corporate Yard area to calculate the action levels for total dust. For Aroclor-1254, the acceptable COPC concentration in dust (0.0018 µg/m^3) was divided by maximum soil concentration and a conversion factor to calculate an action level for total dust [0.0018 µg/m^3 / (110 mg/kg x 0.000001 kg/mg) = 16 µg/m^3]. For the MFA, the lower of the two calculated action levels [cadmium (46 µg/m^3) and mercury (34 µg/m^3)] will be used as the dust action levels that will be implemented during excavation activities. For the Corporation Yard area, the lower of the two calculated action levels

[1] All IURs were obtained from the *Consolidated Table of OEHHA/Air Review Board (ARB) Approved Risk Assessment Health Values* (2013) as follows: PCBs (high risk) = 5.7E-04 $(\mu g/m^3)^{-1}$, PAHs = 1.1E-03 $(\mu g/m^3)^{-1}$, Dioxins = 3.8E+01 $(\mu g/m^3)^{-1}$, Dieldrin = 4.6E-03 $(\mu g/m^3)^{-1}$.

[2] The RfC for mercury (0.3 µg/m^3) was obtained from USEPA's Integrated Risk Information System (IRIS) (2013).

[Aroclor-1254 (16 µg/m^3), dioxins (26 µg/m^3)] was used as the dust action levels implemented during excavation activities.

For the Building 112 and Building 150 areas, the worst-cased COPC concentrations in dust did not exceed the acceptable COPC concentrations in dust for Aroclor-1248, -1254, and -1260; therefore, the PM_{10} standard of 50 µg/m^3 will be used as the dust action levels implemented during excavation activities in these two areas.

2.2 Real-time Mercury Vapor Monitoring

Real-time mercury vapor monitoring will be performed near the work zone as well as at the fenced perimeter of the MFA excavation area. The mercury vapor monitoring will be conducted using Lumex RA-915 mercury vapor meters equipped with data loggers. The Lumex RA-915 meter has a detection limit of 0.002 micro grams per cubic meter (µg/m^3) for mercury. Mercury vapor monitoring in and near the work zone will be performed using a hand-held meter and the perimeter monitoring will be performed by positioning Lumex vapor meters at a height of five feet on fences along each side of the excavation area (a total of four monitors) (Figure D-3). A portable Lumex meter will also be utilized by designated UC Berkeley representatives to monitor for mercury vapor in the immediate vicinity of the MFA excavation area.

The Lumex vapor meters placed along the excavation perimeter fencing will be set to log mercury vapor levels over 5-minute periods and will be will be visually read approximately every hour during the work day and manually recorded in the field logs by an on-site UC Berkeley representative to verify equipment operation and compliance with the target action levels. The data will be downloaded into a computer daily and will be posted on the RBC Environmental Website (http://rfs.berkeley.edu) within two working days.

The Lumex vapor meters will be calibrated daily according to the manufacturer's requirements and maintained in good working conditions. Spare batteries and one spare Lumex vapor meter unit will be maintained on site in the event a unit malfunctions during the work day.

UC Berkeley has set an action level of 0.6 µg/ m^3 for mercury vapors as measured at the MFA excavation fences. The action level is based on the OEHHA acute REL value for 1-hour exposures to mercury and inorganic mercury compounds (OEHHA 2013). Additionally, an 8-hour average mercury concentration will be calculated daily from the Lumex vapor data and compared to the OEHHA 8-hour REL of 0.03 µg/m^3 to ensure exposures over an 8-hour work day are not exceeding the REL. The 8-hour REL is also protective of on-site RBC staff that work in nearby buildings and for off-site residents that live at the nearby Marina Bay housing development.

A stop work notice will be issued to the contractor if vapor concentrations exceed the action level in any of the four perimeter Lumex vapor meters and work will not be allowed to resume until the mercury vapor levels measured at the excavation fence line are less than the action level.

3.0 REFERENCES

ATSDR, 1999. *Toxicological Profile for Mercury*. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. March 1999.

OEHHA, 2013. *Air Toxics Hot Spots Program Technical Support Document for the Derivation of Noncancer Reference Exposure Levels*, Office of Environmental Health Hazard Assessment, Air Toxicology and Epidemiology Branch, Oakland, CA. August 20, 2013.

Tetra Tech. 2013. *Site Characterization Report, Proposed Richmond Bay Campus, Research, Education, and Support Area and Groundwater within the Richmond Field Station Site*. May 28.

USEPA 2013. *Integrated Risk Information System (IRIS)*, US Environmental Protection Agency, accessed October 16, 2013, at http://www.epa.gov/IRIS/.

Figures

Approximate RAW Workzones

- Exclusion Zones
- Decontamination Zones
- Support Zones
- Roll-off Bin Storage Area

Proposed Excavation Areas

- Proposed PCB Excavation Areas
- Proposed MFA Excavation Areas
- Proposed Corporation Yard Excavation Areas
- Proposed Fencing

- Existing Buildings
- Asphalt/Concrete Pads
- Existing Fenceline
- Portion of RFS Property Subject to DTSC order, Defined as "Site"
- Roads and Other Landscape Features

Note:

DTSC	Department of Toxic Substance Control
MFA	Mercury Fulminate Area
PCB	Polychlorinated biphenyls
RFS	Richmond Field Station

TETRA TECH

Richmond Bay Campus

FIGURE D-1
RAW WORK ZONES

Removal Action Workplan
Air Monitoring Plan

Proposed Air Monitoring Locations

- Perimeter Airborne Dust Monitoring Station[1]
- Real-time Mercury Vapor Monitoring Station

Approximate RAW Workzones

- Exclusion Zones
- Decontamination Zones
- Support Zones
- Roll-off Bin Storage Area

Proposed Excavation Areas

- Proposed PCB Excavation Areas
- Proposed MFA Excavation Areas
- Proposed Fencing

- Existing Buildings
- Asphalt/Concrete Pads
- Existing Fenceline
- Portion of RFS Property Subject to DTSC order, Defined as "Site"
- Roads and Other Landscape Features

Notes:
1 Actual perimeter airbborne dust monitoring locations will be based on the wind direction(s) for each day. Two monitors will be sited downwind of the excavation and one monitor sited upwind of the excavation.

DTSC Department of Toxic Substance Control
MFA Mercury Fulminate Area
PCB Polychlorinated biphenyls
RFS Richmond Field Station

TETRA TECH

Richmond Bay Campus

FIGURE D-2
PROPOSED LOCATIONS OF MERCURY VAPOR AND DUST MONITORS FOR THE MFA AND BUILDING 112 TRANSFORMER AREA EXCAVATIONS

Removal Action Workplan
Air Monitoring Plan

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Proposed Air Monitoring Locations

- Perimeter Airborne Dust Monitoring Station[1]

Approximate RAW Workzones

- Exclusion Zones
- Decontamination Zones

Proposed Excavation Areas

- Proposed PCB Excavation Areas
- Proposed Corporation Yard Excavation Areas
- Proposed Fencing

- Existing Buildings
- Asphalt/Concrete Pads
- Existing Fenceline
- Portion of RFS Property Subject to DTSC order, Defined as "Site"
- Roads and Other Landscape Features

Notes:
1 Actual perimeter airborne dust monitoring locations will be based on the wind direction(s) for each day. Two monitors will be sited downwind of the excavation and one monitor sited upwind of the excavation.

DTSC Department of Toxic Substance Control
MFA Mercury Fulminate Area
PCB Polychlorinated biphenyls
RFS Richmond Field Station

TETRA TECH

Richmond Bay Campus

FIGURE D-3
PROPOSED LOCATIONS OF DUST MONITORS FOR THE CORPORATION YARD AND BUILDING 150 TRANSFORMER AREA EXCAVATIONS

Removal Action Workplan
Air Monitoring Plan

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TABLES

Table 1. Proposed Total Dust Action Levels for Excavation Activities.

COPC	Acceptable COPC Concentration in Dust ($\mu g/m^3$)	MFA		Bldg. 112 Area		Bldg. 150 Area		Corporation Yard Area	
		Max. Soil Conc. (mg/kg) (a)	Worst-Case COPC Concentration in Dust ($\mu g/m^3$)	Max. Soil Conc. (mg/kg) (a)	Worst-Case COPC Concentration in Dust ($\mu g/m^3$)	Max. Soil Conc. (mg/kg) (a)	Worst-Case COPC Concentration in Dust ($\mu g/m^3$)	Max. Soil Conc. (mg/kg) (a)	Worst-Case COPC Concentration in Dust ($\mu g/m^3$)
Arsenic	0.015 (a)	46.8	0.00234					40.1	0.002005
Cadmium	0.02 (a)	437	*0.02185* (g)						
Copper	100 (b)							4,560	0.228
Lead	1 (c)	1,140	0.057					571	0.02855
Mercury	0.3 (d)	8,800	*0.44* (g)						
Thallium	NA (e)	3.4	0.00017						
Aroclor-1248	0.0018 (f)			35	0.00175				
Aroclor-1254	0.0018 (f)			24	0.0012			110	*0.0055* (g)
Aroclor-1260	0.0018 (f)					1.7	0.000085		
PAHs (as Benzo(a)pyrene)	0.0009 (f)							15.48	0.000774
Dioxins (as 2,3,7,8-TCDD)	2.6E-08 (f)							0.001	*5.0E-08* (g)
Dieldrin	0.0002 (f)							0.078	3.9E-06
	Total Dust Action Level:	**34 $\mu g/m^3$**		**50 $\mu g/m^3$**		**50 $\mu g/m^3$**		**16 $\mu g/m^3$**	

Notes:
(a) Based on chronic REL value published by OEHHA (August 2013).
(b) Based on acute REL value published by OEHAA (August 2013). No chronic value available.
(c) Based on BAAQMD 30-day average.
(d) Risk-based value calculated using the RfC since RELs based on elemental mercury exposure.
(e) No REL and no inhalation toxicity information available to calculate a risk-based value.
(f) Risk based value calculated using IURs and a target risk of 1E-06.
(g) Values shown in italics indicate the “Worst-Case COPC Concentration in Dust” value exceeds the “Acceptable COPC Concentration in Dust” value.

mg/kg milligrams per kilogram
$\mu g/m^3$ micrograms per cubic meter.

ATTACHMENT E
RAW RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY FOR PUBLIC COMMENTS RECEIVED ON DRAFT REMOVAL ACTION WORKPLAN

UNIVERSITY OF CALIFORNIA BERKELEY FORMER RICHMOND FIELD STATION Research, Education, and Support Areas and Groundwater Within the Former Richmond Field Station Site RICHMOND BAY CAMPUS RICHMOND, CALIFORNIA JULY 18, 2014

Section I – Introduction

On December 5, 2013, the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) held a public meeting on the *Public Draft Removal Action Workplan for the Richmond Bay Campus Research, Education and Support Area and Groundwater within the Former Richmond Field Station Site* (draft RAW) for the University of California Berkeley, Former Richmond Field Site (Former RFS Site or Site) located at 1301 South 46th Street, Richmond, Contra Costa County, California.

The purpose of the meeting was to provide information regarding the draft RAW, and to request public comments on the draft RAW.

The comment period was originally noticed for a 45-day period and ran from November 26, 2013 to January 10, 2014 for the draft RAW. A public notice was placed in the Contra Costa County Times print edition on November 25, 2013. The notice announced the comment period, the date, time and location of the public meeting, and the location of the information repositories. A Fact Sheet that discussed the draft RAW and announced the public meeting and comment period was mailed on November 25, 2013 to the DTSC site mailing list. The list consisted of approximately 5,700 addresses that included residents near the Site, elected officials, government agencies, environmental organizations, other interested parties, and the DTSC Regional and Statewide Mandatory mailing list. The public notice and fact sheet were also sent via electronic mail to approximately 300 addresses. In addition, in response to a request from the public, the public comment period was extended to January 17, 2014, providing for a 52-day comment period. A postcard announcing the Notice of the extension was provided to the same persons identified above via electronic mail on January 7, 2014 and by postcard mailed on December 19, 2013.

Copies of the Fact Sheet, Public Notice, and Notice of Extension are included in Attachment A.

The draft RAW for the Richmond Bay Campus (RBC) includes: a summary of the results of the Site investigations, the risk evaluation, and the remedial alternatives evaluation. The draft RAW contains both site-wide prescriptive requirements, consisting of land use controls (deed restrictions) and a Soil Management Plan (SMP); specific proposed cleanup actions consisting of remediation of soils impacted with metals, polycyclic aromatic hydrocarbons, PCBs and dioxins; and groundwater impacted with carbon tetrachloride. Approximately 1,800 cubic yards of soil would be excavated and disposed at an appropriately permitted off-site facility. Monitoring of natural attenuation processes for groundwater contaminated with carbon tetrachloride is proposed at the western edge of the Coastal Terrace Prairie, as well as continuation of the site-wide groundwater monitoring program. A land use covenant (LUC) would be implemented to restrict site use to commercial/research and development, and to prohibit the use of groundwater for drinking water or irrigation use. Future projects associated with the developable portions of the Site as identified in the Long Range Development Plan (LRDP) prepared by the University of California Berkeley (UC Berkeley) will rely on implementation of a Soil Management Plan to prevent potential exposure to contaminated soil, soil vapor or groundwater.

The University of California (UC) as the lead agency, prepared and approved an Environmental Impact Report (EIR) that examined the potential for environmental impacts from the implementation of the LRDP for purposes of the California Environmental Quality Act (CEQA). The Regents of the University of California met on May 14, 2014 and voted to certify the EIR. UC approved on the project on May 15, 2014. The Final LRDP EIR, dated April 2014 evaluates the impacts of construction and operations associated with development under the LRDP, and include an evaluation of impacts from activities included in the RAW. DTSC is the responsible agency for the activities described in the RAW. The responsible agency is the public agency that proposes to carry out or approve a project, for which a lead agency has prepared an EIR. For the purposes of CEQA, the term “responsible agency” includes all public agencies other than the lead agency that have discretionary approval power over the project. DTSC conducted an independent evaluation of the EIR and determined that the EIR sufficiently included and evaluated the RAW. DTSC’s review is documented in the Responsible Agency checklist, which is filed at DTSC.

Modifications have been made to the draft RAW, including the SMP as follows: (1) added additional measures to protect the Coastal Terrace Prairie (a) during well installation and sampling, (b) that specify that no soil stockpiling associated with implementation of the RAW, including the SMP, will be allowed on the Coastal Terrace Prairie and (c) to require demarcation of vehicle routes consistent with the Coastal Terrace Prairie Management Plan included in the Final Environmental Impact Report; (2) revision to SMP Form A to include a check box to indicate whether radioactive materials were used within the project area and if the area was cleared by California Department of Public Health; (3) revisions to SMP Form B to (a) require submittal of the form to DTSC after internal reviews are completed, and (b) identify the references used to prepare the form; (4) identify that documents will be available for public review in Building 478 of the Former RFS Site. A reading area will be made available in Building

478 to make the reader more comfortable while viewing the documents; (5) UC will prepare a communications guide following approval of the RAW, that will identify UC communications with the public based on the type of document and activity; a new section has been added to the SMP outlining the communication and notification steps within the SMP. (6) revision to the SMP to (a) specify that multiple *de minimis* projects cannot be identified to avoid the prescriptive measures of the SMP, (b) that the *de minimis* threshold has been reduced from 20 cubic yards to 10 cubic yards, and (c) that DTSC may also require changes to the protocols identified in the SMP; (7) SMP Form A will be submitted to DTSC as soon as possible during the next working day for emergency projects; (8) UC will create a publicly available tracking system for activities associated with the SMP. UC will also consider development of an on-line GIS-based map containing environmental information; (9) clarification that the project area is the area described on SMP Form A; (10) add distinct project tracking numbers to SMP Forms A, B and C, and include a maximum time limit to the forms. If the time limit is exceeded, the form will need to be reviewed and updated if necessary; (11) revision to Form C to include the name and dates of all reports discussed, project date, revision date, and date the form was submitted to DTSC; (12) construction fencing with signage will be placed around project areas associated with RAW and SMP activities; (13) correction to Table 3 to increase the sampling density of Area 15 to high; (14) amend the RAW to update the list of remedial goals to be inclusive of all possible receptors, including on-site workers, on-site visitors, and off-site receptors ; (15) clarify Section 5.1.3 of the RAW to describe how the remedial goals will be evaluated and achieved; (16) modify the Remedial Goals Table in the RAW to (a) include the scientific units on the table itself, in addition to being included as a footnote, and (b) add an additional footnote to explain the meaning of each column; (17) additional text to the RAW clarifying what historical data was considered in the preparation of the RAW; (18) adding language related to the off-site transportation of soil as recommended by the City of Richmond, and adding specific City of Richmond staff as an emergency contact; (19) clarifying in the RAW how the cost estimates for the proposed remedies and overall cost was calculated; (20) revision of the RAW to indicate that the deed restriction would prohibit use of the property for a public or private school for persons less than 18 years of age; and (21) revision of footnote “d” of Table ES-1 to cite the correct reference document. In addition, the RAW includes a variety of clarifications and revisions to (a) improve readability, and (b) ensure consistency with other documents.

Verbal and written comments received during the public meeting and comment period are compiled and included in this Responsiveness Summary. The purpose of this document is to present a written response by DTSC to the comments received. This Responsiveness Summary is included in the Final RAW.

This Responsiveness Summary is organized as follows:

- Section I is the Introduction

- Section II provides the verbal and written comments received from the public and provides responses to those comments.

- Attachment A provides copies of the Fact Sheet, Public Notice and Notice of Extension.

- Attachment B provides maps showing the location of the Site.

- Attachment C provides a copy of the written comments that were received.

- Attachment D provides a copy of the transcript from the public meeting held on December 5, 2013.

A copy of the Final RAW and this Responsiveness Summary is available for review at:

Department of Toxic Substances Control
700 Heinz Avenue
Berkeley, California 94710
(510) 540-3800 (appointment necessary)
Hours: Monday through Friday, 8 A.M. to 5 P.M.

The Richmond Public Library, Main Branch
325 Civic Center Plaza
Richmond, California 94804
Reference Desk: (510) 620-6561

Access to this information is also available online at the DTSC EnviroStor website: http://www.envirostor.dtsc.ca.gov/public/. A search can be conducted by City or selection of “Site/Facility Search” and entering 07730003 in the “Site Code” search field and clicking on the “University of California, Richmond SE” “Report” link.

Section II – Comments and Responses
Verbal and Written Comments

Commenter	Comment	Response
C1.C1 Diane Sloat [written comment]	Please do the full cleanup to residential standards. The community, bay and general environment deserve full restoration after what was done to that land.	When making cleanup decisions, one of the criteria considered by DTSC, as well as the U.S. Environmental Protection Agency (US EPA), is the current and foreseeable land use of a site. Cleanups strategies can then incorporate the most reasonable land use(s) that is identified. The Former RFS Site is currently an academic teaching and research facility for the University of California Berkeley (UC Berkeley). Space is also leased to non-UC Berkeley tenants. Based on the results of the studies conducted and risk evaluation, the Site is currently safe for these workers. Areas where potential direct exposure to contaminants above screening levels is possible have been fenced off and caution signs posted (the Mercury Fulminate Area). In addition, maintenance workers have been provided training to identify potential chemical contaminants and how to protect themselves from exposures. The University of California's (UC) Long Range Development Plan (LRDP) identifies two future land uses: 1) Natural Open Space, and 2) Research, Education, and Support. These two land use designations form the site-wide development and guidance on locations of new buildings and infrastructure. Activities within the Natural Open Space areas will be limited to maintenance, field research, and education with the purpose of maintaining these resources in their natural condition. The Research, Education, and Support land use designations include facilities and activities that include laboratory, classroom, and office buildings, support

Commenter	Comment	Response
		infrastructure, community event spaces, amenities such as dining facilities, short-term accommodation facilities for visitors (including adults, children and the elderly), and parking lots and structures. No residential uses are included in the LRDP. This is important as the current and reasonably foreseeable future land use of a site is used to determine the types of potential exposures (who may be exposed and how) and the frequency of exposures that may occur from a contaminant that is present at a site. This information is then evaluated and provides the basis for taking a cleanup action, supporting the development of cleanup options, and determining the level of both current and future risks. The next step is then to focus on the development of clean up alternatives that are consistent with the current and reasonably anticipated future land use, and that will be protective of human health. The different alternatives are then individually evaluated and then compared to each other based on effectiveness, implementability and cost. The result of the comparison is a proposed cleanup remedy. For the Former RFS Site Removal Action Workplan (RAW), all of these factors were considered and the remedy that achieves cleanup levels that allow the Site to be available for the reasonably anticipated future land use (i.e., commercial/research and development) and the current land use was proposed. The RAW also included a Soil Management Plan that includes consideration of, and protection for workers, UC staff and all potential visitors to the site under the current and anticipated land uses included in the LRDP. Since residential use is not included in the proposed LRDP,

Commenter	Comment	Response
		cleanup to residential standards was not selected.
C2.C1 David Gallagher [written comment]	As a resident of Marina (Bay) adjacent to the Field Station, I'd like to see a full cleanup to residential guidelines. With more people living and working in the area it's time to remove all environmental toxics as thoroughly as possible. I hope I can count on your support.	See the response to Commenter 1, Comment 1 (C1.C1) in response to cleanup to residential guidelines.
C3.C1 Norman La Force, Chair, West County Group and Chair Chapter Legal Committee, Sierra Club, San Francisco Bay Chapter [written comment]	Figure 2-2 in the RAW identifies areas of "coastal terrace 'prairie" and areas of "disturbed coastal terrace prairie." It is important to note that areas that have been classified as "disturbed" in Figure 2-2 still qualify as rare plant communities according to the guidelines of *The Second Edition of a Manual of California Vegetation* (MCV2, Sawyer et al. 2009). MCV2 has been adopted as the standard vegetation classification system in California by state and federal agencies (including California Department of Fish and Wildlife, United States Forest Services, National Park Service, and United States Geological Survey). Other areas of "disturbed coastal terrace prairie" at the site have the potential for restoration and are still considered valuable native habitat. In the past, UC Berkeley and Richmond Field Station crews at the Richmond Field Station have used native grassland areas as staging areas on which to park heavy equipment and temporarily store construction materials including contaminated soil. It is critical to	Remediation measures included in the RAW would be required to conform to LRDP policies and mitigation measures approved by the UC Regents. For example, the implementation of the Coastal Terrace Prairie Management Plan included as Appendix G to the Environmental Impact Report will commence with adoption of the LRDP. In addition to those measures, DTSC agrees with the comment and Section 5.3.1.2 (Groundwater Monitoring Well Installation) is revised to indicate that installation of groundwater monitoring wells will occur in the least disturbing way possible, such as when there is no potential for equipment or vehicles to permanently damage the grasslands (i.e., when the soils are sufficiently dry to support vehicles and equipment and will not cause ruts). Also added is that well sampling will be conducted in a manner that will minimize impacts to the prairie and must be protective of the coastal terrace prairie habitat. In addition, Section 5.1.11 of the RAW is revised to indicate that storage of investigation derived waste and soil stockpiles will not be allowed on the coastal prairie.

Commenter	Comment	Response
	include wording in any work plan that ensures that these mistakes do not happen while actions proposed by the RAW are being executed. We recommend avoiding areas known to contain native prairie, such as to drill and install carbon tetrachloride monitoring wells in the Big Meadow as part of recommended alternative GW-4, this access should only be done during the summer months when the prairie is dry. Access during the wet season when the soil is saturated could result in deep tracks from trucks and equipment that would permanently damage the prairie. Any waste dirt created from well drilling or clean-up activities should not be dumped or stored on areas of native prairie.	
C3.C2 Norman La Force, Chair, West County Group and Chair Chapter Legal Committee, Sierra Club, San Francisco Bay Chapter [written comment]	Sierra Club supports alternative GW-4 for the monitoring of carbon tetrachloride in the Big Meadow. This alternative, if executed with attention to minimizing impacts to the prairie, has the potential to accurately monitor the carbon tetrachloride levels of the soil while preserving the integrity of the extremely high quality native prairie ecosystem in the meadow.	Comment noted.
C4.C1 Norman La Force, President, Sustainability, Parks, Recycling And Wildlife Legal	Figure 2-2 in the RAW identifies areas of “coastal terrace prairie” and areas of “disturbed coastal terrace prairie.” It is important to note that areas that have been classified as “disturbed” in Figure 2-2 still qualify as rare plant communities according to the guidelines	See response to Comment C3.C1.

Commenter	Comment	Response
Defense Fund (SPRAWLDEF) [written comment]	of *The Second Edition of A Manual of California Vegetation* (MCV2, Sawyer et al. 2009). MCV2 had been adopted as the standard vegetation classification system in California by state and federal agencies (including California Department of Fish and Wildlife, United States Forest Service, National Park Service, and the United States Geological Survey). Other areas of "disturbed coastal terrace prairie" at the site have the potential for restoration and are still considered valuable native habitat. In the past, UC Berkeley and Richmond Field Station crews at the Richmond Field Station have used native grassland areas as staging areas on which to park heavy equipment and temporarily store construction materials including contaminated soil. It is critical to include wording in any work plan that ensures that these mistakes do not happen while actions proposed by the RAW are being executed. We recommend avoiding areas known to contain native grassland habitat – including those areas described as "disturbed" in figure 2-2 during any activity related to this plan. If trucks and workers must access areas of native prairie, such as to drill and install the carbon tetrachloride monitoring wells in the Big Meadow as part of the recommended alternative GW-4, this access should only be done during the summer months when the	

Commenter	Comment	Response
	prairie is dry. Access during the wet season when the soil is saturated could result in deep tracks from trucks and equipment that would permanently damage the prairie. Any waste dirt created from well drilling or clean-up activities should not be dumped or stored on areas of native prairie.	
C4.C2 Norman La Force, President, Sustainability, Parks, Recycling And Wildlife Legal Defense Fund (SPRAWLDEF) [written comment]	SPRAWLDEF supports alternative GW-4 for the monitoring of carbon tetrachloride in the Big Meadow. This alternative, if executed with attention to minimizing impacts to the prairie, has the potential to accurately monitor the carbon tetrachloride levels of the soil while preserving the integrity of the extremely high quality native prairie ecosystem in the meadow.	Comment noted.
C5.C1 Michael Esposito [written comment]	When considering to what level remediation and cleanup should be carried out at the RFS, DTSC should take into account of the fact that the young children of UCB and LBNL researchers are frequent visitors to the labs where their parents work. Graduate students, postdoctoral fellows and faculty often drop into the lab on weekends to check on the progress of experiments. They are frequently accompanied by their children who are out of school on weekends. Lab holiday parties (e.g. Christmas) are also attended by children.	As discussed in response to C1.C1, DTSC considers the most reasonable potential future use of a property when determining cleanup levels. Cleanup criteria developed for the future maintenance worker and commercial worker are expected to also be protective of children as the potential contaminant exposure to either worker group will be greater than to a child occasionally visiting the Site. The future maintenance worker is assumed to be exposed directly to Site soils and groundwater, while the commercial worker is assumed to be exposed to soils at the Site; however, land use restrictions will be put into place that would prevent direct contact with soil to the commercial worker or site visitor. The Soil Management Plan also includes measures to protect the future maintenance worker, commercial worker and site visitor.

Commenter	Comment	Response
		In addition, DTSC has been provided with a copy of the University of California, Berkeley's policies on access to laboratories containing hazards (http://campuspol.chance.berkeley.edu/policies/LabAccess.pdf) effective September 2004 (revised in April 2011), and Minors in Laboratories and Shops (http://policy.ucop.edu/doc/3500602/MinorsLabsShops) effective October 2013. Both policies restrict access of minors in laboratories that contain hazards with the exception that only persons with legitimate reasons for being in a laboratory that contains hazards are permitted to enter, and only after certain conditions have been met. Minors (any person under 18 years of age) are not allowed in laboratories that contain hazards unless they are registered University of California students or are registered participants in a University-sanctioned project, program or tour. In all cases, minors must be properly supervised while in laboratories.
C6.C1 Mark Casterman Conservation Analyst, California Native Plant Society, East Bay Chapter [written comment]	Figure 2-2 in the RAW identifies areas of "coastal terrace prairie" and areas of "disturbed coastal terrace prairie." It is important to note that areas that have been classified as "disturbed" in Figure 2-2 still qualify as rare plant communities according to the guidelines of *The Second Edition of A Manual of California Vegetation* (MCV2, Sawyer, et al. 2009). MCV2 has been adopted as the standard vegetation classification system in California by state and federal agencies (including California Department of Fish and	Please see response to C3.C1. Mitigation measures as suggested by the commenter are identified in the 2014 LRDP Environmental Impact Report, such as those described in the Coastal Terrace Prairie Management Plan included as Appendix G to the Final Environmental Impact Report.

Commenter	Comment	Response
	Wildlife, United States Forest Service, National Park Service, and United States Geological Survey). Other areas of “disturbed coastal terrace prairie” at the site have the potential for restoration and are still considered valuable native habitat. In the past, UC Berkeley and Richmond Field Station crews at the Richmond Field Station have used native grassland areas as staging areas on which to park heavy equipment and temporarily store construction materials including contaminated soil. It is critical to include wording in any work plan that ensures that these mistakes do not happen while actions proposed by the RAW are being executed. We recommend avoiding areas known to contain native grassland habitat – including those areas described as “disturbed” in figure 202 during any activity related to this plan. If trucks and workers must access areas of native prairie, such as to drill and install the carbon tetrachloride monitoring wells in the Big Meadow as part of recommended alternative GW-4, this access should only be done during the summer months when the prairie is dry. Access during the wet season when the soil is saturated could result in deep tracks from trucks and equipment that would permanently damage the prairie. Any waste dirt created from well drilling or clean-up activities should not be dumped or stored on areas of native	

Commenter	Comment	Response
	prairie. Any impacts to areas of native prairie that occur during the execution of RAW actions must be mitigated at a 3:1 ratio or higher to ensure that no net loss of this CEQA protected sensitive natural community takes place.	
C6.C2 Mark Casterman Conservation Analyst, California Native Plant Society, East Bay Chapter [written comment]	EBCNPS supports alternative GW-4 for the monitoring of carbon tetrachloride in the Big Meadow. This alternative, if executed with attention to minimizing impacts to the prairie, has the potential to accurately monitor the carbon tetrachloride levels of the soil while preserving the integrity of the extremely high quality native prairie ecosystem in the meadow.	Comment noted.
C7.C1 Patricia Jones, Executive Director, Citizens for East Shore Parks [written comment]	Our supporting organizations have submitted thoughtful comments on this workplan, so we ask that you give those letters careful consideration as you move forward. The letters we support include: • Sierra Club, January 15, 2014 • California Native Plant Society, East Bay Chapter, January 17, 2014 (CNPS) • Richmond Southeast Shoreline Area community Advisory Group Toxics Committee, January 17, 2014 (RSSACAG) We urge you to work with the environmental community to address the various issues pointed out in the above comments.	DTSC received comment letters from each of the organizations identified. Individual responses are provided in this section of the Responsiveness Summary.

Commenter	Comment	Response
C7.C2 Patricia Jones, Executive Director, Citizens for East Shore Parks [written comment]	In particular, we would like to highlight the following areas of concern which are explained in more detail in the above letters and should be addressed in the RAW: • Protecting the Coastal Prairie – which is the “last undisturbed native coastal prairie grassland adjacent to the San Francisco Bay Shoreline… Today, less than one percent of California’s original native grassland ecosystems remain intact.”(CNPS) o Figure 2-2 in the RAW identifies areas of “coastal terrace prairie” and areas of “disturbed coastal terrace prairie.” It is important to note that areas that have been classified as “disturbed” in Figure 2-2 still qualify as rare plant communities according to the guidelines of *The Second Edition of a Manual of California Vegetation* (MCV2, Sawyer et al. 2009). (Sierra Club) o Preserving the Coastal Prairie during clean-up and construction – taking care not to use the coastal prairie terrace as a staging area for large equipment during clean-up, construction, restoration and monitoring. We recommend avoiding areas known to contain native grassland habitat – including those areas described as “disturbed”	Please see the response to C3.C1 and C6.C1. It should be noted that both the Sierra Club and California Native Plant Society included in their letters that if access was needed to install groundwater monitoring wells as part of recommended Alternative GW-4, certain precautions should be taken.

Commenter	Comment	Response
	in figure 202 during any activity related to this plan. (CNPS, Sierra Club) o Recommend a 3:1 mitigation ratio for any damage done to native grassland habitat as a result of actions completed as part of the RAW plan (CNPS).	
C7.C3 Patricia Jones, Executive Director, Citizens for East Shore Parks [written comment]	Impacts on wetlands, birds, fauna and creeks need to be addressed during the clean-up (and afterwards). In addition to many burrowing animals on site, according to the Golden Gate Audubon Society, the site is also immediately adjacent to wetlands that (among other things) have been used for breeding by the endangered California Clapper Rail.	The LRDP EIR identified sensitive biological resources at the Former RFS Site, which include areas such as Western Stege Marsh and endangered species such as the California clapper rail. The LRDP EIR also identified mitigation measures to protect biological resources, such as avoiding construction, demolition or renovation activities in areas adjacent to or nearby to marshland nesting bird habitat during the nesting season, maintaining no disturbance buffer zones and consulting with the US Fish and Wildlife Service to address any potential impacts to the clapper rail. Mitigation measures are also included to protect the grassland habitat and wetlands and potential wetlands. These mitigation measures would also apply while the RAW is being implemented.
C7.C4 Patricia Jones, Executive Director, Citizens for East Shore Parks [written comment]	Addressing toxic contamination (a) The RAW should establish unrestricted standards for the clean-up. (b) The RAW should present a site-wide clean-up that is fully characterized. (c) The Draft RAW Soil Management Plan (SMP) is a poorly conceived and executed proposal that will place humans and ecological receptors at	(a) See the response to C1.C1. (b) Based on the site characterization and cleanup activities conducted under the oversight of the San Francisco Bay Regional Water Quality Control Board (RWQCB) and under DTSC's oversight, DTSC concluded that adequate sampling has been conducted to support the preparation of the RAW, which includes identification and evaluation of alternatives, and

Commenter	Comment	Response
	potential risk of hazard exposure. (RSSACAG) (d) The Draft RAW does not establish Remedial Action Objectives (RAOs) that are protective of human health. (RSSACAG) (e) The Draft RAW is based on incomplete and spot-focused site characterization. Extensive areas of the UCRBC remain uncharacterized or not fully characterized. (RSSACAG)	selection of a proposed remedy. Under the RWQCB's oversight, UC conducted investigation of cinders, mercury and PCB contamination in the upland and marsh areas. Those investigations resulted in removal of significant areas of contaminated soil and sediments. While under DTSC's oversight, UC completed three phases of investigation that included filling in significant data gaps and conducting a site-wide groundwater evaluation. Any existing areas which have not been sampled to date will be sampled prior to any new projects, as specified in the RAW, including the Soil Management Plan; however, additional soil characterization at this time at all locations will not improve or affect the protectiveness of the proposed remedies, since the remedy includes proposed cleanup options for all future investigations. (c) The Soil Management Plan (SMP) provides a framework to prohibit uncontrolled soil excavation or soil disturbing activities that may have the potential to expose workers or visitors to unsafe exposures to Site contaminants. The objective of the SMP is to ensure that activities do not adversely impact human health or the environment and that soils are handled, stored and disposed or reused onsite in accordance with applicable laws, regulations, and policies. The SMP requires that soils be sampled prior to being disturbed when future construction, redevelopment or maintenance projects are

Commenter	Comment	Response
		proposed. This will ensure that the soil is properly managed so that no uncontrolled exposures or releases of contaminants occur. Section 5.2.3 of the SMP includes specific measures to address dust control. In addition the RAW includes a separate Air Monitoring Plan to monitor the effectiveness of the dust control measures and to protect on-site workers and off-site communities from potential exposure to chemicals of concern. Air monitoring will be performed during all soil disturbing and excavation activities conducted under the RAW, including the SMP. (d) Remedial action objectives (RAOs) specify: the contaminant(s) and media of concern; the exposure route(s) and receptor(s); and the remediation goal(s) for each exposure route. The RAOs in the RAW were developed to protect human health based on the chemical of concern for each geographic soil and groundwater area and are included in Section 3.1 of the RAW. In general the RAOs are to prevent exposure to commercial, maintenance and construction workers via dermal contact with, and incidental ingestion and inhalation of soil containing chemical concentrations in greater than the appropriate cleanup values. For groundwater, the RAO is to prevent exposures via inhalation of unsafe vapors. DTSC has reviewed and determined that the RAOs included in the RAW meet their intended goal of protection of human health.

Commenter	Comment	Response
		(e) Please see response to C7.C4(b)
C7.C5 Patricia Jones, Executive Director, Citizens for East Shore Parks [written comment]	Note: absence of commentary on topics not specified in this letter does not imply agreement with other conclusions made in the Draft RAW.	Comment noted.
C8.C1 Maggie Lazar, Pavement Research Center [written and verbal comments] Ms. Lazar provided comments in writing and verbally during the public meeting.	Need DTSC oversight and public access to plans for Soil Management at UC Site. DTSC has ordered UC to investigate and clean up its property. The Removal Action Workplan explicitly covers remediation of only a tiny percentage of the area under the order. Soil in the rest of "developable" (Research Education Support) area is relegated to a Soil Management Plan (Appendix C). This Plan seems to be intended to apply to all future situations and actions regarding soil on the site. I object to UC being granted such a blanket approval to self-manage its soil. I believe the public should be able to review proposed actions and be informed of the relevant details, such as the chemicals of concern, the source and scope of the pollution, and the risks to health and habitat. They have the right to know and comment on the activity before the work takes place. This Soil Management Plan would go in effect just as major construction is planned on the property. More than ever, the current occupants and public will then need DTSC to provide rigorous	Please see response to C7.C4(c) regarding the objectives of the Soil Management Plan. The SMP outlines prescriptive protocols to be followed for soil sampling, data analyses, soil management actions or disposal practices, and final reporting. If UC desires to vary from the protocols, DTSC approval must first be obtained. The SMP also includes specific oversight and approvals by DTSC at various points within a project's timeline through the submittal of SMP checklist forms. DTSC also has the ability to require additional information or require additional investigation by UC before a project proceeds. The RAW was revised to require that Form B (Sampling, Data Evaluation, Soil Management Action) be submitted to DTSC after internal approval is completed. Existing community notification procedures and access to documents will continue (e.g., work notices, posting of documents to DTSC's envirostor database, regular scheduled town hall meetings for staff and tenants at RBC, the RFS environmental website (http://www.rfs-env.berkeley.edu/index.html), and routine email communications to staff at RBC). In the future, hard copies of documents will also be made available to the public in Building 478 at the Former Richmond Field

Commenter	Comment	Response
	oversight of these major soil-moving activities.	Station Site. In addition, the SMP has been updated to include a section describing the notification processes associated with implementation of the SMP.
C8.C2 Maggie Lazar, Pavement Research Center [written and verbal comments]	Too much soil activity falls outside of Plan. The Soil Management Plan does not apply to projects that impact less than 20 cubic yards of soil, or less than 500 square feet of hardscape surface. There is a disconnect between the "typical *de minimus"* activities described in Section 3.1, such as utility repair, landscaping, and installation of fence posts, and the amount of 19.9 cubic yards, which is too close to 25 tons of soil! My concept of minor activities would be those involving less than 1 cubic yard. And I would be very surprised if the activities described as typical would require more than 3 cubic yards. If indeed UC will be able to excavate and relocate 19.9 cubic yards of in-place soil on this property, I would like to know if, when and how RFS occupants will be notified, and if UC will be allowed to move a "roll-off bin" of soil from one Plan Area to another. Will *de minimus* projects be tracked and reviewed to make sure work is not broken into smaller chunks to avoid the paperwork required by the Soil Management Plan?	The intent of allowing a *de minimis* volume is to allow small scale routine maintenance projects to be able to proceed. Small scale projects are defined in the Final RAW as projects affecting less than 500 square feet of new hardscape or 10 cubic yards of soil, which corresponds to the approximate volume that a small dump truck can carry. Oversight of the activities will still be conducted directly by UC's Office of Environment, Health and Safety (EH&S) through its existing programs described in the SMP. If any condition arises that may pose an imminent or substantial endangerment to public health or safety or the environment, EH&S will notify DTSC. A determination will then be made whether the SMP is applicable or whether some other action should be taken. Notification of *de minimis* activities will be provided by UC similar to how notifications are currently being provided to the RFS community. Please see response to Comment C8.C1 for a description of these notification methods. This description has been included in the SMP. In addition, language has been added to the SMP indicating that larger projects may not be identified as *de minimis* projects to avoid the prescriptive measures included in the SMP. In addition, the SMP has been updated to include a section describing the notification processes associated with implementation of the SMP.
C8.C3 Maggie Lazar,	Need to ensure timely notifications. I am very concerned that occupants and the public be	Section 5.1 of the SMP identifies potential pre-excavation activities for any SMP project. For

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Pavement Research Center [written and verbal comments]	notified before soil-moving activities take place. In section 5.1.1, the plan says that "RFS on-site worker and employer notifications" will be required. Yet, in Section 5.1 it says that "determination of the need for each activity" – permitting and notification is activity (1) – "will be determined by EH&S." Please clarify the notification procedure.	example, one activity is to abandon and replace a piezometer if it is located within a building footprint. If there is no piezometer located in that area or will not interfere with the project, that activity will not be required. Section 5.1.1 outlines notifications that will be required if soil disturbance activities subject to the SMP are conducted. In this case, on-site workers and employees will be notified of the activities. As stated in response to C8.C1 above, the community will be notified using existing procedures.
C8.C4 Maggie Lazar, Pavement Research Center [written and verbal comments]	In describing the requirements of UC to submit SMP Form A to DTSC 14 days before the activity (page C-18), the Plan recognizes there may be emergency situations when prior notification is not possible. Please describe what would be UC's obligation to notify employees, occupants, and the public under those circumstances. There should also be some mechanism for the public to make inquiries or complaints.	For emergency projects, the SMP has been modified to require that Form A be sent to DTSC as soon as possible during the next working day. A hotline number is currently available to report hazardous materials spills, air releases, nuisance conditions (noise, odors, or dust) or threats to wildlife. Contact EH&S at (510) 642-3073 or after hours call 911 or the UC Police Department at (510) 642-6760. This and other UC contact information is available on the RFS website contacts page at: http://www.rfs-env.berkeley.edu/contact.html If the public has questions or complaints, contact information is also provided on DTSC public fact sheets and work notices Notification procedures during an emergency situation would depend on the type of emergency and level of threat. UC currently maintains an emergency response program which is provided at the RFS facilities web page under "Protect" and can be found at: http://rfs-

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		operations.berkeley.edu/protect_fep.htm
C8.C5 Maggie Lazar, Pavement Research Center [written and verbal comments]	Similarly, there should be some mention of performance standards and how reviews and violations will be addressed.	The SMP contains prescriptive requirements which are the equivalent to performance standards. DTSC will review each of the forms submitted by UC to determine if any additional information is needed. Violations of the SMP will be evaluated and will be addressed as described in DTSC's policies and Cleanup Order.
C8.C6 Maggie Lazar, Pavement Research Center [written and verbal comments]	Property, Order, Site and Areas Boundaries Don't Match Worker Experience. Approval of the RAW and the Soil Management Plan would create an overly complex arrangement where workers would be able to effectively evaluate their safety from industrial pollution at work. Some of the pollution in their workplace is from the Zeneca site. We don't know yet what if anything they are going to do about it. UC's investigation of pollution in the Marsh and Open Areas has not been completed and will have a different cleanup plan. And when our jobs take us to Receiving, Fleet Services and Overstock and Surplus on Regatta Street, we leave the area under DTSC order; yet we are still at work, and still in the same historically industrial and polluted neighborhood. Some of UC's job to address the pollution requires direct oversight by DTSC. Some would be managed under the Soil Management Plan by UC staff with paperwork going to DTSC. And yet another part would be managed by UC alone.	With regards to lodging complaints and posing questions, the public may contact Wayne Hagen, DTSC Public Participation Specialist via electronic mail at wayne.hagen@dtsc.ca.gov or by telephone at (510) 540-3911. An information repository will also be set up at Building 478 at the Former Richmond Field Station Site. Documents are also available on the RFS web site at http://www.rfs-env.berkeley.edu/index.html where site related documents are available for review. UC will also create a publicly available tracking system of the activities conducted under the SMP. Details on the system will be based on Richmond Bay Campus protocols and policies. UC is also considering adding an on-line interactive GIS-based map containing environmental information. In addition, questions and complaints may also be directed to Associate Director for Environmental Protection, Office of EH&S at (510) 642-3073 or ehs@berkeley.edu

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	The Soil Management Plan further divides the "developable" piece of the site into 25 acres (Figure 6) with three levels of soil sampling protocols. My own work group is in three different areas. Then it uses a multi-step decision-tree based on location, scope and historical data to determine if sampling is needed. And if sampling is done, the results are sorted into three levels of chemical risk. How can a worker track all of this and verify that proper procedures are being followed. How do we find out how or when or to whom do we take our questions and complaints?	
C8.C7 Maggie Lazar, Pavement Research Center [written and verbal comments]	Clarify when, where and which soil can be moved within the property to be placed under buildings, roads, parking lots, and landscaped area. In Section 4.2.2 it states that "soil generated from the project must remain within the project boundaries unless DTSC has provided approval otherwise" (C-23). However, on the same page it says if the soil tests out to be less than Category I, "the project can proceed without specific soil management practices" and that this soil is "suitable for commercial reuse within the SMP project area." In this sentence does "project area" refer to the discrete boundaries of the project? Or the Area, as number 1-25, shown in Figure 6? Under what circumstances would DTSC allow soil to be moved and used outside the "project	The Soil Management Plan states that soils that do not exceed Category I criteria (less than risk-based concentrations, background, ambient or TSCA criteria for PCBs) may be reused within the Soil Management Plan project area. Category I criteria are protective of commercial works and visitors to the site. Soils that exceed Category I criteria but that do not exceed Category II criteria (generally equivalent to one order of magnitude greater than Category I criteria) may be managed in place within the project area with an appropriate cover, such as a roadway, parking lot, or a minimum of two feet of clean soil. Soils that exceed Category II criteria will be evaluated for off-site disposal. The Soil Management Plan has been modified to clarify that the project area is the area described in SMP Form A. DTSC will only allow soil to be moved and reused if the soil contaminants will not pose an unacceptable risk to human health or the environment. DTSC's decision will generally take into

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	area"?	consideration, the type of contaminant present, concentration, proposed land use, and geologic and hydrogeological conditions.
C8.C8 Maggie Lazar, Pavement Research Center [written and verbal comments]	The same ambiguity needs to be clarified in the Instructions for Completing SMP Form B (C-27). In item 2.b it says "soil excavated from a SMP project area will remain within the same SMP project area unless it is disposed of off-site; if UC proposes to use the excavated soils in other portions of the RES Area, UC will contact DTSC." Will requests to DTSC and their responses be recorded and made available to the public?	DTSC will post the requests and responses onto its EnviroStor database available on DTSC's website at: http://www.envirostor.dtsc.ca.gov/public/.
C8.C9 Maggie Lazar, Pavement Research Center [written and verbal comments]	Soil Management Plan Documents Should be Public. Employees and the public need access to meaningful information concerning UC Soil Management. The completion reports to be submitted to DTSC, described on pages C-42 – C-43, contain the documents needed and should be posted as public documents on EnviroStor.	DTSC agrees. The completion reports will be posted on DTSC's EnviroStor database at: http://www.envirostor.dtsc.ca.gov/public/
C8.C10 Maggie Lazar, Pavement Research Center [written and verbal comments]	The Soil Management Plan is ambiguous about where various documents will be made available. The impression at the public meetings was that documents would be stored on the UC property in Building 478. Yet on page C-19 reference is made to "additional internal documentation necessary in support of information" in SMP Form A. So, will SMP Forms A, B and C, with their related internal documentation be made available in Building 478?	Printed copies of SMP Form A, B and C, and required documentation identified in the SMP, as well as internal documentation such as sampling strategies and data evaluation will be made available in Building 478. Forms associated with the SMP will also be available on the RFS Environmental website. In addition, reports and forms will be available on DTSC's EnviroStor database. UC has indicated to DTSC that they will be improving the space in Building 478 for visitors wishing to view

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		the hard copies of documents, including a reading area for document review.
C8.C11 Maggie Lazar, Pavement Research Center [written and verbal comments]	The last sentence on page C-19 is particularly vague. "Internal documentation will be available upon request from DTSC." Does this mean that DTSC can request internal documentation from UC? Or that the public needs to go to DTSC to view internal documents UC has submitted to them? Employees and the public need access to the broadest range of documents possible.	In general, documents submitted to DTSC are public records and are available for inspection by the public during regular business hours of the office where the records are located. Requests for public records may be made orally or in writing. The statement on page C-19 of the SMP refers to documents such as contractual scopes of work. Documents directly associated with each specific form (A, B or C) will be submitted concurrently with the form and will be available to the public.
C8.C12 Maggie Lazar, Pavement Research Center [written and verbal comments]	Improve Forms A, B and C. For Form A, some thought should be given to the definition and naming of projects. Consider numbering and dating them so we can have a better idea of how many projects of each type take place, how long they take to complete, and how many are in process. Set a maximum time before a project needs new paperwork to be extended. This would prevent the carry over (sic) of an approved project indefinitely over such a long period that information gets out of date or misapplied.	Form A already includes the date the form is filled out as well as any revisions dates; however, DTSC agrees that a tracking number that follows the project and is included on Forms A, B and C would improve the process. A spreadsheet that will track the different projects will be maintained and updated and be available to the public on the RFS website. Also, see response to C8.C6 regarding the spreadsheet and availability of documents. DTSC also agrees with the commenter that a maximum time limit should be included on the forms. Form A has been revised to indicate that if after 6 months the project has not proceeded to the next step, the information must be reviewed and updated as necessary. Form B and C have been revised to indicate that if the form has not been approved or no activities have occurred for 1 year, the information contained in the form will be reviewed and updated as necessary prior to work occurring in the project area.

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C8.C13 Maggie Lazar, Pavement Research Center [written and verbal comments]	Form B is designed to follow a project through many decisions and steps. I think more information should be included such as the dates steps are started and completed, the person making the decisions, and the resources used for those decisions. As an example for item 1.c.: Chemicals of concern (please list) - __________________, as identified by (give name) __________________, using the following references (please list), __________, ____________, ____________. Groundwater report date (give date) ___________ was consulted.	DTSC agrees with the commenter. Form B has been revised to include the references (name and date of document) used to complete the form. The instructions for Form C in Section 6.0 have been revised to indicate that the summaries will also include the name and dates of all reports discussed. Please also see response to C8.C12. In addition, UC will also maintain a spreadsheet that will track each of the projects and identify the beginning and completion dates of the forms.
C8.C14 Maggie Lazar, Pavement Research Center [written and verbal comments]	Form C should capture the dates of the project, number and dates of revisions, and the date that Form C and the Completion Report are submitted to DTSC.	DTSC agrees with the commenter and Form C has been revised to include the project date, revision dates, and date the form and Completion Report were submitted to DTSC.
C8.C15 Maggie Lazar, Pavement Research Center [written and verbal comments]	Need Improved Accessibility of Documents. This RAW would require workers wishing to be informed to go from place to place to search out documents. Currently UC is maintaining a helpful website where employees can find out about investigation and remediation activities. Yet information on the former Zeneca site can only be found on EnviroStor. Records for the	DTSC will be receiving Form A and B as they are completed and signed off. DTSC will be provided Form C with the individual Project completion reports (see SMP Decision Framework, page C-7 in Appendix C of the RAW). In addition, UC will continue to provide DTSC with the Monthly Summary Reports as required by DTSC's Order. Annual reviews of the SMP will be conducted by UC to evaluate screening criteria, protocols and sampling requirements to ensure they continue to meet the intended purpose of the SMP.

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	projects done under the Soil Management Plan would be stored by in Building 478 on the property. And it is not clear if the public will have any access to documentation of soil projects below the Soil Management Plan threshold. DTSC would only see the paperwork for some of the soil project at the time of UC's 5-year review. This is too long for the public to wait to know how UC is performing and if this new Soil Management Plan works.	The SMP was modified to indicate that DTSC may also require changes to the SMP. Suggested improvements or changes to the SMP by UC will be proposed to DTSC for review and approval, and documented formally as part of the 5-Year review process of the RAW, or more frequently if justified. Copies of the completed forms will be included as part of the RAW 5-Year review. (See page C-8 of the SMP, Appendix C of the RAW) The SMP also states that UC will maintain records of all completed SMP Forms and internal documentation. Copies of Forms A, B, C, and required submittals will be available to the public and will be maintained in the administrative office at Building 478 at the Richmond Field Station and at the EH&S Office on the main campus in addition to being available on-line at: http://www.rfs-env.berkeley.edu/index.html. SMP Form A will be completed for all projects, including those that will disturb soil at volumes less than the SMP threshold.
C8.C16 Maggie Lazar, Pavement Research Center [written and verbal comments]	I believe that UC should provide all documents related to pollution at the entire Richmond Bay campus on its website. I also think that hard copies of documents should be available at the NRLF [Northern Regional Library Facility] Library. This provides a better setting than the Building 478 lobby, since it has chairs and tables as well as quiet and privacy to review documents. I also think that UC should have some budget for providing copies of documents (particularly maps) to the public.	Paper copies of major decision documents, such as the Removal Action Workplan, are printed by UC and made available for the public at the Site information repositories. They are the Richmond Library, located at 325 Civic Center Plaza in Richmond, and DTSC's File Room located at 700 Heinz Avenue in Berkeley. In addition, documents are also available at the Richmond Field Station in Building 478. UC will make improvements to Building 478 to facilitate public review of the documents. Unfortunately, UC has stated that they do not have the budget to provide copies of documents to the public. However, electronic

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		copies of documents will be available to the public on-line at: http://www.rfs-env.berkeley.edu/index.html, or at DTSC's Envirostor web site at: http://www.envirostor.dtsc.ca.gov/public/
C8.C17 Maggie Lazar, Pavement Research Center [written and verbal comments]	Deed Restrictions Nearly Meaningless. A use of terminology in the Removal Action Workplan that I find somewhat misleading is the implication that a deed restriction is a meaningful remedy to handle pollution on property that the University has owned for sixty years. It is high unlikely that the University would sell the property, even less so now, when plans are being made for construction of a second Lawrence Berkeley Lab campus. No one will be seeing or using a newly amended deed.	Land use covenants or LUCs (also commonly known as deed restrictions) may be placed on a property to limit land use and to prevent specific activities from taking place without first obtaining approval from DTSC. As you point out, one of the purposes of the LUC is to inform potential and future property owners of any conditions on a property. As LUCs apply to the existing property owner, the University must abide by the conditions of the LUC as well as the conditions identified in the RAW, including the SMP. The conditions would also apply to any site occupants. The LUC along with existing cleanup order provides DTSC with the authority to take enforcement actions if a condition of the LUC or order is violated.
C8.C18 Maggie Lazar, Pavement Research Center [written and verbal comments]	Post Caution Signs. What would be much more to the point is signage that declares the property as a polluted area where DTSC-mandated investigation and cleanup is in process. The Public needs to be informed. Even the news of a possible second LBNL campus was enough to bring many visitors to the property. Once construction is underway, and the property becomes a more populated and complex place, all sorts of people will be coming and going. Casual visitors won't be taking the online training about the property's history like current employees do.	Construction fencing along with the appropriate signage will be placed around project areas when cleanup and construction activities are occurring or if sampling results indicate a need to fence the project area prior to cleanup. UC will also be developing specific policies which would apply to employee and visitor access to the Richmond Bay Campus once redevelopment begins. The site is currently fenced and the Mercury Fulminate Area has been fenced and posted due to the potential risk posed by direct contact with mercury in the soil.
C8.C19	The nicer the buildings and the landscaping	New features such as landscaped area, roads and bike

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Maggie Lazar, Pavement Research Center [written and verbal comments]	become, the more likely the property is to attract a wide range of visitors. New roads and bike paths will bring in families who will treat the site like a public park. And they will presume that the property is safe.	paths will be required to meet the requirements of the SMP. One of the purposes of the SMP is to ensure the protection of future workers and visitors to the site.
C8.C20 Maggie Lazar, Pavement Research Center [written and verbal comments]	It is too soon to approve a "Final Remedy" for contamination of groundwater at site because UC investigation is incomplete and former Zeneca site team has not published their draft Removal Action Plan. The RAW identifies two areas on the site where there are VOCs in the groundwater, TCEs (sic) along the property line with the former Zeneca site, and carbon tetrachloride near Building 280A. The UC RAW does not address the property line areas because its author attributes the contamination to Zeneca's activities and says the remediation will be handled by their team. However, until the former-Zeneca site RAP is complete, there is no way to know what it may say, or how it will access and address the risks faced by UC employees who work in those areas. If the former Zeneca team does not adequately address that contamination, I would expect UC to take charge of its property and the safety of its workers. I object to UC finalizing its RAW for groundwater before the inter-property responsibilities are formally settled. The remediation team has stated that the discovery of contaminated groundwater in the	The investigations conducted by UC have sufficiently characterized the site in order to propose and evaluate different remedial alternatives. The purpose of site characterization is to gather sufficient information in order to be able to support an informed risk management decision about which remedy is most appropriate for a particular site. When environmental oversight was transferred to DTSC in 2005, DTSC required that a Current Conditions Report be prepared. The Current Conditions Report (available at: http://www.envirostor.dtsc.ca.gov/public/final_documents2.asp?global_id=07730003&doc_id=6013360) summarized all previous site investigations, including investigations and cleanup activities conducted under the Regional Water Quality Control Board oversight, and identified data gaps requiring further investigation. Using this information, UC prepared a Field Sampling Workplan (available at: http://www.envirostor.dtsc.ca.gov/public/final_documents2.asp?global_id=07730003&doc_id=6013361), which identified the methods and approach to completing the site investigation. The workplan was separated into five phases, and UC has completed three of those phases including soil data gap and a comprehensive groundwater evaluation. Several soil cleanups have also been conducted under DTSC oversight. All major significant data gaps identified in the Current

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	Open Space area near Bldg. 280 was a surprise. We don't know the source, or how far the water has moved, or will move. The final remedy should wait until further investigation.	Conditions Report have been characterized. The remaining areas which have not been sampled to date will either be sampled in the future prior to any new redevelopment according to the RAW, including the Soil Management Plan (Appendix C), or for the open space areas, under the fourth and fifth sampling phases. All sampling activities will be conducted under DTSC oversight. The RAW includes a cleanup alternative for groundwater found in the open space area near Building 280. Ongoing soil investigation and future cleanup activities in the Natural Open Space area will be conducted under DTSC oversight as required by the Site cleanup order. Groundwater contamination along the boundary with the Zeneca/Former Stauffer Chemical Site (Zeneca Site) will be addressed under DTSC's cleanup and remediation order on the Zeneca Site. DTSC is currently reviewing a draft of the Feasibility Study/Remedial Action Plan (FS/RAP) submitted under the Zeneca Order. The FS/RAP includes a proposed remedy to address groundwater contaminants located along the Zeneca/RFS boundary. DTSC's review will include an evaluation of the protectiveness of the proposed remedy for both the Zeneca and Former RFS Sites. One groundwater sample contained trichloroethene (TCE) concentrations above its screening value as having the potential to pose a threat from soil vapor. A soil vapor sample collected from this area was less than the commercial/industrial land use

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		screening concentration. Subsequent groundwater samples from the same area have been less than the groundwater screening value. The RAW includes continuation of groundwater monitoring under the on-going site-wide groundwater monitoring program. In the event that DTSC determines that results from the transition area monitoring wells (i.e., between the upland developable area and Western Stege Marsh) demonstrate a likelihood of impacts to Western Stege Marsh and Meeker Slough, the groundwater remedy would allow for continued and ongoing evaluation of actions, including contingences for additional sampling points or more active groundwater actions.
C8.C21 Maggie Lazar, Pavement Research Center [written and verbal comments]	How about the safety of 46th Street? Anyone who has used the receiving entrance to the RFS knows the poor condition of 46th Street that runs between the UC and former Zeneca properties. It needs to be repaired very soon. I understand that ownership is shared and this complicates replacement. But, presumably the same pollutant plume underneath both properties is underneath the road. How will the potential soil and groundwater contamination be handled and the safety of employees at the site protected during repairs? And, if repairs are delayed, how are employees affected by the disintegration of the roadway? Are they exposed to contaminated soil and groundwater vapors below?	The northern portion of South 46th Street is owned by the City of Richmond, while the southern portion is owned by both UC and Cherokee Simeon Ventures I (the Zeneca Site owner also known as CSV). UC and CSV will need to work with the City of Richmond if road work is required. Prior to conducting subsurface work on any portion of South 46th Street an evaluation will need to be performed to determine the proper type of personal protective equipment or if there is insufficient data available from a particular area, sampling will first need to conducted. Soil and groundwater that is removed from the Site will need to be properly handled and characterized prior to off-site disposal. Imported base rock is located directly beneath the asphalted roadway, so if the asphalt is deteriorated, there would still be a layer of base rock present, thus eliminating exposure to contaminated soils. Potential exposure to soil vapors would also be minimal as any vapors would be immediately diluted with the outside ambient air to

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		levels far below screening values.
C8.C22 Maggie Lazar, Pavement Research Center [written and verbal comments]	UC Soil Management Plan should include screening for radioactive soils. With recent attention in the media about radioactive soil found in the Blair Landfill (likely originating from Zeneca) shouldn't there be some investigation of the UC property? In particular, John Fassell of the California Department of Public Health Radiological Health Branch described a distinctive looking soil, white or pinkish. I understand that DTSC does not oversee radiological pollution. However, if UC is preparing a self-management soil plan it should include screening for radioactivity. All employees who dig should be educated in soils that look "different," such as Zeneca "alum mud," in the same way they are taught to identify cinders. UC employees need one place to go to learn about the potential risks in their work environment.	Identification of alum mud has been added to the annual training provided to UC maintenance workers. If the radioactive materials, such as tracers are used, they are regulated under a permit issued by the California Department of Public Health (CDPH). This same permit also requires decommissioning activities be conducted when the radioactive material will no longer be used at a particular building. The activities include a building survey, and if necessary decontamination of the building is conducted. CDPH reviews all reports and provides the necessary clearances. If radioactive materials have been used and there is cause for soil contamination, this issue will be resolved during the building decontamination and decommissioning process. The SMP Form A has been revised to include check boxes to indicate whether radioactive materials have been used within the project area, and if the area has been properly decontaminated and decommissioned and cleared by CDPH. If radioactive material use is suspected and the area has not gone through the decommissioning process, CDPH will be contacted and further implementation of the SMP process will be put on hold until clearance is provided by CDPH.
C8.C23 Maggie Lazar, Pavement Research Center [written and verbal comments]	Summary. I am very disappointed by this Removal Action Plan. I have worked at the Richmond Field Station for 23 years. I have met and interacted with many members of the UC Administration and Environmental Health and Safety Department who have made reassurances to me, most likely with the best	Comment noted. DTSC believes that the Site has been adequately characterized to support the development of a remedy document. Also see response to C8.20.

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	of intentions. I was told the University wanted to clean up to the best standards and this document feels both rushed and like settling for less.	
The commenter, Maggie Lazar, requested confirmation that she understood the answers from the various conversations she had with DTSC and UC staff as follows:		
C8.C24 Maggie Lazar, Pavement Research Center [written and verbal comments]	On December 3, I asked Wayne Hagen about the difference between a Removal Action Workplan (RAW) and a Remedial Action Plan (RAP). He said that the paperwork was different on his end but that I would be equally protected by either action. Is this true? The following quote from Wikapedia seems to imply that a Remedial action is more long term and comprehensive. Wouldn't that be better for me as an employee on the property? • Removal actions. These are typically short-term response actions, where actions may be taken to address releases or threatened releases requiring prompt response. Removal actions are classified as: (1) emergency; (2) time-critical; and (3) non-time critical. Removal responses are generally used to address localized risks such as abandoned drums containing hazardous substances, and contaminated surface soils posing acute risks to human health or the environment. • Remedial actions. These are usually long-term response actions. Remedial actions	The information provided by DTSC public participation specialist Wayne Hagen is correct. A Removal Action Workplan (RAW) is a long-term cleanup plan and is equally as protective and permanent as a Remedial Action Plan (RAP). The California Health and Safety Code (HSC) Section 25323.1 defines a RAW as: …a work plan prepared or approved by the department or a California regional water quality control board that is developed to carry out a removal action, in an effective manner, that is protective of the public health and safety and the environment. The removal action work plan shall include a detailed engineering plan for conducting the removal action, a description of the onsite contamination, the goals to be achieved by the removal action, and any alternative removal options that were considered and rejected and the basis for that rejection. HSC Section 25356.1 outlines the requirements for

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	seek to permanently and significantly reduce the risks associated with releases or threats of releases of hazardous substances, and are generally larger more expensive actions which may include such measures as preventing the migration of pollutants with containment, or preferably removing and/or treating or neutralizing toxic substances. (I apologize for using Wikapedia as a reference. This shows how much I need help from DTSC)	both a RAP and RAW. Some of the differences include: a public meeting is required to be held for a RAP and is optional for a RAW; the estimated cost to implement a RAW must be less than $2 million; alternatives in a RAP are evaluated based on the nine criteria listed in the National Contingency Plan (NCP) while a RAW is evaluated based on the three criteria of implementability, effectiveness and cost; and the RAW includes a description of how the proposed remedy would be implemented while a separate document, the Design and Implementation Plan is prepared after the RAP is approved. The definitions found in Wikipedia do not appear to have considered California statutes, but refer to federal regulation.
C8.C25 Maggie Lazar, Pavement Research Center [written and verbal comments]	On December 12, I met with Karl Hans, Jason Brodersen, and Greg Haet, to ask some detailed questions about areas where my colleagues work at the RFS. They said the SMP Area 15 was at the highest sampling level in the Plan decision tree. On Figure 6 it is outlined in blue (for "high"); but in Table 3, it is listed as "medium." Please clarify which is right and make the appropriate correction.	The commenter is correct in that there is an error in Table 3. Table 3 of the SMP has been modified to indicate that the sampling density for Area 15 is "High".
C8.C26 Maggie Lazar, Pavement Research Center [written and verbal comments]	At the same December 12 meeting, I asked about TCE readings in groundwater near Buildings 450 and 480. I wanted to know if more (or different) action would be taken in those areas if the property was being cleaned up to a residential standard. It was a long answer, with a helpful explanation of the difference between "commercial" and "residential" standards, but I understood it to	The cleanup strategy was based upon the most reasonable future land use for the site, which in this case is a commercial use. Therefore, cleanup goals were developed in the RAW for a commercial worker. See the response to C1.C1 regarding selection of the commercial use scenario. The risk assessment prepared as part of the Site Characterization Report included an evaluation of groundwater via vapor intrusion into indoor air under various use scenarios,

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	be “no.” Please confirm that the TCE levels gathered in those areas are below the levels that would trigger an action in a clean up to residential standards.	including an unrestricted use. Based on this evaluation, the groundwater screening value for trichloroethene (TCE) was calculated to be 180 microgram per liter (µg/L). The groundwater concentrations in monitoring wells B-450 and B-480 have ranged between 5 and 26 µg/L between 2011 and 2013 (the last sampling event); therefore, the TCE levels in groundwater would not pose a threat via vapor intrusion into indoor air under the unrestricted use scenario. Although, the concentration of TCE exceeds the maximum contaminant level for drinking water, the shallow groundwater is not used for drinking water and is not anticipated to be used for drinking water or other purposes. The groundwater in this area will continue to be monitored under the on-going site-wide groundwater monitoring program.
C9.C1 Pamela Sihvola, Committee to Minimize Toxic Waste written comment	Due to almost one and a half centuries of contamination from industrial chemical manufacturing operations at the above referenced site and adjacent properties, it is critical for the RAW to address the cleanup of the entire site, not just piecemealed RES (Research, Education and Support) areas and groundwater, as currently proposed.	The RAW includes cleanup actions that are protective of public health and the environment. Because there are active operations occurring at the site and proposals for future development are in progress that will occur potentially over a number of decades, the proposed RAW would provide the most efficient and effective remedy for the site in coordination with the proposed development. The cleanup goals will be revisited on an annual basis and updated if necessary to ensure that over time, the most up to date scientific information is considered. This strategy along with the Five-Year Reviews of the remedy will ensure that as the Site is developed over time, the most up to date cleanup goals will be used.
C9.C2 Pamela Sihvola,	Water, in addition to air, is the most effective mechanism for contaminant transport,	See the response to C1.C1 with regards to the cleanup standard found in the RAW. In addition, the results of

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Committee to Minimize Toxic Waste written comment	therefore cleanup of the site to the most stringent residential standards is critical.	the current groundwater monitoring program support the finding that contamination in soil is not leaching to groundwater with the possible exception of the coastal terrace prairie. This area will be investigated during the Phase IV site investigation. Groundwater contamination from the areas considered in the RAW is limited to carbon tetrachloride in the northwest portion of the site and TCE that is migrating from the former Zeneca site over the eastern property boundary. The groundwater monitoring results support the finding that the contamination in groundwater is not migrating off-site. Finally, groundwater monitoring will continue under the on-going site groundwater monitoring program. DTSC will be reviewing the data and determining if any future actions are necessary.
C9.C3 Pamela Sihvola, Committee to Minimize Toxic Waste written comment	In addition to the above referenced issues and concerns the RFS/RBC is located next to the Marina Bay residential neighborhood, the popular Bay Trail and the Eastshore State Park. Therefore the DTSC recommended Land Use Controls (LUC), i.e. deed restrictions and soil management plans, as cleanup, are not acceptable.	See the response to C8.C17 with regards to land use controls, and response to comments C10.C2 and C11.C1 regarding exposure to Marina Bay residents and Bay Trail users.
C9.C4 Pamela Sihvola, Committee to Minimize Toxic Waste written comment	We ask that the preferred cleanup plan be the one that prevents all risks to human health and the environment, i.e. excavation and off-site disposal of all contaminated soils, sediments, etc., and the complete remediation of all surface and groundwaters at the site.	See the response to C1.C1 with regard to cleanup of the site to commercial use standards. Please note that the evaluation of Western Stege Marsh and associated sediments and surface water will continue to be investigated during Phase IV and V of the Field Sampling Plan for the Site.
C9.C5 Pamela Sihvola, Committee to	In addition, I am enclosing earlier, related comment letters: 1) to DTSC, dated January 31, 2013	Attachment 1 is a copy of the letter transmitting comments to the Draft Removal Action Workplan for the Stege Property Pistol Range Site. Responses to

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Minimize Toxic Waste written comment	(Attachment 1.) 2) to LBNL/DOE, dated February 1, 2013 (Attachment 2.) and 3) a copy of a notice from DOE, dated January 17, 2013, regarding the preparation of an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA), which will include a floodplain and wetlands assessment for the project (Attachment 3.), and ask that these documents be considered and responded to as part of our comments on the UC RFS/DOE-LBNL RBC RAW/site cleanup proposal.	comments found in the letter were provided in the DTSC's March 28, 2013 Responsiveness Summary to the Removal Action Workplan for the Stege Property Pistol Range Site. The Stege Property Pistol Range Site is not a part of this RAW and DTSC has no additional response other than what has already been provided. Attachment 2 is a copy of a letter that provides comments to the Notice of Preparation (NOP) for the Long Range Development Plan Draft Environmental Impact Report and the Department of Energy's (DOE) notification to prepare an Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA) regulations, and preparation and incorporation of a floodplain and wetlands assessment into the EA. As the lead agency under the California Environmental Quality Act, the University of California is responsible for addressing comments to the NOP. Attachment 3 is DOE's notice to the California Office of Planning and Research and the Federal Emergency Management Agency of the preparation of an EA and floodplain and wetlands assessment in accordance with federal regulation. As the letter is a notification regarding NEPA, no response with regard to the RAW is provided.
C10.C1 University Professional and Technical Employees	The documents under review were not prepared in a way that's conducive to public understanding or input. Readers seeking specific information are referred to sections in other related documents (which are not always	The Removal Action Workplan (RAW) is a technical document, which necessitates the use of technical and scientific terms. The executive summary is an attempt to summarize the contents of the RAW in a way that is less technical and more readable to the lay person.

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(UPTE) Local 1 [written comment]	easy to find), and excessive use of acronyms makes the document particularly difficult to review.	The RAW also contains a summary of other reports such as the remedial investigation, current conditions report, etc. that were relied upon to prepare the RAW, and references are provided to those documents if the reader wishes to review the entire report. The length of the RAW would be excessive if these other documents were included as attachments to the RAW. A list of acronyms and abbreviations is included after the table of contents.
C10.C2 UPTE Local 1 [written comment]	The draft workplan is exceedingly narrow in both area and scope in that it includes only part of the Richmond Bay Campus and doesn't consider the health risks of workers other than "commercial, maintenance, or construction workers" on the UC property, nearby residents or workers adjacent businesses, or people who use the Bay Trail. We would like to see the boundaries redrawn to be more protective of public health.	See the response to C1.C1 regarding selection of the commercial land use scenario. The primary exposure pathway for an off-site receptor (including neighboring residents and businesses) is by the inhalation of dust particles. In addition, a casual visitor to the Site could also potentially be exposed to chemicals by inhalation of dust particles. The RAW was amended to update the list of remedial goals in soil to include goals for off-site receptors, and to use the lower of the multi-pathway (ingestion, skin contact or inhalation of dust particles) value for the commercial, construction or maintenance worker or the inhalation pathway value for the on-site unrestricted receptor (adult or child). These values were calculated as part of the human health risk assessment and use a target risk of one in one million for carcinogens and a hazard index of one for non-carcinogens. In addition, during implementation of the RAW activities, dust control measures and monitoring will be conducted to prevent off-site exposure to dust.
C10.C3 UPTE Local 1 [written comment]	In addition, a number of things in the reports are unclear, including what criteria were used to set remedial goals, what the remedial goals are, and assumptions underlying background	The remedial goals are discussed in the Executive Summary of the RAW (pages ES-2 to ES-5). The goals were identified for future project areas, the Mercury Fulminate Area and Corporation Yard, the

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	toxicity levels, exposure assessment, and human health risks.	PCB Areas, and groundwater containing trichloroethylene or carbon tetrachloride. As stated on page ES-2, for the future project areas, the goal is to prevent unacceptable exposures to commercial, maintenance and construction workers from dermal contact, incidental ingestion and inhalation of soil containing chemicals greater than a risk-based concentration or background, or a regulatory required criteria (i.e., PCBs). Depending on which group of workers would be exposed to the soil, different cleanup criteria can be used based on how they may be exposed. Table 3-1 contains the different cleanup goals for each of the different group of workers. For the Mercury Fulminate Area and Corporation Yard, the goal is to prevent exposure to current commercial workers from dermal contact, incidental ingestion and inhalation of soil containing mercury, arsenic, lead, benzo(a)pyrene equivalents, and dioxins greater than the cleanup goals. The commercial worker cleanup level was selected as there are no immediate development plans for those areas, that is, the site will continue to be used as is and no construction/development will be conducted in the near future. When development of the area does occur, the criteria included in the SMP will be used to determine if further activities will be required. The remedial goals are indicated on Table ES-1 under the column titled "Remedial Goal". In the PCB Areas, the goal is to prevent exposure to current maintenance and construction workers and

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		future commercial, maintenance and construction workers by dermal contact, incidental ingestion and inhalation of soil containing total PCBs greater than the level established by a federal law known as the Toxic Substances Control Act (TSCA). The U.S. Environmental Protection Agency oversees implementation of this Act as they have not delegated this authority to any State. This Act specifies cleanup levels for different levels of land use based upon the how often people will be present. The most stringent of these levels is 1 milligram per kilogram (1 mg/kg) total PCBs, that is the cumulative concentration of the different types of PCBs combined. This is the cleanup goal that was selected for the Site. Clean up goals associated with implementation of the Soil Management Plan are included in Table 1 of the SMP and Table 3-1 of the RAW. The underlying assumptions used to develop the remedial goals can be found in the Site Characterization Report, Appendix C-Development of Risk-Based Concentrations, and Appendix G-Human Health Risk Assessment. The report is available on-line at DTSC's EnviroStor database at: http://www.envirostor.dtsc.ca.gov/public/final_documents2.asp?global_id=07730003&doc_id=60253545 or the UC Richmond Field Station website at: http://rfs-env.berkeley.edu/documents/2013.05.28.RFS.SCR.FINAL.pdf
C10.C4 UPTE Local 1	It is also unclear how and why it was determined that projects affecting less than 20	See the response to comment C8.C2 with respect to *de minimis* sized projects. While *de minimis* projects will

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[written comment]	cubic yards of soil would not be subject to the soil management plan. We conclude that the RAW fails to meet even its first objective: establishing remedial goals.	be under the oversight of UC's Environment, Health and Safety program, state and federal regulations and the remedial goals included in the RAW would still be applicable.
C10.C5 UPTE Local 1 [written comment]	Most importantly, however, the only mention of public participation refers to response to the draft Removal Action Workplan and draft EIR. Apparently UC's Environmental Health & Safety Department expects to be able to determine the need for each activity, with notification to DTSC but no need for prior DTSC approval, or public oversight or comment. "The first component of the SMP process is the determination by EH&S if the project is subject to the SMP requirements." (Attachment C, Soil Management Plan RAW, Richmond Bay Campus, November 25, 2013) We think giving responsible parties almost sole decision-making authority over contaminated sites is bad public policy in general, and is particularly bad given the history of this project and "holes" in the draft RAW.	See the response to C8.C1 regarding the Soil Management Plan (SMP), and additional notification and public participation activities that have been added to the SMP.
C11.C1 Jean Rabovsky [written and verbal comments]	The project boundaries are too narrow. As described in the draft Removal Action Workplan (dRAW) the following adjacent areas are omitted from project consideration. They are the Zeneca/Stauffer site on the east, the Bay Trail and land on the south, the residential community of Marina Bay on the west and the Harbor Front business on the north. The residents of Marina Bay will be impacted by the noise and construction activities and	The Zeneca/Former Stauffer Chemical Site (Zeneca Site) is a separate site that is being investigated under DTSC oversight. As different operations were conducted at the Zeneca Site a separate investigation was conducted and a separate cleanup plan will be prepared. Where contamination has migrated from the Zeneca Site to the Former RFS Site, the Zeneca cleanup document will evaluate different remedy alternatives. The Marina Bay Site is also a site that has been under DTSC oversight for many years.

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	accompanying toxic substances as they were during the unsupervised demolition activities in the early 2000s. The Bay Trail is used for recreation by adults and children with and without dogs. Workers and owners of businesses located in the Harbor Front Tract will be impacted in ways similar to the residents of Marina Bay. Among the people impacted by the construction/excavation activities will be pregnant women and fetuses, childrenelders (sic) and those with suboptimal health. The soil toxins that are present in the University of California Richmond Field Station (UCRFS) side of the east boundary and those that are present in the Zeneca/Stauffer side do not suddenly stop at the line established by the eastern boundary. To ignore the passage of toxic chemicals in both directions is to minimize the potential health risks to exposed populations and is not good public health policy. Recommendation. Redraw the boundaries to include Marina Bay, Bay Trail and areas south, Zeneca/Stauffer, Harbor Front Tract.	Remedies have been implemented and some areas are subject to operation and maintenance activities. The risk assessment prepared for the Former RFS Site evaluated the risks to current and future site workers. Cleanup goals were then developed based on the calculated risks. The RAW was amended to update the list of remedial goals in soil to use the lower of the multi-pathway value for the commercial, construction or maintenance worker (exposure from direct contact, ingestion or inhalation of particulates) or the inhalation value for the on-site unrestricted receptor (adult or child). These values were calculated as part of the human health risk assessment and use a target risk of one in one million for carcinogens and a hazard index of one for non-carcinogens. As the on-site receptor would have the greatest potential exposures to chemicals present at the site, the calculated cleanup goals would also be protective of persons using the Bay Trail, working in the Harbor Front Tract Area or living in the Marina Bay Area, who would have more transient potential exposures due to the distance from the Former RFS Site or the amount of time spent on the Bay Trail. As explained in the response to C10.C2, the primary pathway for off-site receptors (including neighboring residents and businesses) is inhalation of dust particles. In addition, measures will be put into place to control and monitor for dust during implementation of the RAW activities. Risk based dust concentrations that are protective of off-site residents have been calculated and are included in the RAW. Monitoring will be conducted to ensure that these concentrations are not exceeded at the site fence line.

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C11.C2 Jean Rabovsky [written and verbal comments]	Human Receptors. Future potential receptors are defined in the dRAW as "(1) future commercial workers, (2) future construction workers, and (3) future maintenance workers" (p. 17, Exposure Assessment, par. 2). Such future use ignores the presence of residential receptors in Marina Bay, walkers/bikers/children on the Bay Trail and workers/owners of businesses in the Harbor Front Tract. Although recreational users and children who visit the site during field trips are included in the commercial worker exposure pathway (Sect, 3.1, Removal Action Objectives, p.23), these receptors omit those who live near the site and will be exposed during longer intervals. Inclusion within the commercial worker receptor category dilutes the potential risk to this vulnerable group. Also given the educational opportunities that will exist in the RBC as part of its development, young people (elementary, middle school and high school) may be able to participate in many programs that become available after the project is established and for those that are in the K-12 age group, exposure factors for this group should be applied. Recommendation: Include residential receptors in the list of human receptors and apply appropriate exposure factors and toxicity guidelines/standards.	Please see response to C10.C2 regarding remedial goals that are protective of the off-site receptor and children who may occasionally visit the Site. The Long Range Development Plan does not include a school for children in the K-12 age group. If UC proposes this use in the future, they would be required to demonstrate that the location is appropriate for this use or conduct additional cleanup activities under DTSC oversight. DTSC would also have to approve an amendment to the land use covenant that would allow this land use.

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	Apply exposure factors/toxicity values for children in the K-12 age group as a separate receptor category.	
C11.C3 Jean Rabovsky [written and verbal comments]	Specific Toxicity Values. Despite the narrative on p. 18 that explains the source of various toxicity values, the reader is kept ignorant of the specific values that are used until p. 25, Sect. 3.1, in the table titled *Remedial Goals.* The meaning of the table, *Remedial Goals* is unclear. At first reading the column labeled Remedial Goal appears to indicate a toxicity comparison value. The columns for the three worker categories could mean soil (or groundwater) levels but what do these levels signify? Are they soil (or groundwater) levels that are considered without significant adverse effects according to risk based calculations (RBCs)? If the answer to this question is "yes", such levels will be too high because they do not include residential receptors. Do the numbers for the three worker categories represent the amount that will be allowed to remain in the soil without an attempt to further remove them? If an objective of the dRAW is to prevent or reduce risks to public health (DTSC 2013) such a choice will prevent this objective from being met. Recommendation: Provide removal of toxic chemicals to the maximum extent possible as a major cleanup alternative for all toxic chemicals. Where residues remain despite the	Remedial action objectives (RAOs) developed for the Site specifies the contaminants and media of concern, exposure routes and receptors, and the remedial goals for each exposure route. The RAOs are also developed in consideration of the current and most probable future land uses. Therefore, cleanup activities will be conducted based on the commercial cleanup values identified in the RAW and residual levels of contaminants will be compared against the same. With respect to the table included on page 25 of the draft RAW, the column identified as "Remedial Goals" is explained by footnote "a", which states, "Remedial goals are cleanup goals for the PCB Areas, MFA, Corporation Yard, Carbon Tetrachloride Area, and TCE Areas. The commercial worker is the appropriate receptor to evaluate for this RAW; therefore the remedial goals are based on the commercial worker risk-based concentration, background, or TSCA criterion." Section 5.1.3.1 (Confirmation Soil Sampling Locations) states that soil excavation will continue if confirmation samples indicate that the cleanup goals are exceeded. When calculating risk, the calculations use the 95th percent upper confidence level on the arithmetic mean (95% UCL) as the estimate of the chemical exposure concentration. At a minimum, the residual chemical concentration in soil after the RAW activities are completed will meet the cleanup goal as a calculated 95% UCL value. For PCBs or for chemicals that relied

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	use of best available technology, evaluate the potential risk to exposed residents and workers and inform them of the potential risk.	on background concentrations, the remaining chemical concentrations will not exceed the remedial goal(s). Additional text has been added to clarify how the cleanup goals in the table will be applied, that is, a calculated 95% UCL or "not to exceed" value.
C11.C4 Jean Rabovsky [written and verbal comments]	Eight chemicals of concern (COCs) are listed (six in soil and two in groundwater) and three in soil will be discussed in the commentary. They are total polychlorinated biphenyls (PCBs), arsenic and lead (Pb). Note that the absence of discussion on the remaining five chemicals does not indicate either concurrence or disagreement with the information on them. A comment in footnote "a", appears to explain the basis for each remedial goal in the last column. According to my interpretation, the remedial goal (last column) for total PCBs is based on the TSCA standard, that for arsenic is based on background arsenic levels, and that for lead is based on a risk based concentration for the commercial worker. Nowhere in the table on p 25 are the units associated with the numbers. Such units will be different for soil and for groundwater and they should be placed directly in the table. All tables should be able to stand alone. Recommendation. Clarify the meaning of the various columns in the table labeled *Remedial Goals.* Clarify the meaning of the numbers in each of the columns. Insert the appropriate	The notes section of the table include a narrative indicating the appropriate units for each type of media, i.e., mg/kg for soil and µg/L for groundwater; however, to assist the reader the table has been modified to include the units on the table itself. In addition, the format of the table has been modified to improve clarity. Each column of the table is meant to identify for each of the different on-site receptors (e.g., commercial worker) the appropriate corresponding remedial goal for the PCB Areas, MFA, Corporation Yard, Carbon Tetrachloride Area and TCE Area. The column "Remedial Goal" indicates the cleanup goal that was selected for each chemical of concern with the anticipation of no impending redevelopment. If it was known that redevelopment was to occur and intrusive construction activities would be occurring, the construction worker goal would be used if it was lower than the commercial worker goal. Similar information has been included in the Final RAW in Section3.1. An additional footnote has been added to the table to explain the meaning of each of the columns.

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	units for the various numbers. Clearly explain what the soil levels signify. Are they the levels, based on RBCs that will be allowed to remain in the soil with no attempt to remove them to the maximum extent possible?	
C11.C5 Jean Rabovsky [written and verbal comments]	PCBs. Current and future workers (maintenance, construction, commercial) are considered to be protected against PCBs when remediation results in a soil level less than or equal to (≤) 1 milligram (mg) total PCBs per kilogram (kg) soil. The remedial goal of 1 mg/kg is based on a United States Environmental Protection Agency (USEPA) Toxic Substances Control Act (TSCA) (USEPA, 2007) evaluation. The basis for this number is not known and other toxicity criteria strongly suggest public health protection may not be available at the TSCA level. The California Human Health Screening Levels (CHHSLs) for residential and industrial/commercial receptors are 0.089 and 0.3 mg/kg soil, respectively (OEHHA, 2010). The narrative in the dRAW is not clear about the meaning of the remedial goal of 1 mg PCBs/kg soil. Will the soil be excavated to remove as much PCBs as possible with remaining residues assessed by the TSCA standard or will the TSCA standard of 1 mg PCBs/kg soil represent the amount that will be allowed to remain in the soil? Why are the	The development of soil screening numbers (CHHSLs) was required under the California Land Environmental Restoration and Reuse Act; however, the screening numbers are solely advisory and have no regulatory effect. Since being published, the CHSSLs have not been routinely updated, including the PCB values. PCBs are regulated by the federal Toxic Substances Act (TSCA), which is administered by the U.S. EPA and has not been delegated to individual states. TSCA specifies cleanup levels for different levels of land use based upon how often people will be present. The most stringent of these levels is 1 milligram per kilogram (1 mg/kg) total PCBs, that is the cumulative concentration of the different types of PCB aroclors combined. A risk based value would be based upon an exposure concentration that represents a 95% Upper Confidence Level (95% UCL) on the arithmetic mean. This means PCB concentrations in soil greater than 1 mg/kg could be allowed to remain in place and still meet the cleanup goal. This scenario has the potential to be out of compliance with TSCA requirements; therefore, the TSCA value of 1 mg/kg as a “not to exceed value” was selected as the cleanup value for this site.

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	more health protective PCB guidelines not utilized in this analysis? Recommendations: Use the residential CHHSL of 0.089 mg PCBs/kg soil to develop a remedial goal. Remove PCBs to the maximum extent possible with best available technology and apply the residential CHHSL of 0.089 mg PCBs/kg soil to estimate the potential risk of exposure to remaining residues.	
C11.C6 Jean Rabovsky [written and verbal comments]	Arsenic. According to the table *Remedial Goals* that for arsenic is 16 mg/kg. This value is considered the background As level (see footnote "d"). Arsenic values associated with the three worker categories are less than the remedial goal of 16 mg As/kg soil (see the table on p.25). What do these numbers represent? Are they soil levels, developed by RBCs that are considered to be health protective? Will As cleanup then proceed to these levels? How will such cleanup proceed differently for the different worker categories? The narrative (pg. 23-24), however, states the removal action objective will prevent exposure of the workers to soil containing chemical concentrations greater than the appropriate criterion, which in the case of As appear to be 16 mg/kg soil, a soil level higher than that calculated for any of the three worker	The geology of the Former RFS Site as well as adjacent sites consists primarily of alluvial sediments that were deposited from the Berkeley Hills, located east and northeast of the sites. The alluvial plain that extends from the Berkeley Hills consists of relatively recent quaternary age deposits (less than 2 million years old). Metals occur naturally in soil and water at all hazardous substances sites, but risk assessments eliminate from consideration those chemicals whose range of concentrations falls within the range of local ambient conditions. This is done by comparing concentrations of inorganic constituents at the site to a body of data representative of local conditions unaffected by site-related activities. A multivariate statistical approach (K-means cluster analysis) was used to estimate the background concentrations of arsenic for soil at the Zeneca Site. The result of the analysis was a

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	categories. It would thus appear that As will be allowed to remain in the soil at the high background level. However, the CHHSLs for As are 0.07- and 0.24 mg As/kg soil for residential and industrial/commercial receptors respectively (OEHHA, 2010). Only the commercial worker in the dRAW analysis is near the industrial/commercial CHHSL; the construction and maintenance workers will be exposed to As levels greater than the listed CHHSLs. Again, residential receptors are not even included in the dRAW analysis. As described in OEHHA (2010), the CHHSLs for As are to be applied to As from human activity only and naturally occurring As levels may be above these numbers. In other words, the background levels of “naturally” occurring As are toxic. OEHHA (2010) informs the reader that at a given site, “…the agency with authority over remediation decisions should be consulted.” Apparently the authorized agency has determined the remedial goal should be the toxic background level because it is assumed to be naturally occurring. The question remains, what is the source of the “naturally” occurring As? Is it only geologic As found in the crust of the planet. Has As that may be found within rock formations been disturbed and then released into the environment by human activity? How does one draw an inflexible line between levels that	background value of 16 mg/kg arsenic. See the response to C12.C7 for a detailed description of the statistical method used to calculate the background concentrations. Based on the evaluation conducted, this background number has been identified as a remedial goal for arsenic contamination not associated with pyrite cinders.

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	result from human activity and naturally occurring levels? Why are the responsible parties, the University of California and the State satisfied that toxic levels of As can remain in the soil? Recommendations. Use the residential CHHSL of 0.07 mg As/kg soil to develop a remedial goal. If the background level of As is greater than this goal, articulate that this level is itself toxic and that exposure to this background level may result in adverse health effect(s).	
C11.C7 Jean Rabovsky written and verbal comments	Lead (Pb). The remedial goal in the dRAW document for Pb is 320 mg/kg soil. This value is also the CHHSL for commercial/industrial receptors and is based on a pregnant adult worker (OEEHA, 2009, 2010). For reasons stated in previous paragraphs, residential receptors should be included in the analysis. The commercial/industrial CHHSL does not include young children who reside in Marina Bay and walk/run/bike on the Bay Trail. The residential CHHSL for Pb is 80 mg/kg soil and is based on a child resident (OEHHA, 2009). It is of interest that the remedial goal for Pb is the commercial/industrial CHHSL of 320 mg/kg soil and the soil level associated with each of the three worker categories is exactly 320 mg Pb/kg soil. Yet the narrative suggests the soil levels of the various chemical were developed	As the Former RFS Site will not include any residential uses, the commercial/industrial land use scenario was considered in the draft RAW and cleanup goals are based on that land use. See response to comments C1.C1 and C10.C2 with regards to selection of the commercial land use scenario and areas outside of the Former RFS Site boundary. California Human Health Screening Levels (CHHSLs) were calculated using standard exposure parameters for both commercial/industrial and residential receptors. While the calculation for lead is based on a different model than other chemicals, the exposure parameters used are the same. This model does not consider any local sources of lead from a site, but relies on the resulting blood lead level from exposure to lead. Furthermore, the CHHSL value for lead is an occupational adult scenario and is not specific to any one type of worker category. As the RAW relied upon the standards set by the California Office of Environmental Health Hazard

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	through RBCs. Is the reader expected to believe that the RBC calculations for each worker category works out to be exactly the commercial/industrial CHHSL? Recommendations. Use the residential CHHSL of 80 mg Pb/kg soil to develop remedial goals. Explain in detail how the three soil levels, based on RBCs, are exactly commercial/industrial CHHSL of 320 mg Pb/kg soil.	Assessment (OEHHA) for lead, each of the site worker cleanup levels were the same.
C11.C8 Jean Rabovsky [written and verbal comments]	Conclusions. Although the comments on the dRAW have been focused on a small portion of the total document, they exemplify those issues that render the document incomplete and inadequate. Specifically the project boundaries are too narrow and long-term residential receptors are omitted from analyses. By confining the geographical location to a small area and ignoring long-time residents the analyses most likely underestimate the potential risk experienced by the exposed population. The lack of specific information in the *Remedial Goals* table (p.25) prevents the reader from making a comprehensive evaluation of the various remedial goals and their meanings. The deficiencies noted in the dRAW have implications beyond the dRAW itself. This	With respect to enlarging the project boundaries, see response to C11.C1.; see response to C1.C1. regarding the use of commercial cleanup standards; and C11.C4 with regards to the Remedial Goals table.

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	document serves as a basis for the following document the dEIR that is supposed to evaluate the impacts of projects associated with the LRDP. An inadequate and incomplete dRAW, therefore, will render the dEIR also inadequate and incomplete. For the sake of maximum public health protection, the dRAW in its current formulation should be set aside and a new dRAW should be developed so that the objectives of the dRAW (see DTSC, 2013) will be met.	
C12.C1 Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	The University of California (University) is poised to begin development of its new flagship research campus, anticipated to “transform the site into one that is a once *in harmony with the Bay Area ecosystem,* a source of knowledge creation for the country, and an engine of economic growth locally and regionally.” The most critical tool for achieving harmony with the Bay Area ecosystem is the Draft RAW. However, the Draft RAW is fundamentally flawed and wholly inadequate to support the University’s goals for the UCRBC. Implementation of the Draft RAW would leave in place unacceptable levels of soil and groundwater contamination, which would result in a long-term, paved-over source of continuing migration of contaminants across the UCRBC, into Western Stege Marsh, into San Francisco Bay, and into the surrounding community. The Draft RAW is the Department	DTSC believes that the proposed alternatives identified in the RAW are protective of human health and the environment, and will support the redevelopment of the Site as proposed in the Long Range Development Plan.

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	of Toxic Substances Control's (DTSC) opportunity to require the University to take the measures necessary to meet the requirements of the Site Investigation and Remediation Order IS/E-ROA 06/07-004 (Order).	
C12.C2 Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	A Remedial Action Plan (RAP) must be prepared in lieu of the Draft RAW. The extensive environmental issues at the Site cannot be addressed using a tool designed to provide an immediate, short-term response to control specific conditions involving hazardous waste. Given the environmental and ecological complexities of the hazards present, the Site requires a long-term cleanup plan that will control the future release of hazardous substances and reduce the existing danger to public health and the environment. This is something that only a RAP can provide.	See response to C8.C24, which discusses the differences between a removal action workplan (RAW) and a remedial action plan (RAP). While there are some differences, both documents require that the remedies selected be protective of the public health and safety and the environment. The RAW is not a short-term response action to control specific conditions, but is a final remedy document. The Soil Management Plan, which is a part of the RAW includes prescriptive steps that must be followed when redevelopment of the Site occurs. These steps will be reviewed on an annual basis and updated as needed. This will allow UC and DTSC to review the most current science and regulatory policies to ensure that the most up-to-date policies and cleanup standards are followed for all future remedial activities.
C12.C3 Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	Indeed, the consequences of preparing a RAW when the situation calls for a RAP are evident in the artificial limits on the scope and scale of the cleanup proposed in the Draft RAW. The numerous deficiencies in the Draft RAW include, among other things, an inadequate site characterization, the use of inappropriate and/or outdated risk-based thresholds, inadequate assumptions regarding future use by sensitive users such as women of child-bearing age and children, and failure to	See the response to C12.C9 with regards to Site characterization; C12.C5 and C12.C7 with regards to risk-based cleanup goals; C12.C8 with regards to Site receptors; and C12.C10 regarding ecological impacts.

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	consider the ecological impacts that the Preferred Alternatives would have on the Western Stege Marsh, the transition habitat and the San Francisco Bay.	
C12.C4 Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	Further supporting the argument that DTSC has inappropriately chosen a RAW over a RAP in this instance is the fact that a legally adequate cleanup plan that meets the requirements of the Order will exceed the $2,000,000 ceiling for conducting a removal action workplan. In fact, the cost of the preferred remedy ***already*** exceeds $2,000,000. The costs provided for the selected alternatives in Chapter 4 of the Draft RAW exceed the $2,000,000 threshold as follows: 84,507 (PCB Area, Table 4-1) + $1,158,152 (MFA) + $160,284 (Corporation Yard) + $336,224 (Carbon Tetrachloride in groundwater) + $298,618 (Site-wide groundwater, Table 4-1) = $2,037,785. Note that this total does not include any cost for the "Remaining RES Area" selected alternative, which the Draft RAW estimates to be "Moderately High" but too speculative to quantify. Even without considering the additional cost for the Remaining RES Area remedy, the selected alternatives in the Draft RAW exceed the $2,000,000 maximum for a RAW by a significant margin. Thus, the University must prepare a RAP, rather than a RAW.	See the response to C16.C1 which describes how individual alternative cost estimates were calculated and the basis for the total cost estimate.
C12.C5	The Draft RAW does not establish Remedial	The RAW establishes remedial action objectives

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Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	Action Objectives (RAOs) that are protective of human health. The Draft RAW is based on the Zeneca Site Human Health Risk Assessment (Zeneca HHRA) written in 2008, which is specific to and based on Zeneca Site risks and based on risk standards considered protective at that time. Use of the Zeneca HHRA as the basis of UCRBC human health protection is a fatal flaw of the Draft RAW. The Zeneca HHRA was used as a basis for the development of Risk Based Concentrations (RBCs) that are used as the screening criteria to determine the extent of removal needed. However, the RBCs do not reflect current science. Many of the RBCs for both soil and groundwater are much higher than the San Francisco Bay Regional Water Quality Control Board's updated 2013 Environmental Screening Levels (ESLs), which reflect reductions in acceptable vapor intrusion values and in total petroleum hydrocarbon exposure levels, in addition to other changes. Recommendation: Develop a UCRCB Human Health Risk Assessment based on UCRBC site conditions and expected uses, based on current risk standards, including updated TCE limits.	(RAOs) that are protective of human health in Section 3.1; these RAOs were established in the Site Characterization Report for the Former RFS Site (with the exception of trichloroethene, explained below). A human health risk assessment based on current risk standards and site specific conditions was prepared for the Former RFS Site. The risk assessment is included in the Site Characterization Report, Proposed Richmond Bay Campus, dated May 28, 2013 as Appendix C and G. Appendix C describes how the site specific risk-based concentrations were developed and Appendix G is the quantitative risk evaluation for the Mercury Fulminate Area and the Corporation Yard. Appendix C and G identify the potentially exposed populations, exposure assumptions, calculations, and other parameters that were used to develop the RBCs and calculated risk values. For lead, the Office of Environmental Health Hazard Assessment California Human Health Screening Level (OEHHA CHHSL) was used as it incorporates the latest toxicity evaluation method. Risk-based concentrations for the groundwater to indoor air exposure pathway were calculated for each VOC detected in groundwater at the Site, except for six VOCs associated with the groundwater plume originating from the adjacent Zeneca Site. Re-evaluation of TCE at the Zeneca Site was conducted in 2012 based on revised toxicity criteria for TCE. As the groundwater plume is the same plume, with the same exposure parameters and chemicals, it was determined that the risk evaluation was appropriate for use on the Former RFS Site.
C12.C6	The Draft RAW does not develop or evaluate	The RAW includes the development and evaluation of

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Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	groundwater cleanup alternatives for Site-wide groundwater despite the RAO developed specifically in the Draft RAW to "prevent exposure of current maintenance and construction workers and future commercial, maintenance, and construction workers via inhalation of unsafe vapors from groundwater containing carbon tetrachloride or TCE at concentrations greater than commercial vapor intrusion RBCs" (Draft RAW, p. RS-2, #4). In the natural open space area (NOS), rather than developing a Site-wide groundwater remediation plan, the Draft RAW delays action on identification of the source of carbon tetrachloride plum until a remediation plan is prepared for the NOS area. No time frame is provided for the development of such a plan. With respect to the TCE plume migrating from the neighboring Zeneca Site onto the UCRBC property, the Draft RAW passes responsibility to Zeneca for cleanup and monitoring of this contamination stream stating that the "remedy for groundwater contaminants originating from the former Zeneca Site, including TCE and its breakdown components, is subject to the former Zeneca Site Investigation and Remediation Order, and will meet the RAOs identified for groundwater." Zeneca has no plan in place to remediate the	groundwater cleanup alternatives for the Former RFS Site. A proposed cleanup alternative for the carbon tetrachloride contamination in groundwater is included in the RAW. Alternative GW-4 (monitored natural attenuation and land use covenant) was selected as it is protective of human health and the environment (no complete exposure pathways currently exist), groundwater concentrations show a slight decreasing trend since monitoring has been conducted, and existing geochemical data indicate the area is conducive to natural attenuation of carbon tetrachloride. However, in the event that there are indications that the chemical concentrations are increasing or the groundwater plume boundaries are expanding, contingency measures would be implemented. The area of the groundwater contamination is located in a sensitive ecological habitat and the proposed remedy would be the least disturbing to the habitat. UC is currently preparing an investigation work plan for the Natural Open Space areas of the Site and will be conducting the work during the Summer and Fall of 2014. With respect to the trichloroethene groundwater contamination located along the eastern boundary of the Site, remediation of the contamination will be conducted as required by DTSC's investigation and cleanup order for the adjacent Zeneca/Former Stauffer Chemical Site (Zeneca Site). In addition, groundwater treatability studies have been conducted at the Zeneca Site, which evaluated the applicability of injecting various amendments to treat volatile organic

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	TCE plume, nor is there any indication in the Draft RAW as to when such a plan may be developed by Zeneca. The Draft RAW rests with the assumption that at some point in the future Zeneca will remediate the TCE plume which currently and continuously contaminates the UCRBC Site. This is an unacceptable assumption that will indefinitely prevent the Site from achieving its stated RAOs. The longer the TCE source remains in soil on the Zeneca site and TCE remains in groundwater, the more severe the likely impact will be to UCRBC, Western Stege Marsh and the San Francisco Bay. The most recent groundwater data available through the UCRBC Envirostor website confirms that the groundwater at the Site is heavily contaminated with the carcinogens carbon tetrachloride and TCE, among other chemicals, at concentrations at or exceeding California and federal maximum contaminant levels. DTSC cannot continue to risk the health of the current and future users at UCRBC or ecological receptors at the UCRBC and beyond by indefinitely delaying action on Site-wide groundwater. Recommendation: Rewrite the Draft RAW as a RAP that includes a comprehensive evaluation of and selection of a protective remedy for Site-wide groundwater.	compounds.

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C12.C7 Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	The Draft RAW risk evaluation and proposed cleanup alternatives use the Zeneca Site arsenic background level of 16 mg/kg. The use of the highly controversial Zeneca arsenic background level of 16 mg/kg in the Draft RAW is a fatal flaw. The background concentration of 16 mg/kg for arsenic was developed as a site-specific background concentration for the Zeneca Site. This concentration is based on a report prepared by Erler & Kalinowski, Inc., entitled Technical Memorandum: Background Concentrations of Arsenic in Soil at Campus Bay, Campus Bay Site, Richmond, California, dated July 23, 2007. DTSC approved the use of 16 mg/kg as a background concentration for arsenic on October 1, 2007 (Letter to Doug Mosteller from Barbara Cook Concurring on the Recommendation of 16 mg/kg Arsenic as a Good Estimator of the Upper Range of the Ambient Distribution of Arsenic at the Campus Bay Site). The CAG continues to believe that use of the arsenic background concentration of 16 mg/kg is inappropriate. A new HHRA should be prepared in support of a RAP that incorporates a background concentration of 8.9 mg/kg arsenic, as calculated at the Harborfront Tract, located east of the Zeneca Site. This number	The Erler & Kalinowski technical memorandum, which is available on-line at: http://www.envirostor.dtsc.ca.gov/public/community_involvement_documents.asp?global_id=07280002&document_folder=+9502835929 presented the results of a multivariate statistical approach (K-means cluster analysis) that estimated the background concentration of arsenic for soil at the Zeneca Site, using data collected from Lots 1 and 2. Included in the evaluation was a comparison of the Lots 1 and 2 background arsenic population with the background arsenic population from the adjacent Harbor Front property. The data set that was used included 194 samples that were collected from Lots 1 and 2 and 77 known treated cinder samples from Lot 3, for a total of 253 soil samples. The samples were reported on a dry weight basis by the analytical laboratory. The K-means cluster analysis defined four distinct lognormal arsenic populations on the Zeneca Site, with the lowest concentration arsenic population interpreted to represent the background distribution of arsenic in on-site soils. The validity of the arsenic populations that were derived from the cluster analysis were plotted on a site map and found that the spatial distribution of the sample populations matched with the known distribution of cinders and historic site activities. In addition, the background arsenic population that was identified at the Zeneca Site was compared to the arsenic data distribution from the Harbor Front Area. 64 soil samples collected from the Harbor Front Area were used. The analytical results for this data set were

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	is more reflective of a background arsenic concentration at nonindustrial sites than the Zeneca background concentration of 16 mg/kg. Recommendation: Revise the arsenic background level to 8.9 mg/kg, which is the accurate and verified background level at the Harborfront Tract and more representative of nonindustrial sites in the vicinity of UCRBC.	reported on a wet-weight basis. In order to be able to directly compare the two sets of data, the Harbor Front data was corrected to a dry weight basis using the mean measured moisture content of 16.6% of the soil samples collected in Lots 1 and 2. Both data sets were plotted on a log-probability plot and determined to represent the same population. A non-parametric Mann Whitney test also showed that the two populations are not statistically different. Therefore, the arsenic background concentration of 16 mg/kg is valid for the Harbor Front Area. The geology of the Former RFS Site as well as the Zeneca Site consists primarily of alluvial sediments that were deposited from the Berkeley Hills, located east and northeast of the sites. The alluvial plain that extends from the Berkeley Hills consists of relatively recent quaternary age deposits (less than 2 million years old). As the Former RFS and surrounding sites are adjacent to each other and made up of the same quaternary deposits, the arsenic background concentrations would be similar.
C12.C8 Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	The Draft RAW erroneously uses RAOs based on commercial site use. Application of RAOs based on commercial site use is in conflict with the RAO in the Order which states that RAOs "for contaminated media shall be developed that are protective of adults *and children* in a commercial/*educational scenario* and as *recreational users* of open space." (Order, Section 5.1.2, p. 12, emphasis added) The Draft RAW cites this RAO from the Order and summarily declares that the commercial worker scenario is "overly protective" to	The Long Range Development Plan is the guiding document that indicates the most probable future use of the Former RFS Site, which is reflected in the RAW. See response to C1.C1 with regards to land use. As part of the cleanup remedy, a land use covenant (LUC) will be placed on the property to prohibit sensitive uses on the Site. See response to C11.C2 regarding LUCs. See response to C10.C2 with respect to updates to the list of remedial goals in soil to be protective of the off-

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	occasional visitors, including children, but fails to present any support for this conclusion. (Draft RAW, Section 3.1, p.23) It is foreseeable that commercial workers will include women of child-bearing age who will not be "occasional visitors". No consideration is given to other more sensitive Site uses including the possibility of child day care or children under 18 years of age who are in a classroom or building space more than 12 hours per week. Many University faculty and staff state they have children who spend more than 12 hours per week on campus during their entire childhood. No consideration is given to the possibility that the future campus would develop a use that requires a more robust cleanup. The Draft RAW states that a future Site use includes educational programs which would invite elementary and high school aged children to visit the Site. (Section 2.2.2, p. 6.) Relying solely on adult commercial worker exposures to develop RAOs for the Site leaves more sensitive users of the Site unprotected from the contaminated soil and groundwater. Recommendation: Assume sensitive uses will be required on the UCRBC in the future and site cleanup for future sensitive uses is	site receptor as well as the occasional site visitor. See the response to C8.C15 regarding review of the screening criteria (e.g., cleanup goals), and other protocols found in the Soil Management Plan. Cleanup goals for chemicals at the Former RFS Site are calculated using toxicity criteria published by the U.S. Environmental Protection Agency (US EPA) and/or the California Environmental Protection Agency (Cal/EPA). The woman of child-bearing age in the workplace is protected by utilizing non-cancer toxicity criteria: reference doses (RfDs) and reference concentrations (RfCs) from the US EPA and/or reference exposure levels (RELs) from the Cal/EPA. If the chemical toxicity data show that the developmental toxicity endpoint is more sensitive than chronic toxicity endpoints, the reference level for that chemical will be derived based on fetal effects, and the non-cancer cleanup goal will be calculated using that reference level. The chosen cleanup goals are the more protective (lower concentration) of goals calculated using cancer or non-cancer toxicity criteria. The lead cleanup goal for the commercial worker is specifically targeted to the woman of child-bearing age. Please note that remedy document that was prepared is a Removal Action Workplan (RAW) and not a RAP as identified in the comment.

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	required today before the UCRBC is developed. Recommendation: Evaluate an unrestricted use standard as an alternative in the RAP.	
C12.C9 Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	The Draft RAW is based on incomplete and spot-focused site characterization. Extensive areas of the UCRBC remain uncharacterized or not fully characterized. The Draft RAW will remain a faulty plan until the UCRBC is fully characterized and proposals are made for Site-wide cleanup. The Site Characterization Report (SCR) was meant to be a comprehensive investigation of soil and groundwater conditions and provides the basis for many of the conclusions in the Draft RAW; however, the SCR contains many data gaps that leave large portions of the Site uncharacterized and cannot provide the basis for a comprehensive Site-wide remedy. For example, the SCR identifies several areas where the extent of PCB contamination remains undelineated. Despite these data gaps, the Draft RAW presents a remedy or PCB removal that is likely underestimating the extent of PCB-contaminated soil at the Site. The PCBs must be fully delineated before a remedy can be developed and implemented. The SCR's HHRA was limited to two areas of the Site (the Corporation yard and the Mercury	The RAW looked at and evaluated a number of different cleanup alternatives for the Research, Education, and Support Area (RES Area). This included a preliminary screening of general response actions for both soil and groundwater, and identification of proposed alternatives for each media. The objective of site characterization is not the removal of all uncertainty from a site, but rather to gather sufficient information to support an informed risk management decision regarding which remedy appears to be most appropriate for a given site. In the case of the Former RFS Site, based on the information and data presented in the Site Characterization Report, it was determined that the Site was sufficiently characterized to prepare the Draft RAW. Sampling under DTSC oversight was completed in order to cover all major data gaps identified in the site current conditions report for the developable areas of the property as identified in the proposed LRDP. It should be noted that the data gap analysis was conducted after investigation and remediation activities under the oversight of the Regional Water Quality Control Board were concluded. Also see the response to C7.C4(b). In order for data to be considered useable for any purpose, a certain level of confidence in the data must

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	Fulminate Area), leaving the risk in the remainder of the Site unquantified. According to the SCR, a quantified risk assessment for the majority of the Site could not be completed for one of three reasons, including (i) low density of data, (ii) small area of investigation data, and/or (iii) limited number of analytes in a given sample. The methodology used lead to the exclusion of data which likely would have indicated that a greater risk exists at the Site than was presented in the HHRA. For example, concentrations of arsenic more than twice the disputed "background" concentration of 16 mg/kg was measured south of the Mercury Fulminate Area, as well as east of Building 113 were excluded as they did not fall within the areas with dense enough sample patterns. To further compound the inadequacy of the Draft RAW, the results of all of the grab samples and historical samples were summarily discarded during the site characterization process. These data were not excluded because wells were later installed and a sample was collected to provide more current data, the data were simply excluded. Although the quality of the grab groundwater samples may limit their quantitative use, these samples, along with historical data, could have at least qualitatively filled some of the gaps to asses where additional investigations are	be present. To determine which compounds required the calculation of a risk-based screening concentration, all data sets were reviewed and for each chemical detected in soil in the Research, Education and Support (RES) Area, a risk-based concentration was calculated. Risk-based concentrations for the volatile organic compounds in groundwater intruding into the indoor air exposure pathway were calculated for each volatile chemical detected in groundwater at the Site. The data used in the human health assessment were limited to data collected under either the Regional Water Quality Board (RWQCB) or DTSC oversight (i.e., data collected after June 2001) as the quality of these data is known. Data points that represent soils that were previously excavated were not used, as the soil was removed from the Site. Confirmation sampling data were included. Groundwater data collected from piezometers installed under DTSC oversight were used in the RAW evaluation, as the data provide a more comprehensive understanding of the groundwater at the Site. Groundwater was originally collected at two different times of the year, but as it was determined that a seasonal variation in contaminant concentrations was not occurring, annual groundwater monitoring is now being conducted. The Site Characterization Report evaluation included the use of data collected under RWQCB oversight. In addition, the RAW includes the use of the RWQCB data set. Additional text has been added to the RAW to clarify what historic data was considered in preparation of the RAW.

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	necessary. This data set should be incorporated into the site characterization. Until the soil and groundwater at the Site is fully characterized and the risks at the Site quantified, selected remedies cannot be considered comprehensive because they are relying on data with too many gaps. Recommendation: Fully characterize the UCRBC with soil, soil gas and groundwater samples at multiple depths, at multiple times of the year and located on a site-wide grid. Recommendation: Revise the Draft RAW into a RAP that provides alternatives based on sufficient data.	
C12.C10 Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	Paraphrased: The Draft RAW gives no consideration to ecological receptor health risk, thereby ignoring two of the RAOs stated in the Order and putting endangered and sensitive species at risk. Section 5.1.2 of the Order specifically states that RAOs for contaminated media be developed that are protective of endangered and threatened species and their habitat in Western Stege Marsh and the coastal terrace prairie. Risks to endangered and threatened animals and sensitive plant life from contaminated Site runoff, contaminated soil gas and contaminated groundwater are not evaluated as part of the Draft RAW, even though implementing the Draft RAW would leave contamination in place that will continue	DTSC’s ecological risk assessor was involved in reviewing both the Site Characterization Report and draft RAW and determined that the RES Area did not include habitat areas that would require an ecological evaluation. In general, ornamental landscaping associated with commercial developments are not considered habitat areas for purposes of an ecological risk assessment. Installation of groundwater monitoring wells in the native grassland area is the only portion of the RAW that may have potential ecological impacts. Installation of the wells would be required to comply with the Long Range Development Plan (LRDP) policies and mitigation measures with respect to the biological resources. Investigation of the habitat areas are planned as part of Phase IV and V site investigations. If it is determined that these areas

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	to impact the Western Stege Marsh. The Draft RAW excludes the groundwater ESLs for urban area toxicity from the RBCs. The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) assumes that all groundwater may flow to surface water. Here, proximity to the San Francisco Bay and the sensitive habitat in the Western Stege Marsh makes consideration of ecological criteria imperative, as contaminants left in soil or groundwater at the UCRBC should be expected to flow to surface water and potentially impact ecological receptors. Given that the removal work currently contemplated will almost certainly impact the Western Stege Marsh, the revised RAP should include an evaluation of the impacts from any remaining contamination on endangered and sensitive species under each of the alternatives. Delaying consideration of the impact of the Draft RAW on ecological receptors does not comport with the Order. Recommendation: Evaluate the ecological risks posed by each remedial alternative and incorporate measures to protect ecological receptors into a Draft RAP.	require remediation, a separate remedy document will be prepared for public comment and the LRDP policies and mitigation measures will apply. Other recommended alternatives would not have an adverse impact on the habitat areas as the most likely pathway from the RES Area is by groundwater migration, which is being addressed by the ongoing and proposed long-term monitoring program. Results from the current groundwater monitoring program support the finding that contamination in groundwater is not migrating off-site. The Environmental Screening Levels (ESLs) developed by the San Francisco Bay Regional Water Quality Control Board for soil and groundwater are generic screening values that have not been evaluated by DTSC. Instead, site specific screening values for human exposure, including exposure via inhalation, have been calculated for the Site and can be found in the Site Characterization Report.
C12.C11 Stephen Linsley, Chair, Toxics	Paraphrased: The Draft RAW Soil Management Plan (SMP) is a poorly conceived and executed proposal that will place humans	Implementation of the Soil Management Plan (SMP) requires more than a courtesy notification of activities to DTSC. The process outlined in the SMP requires

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Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	and ecological receptors at potential risk of hazard exposure. The SMP proposes self-monitoring, self-reporting and self-evaluation by the University, as this would reduce Cal EPA and DTSC regulatory oversight to mere occasional courtesy notice of activities. The SMP leaves management of soils largely in the hands of the University Office of Environmental Health and Safety (EH&S). The first component of the SMP is for EH&S to determine, with no DTSC oversight, if a proposed “project” involves soil disturbance and is required to be managed under the SMP. This determination is based on whether or not the project will impact less than 20 cubic yards (cy) of soil or 500 square feet (sf) of hardscape surface. Projects meeting or exceeding these thresholds are subject to the SMP, which means the soils must undergo characterization and be subject to on-site or off-site management, as appropriate. The SMP provides no justification for the 20 cy of soil and 500 sf of hardscape thresholds, nor does the SMP contemplate the possibility of projects impacting smaller amounts of soil containing very toxic levels of contaminants (such as PCBs or dioxins). These smaller projects would not require waste characterization and be subject to on-site or off-site management, as appropriate.	specific ongoing oversight and approvals from DTSC before a project proceeds to the next step of the process. At any point, DTSC may request additional information or require additional investigation by UC before the project proceeds. See response to C8.C2 with respect to the rationale for the 10 cubic yards of soil and the 500 square feet of hardscape criteria, as well as the prohibition of breaking up a larger project into smaller projects as a means to avoid having to implement the SMP. Also, as stated in the response to C8.C7, the SMP has been modified to clarify that the project area is the area described in SMP Form A. See response to C8.C15 regarding annual reviews, modifications, and documents associated with the SMP.

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	There is no guidance in the SMP as to what constitutes a "project" for purposes of SMP determinations. Under the SMP as written, a 200 cy "project" could be defined by EH&S as 11 separate projects, each impacting less than 20 cy of soil, and therefore none of the impacted soil would be subject to waste management requirements. In fact, EH&S would not even have to notify DTSC of projects impacting less than 20 cy of soil or 500 sf of hardscape. The SMP states that the University will conduct annual reviews of itself under the SMP. The University may choose to suggest improvements to the SMP process to DTSC, but DTSC is not required to review the University's adherence to the SMP outside of the 5-Year review of the RAW. Recommendation: Retain strict DTSC regulatory oversight of the UCRBC site contaminants. Recommendation: Do not allow the University to become self-monitoring and self-reporting.	
C12.C12 Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community	The Draft RAW SMP allows the University to perform minimal characterization of UCRBC soil during activities involving soil disturbance. The extent of sampling, if any, required under the SMP is to be determined based on the location of the "project." The SMP divides the UCRBC into 25 areas with designated sampling densities based on historical	The density of samples in a specific area is a function of historical activity in the area and the results of previous investigations. Low density sampling areas (125 foot sampling grid) are areas where no historical industrial activities have occurred. Medium density sampling areas (100 foot sampling grid) are areas where some historical industrial activity has occurred or are located adjacent to an area that has had a high

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Advisory Group [written comment]	activities on the UCRBC. More than a third of the 25 areas require only "low density" sampling under the SMP. (SMP, Table 3) Because the UCRBC is so poorly characterized, any soil disturbance must involve an extensive, high density grid of samples to determine the nature and extent of contamination. Recommendation: Require high density sampling of all soil disturbance events at the UCRBC.	level of historical industrial activities. High density sampling (75 foot sampling grid) is required in areas where a high level of historical industrial activity has occurred. In addition, known Site conditions within a project area is considered when the sampling design is developed to determine if additional sampling locations are needed, or if sampling locations should be moved to characterize a certain area. Factors that are considered include: existing buildings, utilities and site features; former buildings, remediated areas and known pyrite cinder areas; historical soil sampling locations; and recent sampling data, if available. In addition, paint applied to the exterior of buildings construction prior to 1993 are likely to have contained lead and lead-based paint may be present in the immediate vicinity of these buildings as a result of weathering or past renovations. Sampling for lead based paint in soil will be conducted if the project area includes a building that was constructed prior to 1993.
C12.C13 Stephen Linsley, Chair, Toxics Committee, Richmond Southeast Shoreline Area Community Advisory Group [written comment]	The Draft RAW proposes managing extensive yet-to-be identified and characterized buried pyrite cinders in place. (SMP, Section 5.2.2, p. C-33) Pyrite cinders are laden with high levels of arsenic and lead. Soil disturbances involving pyrite cinders should require sampling to determine the extent of impact these toxic cinders have had on the surrounding soils. Instead, the SMP states that "during soil disturbance activities that are not conducted to remove contaminated soil, excavated soils, including	In order for a chemical to pose a risk, a complete exposure pathway and a receptor must be present. If either the pathway is incomplete or the receptor is not present, the chemical would not pose a risk. Therefore, placement of the cinder material in a manner that prevents any exposure pathway would not pose a risk. Areas where cinder is encapsulated will be tracked to ensure that the cinder material remains isolated. UC will maintain a tracking system of these areas as was as other activities conducted under the Soil Management Plan as identified in response to C8.C6. Further, as required by guidance documents associated with the current Pyrite Cinder-containing

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	those mixed with cinders, may be deposited back into the original excavation, assuming there is no complete exposure pathway identified." (SMP, Section 5.2.2, p C-34.) Table 3-1 of the Draft RAW provides analytical results for pyrite cinders soils samples from the UCRBC, including arsenic results that are several orders of magnitude greater than the disputed "background" concentration of 16 mg/kg. (Draft RAW, Table 3-1.) Allowing such contaminated material to remain in place creates an unacceptable risk for all current and future users of the UCRBC Site. Recommendation: Fully characterize UCRBC to locate buried pyrite cinders as part of the RAP and remove all pyrite cinders to an off-site hazardous material landfill.	Soil Management Procedures approved by DTSC, any contaminated soil discovered during small excavations will be sampled for management and disposal and results will be reported in writing to DTSC.
C13.C1 Hector Rojas Senior Planner, City of Richmond Planning & Building Services (written comments)	Paraphrased: The City concurs with the statement found in both the Executive Summary and Introduction, "The California Department of Toxic Substances Control (DTSC) decision regarding the finalization of the RAW will take place only if the UC Regents approve the LRDP EIR following the UC California Environmental Quality Act (CEQA) process." The RAW will not be finalized until the Draft Long Range Development Plan Environmental Impact Report (LRDP EIR) for the RBC is approved and final land use plans	DTSC agrees, depending on whether the modification is minor or substantial, that additional review may be needed.

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	are compared to RAW actions and objectives. The City supports the RAW's acknowledgment that it may need modification following the UC CEQA process. At such time, additional review of those modifications may be advisable.	
C13.C2 Hector Rojas Senior Planner, City of Richmond Planning & Building Services (written comment)	Prior to implementing the traffic control and transportation plans outlined below, the City's Public Works and Engineering Departments will require review, comment and approval. Accordingly, the City recommends supplementing Chapter 5.1.12 of the RAW as follows on the next page, in order to achieve the state objective of minimizing disruption to the surrounding community: 5.1.12 Traffic Controls, Transportation Plan Transportation to and from the excavation area will be planned to minimize disruption to operations and to the surrounding community. Truck traffic will be controlled by radio or phone communication to control the number of trucks on stand-by at the excavation area, and en-route to the excavation area on local roads. Flagmen will be placed as needed to direct traffic on local roads surrounding the excavation area. All trucks must follow posted speed limits. The DTSC work notification for the project will include notification to the community regarding truck traffic associated with the excavation and off-site removal.	The proposed additional language has been included in the final RAW with the exception of the second to last sentence, which has been modified as follows, "DTSC will require that all removed and excavated soil will be transported from excavation sites according to all federal, state and local requirements." Because DTSC is not contracting with the hauling company, it cannot direct the truckers, instead DTSC can require that excavated soil be transported according to all federal, state and local requirements.

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	Contractors will prepare a transportation plan following contractor selection and contract award. All drivers will be provided with and will be required to maintain a copy of the transportation plan. DTSC will ensure that all removed and excavated soil will be transported from excavation sites in a manner that protects the human and environmental health of the community. DTSC will require impacted soils to be transported only along routes that avoid residential and business neighborhoods consistent with the proposed truck route in Figure 5-2 of the RAW. (emphasis added)	
C13.C3 Hector Rojas Senior Planner, City of Richmond Planning & Building Services (written comment)	For Section 5.1.13 Offsite Spill Contingency Plan, please add the City's Emergency Services Manager, Kathy Gerk, to the list of those to be notified in a spill or release scenario. The City Office of Emergency Services address is 440 Civic Center Plaza, Richmond, CA 94804, Phone Number 510-620-6866.	Ms. Gerk has been added to the list of persons to contact.
C13.C4 Hector Rojas Senior Planner, City of Richmond Planning & Building Services (written comment)	For Section 5.2.2 SMP Protocols, the City supports these procedures and requests additional notification to supplement the protocols. Specially, City requests that the SMP Protocols include a procedure for notifying the City when contaminated soil is proposed to be removed and/or removed from the site. More specifically, similar to the DTSC notification required on page 83 of the RAW, the City of Richmond would receive notification at least 14 days in advance of any field work	DTSC typically requires 14 days advance notification of site activities so that a work notice can be prepared and sent out to the community prior to the activity occurring. DTSC will continue to provide notifications to the community for activities occurring under the RAW, including the SMP. DTSC recommends that the City contact UC directly to discuss receipt of advance notification.

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	implementing the RAW. This will allow City staff to ensure that community members, particularly those living in the vicinity of the Former RFS Site, are informed about removal activities in a timely fashion.	
C13.C5 Hector Rojas Senior Planner, City of Richmond Planning & Building Services (written comment)	The City requests that it be provided with a copy of the Completion Report described on page 80 upon finalization of the Report.	Electronic copies of final completion reports will be made available to the public on DTSC's EnviroStor website located at: http://www.envirostor.dtsc.ca.gov/public/ DTSC recommends that the City contact UC directly to discuss providing the City with a hard copy of the final completion reports. Alternatively, electronic notification that documents are available for viewing or downloading from the EnviroStor website can be provided by signing up for E-mail Alerts by following the instructions found at the following link: http://www.envirostor.dtsc.ca.gov/public/SubscribeProcess.pdf.
C14.C1 Don Schnepf (verbal comment)	I think this presentation was a fraud. And the land-use covenants were double-talked. On one hand you said they're useless and on the other hand you're using them.	The purpose of the public meeting was to provide an overview of the draft Removal Action Workplan and to provide the community with the opportunity to ask questions and provide input. Land use covenants (LUC) are legally enforceable documents that have been used effectively by both DTSC and other state and federal agencies as one method to protect the public from unsafe exposures to contamination that is left in place. DTSC has adopted regulations to establish standards for cleanups where hazardous substances are left in place at levels not suitable for unrestricted land use. These regulations apply only to

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		DTSC, and require that LUCs be recorded at the county recorder's office so that they will be found during a title search of the property deed. The LUCs are also required to be signed by DTSC and the landowner, must "run with the land" i.e., are binding on current and subsequent property owners, and remain in effect in perpetuity unless modified or terminated in accordance with applicable law. The LUC for the site will clearly set forth and define the land use limitations and covenants
C14.C2 Don Schnepf (verbal comment)	Carbon tetrachloride. You've got many sites, many areas on the campus that have contamination of carbon tetrachloride, but you're only mentioning one. What about the others? The site has not been fully characterized.	See responses to C7.C4(b) and C8.C20 regarding characterization of the Site. Carbon tetrachloride is found in groundwater at the Site. The primary pathway of concern is for the carbon tetrachloride to volatilize from the groundwater into the soil (soil vapor), and then move into indoor air. Figure 2-9 of the RAW shows the sample locations where the concentrations of carbon tetrachloride in groundwater exceed the commercial remedial goals. The RAW includes a proposed remedy (monitored natural attenuation) for groundwater contaminated with carbon tetrachloride. There are no current or proposed development projects located in the areas where the groundwater remedial goal for carbon tetrachloride is exceeded. Groundwater sampling results support the finding that the carbon tetrachloride is not migrating off-site towards the Western Stege Marsh and the San Francisco Bay. In addition, groundwater at the Former RFS Site will continue to be monitored under the existing groundwater monitoring program as well as under the proposed long-term monitoring under the

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		RAW. The RAW addresses the Research, Education, and Support areas and groundwater throughout the portions of the Richmond Bay Campus within the RFS Site. Future investigation and recommended cleanup activities of soil, sediment, or surface waters within the Natural Open Space area will continue as required under the RFS cleanup order.
Ms. Hunter provided comments at two different times during the public meeting. Her comments have been collected here for convenience.		
C15.C1 Cinna Hunter (verbal comment)	I'd like to know if that presentation is available to the residents so that we can actually look at it together and go through it slide by slide and analyze what you've done such a great job on, because it went too fast for me.	Copies of the slide presentation were made available to the public during the public meeting held on December 5, 2013. In addition a copy of the presentation was also made available on-line at the UC Berkeley Richmond Field Station Environmental Web Site (http://rfs-env.berkeley.edu/index.html) on December 6, 2013.
C15.C2 Cinna Hunter (verbal comment)	I'd like to know why the Regatta parcel is not included. I really would, because Marina Bay backs up right against that. And if you're planning to excavate it and do whatever you're doing with it, I think it really directly impacts us.	The Regatta parcel is geographically distinct and separate from the RFS Site. There is no indication that it was historically associated with the California Cap Company, Stauffer Chemical or UC operations. As the Regatta property is included in the Long Range Development Plan, all mitigation measures identified in the Environmental Impact Report would apply to the parcel.
C15.C3 Cinna Hunter (verbal comment)	I'd just like to have you define a couple of things, one of which is "limited human intrusion" and "commercial use only".	While the specific phrase "limited human intrusion" is not used in the Removal Action Workplan (RAW), the RAW states that it is expected that human engagement and intrusion into native open space areas would be limited. The reasoning behind limiting human intrusion

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		into those areas is to protect, restore and maintain the resources in their natural condition. The future and current land use as described in the Richmond Bay Campus Long Range Development Plan (LRDP) was used to identify future land uses and persons who may be exposed to chemicals present at the Site. The LRDP identifies two land uses: 1) research, education and support; and 2) natural open space. The uses defined in the LRDP for research, education and support provide the criteria for a commercial use. Sensitive uses such as residences, day cares, hospitals, etc. are not considered commercial uses under the RAW.
C15.C4 Cinna Hunter (verbal comment)	Is this being taped so we can actually listen to your presentation?	No. The court reporter taped the meeting to assist in preparing the written transcript that is attached to this Responsiveness Summary.
C15.C5 Cinna Hunter (verbal comment)	Paraphrased: I understand why Marina Bay isn't currently included in the RAW. It would cost a ton of money to be able to test the soil, and what would they do if they found something? Are they going to level all of the buildings and transplant everybody? However, they do have to test.	Activities associated with the Marina Bay site are being overseen by DTSC. Information regarding the site can be found on DTSC's EnviroStor database at: http://www.envirostor.dtsc.ca.gov/public/ click on the "Site/Facility Search Tool" link and enter under "Site Code" 07370031.
C15.C6 Cinna Hunter (verbal comment)	I'm not as concerned about UC Berkeley spending the money. I feel that they have to spend the money to do it right; and they're not doing that right now.	See the response to C16.C2 and C20.C2, which describe how alternatives are evaluated.
C16.C1 Paul Carman (verbal comment)	I'd like to know the tonnage of soil that would be excavated under Soil Alternative 3, compared to the tonnage of soil that would be necessary to be excavated under 2. And I would like to know what the cost differential on	The soil excavation estimates and costs for each of the alternatives is found in Tables 4-2, 4-3, 4-7 and 4-8 in the RAW and are as follows: Mercury Fulminate Area: Alternative S-2: 24,024 tons

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	those two alternatives is.	of soil; total estimated cost: $7,541,003 Alternative S-3: 2,420 tons of soil; total estimated cost: $1,158,152 Corporation Yard: Alternative S-2: 62 tons of soil; total estimated cost: $257,957 Alternative S-3: 25 tons of soil; total estimated cost: $160,284 It should be noted that the costs associated with each of the alternatives does not take into account economies of scale that may be realized when implementation of activities may occur consecutively, but were calculated so that the alternatives could be compared to each other. A sentence was added to the section 3.2.5 of the RAW to clarify this point.
C16.C2 Paul Carman (verbal comment)	I'd like to know who makes the evaluation of what's too expensive and too costly to do.	The alternatives in the RAW are evaluated against each other based on effectiveness, implementability and cost. These criteria are used to identify major trade-offs between the remedial alternatives being evaluated, and are then balanced to identify the preferred alternative. Rather than determining if a remedy is "too expensive", remedies are evaluated based on their cost-effectiveness as required by federal law. A remedial alternative is considered cost-effective if its costs are proportional to its overall effectiveness.
C17.C1 Mary Selva, President of Richmond Annex Neighborhood	Our group is just wondering why we are having a public meeting on this so early, considering this big document has just been released and especially during the holidays. This is very tough for our community because our	The purpose of the public meeting is to provide information on the Removal Action Workplan and to receive public comment. Public comments can be submitted at any time during the comment period in writing via US mail or electronic mail, or the can be

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Council (verbal comment)	neighborhood council is not just working on this. Typically you would receive public comments closer to the due date of the written public comment period. We just feel that that it is too early and hard for us to ask questions. We won't have too many comments unless we actually read through the 400-plus-page document. Our advice would be to get these meetings closer and give the public time to review the document and then come to a meeting like this and receive the public comments.	provided orally or in writing during the public meeting. In this case, the comment period was extended from January 10 to January 17, 2014. DTSC appreciates the commenter's sentiment regarding the timing of the meeting. Release of the RAW was linked to the release of the draft Environmental Impact Report (EIR) of the Long Range Development Plan. Based on the date of the public hearing for the EIR and the approaching holidays, it was determined that having the RAW public meeting at this time would be more productive than holding it closer to the holidays.
C18.C1 Jean Robertson, California Native Plant Society (verbal comment)	While the groundwater monitoring wells may not be damaging to the coastal prairie or may be minimally damaging, we are concerned about careless equipment use, parking, heavy equipment, dirt storage, big dirt piles with weeds brought in and not dealt with. We want to have specific language in the RAW that really addresses this very specific concern.	DTSC agrees with the commenter. See response to C3.C1 with respect to including measures to protect the grasslands during monitoring well installation and soil stockpiling.
C18.C2 Jean Robertson, California Native Plant Society (verbal comment)	We would also like to have it clearly spelled out that things are going to be fenced off, that valuable prairie is going to be fenced off so the equipment won't accidentally be driving through it and parking on it and dumping dirt.	DTSC agrees with the commenter. Additional language has been added to Section 5.3.1.1 (Site Preparation) of the RAW to be consistent with Section 3.1.a of the Coastal Terrace Prairie Management Plan, included as Appendix G of the Final EIR. Fencing or other methods of demarcation will be used (in the event installation of fencing will cause a greater impact to the habitat area) to indicate the route that vehicles associated with the installation of the groundwater monitoring wells will be required to use. Vehicles will not be used to sample the wells. In addition, Section 5.1 (Pre-Excavation Activities) of the Soil Management

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		Plan was revised to include the same requirement if work will be conducted in or near the prairie or other habitat areas.
C18.C3 Jean Robertson, California Native Plant Society (verbal comment)	We want to know if any cleanup processes are planned for other meadows, not just that one big meadow in the upper corner.	There are no current proposals to conduct any cleanup activities in other native grassland areas of the Former RFS Site. Mitigation measures to protect the grasslands are identified in the Environmental Impact Report (EIR) for the Long Range Development Plan. Mitigation measures identified in the final EIR also apply to the RAW when work to install or sample groundwater monitoring wells is occurring. Except for groundwater found beneath the grasslands, habitat areas of the Former RFS Site are not included in the RAW. Those areas will be investigated as part of the Natural Open Space (NOS) within the Phase IV investigation under the current DTSC RFS Order. If the investigation finds that cleanup measures will need to be taken, the applicable remedy document will be prepared and a public comment period will be held.
C18.C4 Jean Robertson, California Native Plant Society (verbal comment)	When will the work in grassland area be done?	The RAW can be approved after the EIR for the Long Range Development Plan is approved. If the approvals occur as currently envisioned, the field work in the grasslands would occur in late summer. Regardless of when work occurs, it will be scheduled during dry conditions to minimize impacts to the grasslands.
C19.C1 Eric Blum (verbal comment)	Paraphrased: Is the plan in the RAW to remove contamination except for a few spots that are going to remain. And you're going to monitor it over time to see if it just naturally goes away? And if you're not successful, they you would reevaluate and do go to the next most stringent level? What is the time frame	Only the carbon tetrachloride contamination in groundwater is being considered for natural attenuation. Natural processes would be allowed to break down the contamination to the point where the concentrations of carbon tetrachloride are below the cleanup goals. The concentrations in groundwater will be monitored and evaluated on at least a yearly basis

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	for that?	to determine if this breakdown is occurring. If it is observed that this is not occurring, then an evaluation would be made to determine if additional measures, such as in-situ bioremediation is necessary. For soils, this strategy is not being proposed. Soil excavations in specific locations are proposed in the RAW. Also, soil sampling will be conducted in development areas before any construction activities are allowed. If soils are found to exceed cleanup goals, the soil will need to be managed as specified in the Soil Management Plan.
C19.C2 Eric Blum (verbal comment)	Paraphrased: Why hasn't the entire area been characterized first so that you know where the contamination is and you can form a plan to clean up the hot spots?	See response to C7.C4(b) and C8.C20. Under the oversight of the San Francisco Bay Regional Water Quality Control Board (RWQCB) site investigation and cleanup were previously conducted. When DTSC became the environmental oversight agency, the University of California was required to prepare a Current Conditions Report summarizing the work done under the RWQCB and identifying areas that needed additional investigation based on previous land uses and practices. A phased approach was used to conduct investigations to address those data gaps. Phases I, II and III were conducted in the upland developable areas of the property. The results of those investigations, along with information collected earlier were used to prepare the RAW. It is typical to target sampling activities in areas where there is known or suspected contamination. Areas known to contain chemicals above cleanup goals are included in the RAW, (i.e., the Corporation Yard, Mercury Fulminate Area and PCB Areas) and proposed remedial

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		alternatives are included. Because redevelopment of the Site is expected in the future, a Soil Management Plan was also prepared to ensure that additional sampling is conducted prior to development. (See also response to C7.C4(c) regarding the objectives of the Soil Management Plan) If the sampling results indicate that contamination is present, the area will need to be properly remediated. The Soil Management Plan requires that cleanup goals be re-evaluated yearly to ensure that the most up to date goals are being used. This is especially crucial since the development is planned to take place over the next 50 years.
C19.C3 Eric Blum (verbal comment)	We know that the cap company operated at the site and Zeneca is located next door with all of its levels of pollution, doesn't it make sense to be a little bit extra-aggressive because there are areas that you don't know whether they are polluted or not? We only went after the ones that we already suspected, but there are large areas where we have no idea. So how can we, in good conscience knowing the activities that went on here just leave it that way?	See response to C7.C4(c) and C19.C2. The purpose of the Soil Management Plan is to ensure that contamination is not missed prior to redevelopment of the property, provide a framework to prohibit uncontrolled soil excavation or soil disturbing activities and to ensure that activities do not adversely impact human health or the environment.
C19.C4 Eric Blum (verbal comment)	I'd just like to say, going forward, as a member of the community here, I would love to support the project. And I hope you're willing to work with us. And I hope that you've heard tonight that a lot of people would really like to see better characterization and a more aggressive cleanup and then we can get behind your project.	Comment noted.
C20.C1	I feel like you've glossed over the very serious	See response to C7.C4(b) and C8.C20 with respect to

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Dan Schwab (verbal comment)	nature of the history and pollution of this property, making it sound a little bit like it's Disneyland and everything's going to be groovy because we have done our assessments. Those of us in the community are quite clear that you have not done thorough assessments or taken into account the very real and very serious environmental injustice that has happened in this community in the past as a result of the actions of the Zeneca Corporation and others, which by the way is directly adjacent to the UC Property. And I for one don't believe for a moment that we can address the pollution issues on the field station without at the same time addressing those of the Zeneca property.	the site characterization that was conducted at the Site. The RAW, that is the subject of the comment period, is limited to the Former RFS Site. Activities to remediate the Zeneca property, including the groundwater contamination that has migrated from Zeneca to the Former RFS Site, will be included in a separate cleanup document for the Zeneca property as required by DTSC's site investigation and remediation order.
C20.C2 Dan Schwab (verbal comment)	I was really concerned when you said that the soil removal was not recommended due to cost. Is that really the best reason why we cannot clean-up this property to residential standards – not commercial standards?	Cleanup alternatives are evaluated against each other based on the following factors: effectiveness, implementability, and cost. Effectiveness is the ability of the remedial technology or alternative to achieve the remedial action objective within a reasonable amount of time. Key aspects of this alternative include overall protection of human health and the environment, compliance with applicable laws and statutes, short-term effectiveness on human health and the environment, long-term effectiveness, and the degree to which the action reduces the toxicity, mobility and/or volume of the contamination. Implementablity is evaluated based on the both the technical and administrative feasibility of implementing the alternative. Cost includes the direct and indirect capital costs, and annual operation and maintenance costs.

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		Each remedy is first evaluated individually based on these three factors, and then alternatives are compared to each other using the same three factors. A single factor is not used to select a proposed alternative, but rather all three factors must be considered together.
C20.C3 Dan Schwab (verbal comment)	I for one would appreciate if the University would take a look at this current draft RAW and take a big step back and make sure all of these questions have been thoroughly addressed rather than trying to jam this through with only a month's public comment. If the pollution of this property really goes back to the 1870s, as you said, what's the big rush? What if it takes us another six months or a year or two or ten to make sure that all of the issues of this property have been thoroughly addressed and this doesn't just become another time bomb by San Francisco Bay?	See the response to C7.C4(b), C8.C20 and C19.C2 with regards to characterization of the Site contamination and the use of the Site Management Plan to address future contamination. The public comment period for this RAW was originally 45-days long (November 26, 2013 to January 10, 2014) and was later extended an additional seven days (January 27, 2014) for a total of 53 days. A typical comment period for a RAW is 30 days; therefore, DTSC believes that this provided sufficient time for the public to review and provide comments to the RAW.
C21.C1 Beryl Golden (verbal comment)	If cost were not an issue, if you would only consider feasibility, what would you recommend?	See the response to C20.C2. Three factors are required to be taken into consideration when evaluating cleanup alternatives and are not considered alone.
C22.C1 Andrea Kean (verbal comment)	I was curious about the movement of groundwater. I know carbon tetrachloride is a solvent and I know solvents move. And I would assume that the water that we're talking about, the groundwater, moves too. And I know this is a hydrologically active area. And there's tides and there's drainage to the Bay. So I wonder if you could clarify those questions.	Carbon tetrachloride is a solvent that was used as a degreaser. Groundwater at the Site generally moves from the north to the southwest and towards San Francisco Bay. Groundwater migration is a potential mechanism to transport contamination; however, there is no current indication of groundwater contamination above action levels except for a localized area of carbon tetrachloride in the Natural Open Space (northwestern area of the Site) and a singular exceedence in 2010 of trichloroethene near the southeastern Site boundary.

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		The extent of the carbon tetrachloride contamination in groundwater in the northwest portion of the site is being monitored by testing the groundwater from monitoring wells. The closest location to a surface water body where carbon tetrachloride was found in a groundwater sample is approximately 1400 feet from Meeker Slough. Tidal influence from San Francisco Bay to groundwater at this site is expected to be limited to within approximately 100 feet of the existing site shoreline. Therefore, tidal activity is not expected to directly impact the carbon tetrachloride plume.
C22.C2 Andrea Kean (verbal comment)	Is this also true for the substantive contaminants in the ground – soil – as well? Are they stable in soil?	The soil contaminants at the Site are primarily metals, although there are also PCBs and polycyclic aromatic hydrocarbons (PAHs) in the subsurface soils. All of these compounds typically do not break down very rapidly and are not very mobile in soil. PCBs, PAHs, and most metals in the soils at the Site have been found in the upper two feet. An exception is mercury, which has been detected down to 19 feet below the ground surface in the Mercury Fulminate Area at low levels ; however, mercury has not been detected in groundwater at levels exceeding the federal or California maximum contaminant level (MCL) drinking water standard at piezometer MFA, which is directly downgradient of the MFA. Per the RAW, soils in the Mercury Fulminate Area will be excavated to approximately 10 feet below the original ground surface, or until groundwater is encountered, in order to meet cleanup goals.
C23.C1 David Spinner	Paraphrased: There was a recent report on the local news about the discovery of	The reports in the local news are associated with a different site, located approximately 0.4 miles east of

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(verbal comment)	radioactive materials, or purported radioactive materials. I was curious about how flexible the RAW is, whether it can be adapted as the situation just keeps evolving. Once you begin the process what if you uncover something else? Why hasn't there been a discussion about radioactive materials if they've been found?	the Former RFS Site. Flexibility is provided for future development projects, as the Soil Management Plan, which is a part of the RAW, requires that a Sampling Design Plan be prepared that describes the specific project and sampling details, and that the plan takes into account known conditions within the project area. The purpose of the Sampling Design Plan is to ensure that the appropriate sampling is being conducted during development of the each of the specific projects. With respect to current use of radioactive isotopes at the Former RFS Site, the isotopes are primarily used as tracers by researchers and are all overseen under a permit from the California Department of Public Health (CDPH). When the University makes a decision to stop using radioactive material in a particular building, the University goes through a decommissioning process with CDPH, that includes testing and cleanup if necessary.
C23.C2 David Spinner (verbal comment)	My comment is please test for radioactive materials in soil.	See the response to C8.C22 and C23.C1 with regards to testing for radioactive materials.
C23.C2 David Spinner (verbal comment)	Do exposure limits pertain only to site workers and if so, why are RFS employee exposures not included?	Risk-based concentrations were calculated for commercial and maintenance workers (both commercial and maintenance workers are RFS employees, but who have different jobs), and construction workers. The appropriate cleanup goal will be based on the group of persons who may potentially be exposed to the contaminant. See response to C11.C1 regarding the evaluation of all likely receptors during the cleanup process.
C24.C1	The first (comment) has to do with the total	Risk based concentrations were calculated for each

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Stephen Linsley (verbal comment)	polychlorinated biphenyls, on Table ES1 and the table on page 25. Why is the receptor commercial worker standard listed as 1.59 when in the text the standard is listed as 0.528 for the risk-based concentration?	potential chemical of concern at the Site. Three different PCB aroclors (Aroclor-1248, -1254, and -1260) were identified at the Site and a risk based concentration value of 0.528 mg/kg was calculated for each of the individual aroclors. As stated in footnote "b" of the Remedial Goals table in the RAW, the receptor specific risk based concentration is the sum of the individual RBCs for the three aroclors.
C24.C2 Stephen Linsley (verbal comment)	The second question has to do with the benzo(a)pyrene equivalents. Why is the criteria that is listed as the remedial goal is footnoted as being from the Richmond Bay background concentration when in fact it is derived from some sort of DTSC background of urban soils throughout Northern California, which has nothing to do with the Campus Bay or Richmond Bay Campus. And it was the 95th percentile, which means that only 5 percent of soils in urban areas in Northern California would be worse than that.	The commenter is correct. Footnote d of Table ES-1 should cite the *Background Levels of Polycylic Aromatic Hydrocarbons in Northern California Surface Soil*, June 7, 2002 as the source for the background value. The modification to all applicable footnotes has been made in the RAW.
C24.C3 Stephen Linsley (verbal comment)	Why was the choice made to use the risk-based mercury concentration for commercial workers instead of construction workers?	See the response to C23.C3 regarding the selection of the mercury cleanup goal.
C25.C1 Sherry Padgett (verbal comment)	Overall and in general, I recommend that the cleanup level be changed to an unrestricted standard to allow children to be safe on the site. This is a school, after all.	See response to C1.C1. The future proposed use of the Site does not include a school for children under the age of 18 years.
C25.C2 Sherry Padgett (verbal comment)	Fully characterize the site to fill in serious data gaps, as we noted in 2007.	See the response to C7.C4(b), C8.C20 and C19.C2 with regards to data gaps and site characterization.
C25.C3 Sherry Padgett	Prepare a health risk assessment that includes the entire site. Do not piecemeal the health	The Site Characterization Report (available at: http://www.envirostor.dtsc.ca.gov/public/final_documen

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(verbal comment)	risk assessment by carving out some of the highest level of risk in the open-area carbon tetrachloride hot spot.	ts2.asp?global_id=07730003&doc_id=60253545) includes as an appendix a Human Health Risk Assessment (HHRA) for the developable portions of the Site as defined by the proposed LRDP. First, risk-based concentrations were developed for every chemical detected in soil and groundwater at the Site and for the different site receptors (e.g., commercial worker, maintenance worker, etc.). Each risk-based concentration was calculated to represent a target cancer risk of one in one million and a non-cancer hazard index of 1. The HHRA was conducted in two steps. Step 1 evaluated chemical concentrations at the Site against the risk-based concentration s. Section 8.2 of the Site Characterization Report describes the results of the evaluation. Step 2 of the HHRA was a quantitative, focused HHRA of only those areas of the Site for which adequate data were available to conduct an assessment. Carbon tetrachloride groundwater contamination was evaluated based on potential vapor intrusion exposures. Each individual groundwater point was compared to the commercial risk-based concentration to determine where vapor intrusion may exceed a risk of one in one million. A separate ecological risk evaluation will be conducted on the upland habitat areas after the Phase IV sampling is completed.
C25.C4 Sherry Padgett (verbal comment)	And this goes to your concern about the grasslands. And I'm really sorry for the conflict here, but I think we really need to remove the carbon tetrachloride source, which is in – likely, in that open area where the grasslands are, so there's a hot spot out there right now	Sampling in the grassland areas will be conducted as part of the Phase IV investigation. After the investigation is complete and the data has been evaluated, DTSC will determine what next steps are necessary. It is premature at this point to assume that disturbance of the grasslands will be occurring.

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	you're going to leave as is. So we have a conflict surfacing, as that open area is going to be kept an open area. Then that means we can't go in and clean it up because it's an open area. So I'm not sure how to get through that closed loop.	
C25.C5 Sherry Padgett (verbal comment)	Do not follow through with the open-seed proposal to dig up contaminated soil from one part of the property to relocate and bury elsewhere. The community has very current and fresh experience with the field station forgetting about and overlooking piles and piles of dug-up, uncovered contaminated soil until we ask about them. We have the same experience repeated again and again on the Zeneca site, including mountains of soil dug up from one place, located at another, with hazardous waste levels of arsenic.	The Soil Management Plan states that soils that do not exceed Category I criteria (less than risk-based concentrations, background, ambient or TSCA criteria for PCBs) may be reused within the Soil Management Plan project area. Category I criteria are protective of commercial works and visitors to the Site. Soils that exceed Category I criteria but that do not exceed Category II criteria (generally equivalent to one order of magnitude greater than Category I criteria) may be managed in place within the project area with an appropriate cover, such as a roadway, parking lot, or a minimum of two feet of clean soil. Soils that exceed Category II criteria will be evaluated for off-site disposal. The Soil Management Plan has been modified to clarify that the project area is the area described in SMP Form A. The Soil Management Plan also includes handling and storage requirements for wastes (both hazardous and non-hazardous) generated during excavation and investigation activities.
C25.C6 Sherry Padgett (verbal comment)	Revise the document to include removal – complete and total removal- of VOCs and other groundwater-recontamination source material.	Four different alternatives were developed for the carbon tetrachloride groundwater area. Each alternative was individually evaluated and also evaluated against each other based on the three factors: effectiveness, implementability and cost. Based on the analyses, Alternative 4, monitored natural

Commenter	Comment	Response
		attenuation with land use covenants was selected as the proposed alternative. For the VOCs located along the eastern boundary of the Site, remediation will be covered by DTSC's investigation and remediation order to the responsible parties for the Zeneca Site. See also response to C8.C20 and C12.C6.
C25.C7 Sherry Padgett (verbal comment)	As stated in 2007 regarding the Current Conditions Report, the draft RAW is based on incomplete data. The remediation goals are not protective of human health and, especially children. And we'd really, really appreciate it if you would go back to the drawing board.	DTSC approved the Current Conditions Report because the report adequately identified past uses of the property, previous site investigations and remedies implemented, as well as data gaps. The information obtained from more recent site investigations were used along with historical information to develop the additional phases of investigation. The cleanup goals identified in the RAW were developed based on the future use of the property as identified in the draft LRDP (i.e., commercial land use). As stated in response to C1.C1, C5.C1 and C12.C8, the goals developed for the commercial worker would also be protective of a child who may occasionally visit the Site.
C26.C1 Carolyn Graves (verbal comment)	Why only look for toxics in areas where they are expected to be? And why only look for some toxics?	Site investigations are typically conducted based on evidence that a certain process or types of chemicals were used at a site. If information is available where manufacturing or waste storage areas were located, targeted sampling is conducted in those locations as it is more likely that if a contaminant was released to the environment it would be detectable at those locations. For example, the University of California first conducted a site-wide groundwater evaluation based on the assumption that if a release had occurred to the soil, it would have most likely occurred before environmental laws were enacted, and therefore the contaminant would have had time to migrate to the shallow

Commenter	Comment	Response
		groundwater. Historical locations of electrical transformers were also targeted for investigation. As the fluids in transformers formerly contained PCBs, soil samples around the transformers were analyzed for PCBs. The results of the investigation revealed that some transformers had leaked PCBs above cleanup goals onto the soil and these areas are proposed for excavation in the RAW. In other areas where hazardous wastes were known to be stored, analysis for a variety of chemical groups was included. Due to the variety of uses in the Corporation Yard, samples were located throughout the area to determine if contaminants were present in the soil. Areas that were found to exceed soil cleanup goals are proposed for excavation in the RAW.
C26.C2 Carolyn Graves (verbal comment)	We think they should search not only for the list of things that Zeneca is searching for, but also look for radioactivity. UC has its own dumpsite that it established itself which is generally called "the bulb." They've done very limited testing, probably because they don't want to hit something. A UC worker from the 50's and 60's there got classic symptoms of radiological poisoning when they were dumping barium barrels there.	See the response to C23.C1 regarding general analysis for radionuclides. The "bulb" area is not included in the draft RAW, but investigation of the possible buried drums will be included as part of the Phase IV investigation. DTSC and University of California staff have interviewed the former worker to gather information. The specific content of the drums was not provided except that in one drum the contents resembled large rocks. DTSC previously conducted an investigation at the first location (known as Meeker Beach) identified by the former worker and did not find any evidence of buried drums. This area was not located at the Former RFS Site. The report documenting the investigation can be found at: http://www.envirostor.dtsc.ca.gov/public/final_documents2.asp?global_id=70000176&doc_id=6009555
C26.C3	Another comment is the marsh cleanup that	Western Stege Marsh is not included in the RAW;

Commenter	Comment	Response
Carolyn Graves (verbal comment)	they're so proud of talking about. They dug it up, but they had to bury it back in before they were done because of the bird season coming in. And recent testing – well, testing since the 2000s found that the toxics are back at even higher levels. So don't call it a cleanup. It's not clean.	however, remediation of the marsh was conducted and completed under the oversight and order of the San Francisco Bay Regional Water Quality Control Board (RWQCB) between September and December 2002, and August 2003 and February 2004. The University was required by the RWQCB and federal permits to conduct monitoring activities of the marsh cleanup. UC conducts annual sediment sampling in the restored portion of Western Stege Marsh. Data do not indicate that contaminants are at higher levels than previously encountered or that contaminant concentrations are increasing. In addition, future sampling activities associated with Western Stege Marsh will be conducted under DTSC oversight pursuant to the RFS cleanup and investigation order.
C26.C4 Carolyn Graves (verbal comment)	The RAW describes UC RFS staff taking over the primary role of oversight and DTSC only approving documents. This is really wrong. DTSC has the expertise on testing for toxics, not UC. In addition, there is a major problem with transparency. It should be independent review by a state agency, not UC.	See the response to C8.C5, C8.C15 and C12.C11 regarding the Soil Management Plane (SMP). In general, the SMP outlines prescriptive protocols to be followed for soil sampling, data analyses, soil management actions or disposal practices, and final reporting. DTSC will be kept informed through the submittal of SMP forms. If UC desires to vary from the protocols, DTSC approval must first be obtained. At any time in the process, DTSC may request more information or meet with UC to discuss the project. The RAW has been revised to require that Form B be submitted to DTSC after internal approval is completed. In addition, see response to C8.C1 regarding current and future public participation activities associated with the RAW, including the SMP.
C27.C1 Jaine Gilbert	My main concern is about the wetland habitat and coastal prairie, and the clapper rail. I am	Mitigation measures are included as part of the Long Range Development Plan (LRDP) to protect the

Commenter	Comment	Response
(verbal comment)	mainly concerned about the open space and how much of that is going to be helpful for the ecology of the watershed of the area.	wetland habitat, coastal prairie, clapper rail and other sensitive habitats and species present at the site. Mitigation measures include a Coastal Terrace Prairie Management Plan whose implementation will commence with the adoption of the LRDP. Activities included in the Removal Action Workplan (RAW) are required to follow those mitigation measures. In addition, the removal activities included in the RAW will add to the protective measures.
C27.C2 Jaine Gilbert (verbal comment)	There's been a lot of talk about excavation as the main way to clean up contaminated soils. But I'm interested in whether or not if techniques such as micro-remediation has been considered or other techniques that use plants that absorb toxics from the soil so that there's less disturbance of the soil, which, obviously, when you disturb the soil that causes problems for humans as well as wildlife.	The commenter is correct that there are methods other than excavation to remediate contaminated soils; however, those methods may not be effective at a site. In the RAW, Table 3-3, Preliminary Screening of General Response Actions and Process Options for the RES Area Soil, includes an evaluation of in-situ treatment methods, that is, treatment that can be done without digging up the soil. The methods evaluated included solidification and stabilization (mixing in material that will solidify the soils in place), electrokinetic separation (application of low-intensity direct current to the soil between electrodes, causing ions and water to move towards the electrodes), vitrification (applying high temperature treatment to the soil that reduces the mobility of metals by incorporating them into a vitreous mass), soil flushing (a solution is injected into an area of contamination that mobilizes the contaminants, and then the contaminant-bearing flushing solution is collected and pumped to the surface for treatment or disposal) and phytoremediation (plants are used to remove, transfer, stabilize or destroy contaminants in the soil). The effectiveness, implementability and cost of each of these different

Commenter	Comment	Response
		technologies are evaluated in this table. Each of the technologies was eliminated from further evaluation because of limited effectiveness or implementability. For example, Phytoremediation was determined to have limited effectiveness because plants may accumulate high levels of metals and require treatment prior to disposal, and was found to have low implementability as a large number of plants over the treatment area would likely be required.

Attachment A

Fact Sheet, Public Notice and Notice of Extension

COMMUNITY Notice

The mission of DTSC is to protect California's people and environment from harmful effects of toxic substances through the restoration of contaminated resources, enforcement, regulation and pollution prevention.

UC Richmond Draft Removal Action Workplan Available for Public Comment

Why This Notice?

The California State Department of Toxic Substances Control (DTSC) announces that a Draft Removal Action Workplan (RAW) for the proposed University of California (UC) Richmond Bay Campus is available for public comment. The RAW addresses a part of the proposed Richmond Bay Campus (RBC) property known as the Richmond Field Station (Site) located at 1301 South 46th Street in Richmond, California.

The Environmental Impact Report (EIR)

The activities identified in the draft RAW are also outlined and analyzed in the Draft Environmental Impact Report (EIR) for the proposed RBC Long Range Development Plan (LRDP). UC is conducting a **separate public hearing** in accordance with the California Environmental Quality Act on the Draft RBC LRDP EIR, **December 11, 2013, 7 to 9 pm at the Richmond City Council chambers, 440 Civic Center Plaza in Richmond.** The public comment period on the Draft RBC LRDP EIR extends from November 15, 2013 through January 13, 2014. Comments on the RBC LRDP EIR may be emailed to *rbc@lbl.gov.* Information regarding the EIR, including notice of availability, review period, and public hearing date is provided at:

http://richmondbaycampus.lbl.gov/environmental_documents.html

This fact sheet provides:

- a Site history,
- summary of the proposed cleanup,
- opportunities for public involvement.

DTSC invites you to review and comment on the Draft RAW for the Richmond Bay Campus (RBC) property known as the Richmond Field Station (Site).

Public Comment Period

November 26, 2013 to January 10, 2014

Please submit your comments by **5 pm January 10, 2014** to:

Lynn Nakashima
DTSC Project Manager
700 Heinz Avenue
Berkeley, CA 94710
or *Lynn.nakashima@dtsc.ca.gov*

RAW PUBLIC MEETING:
December 5, 2013,
6:30 to 8:30 pm
Richmond Field Station,
Building 445
Richmond, California

This meeting will provide an opportunity for the community to ask questions, provide input, and learn more about the draft RAW.

For information about public participation, please contact:

Wayne Hagen, DTSC Public Participation Specialist
(510) 540-3911 or
Wayne.hagen@dtsc.ca.gov

History of the Site

The Site is located at 1301 South 46th Street in Richmond, California, along the eastern shoreline of the Richmond Inner Harbor. The Site was owned by the California Cap Company from the 1870s to the 1940s. UC purchased the property in 1950 to house expanding research and academic programs and is cleaning up contamination from previous industrial activities at the Site.

The California Cap Company manufactured blasting caps, shells, and explosives on portions of the Site. The main contaminants identified during initial studies were metals from a former mercury fulminate manufacturing plant, and pyrite cinder waste from sulfuric acid production at the former neighboring Stauffer Chemical plant. The metals include arsenic, cadmium, copper, lead, mercury, selenium, and zinc.

UC Berkeley previously removed contaminants from the Site. In 2002, a large amount of contaminated soil was excavated, treated, and transported off-site for disposal. The excavated areas were restored and are now a native marsh and coastal terrace prairie. In 2005, continued investigation and remediation oversight was transferred to DTSC.

UC Berkeley conducted soil and groundwater investigations between 2010 and 2012 to further characterize site conditions. The results were compiled into a Final Site Characterization Report, which includes a risk assessment. The findings of this document support the final cleanup actions for the Research Education and Support (RES) Area and groundwater.

What is the Contamination?

Based on the information collected, further action is required due to the elevated concentrations of mercury, pyrite cinders-related metals (arsenic and lead), polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH), and dioxins detected in soil, as well as carbon tetrachloride and trichloroethylene (TCE) in groundwater.

What Can Be Done to Clean It Up?

The objective of a draft RAW is to evaluate cleanup alternatives and to identify a preferred cleanup plan which prevents or reduces risks to public health and the environment. Cleanup alternatives are evaluated on the basis of their effectiveness, ability to be implemented, and cost. A draft RAW identifies the cleanup plan that DTSC recommends. Before DTSC makes a final decision to approve or modify a cleanup plan the draft RAW is made available to the public for review during a public comment period. All comments are reviewed and considered before the RAW is approved.

Cleanup Alternatives Considered

Four soil alternatives were identified for the Mercury Fulminate Area (MFA), Corporation Yard, and remainder of RES Area within the Site; a fifth capping alternative was evaluated at the MFA only. An evaluation of alternatives for PCB cleanup was not conducted since excavation and removal is an acceptable alternative.

Four groundwater alternatives were identified to address the carbon tetrachloride. The remedy for TCE in groundwater originating from the former Zeneca Site, is subject to the former Zeneca Site Order and was not evaluated in this draft RAW.

Soil Aternatives

Soil Alternative 1, No Action: Under the no-action alternative, no actions would be taken at the site. Soil would be left in place without any actions.

Soil Alternative 2, Excavation to Unrestricted Reuse and Off-site Disposal: This alternative involves the excavation and disposal of all pyrite cinders and soil in the RES Area containing chemicals at concentrations greater than unrestricted risk-based concentrations.

Soil Alternative 3, Excavation to Commercial Reuse, Off-site Disposal, Land Use Controls, and Soil Management Plan (SMP): This alternative involves excavating soils above commercial cleanup goals, or managing soils above commercial standards so that they are not accessible. Land Use Controls (LUCs) related to soil will be required to restrict use of the Site. An SMP would guide soil sampling and handling during future construction activities.

Soil Alternative 4, Land Use Controls: This alternative would restrict use of the property to prohibit certain activities or uses that would expose people to contamination. The LUCs would be composed of the deed restrictions summarized in Soil Alternative 3. Under this alternative, soil would be left in place without implementing any containment, removal, or treatment actions.

Soil Alternative 5, Asphalt Cap, LUCs, and SMP (MFA only): This alternative involves construction of a single-layer asphalt cap over the areas containing mercury at concentrations greater than the cleanup goals.

Groundwater Alternatives

Groundwater Alternative 1, No Action: Under this alternative, no actions will be taken at the site. Groundwater would be left in place without taking any action.

Groundwater Alternative 2, Permeable Reactive Barrier, LUCs, and Groundwater Monitoring: A funnel and permeable reactive barrier would be designed to treat carbon tetrachloride in groundwater as the groundwater moves through the barrier. LUCs would consist of a deed restriction prohibiting the use of groundwater. This alternative would include groundwater monitoring.

Groundwater Alternative 3, Bioremediation, LUCs, and Groundwater Monitoring: The treatment system would consist of installing approximately 15 to 25 injection point wells within the carbon tetrachloride plume to anaerobically biodegrade carbon tetrachloride in groundwater. LUCs would consist of deed restrictions and monitoring.

Groundwater Alternative 4, Monitored Natural Attenuation and LUCs: Monitored natural attenuation (MNA) refers to the reliance on natural processes to achieve cleanup objectives. This alternative would include installing monitoring wells around the contamination. This alternative includes groundwater monitoring, as well as contingency cleanup measures. LUCs would consist of deed restrictions and reporting.

DTSC Recommended Alternative

DTSC recommends **Soil Alternative 3** and **Groundwater Alternative 4** as the preferred cleanup alternatives for the RES Area and groundwater at the Site. The recommended soil alternative also includes cleanup of PCB-impacted soil. The recommended groundwater alternative also includes continuing an ongoing Site-wide monitoring program. DTSC believes that these alternatives protect human health and the environment, are cost effective, and can be readily implemented.

California Environmental Quality Act (CEQA)

The draft EIR for the proposed RBC LRDP includes discussion of the potential environmental impacts of RAW activities and related LRDP mitigation measures. UC is the lead agency for the EIR that examines the overall effects of implementation of the RAW for purposes of CEQA. DTSC is the responsible agency for the RAW activities. The responsible agency is the public agency which proposes to carry out or approve a project, for which a lead agency has prepared an EIR. The EIR provides information that will inform DTSC decision-making on the actions identified within the RAW. DTSC will document its review of the EIR and responsible agency approval through completion of the CalEPA Responsible Agency Checklist.

What Happens Next?

The draft RAW is not final until all comments from the public are considered. At the end of the public comment period, the comments are evaluated and any necessary changes are made to the RAW. Additionally, DTSC will consider all comments regarding the draft EIR. A Response to Comments document will be sent to all of

How Can I Find Out More?

Information Repositories

DTSC has established the following information repositories for this Site:

Department of Toxic Substances Control
700 Heinz Avenue, Berkeley, CA 94710
Call for appointment (510) 540-3800

Richmond Public Library
325 Civic Center Plaza, Richmond, CA 94804
(510) 620-6554

DTSC's Enivorstor Website: *http://www.envirostor.dtsc.ca.gov/public.* Click on "Site/Facility Search" and enter "Richmond" as the City then click "Get Report." Find the "UC Richmond" Site then click on the "Report" link..

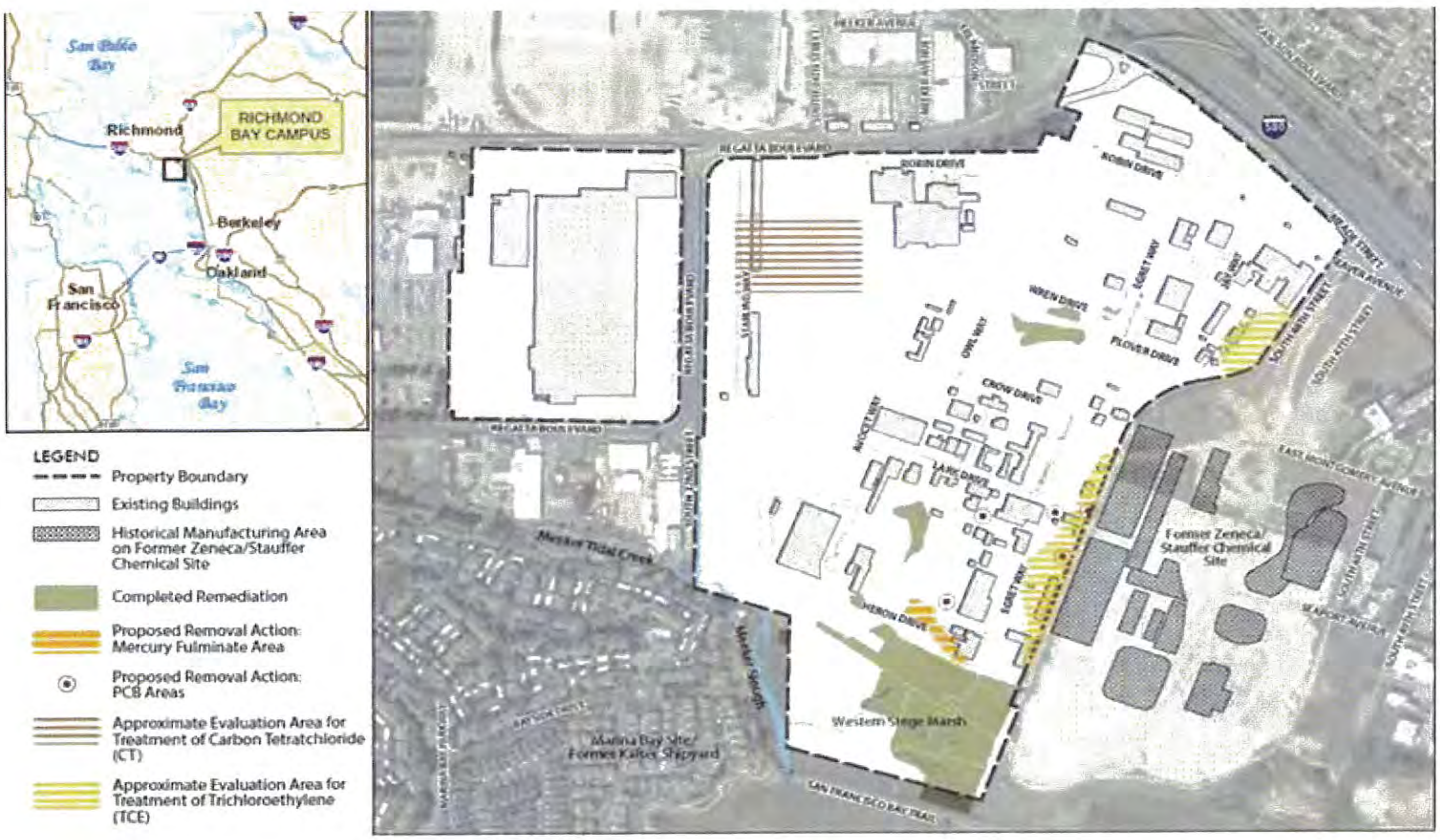
If you also would like DTSC to notify you via email when new Envirostor documents are available online, please sign up to receive email alerts on the EnviroStor report page.

Contact Information:

For questions: Lynn Nakashima, DTSC Project Manager (510) 540-3839 or *Lynn.Nakashima@dtsc.ca.gov.*
For public participation: Wayne Hagen, DTSC Public Participation Specialist (510) 540-3911 or *Wayne.Hagen@dtsc.ca.gov.*
For media inquiries: Sandy Nax (916) 327-6114 or *Sandy.Nax@dtsc.ca.gov.*

All documents made available to the public by DTSC can be provided in an alternative format (i.e. Braille, large print, etc.) or in another language, as appropriate, in accordance with State and Federal law. Please contact the public participation specialist for assistance.

Si prefiere recibir la información en español o hablar con alguin en español acerca de esta información, favor de llamar a Especialista en Participación Pública de el Departmento de Control de Substancias Tóxicas. El numero de telfono es (510) 540-3877



Public Notice

The mission of DTSC is to protect California's people and environment from harmful effects of toxic substances through the restoration of contaminated resources, enforcement, regulation and pollution prevention.

Draft Removal Action Workplan Available for Proposed UC Richmond Bay Campus

Public Comment Period: November 26, 2013 – January 10, 2014

WHAT IS BEING PROPOSED? The California Department of Toxic Substances Control (DTSC) invites the public to comment on the Draft Removal Action Workplan (RAW) for the proposed UC Richmond Bay Campus. The RAW addresses contamination within the Richmond Field Station property (Site), located at 1301 South 46th Street in Richmond, California. From the 1870s to the 1940s; blasting caps, shells, and explosives were manufactured by the California Cap Company on the Site. The University of California (UC) purchased the property in 1950 and is now cleaning up contamination from previous industrial activities. Site investigations identified mercury, pyrite cinders-related metals, polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons, and dioxins in soil samples, as well as carbon tetrachloride and trichloroethylene (TCE) in groundwater.

The proposed soil cleanup includes the excavation of and disposal of soil at an off-site permitted disposal facility. Deed restrictions and a soil mangement plan will be required to restrict future use of the Site. The proposed groundwater cleanup is monitored natural attenuation (MNA) including groundwater monitoring. Deed restrictions will prohibit the use of groundwater.

California Environmental Quality Act: DTSC will be relying on UC's Environmental Impact Report to meet the agency's CEQA requirements.

HOW DO I PARTICIPATE? DTSC encourages you to review the draft RAW and to provide comments.

PUBLIC MEETING – Thursday, December 5, 2013, Richmond Field Station, Building 445, South 47th Street, Richmond, California, 6:30 to 8:30 p.m.

Comments may also be submitted in writing, postmarked or emailed no later than **5:00 p.m. on January 10, 2014**:
Lynn Nakashima, Project Manager, DTSC Berkeley Office, 700 Heinz Avenue Berkeley, California 94710
Phone: 510-540-3839, *Lynn.nakashima@dtsc.ca.gov.*

WHERE DO I GET MORE INFORMATION? A copy of the draft RAW is available at the following locations:
Richmond Public Library, 325 Civic Center Plaza, Richmond, CA 94804, (510) 620-6554
DTSC File Room, 700 Heinz Avenue, Berkeley, CA 94710, Call for appointment (510) 540-3800

DTSC's Enivorstor Website: *http://www.envirostor.dtsc.ca.gov/public.* Click on "Site/Facility Search" and enter "Richmond" as the City then click "Get Report." Find the "UC Richmond" Site then click on the "Report" link.

Contact Information: for questions: Lynn Nakashima, DTSC Project Manager (510) 540-3839 or *Lynn.Nakashima@dtsc.ca.gov.* For public participation activities: Wayne Hagen, DTSC Public Participation Specialist (510) 540-3911 or *Wayne.Hagen@dtsc.ca.gov.* For media inquiries: Sandy Nax (916) 327-6114 or *Sandy.Nax@dtsc.ca.gov.*

IMPORTANT NOTICE

PUBLIC COMMENT PERIOD EXTENSION

Draft Removal Action Workplan for the Proposed Richmond Bay Campus
Public Comment Period extended to **January 17, 2014**

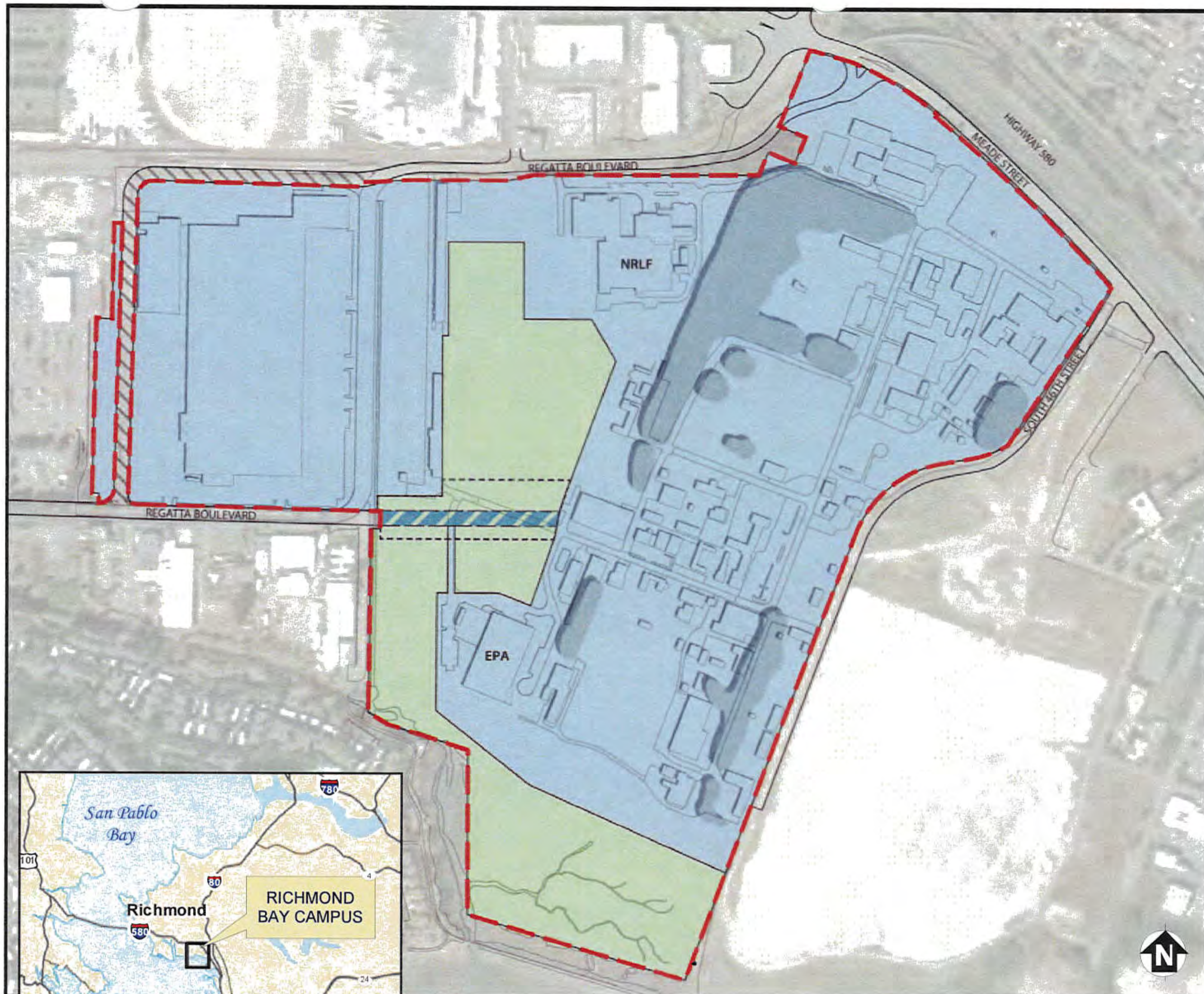
On November 26, 2013 the Department of Toxic Substances Control (DTSC) announced a 45 day public comment period for the Draft Removal Action Workplan for the Proposed Richmond Bay Campus (November 26, 2013 – January 10, 2014). In response to community requests, the comment period has been extended an additional week and will now end at close of business on **Friday, January 17, 2014**.

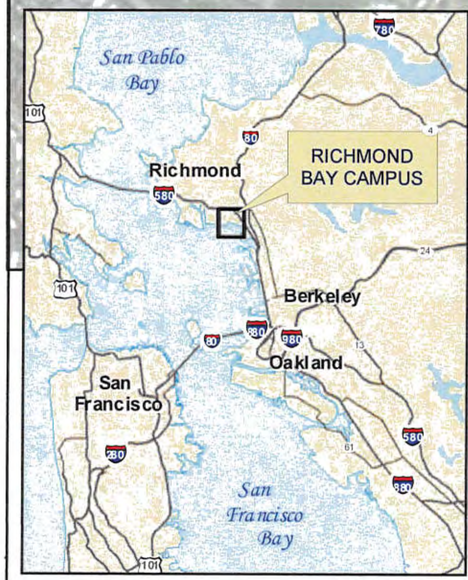
For more information contact:

Wayne Hagen
Public Participation Specialist
Department of Toxic Substances Control
(510) 510-3911 or toll-free (866) 495-5651
Wayne.hagen@dtsc.ca.gov

Attachment B

Site Maps





LEGEND

Property Boundary
133.4 acres

Research, Education & Support
107.4 acres

Natural Open Space - Bay Campus
25.2 acres

Zone of Potential Road Crossing
Natural Open Space

Potential Road Alignment
Through Natural Open Space
0.8 acres

NOTE: The potential road alignment is illustrative. A road with similar dimensions may be aligned differently but will fall within the Zone of Potential Road Crossing Natural Open Space.

City of Richmond Realigned
Regatta Boulevard

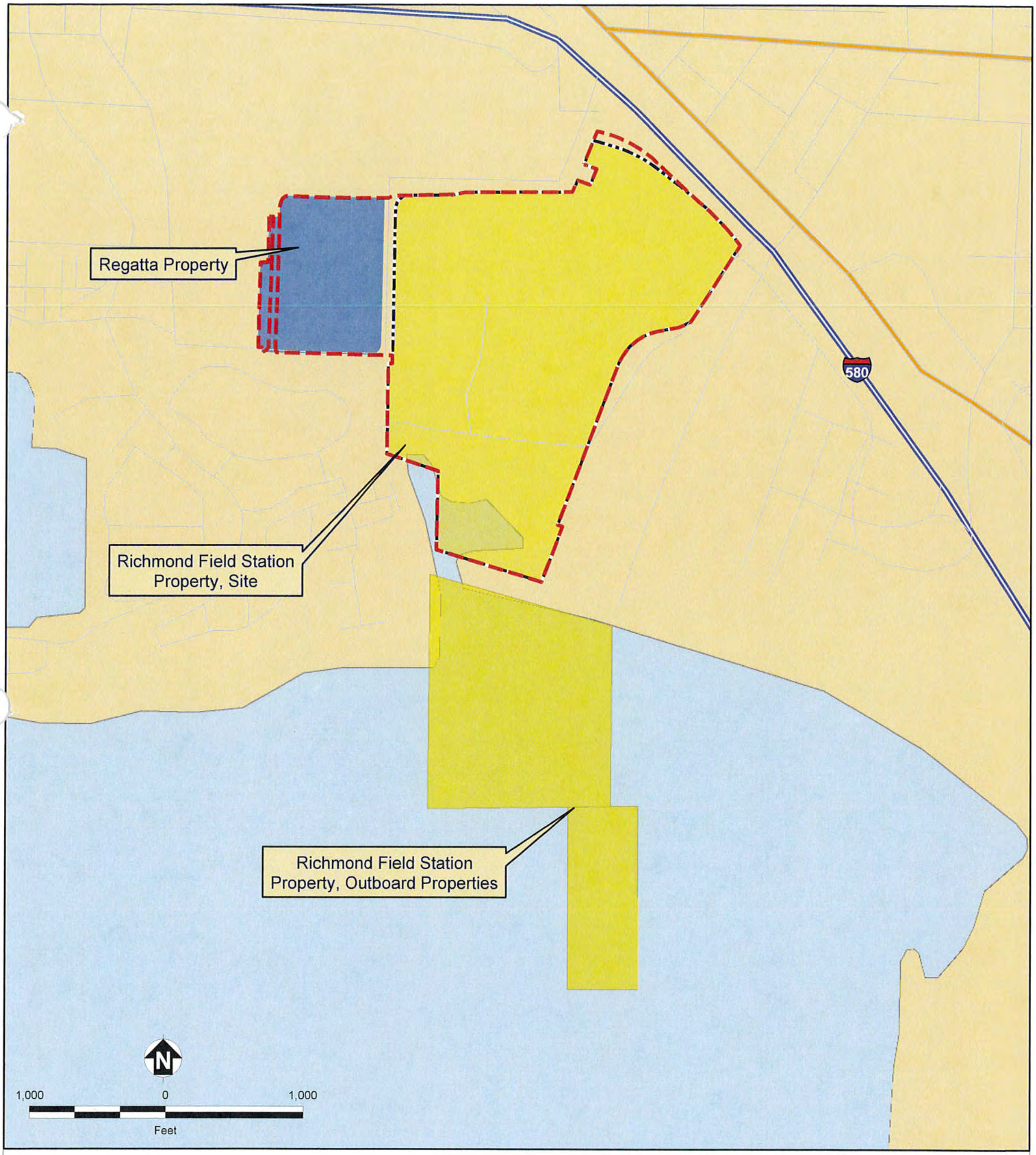
Source:
Adopted from Figure 1, LRDP Land Use Plan, in: LBNL. 2013. Notice of Preparation, Draft Environmental Impact Report, Richmond Bay Campus 2013 Long Range Develpment Plan and Phase 1 Development, Richmond Bay Campus, Richmond Field Station. January 4.

TETRA TECH

Richmond Bay Campus

FIGURE 1-1
RICHMOND BAY CAMPUS
LOCATION MAP

Removal Action Workplan



Richmond Field Station Property

Portion of RFS Property Subject to DTSC order, Defined as "Site"

Regatta Property

Richmond Bay Campus

Note:
DTSC Department of Toxic Substances Control
RFS Richmond Field Station

TETRA TECH

Richmond Bay Campus

FIGURE 1-2
UNIVERSITY OF CALIFORNIA PROPERTIES

Removal Action Workplan

2013-11-07 V:\Misc_GIS\Richmond_Field_Station\Projects\RAW\Layouts\University of California Properties.mxd TtEMI-OAK carolyn.ferlic

Attachment C

Written Comments

Nakashima, Lynn@DTSC

From: Diana Sloat <sloatdj@gmail.com>
Sent: Sunday, January 12, 2014 11:20 AM
To: Nakashima, Lynn@DTSC; eastshorepark@hotmail.com
Subject: Richmond Field Station Cleanup

Dear Ms. Nakashima,

Please do the full cleanup to residential standards. The community, bay and general environment deserve full restoration after what was done to that land.

Diana Sloat. Albany resident.

Nakashima, Lynn@DTSC

From: David Gallagher <dgalla@gmail.com>
Sent: Friday, January 10, 2014 3:43 PM
To: Nakashima, Lynn@DTSC
Subject: RichmondFieldStation

As a resident of Marina adjacent to the Field Station, I'd like to see a full cleanup to residential guidelines. With more people living and working in the area it's time to remove all environmental toxins as thoroughly as possible. I hope I can count on your support.

SIERRA CLUB
FOUNDED 1892

San Francisco Bay Chapter
Serving Alameda, Contra Costa, Marin and San Francisco Counties

REPLY TO: 802 Balra Drive
El Cerrito, CA 94530

January 15, 2014

lynn.nakashima@dtsc.ca.gov
Lynn Nakashima
DTSC Project Manager
700 Heinz Avenue Berkeley, California 94710

RE: Draft Removal Action Workplan for Proposed UC Richmond Bay Campus

Dear Ms. Nakashima,

The Sierra Club is writing to comment on the Draft Removal Action Workplan for the Proposed UC Richmond Bay Campus. The Sierra Club has followed the work to create a Long Range Development Plan for the UC Richmond Bay Campus since the plan's inception and has provided comments at every opportunity regarding the importance of preserving the remnant coastal prairie grassland present at the site. Our comments in this letter will be reflected in our forthcoming comment letter for the Long Range Development Plan Draft Environmental Impact Report.

Figure 2-2 in the RAW identifies areas of "coastal terrace prairie" and areas of "disturbed coastal terrace prairie." It is important to note that areas that have been classified as "disturbed" in Figure 2-2 still qualify as rare plant communities according to the guidelines of *The Second Edition of A Manual of California Vegetation* (MCV2, Sawyer et al. 2009). MCV2 has been adopted as the standard vegetation classification system in California by state and federal agencies (including California Department of Fish and Wildlife, United States Forest Service, National Park Service, and United States Geological Survey). Other areas of "disturbed coastal terrace prairie" at the site have the potential for restoration and are still considered valuable native habitat.

In the past, UC Berkeley and Richmond Field Station crews at the Richmond Field Station have used native grassland areas as staging areas on which to park heavy equipment and temporarily store construction materials including contaminated soil. It is critical to include wording in any work plan that ensures that these mistakes do not happen while actions proposed by the RAW are being executed. We recommend avoiding areas known to contain native grassland habitat – including those areas described as "disturbed" in figure 2-2 during any activity related to this plan. If trucks and workers must access areas of native prairie, such as to drill and install the carbon tetrachloride monitoring wells in the Big Meadow as part of recommended alternative GW-4, this access should only be done during the summer months when the prairie is dry. Access during the wet season when the soil is saturated could result in deep tracks from trucks and equipment that would permanently damage the prairie. Any waste dirt created from well drilling or clean-up activities should not be dumped or stored on areas of native prairie.

Sierra Club supports alternative GW-4 for the monitoring of carbon tetrachloride in the Big Meadow. This alternative, if executed with attention to minimizing impacts to the prairie, has the potential to accurately monitor the carbon tetrachloride levels of the soil while preserving the integrity of the extremely high quality native prairie ecosystem in the meadow.

Sincerely yours,

Norman La Force

Norman La Force, Chair
West County Group and
Chair Chapter Legal Committee

SPRAWLDEF

Sustainability, Parks, Recycling And Wildlife Legal Defense Fund

802 Balra Drive, El Cerrito, CA 94530
510 526-4362 www.sprawldef.org n.laforce@comcast.net

January 15, 2014

lynn.nakashima@dtsc.ca.gov
Lynn Nakashima
DTSC Project Manager
700 Heinz Avenue Berkeley, California 94710

RE: Draft Removal Action Workplan for Proposed UC Richmond Bay Campus

Dear Ms. Nakashima,

SPRAWDEF is writing to comment on the Draft Removal Action Workplan for the Proposed UC Richmond Bay Campus. SPRAWLDEF joins in the comments of The California Native Plant Society.

SPRAWLDEF has followed the work to create a Long Range Development Plan for the UC Richmond Bay Campus since the plan's inception and has provided comments at every opportunity regarding the importance of preserving the remnant coastal prairie grassland present at the site. Our comments in this letter will be reflected in our forthcoming comment letter for the Long Range Development Plan Draft Environmental Impact Report.

Figure 2-2 in the RAW identifies areas of "coastal terrace prairie" and areas of "disturbed coastal terrace prairie." It is important to note that areas that have been classified as "disturbed" in Figure 2-2 still qualify as rare plant communities according to the guidelines of *The Second Edition of A Manual of California Vegetation* (MCV2, Sawyer et al. 2009). MCV2 has been adopted as the standard vegetation classification system in California by state and federal agencies (including California Department of Fish and Wildlife, United States Forest Service, National Park Service, and United States Geological Survey). Other areas of "disturbed coastal terrace prairie" at the site have the potential for restoration and are still considered valuable native habitat.

In the past, UC Berkeley and Richmond Field Station crews at the Richmond Field Station have used native grassland areas as staging areas on which to park heavy equipment and temporarily store construction materials including contaminated soil. It is critical to include wording in any work plan that ensures that these mistakes do not happen while actions proposed by the RAW are being executed. We recommend avoiding areas known to contain native grassland habitat – including those areas described as "disturbed" in figure 2-2 during any activity related to this plan. If trucks and workers must access areas of native prairie, such as to drill and install the carbon tetrachloride monitoring wells in the Big Meadow as part of recommended alternative GW-4, this access should only be done during the summer months when the prairie is dry. Access during the wet season when the soil is saturated could result in deep tracks from trucks and equipment that would permanently damage the prairie. Any waste dirt created from well drilling or clean-up activities should not be dumped or stored on areas of native prairie.

SPRAWLDEF supports alternative GW-4 for the monitoring of carbon tetrachloride in the Big Meadow. This alternative, if executed with attention to minimizing impacts to the prairie, has the potential to accurately monitor the carbon tetrachloride levels of the soil while preserving the integrity of the extremely high quality native prairie ecosystem in the meadow.

Sincerely yours,

Norman La Force

Norman La Force
President

NL:sw

Nakashima, Lynn@DTSC

From:	Hagen, Wayne@DTSC
Sent:	Friday, January 10, 2014 9:55 AM
To:	Nakashima, Lynn@DTSC
Subject:	FW: Child visitation of UCB and LBNL labs

Lynn

This appears to be a public comment On UC Richmond.

Wayne

From: Michael Esposito [mailto:msaesposito@gmail.com]
Sent: Friday, January 10, 2014 9:43 AM
To: Hagen, Wayne@DTSC
Cc: Eric Blum; Sherry Padgett; Carolyn Graves
Subject: Child visitation of UCB and LBNL labs

When considering to what level remediation and cleanup should be carried out at the RFS, DTSC should take account of the fact that the young children of UCB and LBNL researchers are frequent visitors to the labs where their parents work.Graduate students, postdoctoral fellows and faculty often drop into the lab on weekends to check on the progress of experiments. They are frequently accompanied by their children who are out of school on weekends.

Lab holiday parties (e.g.Christmas) are also attended by children.

Thank you for the opportunity to offer comment.

Michael S.Esposito, Ph.D.
Senior Staff Scientist (Ret.)
Lawrence Berkeley National Laboratory
University of California-Berkeley

CALIFORNIA NATIVE PLANT SOCIETY

East Bay Chapter, www.ebcnps.org
PO Box 5597, Elmwood Station, Berkeley, CA 94705

01/17/14

Submitted via email to:

lynn.nakashima@dtsc.ca.gov
Lynn Nakashima
DTSC Project Manager
700 Heinz Avenue Berkeley, California 94710

RE: Draft Removal Action Workplan for Proposed UC Richmond Bay Campus

Dear Ms. Nakashima,

The California Native Plant Society's East Bay Chapter is writing to comment on the Draft Removal Action Workplan for the Proposed UC Richmond Bay Campus. The California Native Plant Society is a statewide non-profit organization that works to protect California's native plant heritage and preserve it for future generations. The Society's mission is to increase the understanding and appreciation of California's native plants and to preserve them in their natural habitat. We promote native plant appreciation, research, education, and conservation through our 5 statewide programs and 33 regional chapters in California. The East Bay Chapter (EBCNPS) covers Alameda and Contra Costa Counties and represents some 1100 members.

EBCNPS has followed the work to create a Long Range Development Plan for the UC Richmond Bay Campus since the plan's inception and has provided comments at every opportunity regarding the importance of preserving the remnant coastal prairie grassland present at the site. Our comments in this letter will be reflected in our forthcoming comment letter for the Long Range Development Plan Draft Environmental Impact Report.

Figure 2-2 in the RAW identifies areas of "coastal terrace prairie" and areas of "disturbed coastal terrace prairie." It is important to note that areas that have been classified as "disturbed" in Figure 2-2 still qualify as rare plant communities according to the guidelines of *The Second Edition of A Manual of California Vegetation* (MCV2, Sawyer et al. 2009). MCV2 has been adopted as the standard vegetation classification system in California by state and federal agencies (including California Department of Fish and Wildlife, United States Forest Service, National Park Service, and United States Geological Survey). Other areas of "disturbed coastal terrace prairie" at the site have the potential for restoration and are still considered valuable native habitat.

In the past, UC Berkeley and Richmond Field Station crews at the Richmond Field Station have used native grassland areas as staging areas on which to park heavy equipment and temporarily store construction materials including contaminated soil. It is critical to include wording in any work plan that ensures that these mistakes do not happen while actions proposed by the RAW are being executed. We recommend avoiding areas known to contain native grassland habitat – including those areas described as "disturbed" in figure 2-2 during any activity related to this plan. If trucks and workers must access areas of native prairie, such as to drill and install the carbon tetrachloride monitoring wells in the Big Meadow as part of recommended alternative GW-4, this access should only be done during the summer months when the prairie is dry. Access during the wet season when the soil is saturated could result in deep tracks from trucks and equipment that would permanently damage the prairie. Any waste dirt created from well drilling or clean-up activities should not be dumped or stored on areas of native prairie. Any impacts to areas of native prairie that occur during the execution of RAW actions must be mitigated at a 3:1 ratio or higher to ensure that no net loss of this CEQA protected sensitive natural community takes place.

EBCNPS supports alternative GW-4 for the monitoring of carbon tetrachloride in the Big Meadow. This alternative, if executed with attention to minimizing impacts to the prairie, has the potential to accurately monitor the carbon tetrachloride levels of the soil while preserving the integrity of the extremely high quality native prairie ecosystem in the meadow.

EBCNPS appreciates the consideration of these comments and will look forward to following this project in the future. As stated above, we will also be commenting on the proposed actions of this RAW in our forthcoming comments on the DEIR for the UC Richmond Bay Campus LRDP. Please do not hesitate to contact us with questions at conservation@ebcnps.org or by phone at (510) 734-0335.

Sincerely,

Mack Casterman
Conservation Analyst
California Native Plant Society, East Bay Chapter

Nakashima, Lynn@DTSC

From:	Citizens for east shore parks <eastshorepark@hotmail.com>
Sent:	Friday, January 17, 2014 2:42 PM
To:	Nakashima, Lynn@DTSC
Cc:	Gayle McLaughlin ; Hector Rojas
Subject:	CESP's comments on Draft RAW for proposed UC -Richmond Bay Campus
Attachments:	CESP_DTSC_RAW_Jan2014.pdf

Jan 17, 2014

Lynn Nakashima, DTSC Project Manager
700 Heinz Avenue
Berkeley, CA 94710

Draft Removal Action Workplan (RAW) for Proposed UC at Richmond Bay Campus

Dear Ms. Nakashima:

Thank you for the opportunity to make comments on this project.

Citizens for East Shore Parks (CESP) is an environmental non-profit organization that was instrumental in creating McLaughlin Eastshore State Park which is on the west side of the UC Richmond Bay Campus project. Because this property is adjacent to what little is left of our undeveloped San Francisco Bay shoreline, it is important that you strive to see that this clean-up sets a high standard as a public and natural resource for generations to come. While past generations thought nothing of trashing our Bay and shoreline, we now know that we can do better. We look forward to a clean-up that respects the Park and the shoreline in terms of habitat conservation, public access and community health.

Our supporting organizations have submitted thoughtful comments on this workplan, so we ask that you give those letters careful consideration as you move forward. The letters we support include:

- Sierra Club, January 15, 2014
- California Native Plant Society, East Bay Chapter, January 17, 2014 (CNPS)
- Richmond Southeast Shoreline Area Community Advisory Group Toxics Committee, January 17, 2014 (RSSACAG)

We urge you to work with the environmental community to address the various issues pointed out in the above comments. In particular, we would like to highlight the following areas of concern which are explained in more detail in the above letters and should be addressed in the RAW:

- Protecting the Coastal Prairie- which is the "last undisturbed native coastal prairie grassland adjacent to the San Francisco Bay Shoreline... Today, less than one percent of California's original native grassland ecosystems remain intact." (CNPS)
    - Figure 2-2 in the RAW identifies areas of "coastal terrace prairie" and areas of "disturbed coastal terrace prairie." It is important to note that areas that have been classified as "disturbed" in Figure 2-2 still qualify as rare plant communities according to the guidelines of *The Second Edition of a Manual of California Vegetation* (MCV2, Sawyer et al. 2009). (Sierra Club)
    - Preserving the Coastal Prairie during clean-up and construction- taking care not to use the coastal prairie terrace as a staging area for large equipment during clean-up, construction, restoration and monitoring. We recommend avoiding areas known to contain native grassland habitat – including those areas described as "disturbed" in figure 2-2 during any activity related to this plan. (CNPS, Sierra Club)

- Recommend a 3:1 mitigation ratio for any damage done to native grassland habitat as a result of actions completed as part of the RAW plan. (CNPS)

- Impacts on wetlands, birds, fauna and creeks need to be addressed during the clean-up (and afterwards). In addition to many burrowing animals on site, according to the Golden Gate Audubon Society, the site is also immediately adjacent to important wetlands that (among other things) have been used for breeding by the endangered California Clapper Rail.

- Addressing toxic contamination
  - The RAW should establish unrestricted standards for the clean-up.
  - The RAW should present a site-wide clean-up plan that is fully characterized.
  - The Draft RAW Soil Management Plan (SMP) is a poorly conceived and executed proposal that will place humans and ecological receptors at potential risk of hazard exposure (RSSACAG)
  - The Draft RAW does not establish Remedial Action Objectives (RAOs) that are protective of human health. (RSSACAG)
  - The Draft RAW is based on incomplete and spot-focused site characterization. Extensive areas of the UCRBC remain uncharacterized or not fully characterized. (RSSACAG)

Note: absence of commentary on topics not specified in this letter does not imply agreement with other conclusions made in the Draft RAW.

CESP looks forward to seeing a revised plan that will return the property to useful purpose which includes the ability of humans and wildlife to access the area without fear of potential exposure to high industrial levels of contaminants. CESP hopes that our comments will be helpful and lead to a respectful workplan with reduced negative impacts and increased public support.

Sincerely,

Patricia V. Jones

Patricia Vaughan Jones
Executive Director

CC: CESP Board, Sierra Club, CNPS, RANC, RSSA CAG, GGAS
Mayor Gayle McLaughlin, Richmond City Council, Richard Mitchell & Hector Rojas, DOE

Attachment: CESP_DTSC _*RAW*_Jan2014

Patricia Jones
Executive Director
Citizens for East Shore Parks
P.O. Box 6087
Albany, CA 94706
(510) 524 - 5000 (office)
(510) 524 - 5008 (fax)
(510) 461 - 4665 (cell)

Citizens for East Shore Parks

Mail: PO Box 6087, Albany, Ca 94706 Office: 520 El Cerrito Plaza, El Cerrito CA 94530
Ph: 510. 524.5000 Fax: 510.524.5008 eastshorepark@hotmail.com www.eastshorepark.org

January 17, 2014

Lynn Nakashima, Project Manager
DTSC Berkeley Office
700 Heinz Avenue
Berkeley, CA 94710 via email: Lynn.nakashima@dtsc.ca.gov

Re: Draft Removal Action Workplan (RAW) for Proposed UC Richmond Bay Campus

Dear Ms. Nakashima:

Citizens for East Shore Parks (CESP) is an environmental non-profit organization that was instrumental in creating McLaughlin Eastshore State Park which is on the west side of the UC Richmond Bay Campus project. Because this property is adjacent to what little is left of our undeveloped San Francisco Bay shoreline, it is important that you strive to see that this clean-up sets a high standard as a public and natural resource for generations to come. While past generations thought nothing of trashing our Bay and shoreline, we now know that we can do better. We look forward to a clean-up that respects the Park and the shoreline in terms of habitat conservation, public access and community health.

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We urge you to work with the environmental community to address the various issues pointed out in the above comments. In particular, we would like to highlight the following areas of concern which are explained in more detail in the above letters and should be addressed in the RAW:

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  - Figure 2-2 in the RAW identifies areas of "coastal terrace prairie" and areas of "disturbed coastal terrace prairie." It is important to note that areas that have been classified as "disturbed" in Figure 2-2 still qualify as rare plant communities according to the guidelines of *The Second Edition of a Manual of California Vegetation* (MCV2, Sawyer et al. 2009). (Sierra Club)

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Sincerely,

Patricia V. Jones

Patricia Vaughan Jones
Executive Director

CC: CESP Board, Sierra Club, CNPS, RANC, RSSA CAG, GGAS
Mayor Gayle McLaughlin, Richmond City Council, Richard Mitchell & Hector Rojas, DOE

Maggie Lazar
Pavement Research Center
1353 S. 46th St.
Richmond, CA 94804

Need DTSC oversight and public access to plans for Soil Management at UC Site

DTSC has ordered UC to investigate and clean up its property. The Removal Action Workplan explicitly covers remediation of only a tiny percentage of the area under the order. Soil in the rest of "developable" (Research Educational Support) area is relegated to a Soil Management Plan (Appendix C). This Plan seems to be intended to apply to all future situations and actions regarding soil on the site. I object to UC being granted such a blanket approval to self-manage its soil. I believe the public should be able to review proposed actions and be informed of the relevant details, such as the chemicals of concern, the source and scope of the pollution, and the risks to health and habitat. They have the right to know and comment on the activity before the work takes place. This Soil Management Plan would go in effect just as major construction is planned on the property. More than ever, the current occupants and public will then need DTSC to provide rigorous oversight of these major soil-moving activities.

Too much soil activity falls outside of Plan

The Soil Management Plan does not apply to projects that impact less than 20 cubic yards of soil, or less than 500 square feet of hardscape surface. There is a disconnect between the "typical *de minimus*" activities described in Section 3.1, such as utility repair, landscaping, and installation of fence posts, and the amount of 19.9 cubic yards, which is to close to 25 tons of soil! My concept of minor activities would be those involving less than 1 cubic yard. And I would be very surprised if the activities described as typical would require more than 3 cubic yards. If indeed UC will be able to excavate and relocate 19.9 cubic yards of in-place soil on this property, I would like to know if, when and how RFS occupants will be notified, and if UC will be allowed to move a "roll-off bin" of soil from one Plan Area to another. Will *de minimus* projects be tracked and reviewed to make sure work is not broken into smaller chunks to avoid the paperwork required by the Soil Management Plan?

Need to ensure timely notifications

I am very concerned that occupants and the public be notified before soil-moving activities take place. In Section 5.1.1, the plan says that "RFS on-site worker and employee notifications" will be required. Yet in Section 5.1 it says that "determination of the need for each activity" – permitting and notification is activity (1) -- "will be determined by EH&S." Please clarify the notification procedure.

In describing the requirements of UC to submit SMP Form A to DTSC 14 days before the activity (page C-18), the Plan recognizes there may be emergency situations when prior notification is not possible. Please describe what would be UC's obligation to notify employees, occupants, and the public under those circumstances. There should also be some mechanism for the public to make inquires or complaints.

Similarly, there should be some mention of performance standards and how reviews and violations will be addressed.

Property, Order, Site and Areas Boundaries Don't Match Worker Experience

Approval of the RAW and the Soil Management Plan would create an overly complex arrangement where workers would not be able to effectively evaluate their safety from industrial pollution at work. Some of the pollution in their workplace is from the former Zeneca site. We don't know yet what if anything they are going to do about it. UC's investigation of pollution in the Marsh and Open Areas has not been completed and will have a different clean up plan. And when our jobs take us to Receiving, Fleet Services, and Overstock and Surplus on Regatta Street, we leave the area under DTSC order; yet we are still at work, and still in the same historically industrial and polluted neighborhood.

Some of UC's job to address the pollution requires direct oversight by DTSC. Some would be managed under the Soil Management Plan by UC staff with paperwork going to DTSC. And yet another part would be managed by UC alone.

The Soil Management Plan further divides the "developable" piece of the site into 25 areas (Figure 6) with three levels of soil sampling protocols. My own work group is in three different areas. Then it uses a multi-step decision-tree based on location, scope and historical data to determine if sampling is needed. And if sampling is done, the results are sorted into three levels of chemical risk. How can a worker track all of this and verify that proper procedures are being followed? How do we find out how or when or to whom do we take our questions and complaints?

Clarify when, where and which soil can be moved within the property to be placed under buildings, roads, parking lots, and landscaped area.

In Section 4.2.2 it states that "soil generated from the project must remain within the project boundaries unless DTSC has provided approval otherwise" (C-23). However on the same page it says if the soil tests out to be less than Category I, "the project can proceed without specific soil management practices" and that this soil is "suitable for commercial reuse within the SMP project area." In this sentence does "project area" refer to the discrete boundaries of the project? Or the Area, as numbered 1 – 25, shown in Figure 6? Under what circumstances would DTSC allow soil to be moved and used outside the "project area"?

The same ambiguity needs to be clarified in the Instructions for Completing SMP Form B (C-27). In item 2.b it says "soil excavated from a SMP project area will remain within the same SMP project area unless it is disposed of off-site; if UC proposes to use the excavated soils in other portions of the RES Area, UC will contact DTSC." Will requests to DTSC and their responses be recorded and made available to the public?

Soil Management Plan Documents Should be Public

Employees and the public need access to meaningful information concerning UC Soil Management. The completion reports to be submitted to DTSC, described on pages C-42 – C-43, contain the documents needed and should be posted as public documents on Envirostor.

The Soil Management Plan is ambiguous about where various documents will be made available. The impression at the public meetings was that documents would be a stored on the UC property in Building 478. Yet on page C-19 reference is made to "additional internal documentation necessary in support of information" in SMP Form A. So, will SMP Forms A, B, and C, with their related internal documentation be made available in Building 478?

The last sentence on page C-19 is particularly vague. "Internal documentation will be available upon request from DTSC." Does this mean that DTSC can request internal documentation from UC? Or that the public needs to go to DTSC to view the internal documents UC has submitted to them? Employees and the public need access to the broadest range of documents possible.

Improve Forms A, B and C

For Form A, some thought should be given to the definition and naming of projects. Consider numbering and dating them so we can have a better idea of how many projects of each type take place, how long they take to complete, and how many are in process. Set a maximum time before a project needs new paperwork to be extended. This would prevent the carry over of an approved project indefinitely over such a long period that information gets out of date or misapplied.

Form B is designed to follow a project through many decisions and steps. I think more information should be included such as the dates steps are started and completed, the person making the decisions, and the resources used for those decisions. As an example for item 1.c.:

> Chemicals of concern (please list) ______________________, as identified by (give name) ___________________, using the following references (please list), ________________, __________________, _______________________. Groundwater report dated (give date) ____________________ was consulted.

Form C should capture the dates of the project, number and dates of revisions, and the date that Form C and the Completion Report are submitted to DTSC.

Need Improved Accessibility of Documents

This RAW would require workers wishing to be informed to go from place to place to search out documents.

Currently UC is maintaining a helpful website where employees can find out about investigation and remediation activities. Yet information on the former Zeneca site can only be found on Envirostor. Records for the projects done under the Soil Management Plan would be stored by in Building 478 on the property. And it is not clear if the public will have any access to documentation of soil projects below the Soil Management Plan threshold. DTSC would only see the paperwork for some of the soil project at the time of UC's 5-year review. This is too long for the public to wait to know how UC is performing and if this new Soil Management Plan works.

I believe that UC should provide all documents related to pollution at the entire Richmond Bay campus on its website. I also think that hard copies of documents should be available at the NRLF Library. This provides a better setting than the Building 478 lobby, since it has chairs and tables as well as quiet and privacy to review documents. I also think that UC should have some budget for providing copies of documents (particularly maps) to the public.

Deed Restrictions Nearly Meaningless

A use of terminology in the Removal Action Workplan that I find somewhat misleading is the implication that a deed restriction is a meaningful remedy to handling pollution on property that the University has owned for sixty years. It is highly unlikely that the University would sell the property, even less so now, when plans are being made for construction of a second Lawrence Berkeley Lab campus. No one will be seeing or using a newly amended deed.

Post Caution Signs

What would be much more to the point is signage that declares the property as a polluted area where DTSC-mandated investigation and cleanup is in process. The Public needs to be informed. Even the news of a possible second LBNL campus was enough to bring many visitors to the property. Once construction is underway, and the property becomes a more populated and complex place, all sorts of people will be coming and going. Casual visitors won't be taking the online training about the property's history like current employees do.

The nicer the buildings and the landscaping become, the more likely the property is to attract a wide range of visitors. New roads and bike paths will bring in families who will treat the site like a public park. And they will presume that the property is safe.

It is too soon to approve a "Final Remedy" for contamination of groundwater at site because UC investigation is incomplete and former Zeneca site team has not published their draft Removal Action Plan.

The RAW identifies two areas on the site where there are VOCs in the ground water, TCEs along the property line with the former Zeneca site, and carbon tetrachloride near Building 280A. The UC RAW does not address the property line areas because its author attributes the contamination to Zeneca's activities and says the remediation will be handled by their team. However, until the former-Zeneca site RAP is complete, there is no way to know what it may say, or how it will access and address the risks faced by UC employees who work in those areas.

If the former Zeneca team does not adequately address that contamination, I would expect UC to take charge of its property and the safety of its workers. I object to UC finalizing its RAW for groundwater before the inter-property responsibilities are formally settled.

The remediation team has stated that the discovery of contaminated water in the Open Space area near Bldg. 280 was a surprise. We don't know the source, or how far the water has moved, or will move. The final remedy should wait until further investigation.

How about the safety of 46th Street?

Anyone who has used the receiving entrance to the RFS knows the poor condition of 46th Street the runs between the UC and former Zeneca properties. It needs to be repaired very soon. I understand that ownership is shared and this complicates replacement. But, presumably the same pollutant plume underneath both properties is underneath the road. How will the potential soil and groundwater contamination be handled and the safety of employees at the site protected during repairs? And, if repairs are delayed, how are employees affected by the disintegration of the roadway? Are we exposed to contaminated soil and groundwater vapors below?

UC Soil Management Plan should include screening for radioactive soils

With recent attention in the media about radioactive soil found in the Blair landfill (likely originating from Zeneca) shouldn't there be some investigation of the UC property? In particular, John Fassell of the California Department of Public Health Radiological Health Branch described a distinctive looking soil, white or pinkish. I understand that DTSC does not oversee radiological pollution. However if UC is preparing a self-management soil plan it should include screening for radioactivity. All employees who dig should be educated in soils that look "different," such as Zeneca "alum mud," in the same way they are taught to identify the cinders. UC employees need one place to go to learn about the potential risks in their work environment.

Summary

I am very disappointed by this Removal Action Plan. I have worked at the Richmond Field Station for 23 years. I have met and interacted with many members of the UC Administration and Environmental Health and Safety Department who have made reassurances to me, most likely with the best of intentions. I was told the University wanted to clean up to the best standards and this document feels both rushed and like settling for less.

Confirmation Needed

I was lucky enough to have several opportunities outside the Public meeting to ask questions. I would like to confirm I understood the answers.

(1) **On December 3, I asked Wayne Hagen about the difference between a Removal Action Workplan (RAW) and a Remedial Action Plan (RAP).** He said that the paperwork was different as his end but that I would be equally protected by either action. Is this true? The following quote from Wikapedia seems to imply that a Remedial action is more long term and comprehensive. Wouldn't that be better for me as an employee on the property?

- **Removal actions.** These are typically short-term response actions, where actions may be taken to address releases or threatened releases requiring prompt response. Removal actions are classified as: (1) emergency; (2) time-critical; and (3) non-time critical. Removal responses are generally used to address localized risks such as abandoned drums containing hazardous substances, and contaminated surface soils posing acute risks to human health or the environment.
- **Remedial actions.** These are usually long-term response actions. Remedial actions seek to permanently and significantly reduce the risks associated with releases or threats of releases of hazardous substances, and are generally larger more expensive actions which may include such measures as preventing the migration of pollutants with containment, or preferably removing and/or treating or neutralizing toxic substances.

(I apologize for using Wikapedia as a reference. This shows how much I need help from DTSC!)

(2) **On December 12, I met with Karl Hans, Jason Brodersen, and Greg Haet**, to ask some detailed questions about areas where my colleagues work at the RFS. They said that SMP **Area 15** was at the highest sampling level in the Plan decision tree. On Figure 6 it is outlined in blue (for "high"); but in Table 3, it is listed as "medium." Please clarify which is right and make the appropriate correction.

(3) At the same **December 12 meeting, I asked about TCE readings in the groundwater near Buildings 450 and 480.** I wanted to know if more (or different) action would be taken in those areas if the property was being cleaned up to a residential standard. It was a long answer, with a helpful explanation of the difference between "commercial" and "residential" standards, but I understood it be "no." Please confirm that the TCE levels gathered in those areas are below the levels that would trigger an action in a clean up to residential standards.

Nakashima, Lynn@DTSC

From:	Nakashima, Lynn@DTSC
Sent:	Friday, January 17, 2014 1:46 PM
To:	Hagen, Wayne@DTSC; mpaul@berkeley.edu
Subject:	RE: UC Draft RAW

Hi Maggie – Thanks for forwarding your comments to Wayne. For some reason yesterday our server did let your email through. Yours wasn't the only one.

Lynn

From: Hagen, Wayne@DTSC
Sent: Friday, January 17, 2014 10:17 AM
To: Nakashima, Lynn@DTSC
Cc: mpaul@berkeley.edu
Subject: FW: UC Draft RAW

Lynn

Maggie sent me this.

Wayne

From: Maggie Paul LAZAR [mailto:mpaul@berkeley.edu]
Sent: Friday, January 17, 2014 9:35 AM
To: Hagen, Wayne@DTSC
Subject: Fwd: UC Draft RAW

Hi, Wayne,

I didn't get an acknowledgement from Lynn so I'm sending you a copy to make sure my comments meet the deadline.

Thank you for encouraging public comment. Have a good weekend.

Maggie

---------- Forwarded message ----------
From: **Maggie Paul LAZAR** <mpaul@berkeley.edu>
Date: Thu, Jan 16, 2014 at 10:02 AM
Subject: UC Draft RAW
To: lynn.nakashima@dtsc.ca.gov

Dear Lynn,

Attached please find my comments on the *Draft Removal Action Workplan for the Proposed Richmond Bay Campus.*

Sincerely,

Maggie Lazar
(510) 665-3411
1353 S. 46th St
Richmond, CA 94804

Committee to Minimize Toxic Waste

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

January 15, 2014

Re: Comments on the Draft Removal Action Workplan (RAW) for the University of California (UC) Richmond Field Station (RFS) site, i.e. the Department of Energy (DOE) owned Lawrence Berkeley National Laboratory's (LBNL) proposed Richmond Bay Campus (RBC)

Dear Ms. Nakashima,

Due to almost one and a half centuries of contamination from industrial chemical manufacturing operations at the above referenced site and adjacent properties, it is critical for the RAW to address the cleanup of the <u>entire site</u>, not <u>just</u> piecemealed RES (Research, Education and Support) areas and groundwater, as is currently proposed.

The legacy contamination at the site includes metals (arsenic, cadmium, copper, lead, mercury, selenium and zinc) from mercury fulminate manufacturing, pyrite cinder waste from sulfuric acid production at the Stauffer Chemical plant next door as well as various residues from explosives manufacturing, i.e. HMX, RDX, TNT etc.

In addition to polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH), diesel (TPH), dioxins in soil and carbon tetrachloride and trichloroethylene (TCE) in groundwater, radioactive materials were used at the site including cesium-134 and 137, iodine-131, strontium-89 and 90, tritium and carbon-14.

Approximately 14% of the original RFS area is covered by marshlands, jurisdictional wetlands including the Western Stege Marsh, Meeker Slough, Meeker Tidal Creek etc. which are in the Flood Hazard Zone, subject to water inundation due to storm surges, tsunamis and sea level rise due to global climate change.

<u>WATER</u>, in addition to air, is the most effective mechanism for contaminant transport, therefore cleanup of the site to the most stringent <u>residential</u> standards is <u>critical</u>.

In addition to the above referenced issues and concerns, the RFS/RBC is located next to the Marina Bay residential neighborhood, the popular Bay Trail and the Eastshore State Park. Therefore the DTSC recommended Land Use Controls (LUC), i.e. deed restrictions and soil management plans, as cleanup, are <u>not</u> acceptable.

We ask that the preferred cleanup plan be the one that <u>prevents</u> all risks to human health and the environment, i.e. excavation and off-site disposal of all contaminated soils, sediment etc., and the complete remediation of all surface and groundwaters at the site.

In addition, I am enclosing earlier, related comment letters:
1) to DTSC, dated January 31,2013 (Attachment 1.)
2) to LBNL/DOE, dated February 1, 2013 (Attachment 2.) and
3) a copy of a notice from DOE, dated January 17, 2013, regarding the preparation of an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA), which will include a <u>floodplain and wetlands assessment</u> for the project (Attachment 3.), and ask that these documents be considered and responded to as part of our comments on the UC RFS/DOE-LBNL RBC RAW/site cleanup proposal.

Pamela Sihvola
CMTW
P.O. Box 9646
Berkeley, CA 94709

ATTACHMENT 1.
(3 PAGES)

Committee to Minimize Toxic Waste

Lynn Nakashima, DTSC Project Manager
700 Heinz Ave.
Berkeley, CA 94710

January 31, 2013

Re: Comments on the Draft Removal Action Workplan (RAW) for the Stege Property Pistol Range site, along the SE Richmond, California shoreline.

Dear Ms.Nakashima,

The above referenced proposed Stege Property cleanup site is located in the area of the Eastshore State Park and the Point Isabel Regional Shoreline by the San Francisco Bay.

It is critical that this site, formerly a Superfund site, listed on the National Priorities List (NPL) be properly characterized; sampled, tested prior to any cleanup. All the documentation that was prepared for the CERCLA process must be carefully reviewed to determine if the site characterization initially had been adequate. A proper analysis of the historical uses of the property and its surroundings, including the Liquid Gold site, Blair Landfill, used by Stauffer Chemical as a dump site, etc. must be performed to determine the extent of hazardous materials handled in the area and the wastes dumped there.

In addition there must be a comprehensive surface-water and sediment sampling plan for the entire length of Baxter Creek along the above referenced properties.

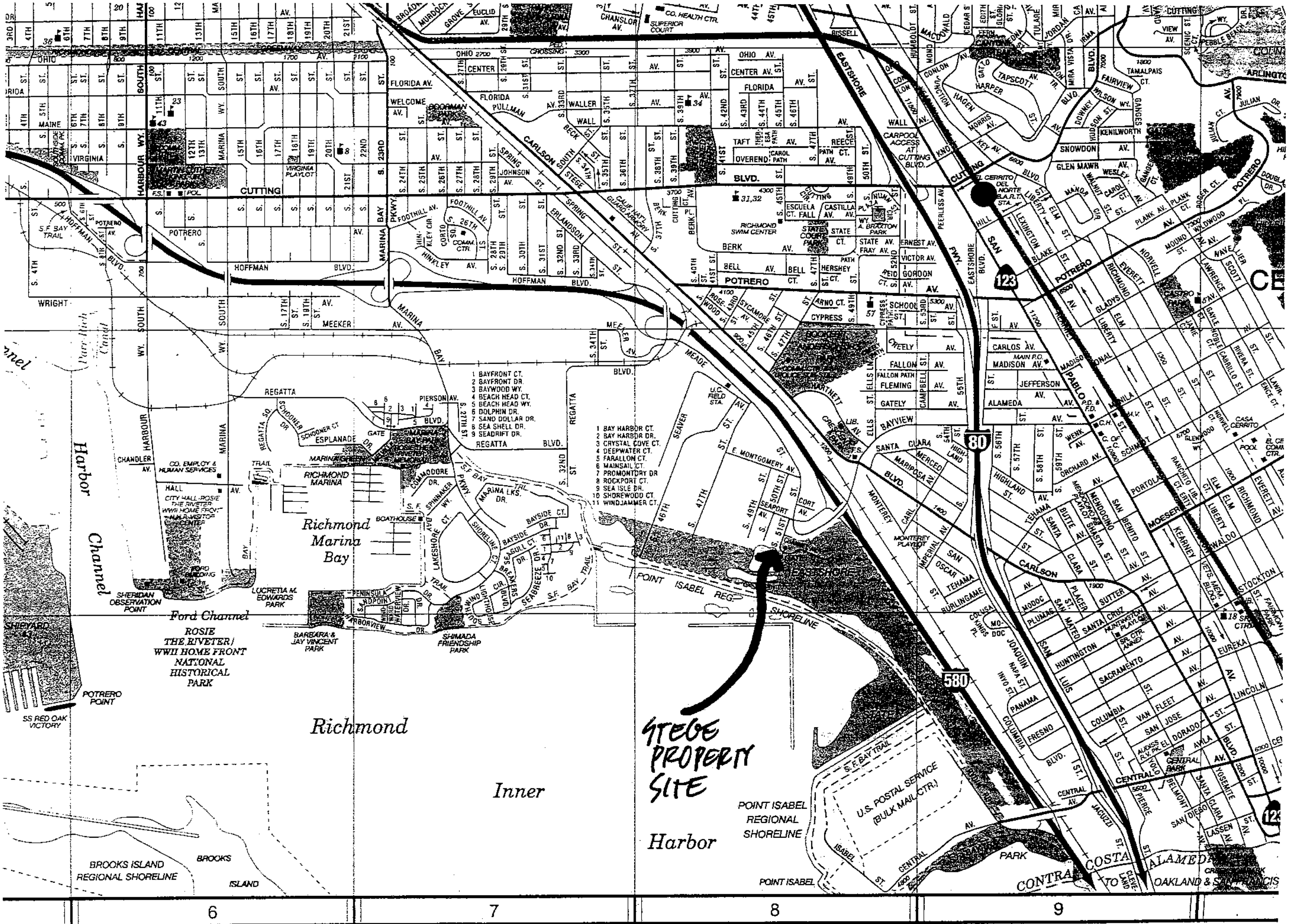
The proposed Workplan is <u>inadequate</u> in addressing the extent and degree of the potential hazards to human health and the environment from the legacy waste at the site, and its proposed removal.

Fencing and deed restrictions are not adequate solutions to a prime, San Francisco Bay waterfront area. The property must be adequately tested for all hazardous chemicals & metals potentially in the soil, sediment and grounwater, i.e. soils must be tested all the way to the watertable. Nothing less than a cleanup plan to the most restrictive residential standards is acceptable, due to the site's proximity to the marsh/wetland areas of the Bay. DTSC appears to continue piecemealing projects, now 22 in total, in the SE Richmond area, a practice not allowed by CEQA.

Pamela Sihvola

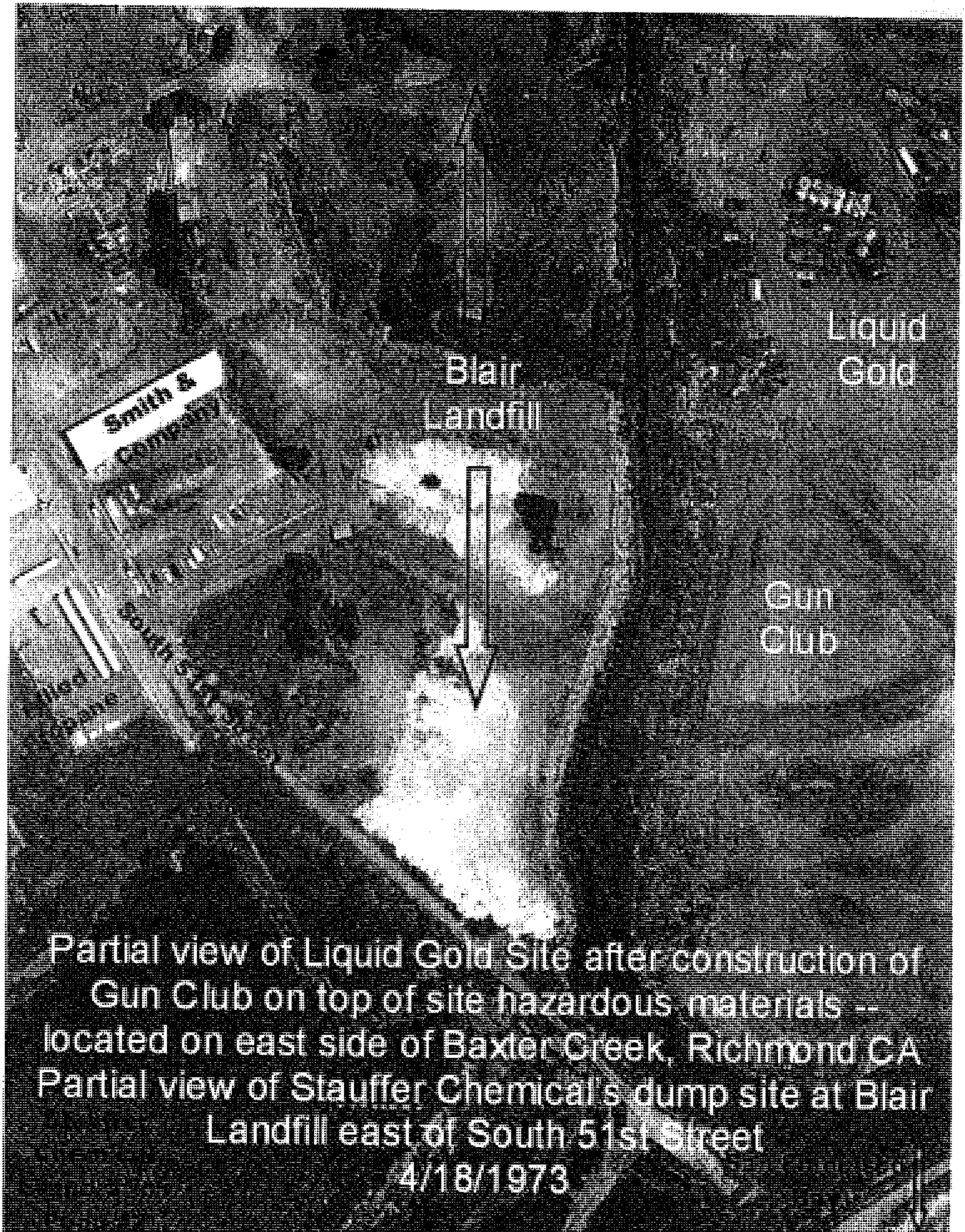
Pamela Sihvola/CMTW
P.O. Box 9646
Berkeley, CA 94709

Attachments: 2 maps



FOR CONTI

ATTACHMENT 1.



Attachment Z

ATTACHMENT 2.
(6 PAGES)

Committee to Minimize Toxic Waste

Jeff Philliber, Environmental Planner
LBNL
One Cyclotron Road, MS 76-225
Berkeley, CA 94720

Kim Abbott, NEPA Document Manager
Department of Energy
Berkeley Site Office
LBNL
One Cyclotron Road, MS 90-1023
Berkeley, CA 94720

February 1, 2013

Subject: General comments on the Notice of Preparation (NOP) for Lawrence Berkeley National Laboratory's (LBNL) Richmond Bay Campus (RBC) 2013 Long Range Development Plan (LRDP) and Phase 1 Development Draft Environmental Impact Report (DEIR) projects under the California Environmental Quality Act (CEQA) and Department of Energy's (DOE) Floodplains/Wetlands Notification and Notice of Determination to Prepare an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) regulations for the above referenced projects.

Dear Mr. Philliber and Mr. Abbott;

Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory as well as the proposed Richmond National Laboratory aka LBNL's Richmond Bay Campus are and will be owned and operated by the Department of Energy , previously known as the Atomic Energy Commission, and managed for the DOE by the University of California (UC) under contracts generally negotiated for 5 year terms.

A clear description of the proposed management relationship must be included in the Project Descriptions, ie. what are potential environmental implications from operations of a DOE owned facility versus UC? Has a lease agreement been signed for the UC Richmond Field Station property with the UC Regents? If not, when? Has a management agreement been signed by the UC Regents for the proposed Richmond Campus? If not, when?

Lessons learnt from the past:

Half of LBNL's 72+ years of operations in the fragile Strawberry Creek Watershed took place without any environmental laws or regulations. Even after the Clean Air Act and the Clean Water Act, radioactive pollution continued in Berkeley next to the Lawrence Hall of Science, a childrens' museum, and residential neighborhoods, as tritium, a radioactive isotope of hydrogen was released into the air and waters of Strawberry Canyon and surrounding areas.

Regarding the proposed Richmond Campus, it is critical that UC, LBNL and DOE prepare individual EIRs and EISs (Environmental Impact Statements under NEPA) for each of the structures/facilities proposed in the Phase 1 Development, to analyze not only impacts from construction, traffic etc. but also impacts from operations for the entire life span of each building. There should be a clear description of proposed operations for each building, as well as all the inventories of hazardous, radioactive, synthetic, nanoscale, bio etc. materials to be used and wastes generated.

Had we had a chance in Berkeley to comment on the National Tritium Labeling Facility project, during its planning phase, we would have learnt from the documentation that almost 30 times larger inventories of radioactive tritium were allowed in its inventory at LBNL compared to central campus at UC Berkeley, ie. 25,000 curies vs. approx. 900.

Furthermore, commercial pharmaceutical companies were allowed even smaller inventories of tritium, so they came to Berkeley to tritiate (label) their chemical compounds, leaving radioactive pollution behind in our neighborhoods without liability. The NTLF was shut down by the National Institutes of Health, which ironically funded the facility, but pulled the funding in 2001 when it was clear that the NTLF could not fulfill NIH's new more rigorous pollution control demands.

It is critical to describe all the various waste streams associated with the laboratories in Phase 1 Development and how the wastes be handled. Is there going to be a Hazardous Waste Handling Facility at the Richmond site or will all wastes be hauled up the hill to LBNL - and then hauled out again to off site disposal facilities. Please, also describe in detail all the proposed pollution control measures to be implemented at RBC, especially for nano-scale/synthetic-bio materials, for which there are no current regulations. Indeed, what are the proposed sampling protocols for airborn emissions?

In summary, since the Richmond National Laboratory is a Federal Facility, the proposed Programmatic EIR under CEQA must be accompanied by a full blown EIS under NEPA, to fully analyze all potential health risks and environmental impacts for the entire life span of the RBC project. We also ask that LBNL, DOE, UC be more transparent with the Richmond community, immediately establish a Community Advisory Group (CAG) for local residents and respond to all their concerns more truthfully than has been the case with LBNL in Berkeley.

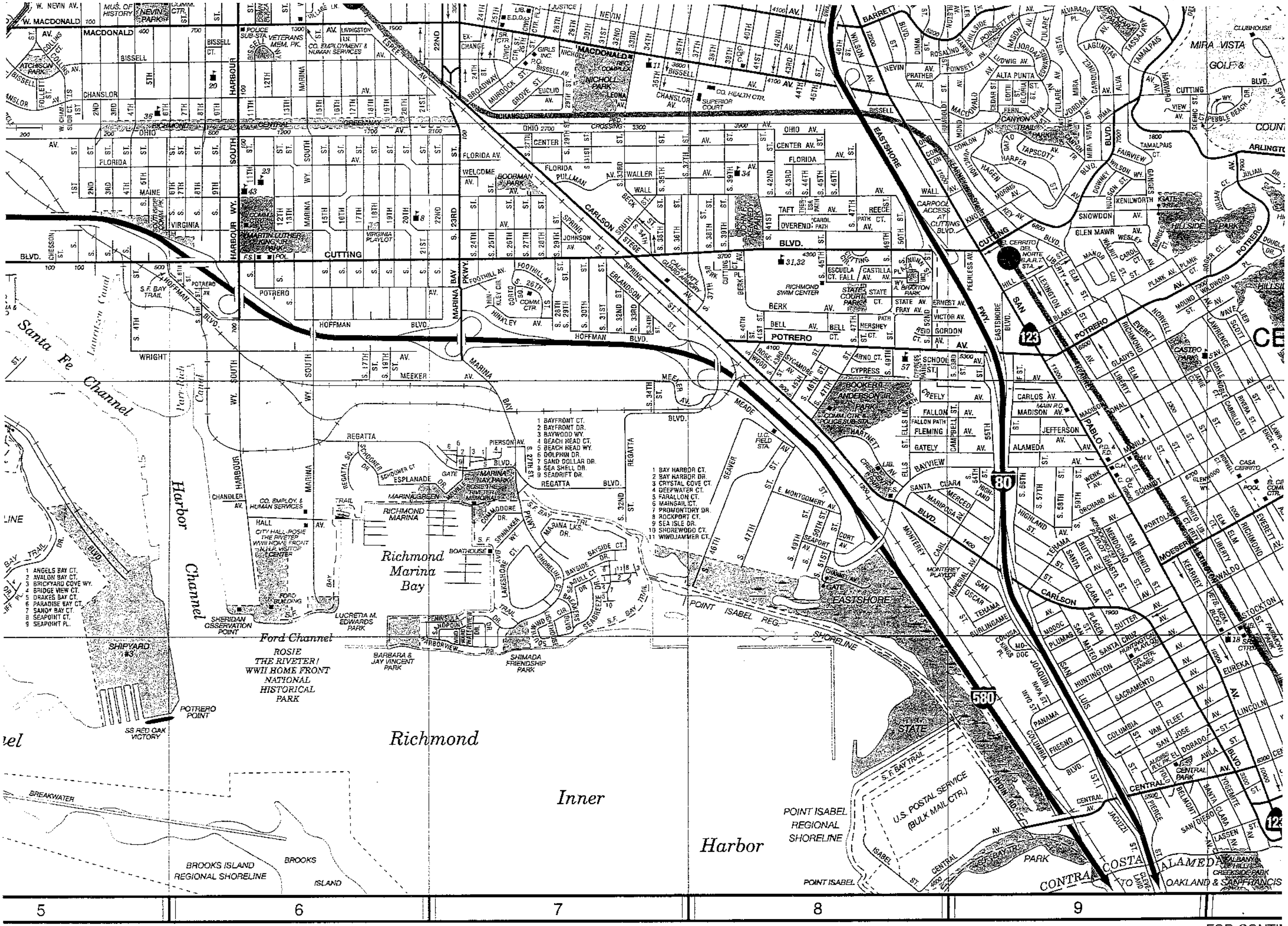
Pamela Sihvola/CMTW
P.O. Box 9646
Berkeley, CA 94709

PS.

Maps attached to the Initial Study were inadequate. Please prepare maps that show clearly all the residential neighborhoods, streets etc. from Marina Bay to Richmond Annex and beyond. Please also show clearly the San Francisco Bay, the shoreline, Eastshore State Park, all the marshes and wetland areas, all the creeks in the vicinity, including Baxter Creek and others (See attachment 1.)

Also include the California Department of Conservation's Tsunami Inundation Map for Emergency Planning Richmond Quadrangle/San Quentin Quadrangle and show the designated tsunami evacuation zones for RBC.

Please also include all the 22 hazardous materials and waste sites in the vicinity currently managed by the Department of Toxic Substances Control (DTSC). Show them on a map with a full listing of names and addresses. Describe the potential cumulative impacts to the RBC project. (See attachments 2 and 3).



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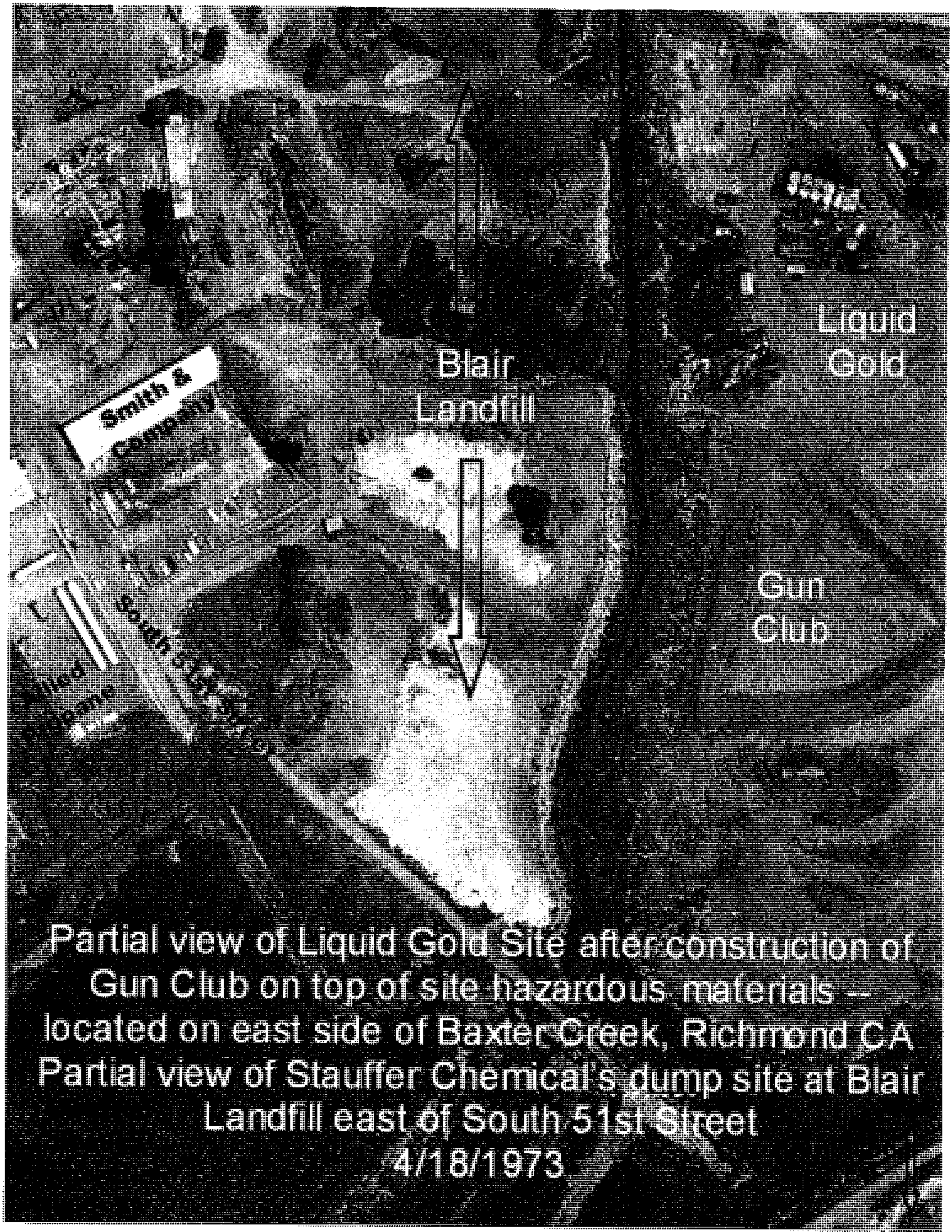
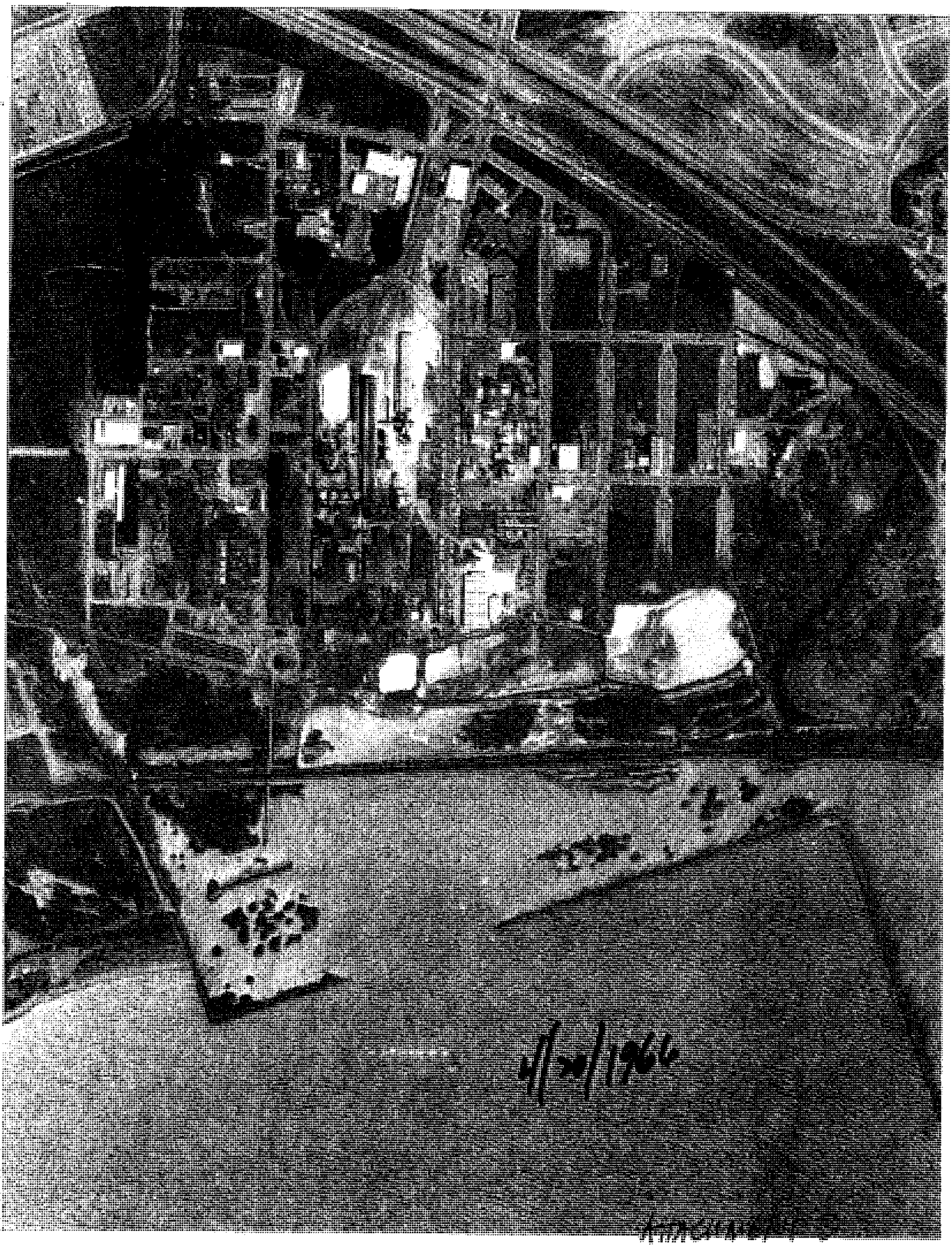
ATTACHMENT 1.



Attachment 2.


4/30/1966

ATTACHMENT 3.
(2 PAGES)

Department of Energy
Office of Science
Berkeley Site Office
Lawrence Berkeley National Laboratory
1 Cyclotron Road, MS 90-1023
Berkeley, California 94720

JAN 17 2013

Ms. Cynthia Bryant
Director
Office of Planning and Research
State of California
1400 Tenth St.
Sacramento, CA 95814

Ms. Nancy L. Ward
Regional Administrator
Federal Emergency Management Agency Regional Office
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

Subject: Floodplains/Wetlands Notification and Notice of Determination to Prepare an Environmental Assessment of the Proposed Project for the Relocation and Consolidation of Lawrence Berkeley National Laboratory (LBNL) Off-Site Research Programs

Dear Ms. Bryant and Ms. Ward:

In accordance with the U.S. Department of Energy (DOE) National Environmental Policy Act (NEPA) regulations, 10 CFR 1021, DOE is preparing an Environmental Assessment (EA) for the subject proposed project. DOE will also prepare and incorporate into the EA a floodplain and wetlands assessment in accordance with 10 CFR 1022.

DOE proposes to relocate and consolidate some of its off-site LBNL research to a new 110,000 to 150,000 gross-square-foot facility that DOE would construct at the Richmond Field Station (RFS), in Richmond, California. DOE may also choose to occupy additional facilities that may be constructed by others at approximately the same time as the DOE building construction. These construction efforts represent the first phase of development at RFS, which is anticipated to begin in 2014, and may consist of the construction of two or more research and development buildings. These buildings would support the aforementioned existing off-site LBNL research projects as well as other closely related research programs, and synergistic research institutions.

C. Bryant

The RFS is a 195 acre site owned by the University of California (UC) and located along the eastern shore of the San Francisco Bay in Contra Costa County, at 1301 South 46th Street, Richmond, California. The RFS consists of 136-acres of upland areas developed with buildings that are used for academic teaching and research activities and spaces leased by private entities, a north-south oriented planting of eucalyptus trees in the central portion of the site, a tidal salt marsh (known as the Western Stege Marsh), and a transition zone between the upland areas and marsh. Costal grasslands occur in a number of meadows on the RFS site. A stretch of the San Francisco Bay Trail is south of the site.

The NEPA review will analyze the potential environmental impacts that may result from the subject proposed project, as well as the cumulative impacts that may result from other reasonably foreseeable projects in the area.

UC is preparing an Environmental Impact Report (EIR) for a Long Range Development Plan (LRDP) addressing the development of the RFS. The EIR will provide a comprehensive program-level analysis of the 2013 LRDP and its potential impacts on the environment, in accordance with Section 15168 of the CEQA Guidelines. As part of the EIR process, UC will hold a Public Scoping meeting in late January 2013.

The RFS includes low-lying areas to the south and east, which are located in the floodplain and the activities required to implement the subject proposed project have the potential to impact the floodplain and wetlands. The location of the proposed DOE facility would not be in the floodplain and DOE will perform the subject project in a manner so as to avoid or minimize potential harm to or within the affected floodplain and wetlands. However, other facilities that may be built at RFS and occupied by DOE could be in the designated floodplain or impact the wetlands. DOE will therefore prepare a floodplain and wetland assessment and include the assessment in the draft EA.

The NEPA Compliance Officer for this document is Mr. Gary S. Hartman (Oak Ridge Office of Science Integrated Support Center). He can be reached at 865-576-0273. I am the NEPA Document Manager. If you have any questions regarding the NEPA document or process for this project, please contact me at (510) 486-7909. DOE will also provide informational posters about the proposed DOE action and the NEPA process at the Public Scoping Meeting that UC will conduct in late January.

Sincerely,

K. Abbott

Kim Abbott
NEPA Document Manager
Berkeley Site Office

cc:
Carol Borgstrom, GC-20, HQ/FORS
Distribution List

Nakashima, Lynn@DTSC

From: uptelocal1 <uptelocal1@igc.org>
Sent: Wednesday, January 15, 2014 3:21 PM
To: Nakashima, Lynn@DTSC
Subject: Public Comment on Draft Removal Action Workplan, Richmond Bay Campus

Jan. 16, 2014

Dear Lynn Nakashima:

The documents under review were not prepared in a way that's conducive to public understanding or input. Readers seeking specific information are referred to sections in other related documents (which are not always easy to find), and excessive use of acronyms makes the document particularly difficult to review.

The draft workplan is exceedingly narrow in both area and scope in that it includes only part of the Richmond Bay Campus and doesn't consider the health risks of workers other than "commercial, maintenance, or construction workers" on UC property, nearby residents or workers in adjacent businesses, or people who use the Bay Trail. We would like to see the boundaries redrawn to be more protective of public health.

In addition, a number of things in the reports are unclear, including what criteria were used to set remedial goals, what the remedial goals are, and assumptions underlying background toxicity levels, exposure assessment, and human health risks. It is also unclear how and why it was determined that projects affecting less than 20 cubic yards of soil would not be subject to the soil management plan. We conclude that the RAW fails to meet even its first objective: establishing remedial goals.

Most importantly, however, the only mention of public participation refers to response to the draft Removal Action Workplan and draft EIR. Apparently UC's Environmental Health & Safety Department expects to be able to determine the need for each activity, with notification to DTSC but no need for prior DTSC approval, or public oversight or comment. "The first component of the SMP process is the determination by EH&S if the project is subject to the SMP requirements." (Attachment C, Soil Management Plan RAW, Richmond Bay Campus, November 25, 2013) We think giving responsible parties almost sole decision-making authority over contaminated sites is bad public policy in general, and is particularly bad given the history of this project and "holes" in the draft RAW.

We thank you for considering our comments.

Tanya Smith, Laurel Lucia, Steven Butler, Paul Brooks, Paul Haller, Jean Day, Jim Hockridge, Kathryn Kowalewski, and Pam Pack

Local 1 executive board of UPTE-CWA 9119, representing technical, research and health care professionals at the UC Berkeley campus (and the Richmond Field Station) and UC Office of the President
Joan Lichterman, UPTE Statewide Health & Safety Director

UPTE Local 1

A Member Run Union

13 January 2014

Lynn Nakashima
DTSC Project Manager
700 Heinz Ave.
Berkeley, CA 94710

Dear Ms/ Nakashima,

Entered below are comments on the Richmond Bay Campus (RBC) draft Removal Action Workplan (dRAW). The dRAW document is dated 25 November 2013 and was made available to the public on 26 November 2013. The comments entered below are based on but not necessarily identical to oral comments presented at the public meeting that was held in Richmond on 05 December 2013.

According to the Community Notice of November 2013 (DTSC, 2013) the purpose of the dRAW is to "...evaluate cleanup alternatives and to identify a preferred cleanup plan which prevents or reduces risks to public health and the environment." The dRAW then forms the basis of a draft Environmental Impact Report (dEIR) that is prepared to evaluate the environmental and public health impact(s) during the implementation of the proposed RBC Long Range Development Plan (LRDP, see dEIR, RBC LRDP, 15 November 2013). Hence the dRAW must provide a high level of scientific and technical skill in order for the dEIR to adequately evaluate such environmental and public health impacts.

Unfortunately the dRAW does not accomplish these objectives. Review of specific sections leads to the conclusion that the document is inadequate and incomplete. Briefly, project borders are too narrow, residential receptors are ignored and remedial goals are set too high. In addition, incomplete information prevents thorough evaluation.

Three issues in the dRAW were considered for this discussion. They are the physical boundaries of the project, human receptors used in the health risk assessment and specific toxicity values used for comparisons with estimated body burdens and/or estimated soil levels. Please note the absence of commentary on other sections of the dRAW do not imply concurrence or nonconcurrence with those sections.

It should be noted that the dRAW section on risk assessment is sparse on details and does not permit an adequate evaluation of the assumptions and decisions used in exposure assessment, dose-response assessment, toxicity values and risk characterization. Community members and volunteers who take the time to review large complex documents should not have to search other large complex documents for specific information that should be included in the document under evaluation.

<u>Project Boundaries</u>

The project boundaries are too narrow. As described in the dRAW the following adjacent areas are omitted from project consideration. They are the Zeneca/Stauffer site on the east, the Bay Trail and land on the south, the residential community of Marina Bay on the west and the Harbor Front businesses on the north. The residents of Marina Bay will be impacted by noise and construction activities and accompanying toxic substances as they were during the unsupervised demolition activities in the early 2000s. The Bay Trail is used for recreation by adults and children with and without dogs. Workers and owners of businesses located in the Harbor Front Tract will be impacted in ways similar to the residents of Marina Bay. Among the people impacted by the construction/excavation activities will be pregnant women and fetuses, childrenelders and those with suboptimal health. The soil toxins that are present in the University of California Richmond Field Station (UCRFS) side of the east boundary and those that are present in the Zeneca/Stauffer side do not suddenly stop at the line established by the eastern boundary. To ignore the passage of toxic chemicals in both directions is to minimize the potential health risks to exposed populations and is not good public health policy.

> **Recommendation**. Redraw the boundaries to include Marina Bay, Bay Trail and areas south, Zeneca/Stauffer, Harbor Front Tract.

<u>Human Receptors</u>

Future potential receptors are defined in the dRAW as "(1) future commercial workers, (2) future construction workers, and (3) future maintenance workers" (p. 17, Exposure Assessment, par. 2). Such future use ignores the presence of residential receptors in Marina Bay, walkers/bikers/children on the Bay Trail and workers/owners of businesses in the Harbor Front Tract. Although recreational users and children who visit the site during field trips are included in the commercial worker exposure pathway (Sect, 3.1, Removal Action Objectives, p. 23), these receptors omit those who live near the site and will be exposed during longer intervals. Inclusion within the commercial worker receptor category dilutes the potential risk to this vulnerable group. Also given the educational opportunities that will exist in the RBC as part of its development, young people (elementary, middle school and high school) may be able to participate in many programs that become available after the project is established and for those that are in the K-12 age group, exposure factors for this group should be applied

> **Recommendation.** Include residential receptors in the list of human receptors and apply appropriate exposure factors and toxicity guidelines/standards.
>
> Apply exposure factors/toxicity values for children in the K-12 age group as a separate receptor category.

<u>Specific Toxicity Values</u>

Despite the narrative on p. 18 that explains the source of various toxicity values, the reader is kept ignorant of the specific values that are used until p. 25, Sect. 3.1, in the table titled *Remedial Goals*. The meaning of the table, *Remedial Goals* is unclear. At first reading the column labeled <u>Remedial Goal</u> appears to indicate a toxicity comparison value. The columns for the three worker categories could mean soil (or groundwater) levels but what do these levels signify? Are they soil (or groundwater) levels that are considered without significant adverse effects according to risk based calculations (RBCs)? If the answer to this question is "yes", such levels will be too high because they do not include residential receptors. Do the numbers for the three worker categories represent the amount that will be allowed to remain in the soil without an attempt to further remove them? If an objective of the dRAW is to prevent or reduce risks to public health (DTSC, 2013) such a choice will prevent this objective from being met.

> **Recommendation.** Provide removal of toxic chemicals to the maximum extent possible as a major cleanup alternative for all toxic chemicals. Where residues remain despite the use of best available technologies, evaluate the potential risk to exposed residents and workers and inform them of the potential risk.

Eight chemicals of concern (COCs) are listed (six in soil and two in groundwater) and three in soil will be discussed in this commentary. They are total polychlorinated biphenyls (PCBs), arsenic and lead (Pb). Note that the absence of discussion on the remaining five chemicals does not indicate either concurrence or disagreement with the information on them.

A comment in footnote "a", appears to explain the basis for each remedial goal in the last column. According to my interpretation, the remedial goal (last column) for total PCBs is based on the TSCA standard, that for arsenic is based on background arsenic levels, and that for lead is based on a risk based concentration for the commercial worker. Nowhere in the table on p 25 are the units associated with the numbers. Such units will be different for soil and for groundwater and they should be placed directly in the table. All tables should be able to stand alone.

> **Recommendation.** Clarify the meaning of the various columns in the table labeled *Remedial Goals*. Clarify the meaning of the numbers in each of the columns. Insert the appropriate units for the various numbers.
>
> Clearly explain what the soil levels signify. Are they the levels, based on RBCs that will be allowed to remain in the soil with no attempt to remove them to the maximum extent possible?

PCBs. Current and future workers (maintenance, construction, commercial) are considered to be protected against PCBs when remediation results in a soil level less than or equal to (≤) 1 milligram (mg) total PCBs per kilogram (kg) soil. The remedial goal of 1 mg/kg is based on a United States Environmental Protection Agency (USEPA) Toxic Substances Control Act (TSCA) (USEPA, 2007) evaluation. The basis for this number is not known and other toxicity criteria strongly suggest public health protection may not be available at the TSCA level. The California Human Health Screening Levels (CHHSLS) for residential and industrial/commercial receptors are 0.089 and 0.3 mg/kg soil, respectively (OEHHA, 2010).

The narrative in the dRAW is not clear about the meaning of the remedial goal of 1 mg PCBs/kg soil. Will the soil be excavated to remove as much PCBs as possible with remaining residues assessed by the TSCA standard or will the TSCA standard of 1 mg PCBs/kg soil represent the amount that will be allowed to remain in the soil? Why are the more health protective PCB guidelines not utilized in this analysis?

> **Recommendations**: Use the residential CHHSL of 0.089 mg PCBs/kg soil to develop a remedial goal.
>
> Remove PCBs to the maximum extent possible with best available technology and apply the residential CHHSL of 0.089 mg PCBs/kg soil to estimate the potential risk of exposure to remaining residues.

Arsenic. According to the table *Remedial Goals* that for arsenic is 16 mg/kg soil. This value is considered the background As level (see footnote "d"). Arsenic values associated with the three worker categories are less than the remedial goal of 16 mg As/kg soil (see the table on p.25). What do these numbers represent? Are they soil levels, developed by RBCs that are considered to be health protective? Will As cleanup then proceed to these levels? How will such cleanup proceed differently for the different worker categories? The narrative (pg. 23-24), however, states the removal action objective will prevent exposure of the workers to soil containing chemical concentrations greater than the appropriate criterion, which in the case of As appears to be 16 mg/kg soil, a soil level higher than that calculated for any of the three worker categories. It would thus appear that As will be allowed to remain in the soil at the high background level. However, the CHHSLs for As are 0.07- and 0.24 mg As/kg soil for residential and industrial/commercial receptors respectively (OEHHA, 2010). Only the commercial worker in the dRAW analysis is near the industrial/commercial CHHSL; the construction and maintenance workers will be exposed to As levels greater than the listed CHHSLs. Again, residential receptors are not even included in the dRAW analysis.

As described in OEHHA (2010), the CHHSLs for As are to be applied to As from human activity only and naturally occurring As levels may be above these numbers. In other words, the background levels of "naturally" occurring As are toxic. OEHHA (2010) informs the reader that at a given site, "...the agency with authority over remediation decisions should be consulted." Apparently the authorized agency has determined the remedial goal should be the toxic background level because it is assumed to be naturally occurring. The question remains, what is the source of the "naturally" occurring As? Is it only geologic As found in the crust of the planet? Has As that may be found within rock formations been disturbed and then released into the environment by human activity? How does one draw an inflexible line between levels that result from human activity and naturally occurring levels? Why are the responsible parties, the University of California and the State satisfied that toxic levels of As can remain in the soil?

> **Recommendations** Use the residential CHHSL of 0.07 mg As/kg soil to develop a remedial goal. If the background level of As is greater than this goal, articulate that this level is itself toxic and that exposure to this background level may result in adverse health effect(s).

Lead (Pb). The <u>remedial goal</u> in the dRAW document for Pb is 320 mg/kg soil. This value is also the CHHSL for commercial/industrial receptors and is based on a pregnant adult worker (OEHHA, 2009, 2010). For reasons stated in previous paragraphs, residential receptors should be included in the analysis. The commercial/industrial CHHSL does not include young children who reside in Marina Bay and walk/run/bike on the Bay Trail. The residential CHHSL for Pb is 80 mg/kg soil and is based on a child resident (OEHHA, 2009).

It is of interest that the <u>remedial goal</u> for Pb is the commercial/industrial CHHSL of 320 mg Pb/kg soil and the soil level associated with each of the three worker categories is exactly 320 mg Pb/kg soil. Yet the narrative suggests the soil levels of the various chemicals were developed through RBCs. Is the reader expected to believe that the RBC calculations for each worker category works out to be exactly the commercial/industrial CHHSL?

> **Recommendations**. Use the residential CHHSL of 80 mg Pb/kg soil to develop remedial goal.
>
> Explain in detail how the three soil levels, based on RBCs, are exactly commercial/industrial CHHSL of 320 mg Pb/kg soil.

<u>Conclusions.</u>

Although the comments on the dRAW have been focused on a small portion of the total document, they exemplify those issues that render the document incomplete and inadequate. Specifically the project boundaries are too narrow and long-term residential receptors are omitted from analyses. By confining the geographical location to a small area and ignoring long-time residents the analyses most likely underestimate the potential risk experienced by the exposed populations. The lack of specific information in the *Remedial Goals* table (p. 25) prevents the reader from making a comprehensive evaluation of the various remedial goals and their meanings.

The deficiencies noted in the dRAW have implications beyond the dRAW itself. This document serves as a basis for the following document the dEIR that is supposed to evaluate the impacts of projects associated with the LRDP. An inadequate and incomplete dRAW, therefore, will render the dEIR also inadequate and incomplete.

For the sake of maximum public health protection, the dRAW in its current formulation should be set aside and a new dRAW should be developed so that the objectives of the dRAW (see DTSC, 2013) will be met.

Your time and patience that are needed to read this letter are appreciated.

Sincerely yours,

Jean Rabovsky

Jean Rabovsky, Ph.D., retired
Ad hoc member, Toxics Committee, Community Advisory Group.

References

DTSC (Department of Toxic Substances Control, 2013). Community Notice. UC Richmond Draft Removal Action Workplan Available for Public Comment. November 2013.

OEHHA (Office of Environmental Health Hazard Assessment, 2008). Revised California Human Health Screening Levels for Lead. Integrated Risk Assessment Branch, OEHHA, California Environmental Protection Agency. September 2009. Available at LeadCHHSL_091709Final.pdf.

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USEPA (United States Environmental Protection Agency, 2007). Code of Federal Regulations, Title 40, Section 761.61-PCB Remediation Waste. Vol 30, 01 July 2007. Available at USEPA_PCBs_FedReg2007.

January 17, 2014

Barbara Cook
Acting Assistant Deputy Director
Brownfields and Environmental Restoration Program
Department of Toxic Substances Control
700 Heinz Avenue
Berkeley, CA 94710

Lynn Nakashima, Project Scientist
Department of Toxic Substances Control
700 Heinz Avenue, #200
Berkeley, CA 94710-2721

Subject: University of California Berkeley, Richmond Field Station
Draft Removal Action Workplan, November 25, 2013

Dear Ms. Cook and Ms. Nakashima:

Members of the Toxics Committee of the Richmond Southeast Shoreline Area (RSSA) Community Advisory Group (CAG) reviewed the document, *Public Draft Removal Action Workplan, Richmond Bay Campus, Richmond, California Research, Education and Support Area and Groundwater within the Former Richmond Field Station Site, University of California Berkeley*, hereafter referred as the Draft RAW, prepared by Tetra Tech and dated November 25, 2013. The proposed Richmond Bay Campus on the former Richmond Field Station Site is hereafter referred to as the UCRBC or the Site. Please note that only the topics specified in this letter were reviewed by Toxics Committee members. Absence of commentary on topics not specified in this letter does not imply agreement or disagreement among all of the members of the CAG with any of the assumptions used or conclusions made in the Draft RAW.

GENERAL COMMENTS

The University of California (University) is poised to begin development of its new flagship research campus, anticipated to "transform the site into one that is at once *in harmony with the Bay Area ecosystem*, a source of knowledge creation for the country, and an engine of economic growth locally and regionally."[1] The most critical tool for achieving harmony with the Bay Area ecosystem is the Draft RAW. However, the Draft RAW is fundamentally flawed and wholly inadequate to support the University's goals for the UCRBC. Implementation of the Draft RAW would leave in place unacceptable levels of soil and groundwater contamination, which would result in a long-term, paved-over source of continuing migration of contaminants across the UCRBC, into the Western Stege Marsh, into San Francisco Bay,

[1] University of California Richmond Bay Campus Long Range Development Plan, Community Draft, November 15, 2013, p. i (emphasis added).

and into the surrounding community. The Draft RAW is the Department of Toxic Substances Control's (DTSC) opportunity to require the University to take the measures necessary to meet the requirements of Site Investigation and Remediation Order IS/E-ROA 06/07-004 (Order).

A Remedial Action Plan (RAP) must be prepared in lieu of the Draft RAW. The extensive environmental issues at the Site cannot be addressed using a tool designed to provide an immediate, short-term response to control specific conditions involving hazardous waste. Given the environmental and ecological complexities of the hazards present, the Site requires a long-term cleanup plan that will control the future release of hazardous substances and reduce the existing danger to public health and the environment. This is something that only a RAP can provide.

Indeed, the consequences of preparing a RAW when the situation calls for a RAP are evident in the artificial limits on the scope and scale of the cleanup proposed in the Draft RAW. The numerous deficiencies in the Draft RAW include, among other things, an inadequate site characterization, the use of inappropriate and/or outdated risk-based thresholds, inadequate assumptions regarding future use by sensitive users such as women of child-bearing age and children, and failure to consider the ecological impacts that the Preferred Alternatives would have on the Western Stege Marsh, the transition habitat and the San Francisco Bay.

Further supporting the argument that DTSC has inappropriately chosen a RAW over a RAP in this instance is the fact that a legally adequate cleanup plan that meets the requirements of the Order will exceed the $2,000,000 ceiling for conducting a removal action workplan.[2] In fact, the cost of the preferred remedy *already* exceeds $2,000,000. The costs provided for the selected alternatives in Chapter 4 of the Draft RAW exceed the $2,000,000 threshold as follows: $84,507 (PCB Area, Table 4-1) + $1,158,152 (MFA) + $160,284 (Corporation Yard) + $336,224 (Carbon Tetrachloride in groundwater) + $298,618 (Site-wide groundwater, Table 4-1) = $2,037,785. Note that this total does not include any cost for the "Remaining RES Area" selected alternative, which the Draft RAW estimates to be "Moderately High" but too speculative to quantify. Even without considering the additional cost for the Remaining RES Area remedy, the selected alternatives in the Draft RAW exceed the $2,000,000 maximum for a RAW by a significant margin. Thus, the University must prepare a RAP, rather than a RAW.

SPECIFIC COMMENTS

1) The Draft RAW does not establish Remedial Action Objectives (RAOs) that are protective of human health. The Draft RAW is based on the Zeneca Site Human Health Risk Assessment (Zeneca HHRA) written in 2008, which is specific to and based on Zeneca Site risks and based on risk standards considered protective at that time. Use of the Zeneca HHRA as the basis of UCRBC human health protection is a fatal flaw of the Draft RAW.

[2] HSC 25356.1(h)(1) states that a RAP is not required "if conditions present at a site present an imminent or substantial endangerment to the public health and safety or to the environment or, if the department, a regional board, or a responsible party takes a removal action at a site and the estimated cost of the removal action is less than two million dollars ($2,000,000). The department or a regional board shall prepare or approve a removal action work plan for all sites where a nonemergency removal action is proposed and where a remedial action plan is not required."

The Zeneca HHRA was used as a basis for the development of Risk Based Concentrations (RBCs) that are used as the screening criteria to determine the extent of removal needed. However, the RBCs do not reflect current science. Many of the RBCs for both soil and groundwater are much higher than the San Francisco Bay Regional Water Quality Control Board's updated 2013 Environmental Screening Levels (ESLs), which reflect reductions in acceptable vapor intrusion values and in total petroleum hydrocarbon exposure levels, in addition to other changes.

Recommendation: Develop a UCRCB Human Health Risk Assessment based on UCRCB site conditions and expected uses, based on current risk standards, including updated TCE limits.

2) The Draft RAW does not develop or evaluate groundwater cleanup alternatives for Site-wide groundwater despite the RAO developed specifically in the Draft RAW to "prevent exposure of current maintenance and construction workers and future commercial, maintenance, and construction workers via inhalation of unsafe vapors from groundwater containing carbon tetrachloride or TCE at concentrations greater than commercial vapor intrusion RBCs" (Draft RAW, p. RS-2, #4).

In the natural open space (NOS), rather than developing a Site-wide groundwater remediation plan, the Draft RAW delays action on identification of the source of the carbon tetrachloride plume until a remediation plan is prepared for the natural open space (NOS) area. No time frame is provided for the development of such a plan.

With respect to the TCE plume migrating from the neighboring Zeneca Site onto the UCRBC property, the Draft RAW passes responsibility to Zeneca for cleanup and monitoring of this contamination stream stating that the "remedy for groundwater contaminants originating from the former Zeneca Site, including TCE and its breakdown components, is subject to the former Zeneca Site Investigation and Remediation Order, and will meet the RAOs identified for groundwater."

Zeneca has no plan in place to remediate the TCE plume, nor is there any indication in the Draft RAW as to when such a plan may be developed by Zeneca. The Draft RAW rests with the assumption that at some point in the future Zeneca will remediate the TCE plume which currently and continuously contaminates the UCRBC Site. This is an unacceptable assumption that will indefinitely prevent the Site from achieving its stated RAOs. The longer the TCE source remains in soil on the Zeneca site and TCE remains in groundwater, the more severe the likely impact will be to UCRBC, Western Stege Marsh and the San Francisco Bay.

The most recent groundwater data available through the UCRBC Envirostor website confirms that the groundwater at the Site is heavily contaminated with the carcinogens carbon tetrachloride and TCE, among other chemicals, at concentrations at or exceeding California and federal maximum contaminant levels.[3] DTSC cannot continue to risk the

[3] Available at:
http://www.envirostor.dtsc.ca.gov/regulators/deliverable_documents/3236744523/2013.10.10.FINAL_TechMemo_2013GWSamplingResults.pdf (p. 14)

health of the current and future users at UCRBC or ecological receptors at the UCRBC and beyond by indefinitely delaying action on Site-wide groundwater.[4]

Recommendation: Rewrite the Draft RAW as a RAP that includes a comprehensive evaluation of and selection of a protective remedy for Site-wide groundwater.

3) The Draft RAW risk evaluation and proposed cleanup alternatives use the Zeneca Site arsenic background level of 16 mg/kg. The use of the highly controversial Zeneca arsenic background level of 16 mg/kg in the Draft RAW is a fatal flaw.

   The background concentration of 16 mg/kg for arsenic was developed as a site-specific background concentration for the Zeneca Site. This concentration is based on a report prepared by Erler & Kalinowski, Inc., entitled Technical Memorandum: Background Concentrations of Arsenic in Soil at Campus Bay, Campus Bay Site, Richmond, California, dated July 23, 2007. DTSC approved the use of 16 mg/kg as a background concentration for arsenic on October 1, 2007 (Letter to Doug Mosteller from Barbara Cook Concurring on the Recommendation of 16 mg/kg Arsenic as a Good Estimator of the Upper Range of the Ambient Distribution of Arsenic at the Campus Bay Site.)

   The CAG continues to believe that use of the arsenic background concentration of 16 mg/kg is inappropriate. A new HHRA should be prepared in support of a RAP that incorporates a background concentration of 8.9 mg/kg arsenic, as calculated at the Harborfront Tract, located east of the Zeneca Site.[5] This number is more reflective of a background arsenic concentration at nonindustrial sites than the Zeneca background concentration of 16 mg/kg.

   Recommendation: Revise the arsenic backgrouud level to 8.9 mg/kg, which is the accurate and verified background level at the Harborfront Tract and more representative of nonindustrial sites in the vicinity of UCRBC.

4) The Draft RAW erroneously uses RAOs based on commercial site use. Application of RAOs based on commercial site use is in conflict with the RAO in the Order which states that RAOs "for contaminated media shall be developed that are protective of adults *and children* in a commercial/*educational scenario* and as *recreational users* of open space." (Order, Section 5.1.2, p. 12, emphasis added) The Draft RAW cites this RAO from the Order and summarily declares that the commercial worker scenario is "overly protective" to occasional visitors, including children, but fails to present any support for this conclusion. (Draft RAW, Section 3.1, p. 23) It is foreseeable that commercial workers will include women of child-bearing age who will not be "occasional visitors".

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[4] The overly narrow view of the groundwater issues presented in the Draft RAW and the implications of improperly segmenting the UCRBC and Zeneca components of the groundwater plume will be addressed in more detail in forthcoming comments on the related Environmental Impact Report (EIR) prepared in support of the Draft RAW pursuant to the California Environmental Quality Act (CEQA).

[5] The Soil and Ground Water Sampling and Analysis Report for Harborfront Tract Site, Richmond, California, dated October 5, 2006, is available at the following link: http://www.envirostor.dtsc.ca.gov/public/final_documents2.asp?global_id=70000178&doc_id6009599.

No consideration is given to other more sensitive Site uses including the possibility of child day care or children under 18 years of age who are in a classroom or building space more than 12 hours per week. Many University faculty and staff state they have children who spend more than 12 hours per week on campus during their entire childhood.

No consideration is given to the possibility that the future campus would develop a use that requires more robust cleanup.

The Draft RAW states that a future Site use includes educational programs which would invite elementary and high school aged children to visit the Site. (Section 2.2.2, p. 6.)

Relying solely on adult commercial worker exposures to develop RAOs for the Site leaves more sensitive users of the Site unprotected from the contaminated soil and groundwater.

Recommendation: Assume sensitive uses will be required on the UCRBC in the future and site cleanup for future sensitive uses is required today before the UCRBC is developed.

Recommendation: Evaluate an unrestricted site use standard as an alternative in the RAP.

5) The Draft RAW is based on incomplete and spot-focused site characterization. Extensive areas of the UCRBC remain uncharacterized or not fully characterized. The Draft RAW will remain a faulty plan until the UCRBC is fully characterized and proposals are made for Site-wide cleanup.

The Site Characterization Report for the Proposed Richmond Bay Campus prepared by Tetra Tech and dated May 28, 2013 (the "SCR") was meant to be a comprehensive investigation of soil and groundwater conditions at the Site and provides the basis for many of the conclusions in the Draft RAW.

However, the SCR contains many data gaps that leave large portions of the Site uncharacterized and, therefore, cannot provide the basis for a comprehensive Site-wide remedy. For example, the PCB investigation in the SCR identifies several areas where the extent of PCB contamination remains undelineated. (SCR, Section 6.3.1.1.8, p. 6-9.) Despite these data gaps, the Draft RAW presents a remedy for PCB removal that is likely underestimating the extent of PCB-contaminated soil at the Site. PCBs must be fully delineated before a remedy can be developed and implemented.

Furthermore, the SCR's HHRA was limited to two areas of the Site (the "Corporation Yard" and the "Mercury Fulminate Area"), leaving the risk in the remainder of the Site unquantified (SCR, Section 8.1.1.2, p. 8-3). According to the SCR, a quantitative risk assessment for the majority of the Site could not be completed for one of three reasons, including (i) low density of data, (ii) small area of investigation data, and/or (iii) limited number of analytes in a given sample. (SCR, Section 8.1.1.2, p. 8-3.)

This methodology lead to the exclusion of data which likely would have indicated that a greater risk exists at the Site than was presented in the HHRA. For example, concentrations of arsenic more than twice the disputed "background" concentration of 16 mg/kg were measured south of the Mercury Fulminate Area, as well as east of Building

113. Because these sample locations did not fall within areas with dense enough sample patterns, they were simply excluded from the quantitative risk assessment in the SCR.[6]

The Draft RAW relies on the HHRA from the SCR as comprehensive for the site while it is limited to risk in the Corporation Yard and Mercury Fulminate Area. The health risk for the remainder of the Site is left unquantified due to lack of additional sampling.

To further compound the inadequacy of the Draft RAW, the results of all of the grab samples and historical samples were summarily discarded during the site characterization process. These data were not excluded because wells were later installed and samples were later collected to provide more current data. The data were simply excluded. Although the quality of the grab groundwater samples may limit their quantitative use, these samples, along with the historical data, could have at least qualitatively filled some of the gaps in the SCR to assess where additional investigations are necessary. This data set should be incorporated into the site characterization.

Until the soil and groundwater at the Site is fully characterized and the risks at the Site quantified, selected remedies cannot be considered comprehensive because they are relying on data with too many gaps.

Recommendation: Fully characterize the UCRBC with soil, soil gas and groundwater samples at multiple depths, at multiple times of year and located on a site-wide grid.

Recommendation: Revise the Draft RAW into a RAP that provides alternatives based on sufficient data.

6) The Draft RAW gives no consideration to ecological receptor health risk, thereby ignoring two of the RAOs stated in the Order and putting endangered and sensitive species at risk. Section 5.1.2 of the Order specifically states the following RAOs:

   a. "Western Stege Marsh is a sensitive habitat for the California Clapper Rail, an endangered species. Therefore, [RAOs] for contaminated media shall be developed that are *protective of endangered and threatened species* that have been identified at the Site *and their habitat*; and

   b. The coastal terrace prairie is a sensitive habitat for native grasses and forbs. Therefore, [RAOs] for contaminated media shall be developed that are *protective of sensitive species and their habitat*." (DTSC Order Section 5.1.2, p. 12, emphasis added)

Impacts of risk to endangered and threatened animals and sensitive plant life from contaminated Site runoff, contaminated soil gas and contaminated groundwater are not evaluated as part of the Draft RAW, even though implementing the Draft RAW would leave contamination in place that will continue to impact the Western Stege Marsh.

As discussed above, the Draft RAW excludes the groundwater ESLs for urban area toxicity from the RBCs. The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) assumes that all groundwater may flow to surface water. Here, proximity to the San Francisco Bay and the sensitive habitat in the Western Stege Marsh makes consideration of

[6] See Figures 8-1 and B-2 in the SCR.

ecological criteria imperative, as contaminants left in soil or groundwater at the UCRBC should be expected to flow to surface water and potentially impact ecological receptors.

Given that the removal work currently contemplated will almost certainly impact the Western Stege Marsh, the revised RAP should include an evaluation of the impacts from any remaining contamination on endangered and sensitive species under each of the alternatives. Delaying consideration of the impact of the Draft RAW on ecological receptors does not comport with the Order.

Recommendation: Evaluate the ecological risks posed by each remedial alternative and incorporate measures to protect ecological receptors into a Draft RAP.

7) The Draft RAW Soil Management Plan (SMP) is a poorly conceived and executed proposal that will place humans and ecological receptors at potential risk of hazard exposure. The SMP proposes self-monitoring, self-reporting and self-evaluation by the University, as this would reduce Cal EPA and DTSC regulatory oversight to mere occasional courtesy notice of activities.

The SMP leaves management of on-site soils largely in the hands of the University Office of Environmental Health and Safety (EH&S). The first component of the SMP is for EH&S to determine, with no DTSC oversight, if a proposed "project" involving soil disturbance is required to be managed under the SMP. (SMP, Section 1.2, p. C-4.) This determination is based on whether or not the project will impact less than 20 cubic yards (CY) of soil or 500 square feet of hardscape surface. (SMP, Section 1.2, p C-5.) Projects meeting or exceeding these thresholds are subject to the SMP, which means the soils must undergo waste characterization and be subject to on-site or off-site management, as appropriate.

The SMP provides no justification for the 20 CY of soil and 500 square feet of hardscape thresholds, nor does the SMP contemplate the possibility of projects impacting smaller amounts of soil containing very toxic levels of contaminants (such as PCBs or dioxins). These smaller projects would not require waste characterization, nor would the soils be subject to any remediation or special management.

There is no guidance in the SMP as to what constitutes a "project" for purposes of SMP determinations. Under the SMP as written, a 200 CY "project" could be defined by EH&S as eleven separate projects, each impacting less than 20 CY of soil, and therefore none of the impacted soil would be subject to waste management requirements. In fact, EH&S would not even have to notify DTSC of projects impacting less than 20 CY of soil or 500 square feet of hardscape.

Additionally, the SMP states that the University will conduct annual reviews of itself under the SMP. (SMP, Section 1.3, p. C-8.) The University may choose to suggest improvements to the SMP process to DTSC, but DTSC is not required to review the University's adherence to the SMP outside of the five-year review of the RAW.

Recommendation: Retain strict DTSC regulatory oversight of the UCRBC site contaminants.

Recommendation: Do not allow the University to become self-monitoring and self-reporting.

8) The Draft RAW SMP allows the University to perform minimal characterization of UCRBC soil during activities involving soil disturbance. The extent of sampling, if any, required under the SMP is to be determined based on the location of the "project." The SMP divides the UCRBC into 25 areas with designated sampling densities based on historical activities on the UCRBC. More than a third of the 25 areas require only "low density" sampling under the SMP. (SMP, Table 3.) Because the UCRCB is so poorly characterized, any soil disturbance must involve an extensive, high density grid of samples to determine the nature and extent of contamination.

   Recommendation: Require high density sampling of all soil disturbance events at the UCRBC.

9) The Draft RAW proposes managing extensive yet-to-be identified and characterized buried pyrite cinders in place. (SMP, Section 5.2.2, p. C-33.) Pyrite cinders are laden with high levels of arsenic and lead.

   Soil disturbances involving pyrite cinders should require sampling to determine the extent of impact these toxic cinders have had on the surrounding soils. Instead, the SMP states that "during soil disturbance activities that are not conducted to remove contaminated soil, excavated soils, including those mixed with cinders, may be deposited back into the original excavation, assuming there is no complete exposure pathway identified." (SMP, Section 5.2.2, p C-34.)

   Table 3-1 of the Draft RAW provides analytical results for pyrite cinders soils samples from the UCRBC, including arsenic results that are several orders of magnitude greater than the disputed "background" concentration of 16 mg/kg. (Draft RAW, Table 3-1.) Allowing such contaminated material to remain in place creates an unacceptable risk for all current and future users of the UCRBC Site.

   Recommendation: Fully characterize UCRCB to locate buried pyrite cinders as part of the RAP and remove all pyrite cinders to an off-site hazardous material landfill.

Your consideration of our comments is appreciated.

Sincerely,

/s/

Stephen Linsley
Chair, Toxics Committee
Richmond Southeast Shoreline Area Community Advisory Group

Copies:

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PLANNING AND BUILDING SERVICES DEPARTMENT
Planning Division

City of **Richmond**

January 17, 2014

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State of California
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Berkeley, CA. 94710
lynn.nakashima@dtsc.ca.gov

Subject: City of Richmond Comments on the Public Draft Removal Action Workplan for the Richmond Bay Campus

Dear Ms. Nakashima,

The City of Richmond would like to thank the Department of Toxic Substance Control (DTSC) for extending the opportunity to provide comments on the Draft Removal Action Workplan (RAW) for the proposed University of California (UC) Berkeley and Lawrence Berkeley National Laboratory (LBNL) Richmond Bay Campus (RBC). The City of Richmond's general comments are as follows:

General Comments:

1) The City concurs with the bolded statement below, which is found in both the Executive Summary and Introduction. The RAW will not be finalized until the Draft Long Range Development Plan Environmental Impact Report (LRDP EIR) for the RBC is approved and final land use plans are compared to RAW actions and objectives. The City supports the RAW's acknowledgement that it may need modification following the UC CEQA process. At such time, additional review of those modifications may be advisable.

   "The technical approaches in this Removal Action Workplan (RAW) are based on the proposed land use designations in the Draft Long Range Development Plan Environmental Impact Report (LRDP EIR) for the Proposed Richmond Bay Campus, which is scheduled for University of California (UC) Regent review in 2014. ***The California Department of Toxic Substances Control (DTSC) decision regarding the finalization of the RAW will take place only if the UC Regents approve the LRDP EIR following the UC California Environmental Quality Act (CEQA) process.*** *Any relevant changes to the LRDP EIR or descriptions of land use designations that arise in connection with the UC CEQA process will be incorporated into this document prior to finalization, subject to any further public review process which maybe be required by DTSC."*

2) Prior to implementing the traffic control and transportation plans outlined below, the City's Public Works and Engineering Departments will require review, comment and approval. Accordingly, the City recommends supplementing Chapter 5.1.12 of the RAW as follows on the next page, in order to achieve the stated objective of minimizing disruption to the surrounding community:

5.1.12 Traffic Controls, Transportation Plan

Transportation to and from the excavation area will be planned to minimize disruption to operations and to the surrounding community. Truck traffic will be controlled by radio or phone communication to control the number of trucks on stand-by at the excavation area, and en-route to the excavation area on local roads. Flagmen will be placed as needed to direct traffic on local roads surrounding the excavation area. All trucks must follow posted speed limits. The DTSC work notification for the project will include notification to the community regarding truck traffic associated with the excavation and off-site removal. Contractors will prepare a transportation plan following contractor selection and contract award. All drivers will be provided with and will be required to maintain a copy of the transportation plan. DTSC will ensure that all removed and excavated soil will be transported from excavation sites in a manner that protects the human and environmental health of the community. DTSC will require impacted soils to be transported only along routes that avoid residential and business neighborhoods consistent with the proposed truck route in Figure 5-2 of the RAW.

3) For Section 5.1.13 Offsite Spill Contingency Plan, please add the City's Emergency Services Manager, Kathy Gerk, to the list of those to be notified in a spill or release scenario. The City Office of Emergency Services address is 440 Civic Center Plaza, Richmond, CA 94804, Phone Number 510-620-6866.

4) For Section 5.2.2 SMP Protocols, the City supports these procedures and requests additional notification to supplement the protocols. Specifically, City requests that the SMP Protocols include a procedure for notifying the City when contaminated soil is proposed to be removed and/or removed from the site. More specifically, similar to the DTSC notification required on page 83 of the RAW, the City of Richmond would receive notification at least 14 days in advance of any field work implementing the RAW. This will allow City staff to ensure that community members, particularly those living in the vicinity of the Former RFS Site, are informed about removal activities in a timely fashion.

5) The City requests that it be provided with a copy of the Completion Report described on page 80 upon finalization of the Report.

We understand that the RAW may be revised if substantive changes are made to the RBC Long Range Development Plan or its Environmental Impact Report. The City of Richmond strongly encourages DTSC to require further public review if the RAW is revised. Please feel free to direct any questions you have regarding this letter to Hector Rojas, Senior Planner at (510) 620-6662 or hector_rojas@ci.richmond.ca.us.

Sincerely,

Richard H. Mitchell
Director of Planning and Building Services

Cc: Bill Lindsay, City Manager
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Attachment D

Public Meeting Transcript

PUBLIC MEETING - FOR COMMENT ON DRAFT REMOVAL ACTION WORKPLAN FOR THE PROPOSED UC RICHMOND BAY CAMPUS

PROCEEDINGS - Vol. 1

December 5, 2013

MERRILL CORPORATION

LegaLink, Inc.

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San Francisco, CA 94105
Phone: 415.357.4300
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PUBLIC MEETING

FOR COMMENT ON DRAFT REMOVAL ACTION WORKPLAN

FOR THE PROPOSED UC RICHMOND BAY CAMPUS

DECEMBER 5, 2013

RICHMOND FIELD STATION, BUILDING 445

1301 SOUTH 46TH STREET

RICHMOND, CA

REPORTED BY: FREDDIE REPPOND

A P P E A R A N C E S

Representing the Project:

Wayne Hagen, Department of Toxic Substances Control

Lynn Nakashima, Department of Toxic Substances Control

Jason Broderson, Tetra Tech, Inc.

Scott Shackleton, UC Berkeley RES

Members of the Public:

Don Schnepf

Cinna Hunter

Jean Rabovsky

Paul Carman

Mary Selva

Jean Robertson

Eric Blum

Dan Schwab

Beryl Golden

Andrea Kean

David Spinner

Stephen Linsley

Maggie Lazar

Sherry Padgett

Carolyn Graves

Jaine Gilbert

Wednesday, December 4, 2013 6:32 p.m.

PROCEEDINGS

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MR. HAGEN: I don't know how many more people will be coming and how many people are in the parking lot, but it is 6:30. We have got a lot to go through here. And I'm sure we do not have enough time to do it all. But we're going to get as much done as we can this evening, so we'd better start on time.

My name is Wayne Hagen. I'm the public participation specialist for the Department of Toxic Substances Control. And I want to welcome you all to the public meeting for the draft Removal Action Workplan, or RAW -- when we say the word "RAW" that's what we are talking about -- for the UC Richmond Field Station.

The purpose of this meeting is to provide the community with the opportunity to learn more about the draft RAW, to ask questions about the draft RAW, and to provide input about the draft RAW. This is only the first stage of making comments about the draft RAW. The public comment period will last until January 10th. So you don't absolutely have to get in a comment today. You can submit your comments to Lynn; and we'll explain further how to do that as we go on here.

Just a few things that you should know. The bathrooms are right through that door there. Very nice bathrooms, by the way. It's a nice room for a meeting. I appreciate that.

And we actually have -- we don't anticipate any emergencies, but of course we go through this. We actually have three exits here, so if anything should happen that would require the emergency exits, please, people on that side that way, people over here that way, people in the back out that door.

It's very important to remember that this meeting is scheduled to end at 8:30. That is a hard time limit, because the gates close at 9:00 and you want to be able to get out before the gates close and they lock you in here. Please keep that in mind.

As you're asking questions and making comments, we want to hear from everybody who is in attendance at this meeting. On the back table are copies of the fact sheet. And also the gold public comment cards. If you could, please fill out the card with your name and address on the card. When you are called up to make a comment and ask a question, we've got a microphone here. I can take the card from you.

At the end of the public comment period, Lynn will be writing a document called a Response to

Comments. She will be responding to all of the comments that are made throughout the entire public comment period. And that document is supposed to be sent to everybody who has made comments. So we need your address.

Now, this meeting is only to address the draft RAW, which addresses the cleanup of the campus prior to any of the work that can be done on it. Next week, December 11th, from 7:00 to 9:00 p.m. in the Richmond City Council Chambers at 440 Civic Center Plaza, is a public hearing on the draft Environmental Impact Report.

If you have comments or questions related to the environmental impact report, you should go to that meeting. If you make a comment here that applies to the EIR, it will be a part of the public record. And, actually, we have Jennifer here. She has cards for public comments for the EIR. And because it will be part of the public record here, that comment will be a part of the EIR public comment.

But we appreciate it if people try to keep their comments tonight, because we've got a lot of people, to those questions involving the cleanup.

So we're going to begin with a short presentation by our DTSC project manager, Lynn, who will explain the RAW process and where we are. Jason

Broderson, the project manager for Tetra Tech, will give a short review of the RAW and the soil management plan. We're going to have Scott Shackleton say a few words about what this means to the Richmond Field Station. And then it will be your chance to ask questions and provide comments.

Thank you very much.

Lynn.

MS. NAKASHIMA: Thank you, Wayne. My name is Lynn Nakashima. I'm with DTSC as the project manager.

What I'm going to do tonight is just briefly explain what the process is that the site has been going through for the investigation and cleanup and then briefly explain how the Environmental Impact Report that Wayne just talked about fits into our process.

So for this site it was originally under the oversight of the Regional Water Quality Control Board, which their investigations began in 1992 and also resulted in cleanup actions being taken between 2002 and 2004. In 2005, that oversight was transferred to the DTSC.

And when we took over the site, one of the first things we had the University do was to put together a Current Conditions Report. The Current Conditions Report summarizes all the past investigations that were done under the Water Board; and it also identified areas that needed more or additional investigation. So what it did was identify data gaps. We also -- DTSC prepared what is known as a Public Participation Plan at the same time. And this is a description of the community and ways to inform the community about what's going on.

So based on the Current Conditions Report, as I said, they identified data gaps. Three phases of the investigation were put together and they were conducted between 2010 and 2012.

After all the investigations were completed, they collected all the data and put together what is called a Site Characterization Report. That report identified the nature and extent of contamination at the property. And also it included what is known as a Human Health Risk Assessment. And that assessment took the data and evaluated the health risks that were posed by the site.

After we approved the Site Characterization Report, then UC put together a draft Removal Action Workplan, which is what we're here to talk about tonight. That included sending out fact sheets and putting a public notice in the newspaper and then holding this public meeting tonight.

So the RAW evaluates different cleanup alternatives and proposes preferred alternatives. And then, as Wayne said, Jason is going to be following me and talking more about what's in the RAW.

The other part of this phase is that, as a responsible agency, DTSC also has to comply with the California Environmental Quality Act. The California Environmental Quality Act is required whenever a state agency makes a decision about a project that may have a significant environmental effect. If there's more one agency involved, then one of them is considered the lead agency and the other ones have the primary responsibility for approving the project. The lead agency is generally the agency who has the more overreaching or general governmental powers.

So in this case UC is the lead agency because they're approving the long-range development plan for the Richmond Bay Campus. And included in that EIR, the Environmental Impact Report, is the Removal Action Workplan; but that is just a smaller part of the larger document. So then DTSC becomes what is known as the responsible agency. That's because we are just -- we are tasked with approving the RAW.

So the EIR includes evaluation of impacts from construction and operation associated with the development and also includes impacts from the RAW. So what DTSC will do is we will evaluate UC's Environmental Impact Report, determine if it's adequate. If it's not, then we will make comments to UC during the current public comment period that's going on right now. After UC certifies their Environmental Impact Report, then we will go back and relook at the EIR; and if it sufficiently covers all of our concerns, then we'll move on to the next step. So once UC certifies their Environmental Impact Report, then DTSC can approve the Removal Action Workplan.

After we approve the Removal Action Workplan, then UC will be able to implement the actions that are identified in it. And after they document -- they'll document the work. And then as part of it, if there needs to be a deed restriction on the property, then we will enter into a deed restriction with UC; and then the site can be certified for those cleanup actions that were completed.

If there's any kind of long-term management or care that's required, then we will also follow up on that after the certification is completed.

So that's just basically the general process that we followed for this site; and where it's circled in orange is where we are tonight. Thank you.

MR. BRODERSON: Thank you, Lynn.

I'm going to introduce myself. My name is Jason Broderson. I am a California-registered professional geologist. I work for Tetra Tech. We're the environmental consultant for UC Berkeley. I've been with Tetra Tech for about 23 years. I've been on this project since 2007 and am the principal in charge for all the primary documents that we issue. And that started with the Current Conditions Report through the Site Characterization Report and through the RAW and all other documents that we've submitted. And I'm happy to be here to present this information on the RAW on behalf of UC Berkeley.

So for those who maybe drove in at night and not familiar with the field station, the plots that you see up here are UC-owned properties in Richmond. And this is the area we refer to as the field station. There's an offshore. And there is the 3300 Regatta property, also owned by UC Berkeley. These two parcels are neither included in the order and work we're doing nor are they included in the RAW -- in the scope of the RAW.

To give some -- a couple of words and a couple of names of areas that I'm going to be talking about in my brief presentation, Stege Marsh is located right here. This is the East Bay Regional Park Trail that cuts across here. Marina Bay development. This is the former Zeneca site, which I'll be mentioning a few times. And, lastly, we'd like to call attention to this blue line, which is the former Bay line. And that's important because over the years a lot of deposition occurred on the south side of the former Bay line. And in the early stage of the investigation there was a lot of focus put towards investigating and remediating those areas.

Okay. A little history. From 1870 until about 1940 the field station was owned by the California Cap Company. And the California Cap Company was in the business of manufacturing blasting caps and explosives and shells. And the primary function -- or the primary active agent for these blasting caps that the California Cap Company used was a product called mercury fulminate. And mercury fulminate is a white powder that is explosive and it's similar to the black powder of TNT that most of us are more familiar with in terms of explosives.

Mercury fulminate is very easy to develop; however, it's fairly unstable and really was not created much in the U.S. or abroad and stopped, really. I think California Cap Company -- there's another Dupont property were kind of the final operators and manufacturers of mercury fulminate.

It was created at the mercury fulminate area, which you'll be hearing also in a little bit. And this is a photo of the mercury fulminate area, which was located fairly close to the edge of the former Bay Trail -- I'm sorry, the former Bay -- that I showed earlier.

UC Berkeley purchased the property in 1950 and the property was purchased to help expand academic and research programs within UC Berkeley. And as a part of the redevelopment at that time they began investigating and responsible for the cleanup that was left over from California Cap Company.

I put this slide up because the yellow that you see, those are former California Cap Company buildings. And the gray ones that you see, those are current UC Berkeley buildings. There is some overlap. But the reason I put this slide up is that the bulk of the activity of the California Cap Company was in the center core of the current field station. There are a couple of buildings out here; but, when you look at these other areas, there really was not much California Cap Company activity. And I think -- here's the mercury fulminate area, this round item down here that I mentioned earlier. So this was really the center of the bulk of the production of these blasting caps. And then some of this was office space and other research activities.

In the late '80s and '90s and early 2000s, UC Berkeley engaged in some fairly significant cleanup activities under, like Lynn said, the jurisdiction and oversight of the Water Board. The first activities that they did was to excavate tens of thousands of cubic yards of contaminated soil from Western Stege Marsh, which is located down here. This photo shows what Stege Marsh looked like prior to the cleanup in 2000. The orange that you see is iron oxidized from -- I guess it was cinder-related materials and like when there's mercury and PCBs as well that were excavated.

Here's what the excavation looked like. So this photograph is looking from west to east. So here's the field station. This is Western Stege Marsh. Here's the former Zeneca property we're looking beyond. And if you were to go this way, that's up towards the field station and the Bay is down towards your right.

So where are we today? Well, there was in the 200s, like I said, some significant sources removed. It wasn't just Western Stege Marsh that was remediated and restored. There were significant areas of pyrite cinders which were also removed during that period.

And since the DTSC came on board, we kind of changed some of the terminology and we started into this phased field-sampling workplan approach. We have completed three of the five proposed phases. The three phases are what we're really talking about here, which culminate with this RAW.

And so phase -- we call the Site Characterization Report presented in Phases 1, 2, and 3. And the result of that report indicated several areas that mandated evaluation for further evaluation for cleanup. And that's what we'll be talking about tonight. And that is the scope of the RAW.

And those areas which require further evaluation are the mercury fulminate area, the corporation yard, and some former transformer and PCB areas as well as groundwater and a carbon tetrachloride area up here that requires further evaluation.

There are other known contaminants that are identified in the site-characterization report, primarily in groundwater. There are some organic chemicals that have been deemed to be originated from our neighbor site at the Campus Bay.

TCE, trichloroethylene, is the one that is kind of an indicator contaminant. And there are ongoing activities with TCE. There's been some treatment studies up at the north end of the boundary, where you drove in, as well as some down on this edge as well as some ongoing activity within this biologically active permeable barrier. The TCE that is associated with the former Zeneca property, the remediation of that and the evaluation of remediation of that is to be addressed in the upcoming feasibility study, the FS RAP for the Zeneca property. It's important that that's clear, that this document does not include that because it is intended to be addressed by the upcoming document from our neighbors.

Okay. So now fast forward to today. I guess it's almost two years in the making now -- a year in the making -- the proposed Richmond Bay Campus. The proposed Richmond Bay Campus as outlined here does include the Regatta property. But like I said earlier, the Regatta property is not a scope of the RAW. As many of you probably heard presentations in the city of Richmond, the proposed Richmond Bay Campus is a joint collaboration with UC Berkeley and Lawrence Berkeley Lab.

This comes straight out of the EIR report. And this is a land-use map, which is important in terms of the scope of the RAW. The blue indicates what we call the RES area, research, education, and support. The easiest way to think of the blue area is this is developable property. And then the green area is designated as natural open space, or the NOS area; and that's not intended to be developed or, at least, intended to be protected.

So this is what the RES area looks like for the entire proposed Richmond Bay Campus. And here's the green open space on the entire campus. I say "entire campus" because the scope of this RAW is what we think of as the Richmond Field Station. And specifically the scope of this RAW is the soil within the RES area -- so the blue -- and it's the groundwater of everything else. So there's some -- it's not a one-to-one between soil and groundwater. What is not included in this RAW is the natural open space area; and that is going to be addressed -- actually, it is being addressed through ongoing investigations. I mentioned earlier there's three phases. Phases 1, 2, and 3 are complete; and Phases 4 and 5 are going to be targeting the natural open space areas that remain.

Okay. Just a summary of a couple of the key milestones. In May 2013 is when we issued the final Site Characterization Report that Lynn mentioned. We just finalized the public draft RAW. We are currently in the review period. Just so people know what the review outreach was, we sent 6,000 mailers. We sent email distributions. There's a newspaper announcement. And then, of course, we are having this December 5th public meeting. Lynn mentioned the process. The final RAW will come out following UC certification of the EIR. And the EIR is currently planned to go to the Regents in May of 2014.

What is RAW? A RAW is a document that is intended to evaluate what possible cleanup alternatives can be applied and what's the best cleanup alternative for your site. That's the easiest way to think about it, rather than just selecting a remedy and look at what's available. And then it begins to narrow them down into what's best for your site.

So the first thing the RAW does is it looks at the universe of technologies. And it looks at everything. It looks at reuse, recycling, neutralization, in situ stabilization. There's a lot of different techniques out there. And it pares those down to what is reasonable for what this site needs and the kind of contaminants that this site has.

The next thing the RAW does is it looks at the range of those technologies and combines them together into what you'll see we call alternatives. So there are soil remedial alternatives and there are groundwater remedial alternatives. And we package alternatives to encompass a range of protectiveness in regard to cleanups. And the range usually goes from no action whatsoever to an action that gets you to an unrestricted use. That tends to bookend the types of alternatives you have.

And then we evaluate those alternatives against three criteria: effectiveness, implementability, and cost. Once we go through that evaluation there's a recommended remedy. So if you look at -- the bulk of the RAW is getting us to this stage. So Sections 1, 2, 3, and 4 are an evaluation of the technologies, the alternatives; and then it evaluates each of the alternatives for these effectiveness, implementability, and cost.

The last section of the RAW is a description of the proposed action. And that's where we are here. So these are the five alternatives that we've isolated in the RAW for soil.

The first alternative is no action, which is mandated by state and federal law. That was not proposed because it's not protective. It is cost-efficient-and it's easily implemented, however.

The second was an excavation to unrestricted use with offsite disposal. It's also not proposed. It's effective, but it's not very implementable and it's not as cost-effective.

Soil Alternative 3 is an excavation to commercial use with offsite disposal. It also includes a soil management plan and ongoing land-use controls. That is the proposed remedy.

Soil 4, with land-use controls only. In other words, what if we just tell people you can't dig, in perpetuity? And while that also scores high with cost and implementability, it's not as effective.

And then the last alternative, Soil Alternative 5, was really just applied to the mercury fulminate area. What would happen and how efficient would it be just to cap it with an asphalt cap? It is similar in cost; however, is not, in the long-term, as effective as excavation and removal.

For groundwater we only looked at carbon tetrachloride, like I mentioned earlier. The TCE is being addressed from neighbors next door. And there were no other chemicals in any other areas that mandate further evaluation for cleanup. We looked at four alternatives. We looked at the no action, which was not proposed. And we looked at three remediation technologies.

The first, Groundwater 2, is permeable reactive barrier with land-use controls. And really what that entails is a backhoe going out and trenching through the ground and installing a fence or a wall. But it's designed so that water passes through it and it treats the water as it goes through it.

The third alternative is a bioremediation alternative, which is, in fact, very similar to the pilot studies which are ongoing currently within the Zeneca and bordering into the radiation. That entails installing wells and injecting different materials to help enhance bioremediation.

And then the fourth is monitored natural attenuation with land-use controls and monitoring. This is the recommended remedy. This is a process that allows you to watch closely whether or not the natural processes can help degrade these organics and help bring them to both a stable state and a lower concentration state. It's important to note that under the Groundwater 4 alternative there is a contingency that if this doesn't work that we would trigger evaluation of either of the two more active remediation technologies for groundwater.

So this is what it looks like in the end in terms of activities that are going to happen. The proposed remedy would have us installing some new monitoring wells and doing some intense monitoring up in the carbon tetrachloride area, excavating the mercury fulminate area, excavating some PCB areas and some areas within the corporation yard, and then ongoing monitoring. There's also deed restrictions for soil and groundwater. The deed restrictions for soil are basically that the reuse can only be commercial and no sensitive uses within that commercial. They will also mandate the implementation of a soil management plan. So we're going to talk about that a little bit. That's going to be in the last part of my presentation.

For groundwater, the deed restrictions are not to use the groundwater. It seems fairly straightforward, but not to use it for drinking or other beneficial uses. The only time that groundwater can be used or would be impacted is if you have a dewatering program and that soil management plan would allow to make sure that there's no unacceptable exposures for that. And then annual monitoring for groundwater across the entire field station.

So the last piece of my presentation is the soil management plan. This is important to note that the soil management plan is included as Appendix C in the RAW. I'm sorry. Attachment C in the RAW. The soil management planning is intended to be a stand-alone document to help ensure that in the future for any new developments or any soil disturbance the activities, that there's soil investigation prior to those activities. It ensures that there are no unsafe conditions present for construction workers, any on-site tenants, or off-site communities. That is the primary intent and objective of the soil management plan. It also ensures that in the future there are no exposures to unsafe soil or groundwater contaminants. Those two are very similar. It provides rigorous documentation and multiple steps for both UC, EH&S, and for DTSC approval throughout the process. And it's constantly monitored and updated.

So here's really how it happens. Something comes up -- a new building, maybe a significant landscaping project, maybe a new roadway. Once that activity is identified, we look and see, well, where is it on the field station? Is it an area that had historic contamination where there might be cinders? Is it an area where there wasn't contamination? Depending on where it is, the soil management plan outlines a cookbook or a recipe for how to investigate that area. It tells you how often to sample. It tells you what to test for. It tells you how deep to test.

The sampling will be conducted based on the results. And there's chemical screening criteria in the RAW that are all based on commercial exposure. Basically the options are you don't have to do anything special. No action is necessary. There could be offsite disposal options or on-site management. And there's always the opportunity for either DTSC or UC Berkeley on a case-by-case level to deviate from the soil management plan, with approval, of course, and then implement it.

Okay. This is my last slide. So there's a lot of different places you can find more information on all these documents, not just the RAW. UC Berkeley maintains the Richmond Field Station environmental Website. There's the EnviroStor Website that Wayne will talk about in a second here. The RAW is currently available at three locations in hard copy. There are two copies at the Richmond library. There's one copy at DTSC's office and you just need to ask Lynn for an appointment to see it. And there's a copy right at the front in Building 478 at the field station here.

My last reminder is that RAW comments are due to DTSC by January 10th.

Wayne.

MR. HAGEN: I want to the walk people through getting to the EnviroStor Website a little bit, because unfortunately it is not incredibly intuitive to find it.

But the easiest way is to go to the Department of Toxic Substances Control Website at dtsc.ca.gov. And this is what the first page looks like. This is not the current first page, because there's a lot other stuff over there on the far right-hand side. I chose a previous slide of the Web page because it shows you where the EnviroStor button is, over there on the right-hand side. If you click that button, you get to this particular little picture here --

Did I skip one here? No.

You should be getting to this. You want to go to "Site Facilities Search." Put in the "City of Richmond." Because this is screen-shot, down at the bottom I don't have the button. I don't show the button that says "Get Report" at the bottom. But you scroll down there and you have to hit that button that says "Get Report." That that will take you to a list of all of the sites associated with the City of Richmond. On page 3 down towards the bottom is "the University of California Richmond." And you click on the report. You get a page that looks like this. Go over to "Community Involvement." Click on that and you have the "draft RAW." You click on that, the "draft RAW." You can save it to your computer so you can read it at any time that you wish. And, also, if you click on this button up on the far right-hand corner, "Sign Up for Email Alerts," any time something new is added to that EnviroStor Website, you will be alerted. So that's very handy. If you've got a site that you're really interested in, that's a very handy way of getting all the new documents that are posted to the public on EnviroStor.

So I am going to open it up to public comments in just a minute, but I would like to ask Scott Shackleton to say a few words about what this whole project means to UC Richmond and the field station.

MR. SHACKLETON: Thanks, Wayne.

Good evening. My name is Scott Shackleton. I'm the manager of the Richmond Field Station and soon to be Richmond Bay Campus. I just want to welcome you.

For those of you who have never been out here before, I'm sorry it's so dark tonight. I know it's tough to see what we have out here. It's a beautiful site. I hope you take the time some day to come out during the daytime and take a look at what's here. Obviously, we have been out here since 1950, so this is very important for us. We're looking forward to the next generation of the campus. A lot of the buildings out here have been here since before we were here. So we're anxious to see those some day go away and be replaced with new buildings and start to grow our population out here.

So this step is a huge part that's taken years to get to this point. And we've worked closely with DTSC. And we appreciate your time tonight coming here and your interest in this. And we appreciate your comments. We enjoy being neighbors. We're here for the long haul and we want you to know that we plan to be here for a long time and we want to work closely with you. So we appreciate your taking the time and look forward to working with you as we develop the station.

Thank you.

MR. HAGEN: Thanks, Scott.

Now it's your turn. This is not a public hearing. We do not have a clock limiting the time that you have to speak. But do remember that we have to leave at 8:30. That is a hard time, so please be respectful of everybody. I would like everybody who is here to get a chance to speak, to get a chance to ask questions.

As you recognize -- we'd just like to go ahead and have people kind of raise their hands. And as you're recognized, if you could please hand us the yellow card. And, also, say your name. Everything that is said tonight is being recorded by a court reporter. So there will be a transcript. And we will go through that transcript and pull these comments and these questions out and you will get a copy of the Response to Comments document. So it's very important that we have your address.

So why don't we go ahead and -- the gentleman here in front has his card up, so we may as well give him a change. Thank you.

MR. SCHNEPF: I think this presentation was a fraud. And the land-use covenants were double-talked. On one hand you said they're useless and on the other hand you're using them.

Carbon tetrachloride. You've got many sites, many areas on the campus that have contamination of carbon tetrachloride, but you're only mentioning one. What about the others? The site has not been fully characterized.

Thank you.

MR. HAGEN: Do you want to respond to that or just take it as a comment? Just take it as a comment? Okay.

MS. HUNTER: My name is Cinna Hunter. I'm a resident of Marina Bay.

I thought this presentation was also pretty slick. And as a resident, I found it meaningless actually. You went through it very quickly. This is the first time I've been here.

I have a couple of questions, one of which is I'd like to actually know if that presentation is available to the residents so that we can actually look at it together and go through it slide by slide and analyze what you've done such a great job on, because it went too fast for me. Anyway, that's the comment on that.

I'd like to know why the Regatta parcel is not included. I really would, because Marina Bay backs up right against that. And if you're planning to excavate it and do whatever you're doing with it, I think it really directly impacts us.

And then, lastly, I'd just like to have you define a couple of things, one of which is "limited human intrusion" and "commercial use only."

MR. BRODERSON: The presentation will be available on the Richmond Field Station Website tomorrow. It's also on the handout upfront.

MS. HUNTER: [off-mic]

MR. BRODERSON: It's the same presentation.

MS. HUNTER: Is this being taped so we can actually listen to what your discussion was about --

your presentation? Because I have the thumbnails, but can we get, like, the whole thing?

MR. BRODERSON: The transcript will be available, but I assume that he was -- actually, I don't think I'll be able to answer that.

Let me go through -- I can answer a lot of questions very quickly. I apologize for how short it was. We were directed to give 20 minutes and I tried to keep it to 20 minutes. The presentation -- larger than just the thumbnails -- the entire presentation will be available on the Richmond Field Station Website tomorrow. I don't know if the transcript is a public document. I assume it is.

MR. HAGEN: Yes.

MR. BRODERSON: In this case, you can hear -- you can read everything that I stated.

The Regatta property -- that's up to you to respond. It's not in the RAW because it's not in the order. It's not something we've been looking at. We not currently proposing any cleanup activity at the Regatta property.

MS. HUNTER: [off mic]

MR. BRODERSON: Oh, the definition of the two things?

MS. HUNTER: [off mic]

MR. BRODERSON: Commercial use. There are some -- commercial use has a handful of specific sensitive uses that are not allowed, such as daycare, hospitals, community gardens, K-through-12 schools. What else? Hospitals. Housing is residential. It's not commercial. So, yes. No housing. That's part of the restriction too.

MS. HUNTER: Limited human intrusion?

MR. BRODERSON: I don't believe I used that term. I'm not sure what you're referring to.

MS. HUNTER: It's on the land-use plan under natural open space, 25 acres. It says "limited human intrusion."

MR. BRODERSON: That is part of the description of land use for the proposed campus?

MS. HUNTER: I'm looking right at it.

MR. BRODERSON: Right. I don't -- that's in the EIR. I don't have a specific description of what that is.

MS. RABOVSKY: My name is Jean Rabovsky. I am a resident of El Cerrito and a retiree. I am a scientist and at the time of retirement was working as a toxicologist where I reviewed and prepared documents on human health effects of chemicals. For two years I was an active member of the Community Advisory Group and its toxics committee. At the present time I am an ad hoc member of the toxics Committee.

I want to thank you for providing this public meeting to discuss the draft Removal Action Workplan otherwise known as dRAW.

I just want to point out that this document is dated the 25th of November, 2013, and then made available to the public on the 26th of November of this year.

I want to discuss three issues that require additional consideration in the dRAW. They are the physical boundaries of the project, human receptors used in the health risk assessment, and specific toxicity values used for comparisons with estimated body burdens. Each will be described subsequently. Please note that the absence of commentary on any other section of the dRAW do not imply concurrence or nonconcurrence with those sections.

Before proceeding with specific concerns, it should be noted that the dRAW section on risk assessment is sparse on details and does not permit an adequate evaluation of the assumptions and decisions used in exposure assessment, dose-response assessment, toxicity values, and risk characterization. My comments are therefore based on incomplete information.

Project Boundaries. The project boundaries are too narrow. As described in the dRAW, the following adjacent areas are omitted from project consideration. They are: the Zeneca/Stauffer site on the east, the Bay Trail and lands on the south, the residential community of Marina Bay on the west, and the Harbor Front businesses on the north.

The residents of Marina Bay will be impacted by noise and construction activities, as they were during the unsupervised demolition activities in the early 2000s.

The Bay Trail is used for recreation by adults and children with and without dogs.

Employees and owners of the businesses of the Harbor Front tract will be impacted in ways similar to the residents of Marina Bay.

Among the people impacted by the construction and excavation activities will be pregnant women and fetuses, children, elders, and those with suboptimal health.

The soil toxins that are present in the University of California Richmond Field Station side of the east boundary and those that are present in the Zeneca/Stauffer side do not suddenly stop at a line established by the eastern boundary. To ignore the passage of toxic chemicals in both directions is to minimize the potential health risks to exposed populations and is not good public health policy.

I therefore recommend that the boundaries be redrawn to include the Marina Bay, Bay Trail and areas south, the Zeneca/Stauffer, and the Harbor Front tract.

Human Receptors. Future receptors are defined in the dRAW as "future commercial workers, future construction workers, and future maintenance workers." Such future ignores the presence of residential receptors in Marina Bay; walkers, bikers, and children on the Bay Trail; and employees and owners of the businesses in the Harbor Front tract. Although recreational users and children who visit the site during field trips are included, apparently in the commercial worker exposure pathway, these receptors omit those who live near the site and will be exposed during longer durations. The omission of residential receptors is not in the best interest of public health protection.

I therefore recommend to include the residential receptors in the list of human receptors and apply appropriate exposure factors and toxicity guidelines and standards.

Specific Toxicity Values. Despite the narrative on page 18 that explains the source of various toxicity values, the reader is kept ignorant of the specific values that are used until Section 3.1, page 25, in the table called "Remedial Goals." Eight chemicals of concern are listed, six in soil and two in groundwater. I will discuss only three in soil.

They are total polychlorinated biphenyls, otherwise known as PCBs; arsenic; and lead. Note again that the absence of discussion on the remaining five chemicals does not indicate either concurrence or disagreement with the information on them. The meaning of the table "Remedial Goals" is unclear. At first reading, the column labeled "Remedial Goal" appears to indicate a toxicity-comparison value. A comment in Footnote A, however, appears to explain the basis for each remedial goal. According to my interpretation, the remedial goal for total PCBs is based on the TSCA standard, that for arsenic is based on background arsenic levels, and that for lead is based on a risk-based concentration for the commercial worker.

I therefore recommend clarifying the meaning of the various columns in the table labeled "Remedial Goals," specifically for the three chemicals that I mentioned.

First, PCBs. Current and future workers are considered to be protected against PCBs when the remediation results in a soil level less than or equal to 1 milligram total PCBs per kilogram of soil. The remedial goal of 1 mg per kg is based on a USEPA Toxic Substances Control Act regulation that sets this level for unrestricted access. The basis for this number is not known. Many of us have spent many hours looking for it. It doesn't exist. Or if it exists, it's hidden somewhere. The basis for this number, as I say, is not known; and other toxicity criteria strongly suggest that public health protection may not be available at this level.

It turns out that there are other levels that have been developed based on health-risk calculations. One is the California Health-Screening Level for both residential and commercial receptors. They are both less than one milligram per kilogram. Doesn't matter what the actual numbers are right now, but they are less than one mg per kilogram. There is also a USEPA preliminary remediation goal for cancer and non-cancer. And for the noncancer, again, much less than this one milligram per kilogram.

Now, the narrative in the dRAW is not clear about the meaning of the remedial goal of the one milligram per kilogram soil. Now, will the soil be excavated to remove as much PCBs as possible with remaining residues assessed by the TSCA standard? Or will the TSCA standard represent that amount that will be allowed to remain in the soil? These are two different questions and they really include two different concepts that must be clarified.

Arsenic. According to the table "Remedial Goals," that for arsenic is 16 mgs per kilogram - we'll just use the number 16. The units don't matter here. This value is considered to be the background or control level. The exposures for the three worker categories are less than this remedial goal of 16. The narrative states that the removal action objective will prevent exposure to the workers to soil containing chemical concentrations greater than the appropriate criterion, which in the case of arsenic, as I said, is 16. It would thus appear that arsenic will be allowed to remain in the soil. That is my reading of this section.

However, the California Human Health Screening Levels for arsenic are much, much less than 16 for both residential and industrial commercial receptors. Only the commercial worker in the dRAW analysis is near the industrial/commercial CHHSL. The construction and maintenance workers will be exposed to arsenic levels greater than that listed in the California Human Health Screening Levels. Residential receptors are not even included in the analysis.

Now, as described in the OEHHA document, the table that lists all the CHHSLs, the CHHSL for arsenic -- the CHSSLs for arsenic are to be applied to arsenic from human activity only and naturally occurring arsenic levels may be above those numbers. In other words, the background levels of naturally occurring arsenic are toxic. We are then informed that at a given site, quote, The agency with authority over remediation decisions should be consulted.

Now, apparently the authorized agency has determined that the remedial goal should be the toxic background level because it is assumed to be naturally occurring. The question remains, what is the source of the naturally occurring arsenic? Is it only geologic arsenic found in the crust of the planet? Has arsenic that may be found within rock formations been disturbed and released into the environment by human activity? How does one draw an inflexible line between levels that result from human activity and naturally occurring levels? And why are the responsible parties, the University of California and the State, satisfied that toxic levels of arsenic can remain in the soil?

Lead. The remedial goal in the dRAW document for lead is 320 milligrams per kilogram soil. This value is the CHHSL for commercial/industrial receptors. For reasons already stated, the residential receptors should be included in the analysis. Now, keep in mind that the commercial/industrial CHHSL does not include young children who are going to reside in Marina Bay and walk and run and bike on the Bay.

Trail. The residential CHHSL for lead is 80 milligrams per kilogram and is based on a child resident. So in terms of recommendations for these three chemicals -- PCBs, arsenic, and lead -- I think that the residential CHHSL should be used to at least get a handle and try to protect human health to the best extent possible.

Thank you.

THE REPORTER: Excuse me, ma'am. Could I get a copy of what you read from? It would be a big help for me.

MS. RABOVSKY: You know, what I have right now -- I'm in a draft and I'm still rewriting it a little bit. What I can do --

THE REPORTER: I need to do it verbatim. Whatever you said tonight will be in the transcript.

MS. RABOVSKY: Well, it may not be exactly verbatim, because I'm reading from this.

THE REPORTER: I'll see you afterwards.

MS. RABOVSKY: Why don't we do that and we can figure out something.

THE REPORTER: Sorry for the interruption.

MR. HAGEN: Yes. And if you could please, when you finish with that, make sure that Lynn gets it.

MS. RABOVSKY: I will be submitting this for written comments. Does that make a difference? You still want my --

THE REPORTER: It has to be in the record for tonight.

MS. RABOVSKY: Why don't we speak afterwards and I'll figure out how to get something to you, because my stuff is being re-written here.

THE REPORTER: Thank you.

MR. HAGEN: Thank you very much. That was pretty extensive.

Is there anything about that comment -- anything that either, Jason or Lynn, you would like to address?

MR. BRODERSON: So, Jean, to clarify, the RAW summarizes the risk assessment. It is not intended to be stand-alone. The Site Characterization Report has all the detail you're interested in.

MR. HAGEN: Okay. This gentleman back here has had his hand up for quite some time.

UNIDENTIFIED SPEAKER: Could we get a map up for background? Thank you.

MR. HAGEN: Thank you. Good question. We can do that. Nobody needs to be staring at EnviroStor. And you're right, the map would give a much better background for everybody's discussion. Do you have a yellow card?

MR. CARMAN: I do, but I haven't filled it out yet.

MR. HAGEN: Yeah. Could you give it to me?

I'll get it to you.

MR. HAGEN: And please say your name and address for the court reporter.

MR. CARMAN: My name is Paul Carman. My address is 5800 Burlingame Avenue, Richmond, California.

My question is on the soil alternatives. I'd like to know the tonnage of soil that would be excavated under Soil Alternative 3, compared to the tonnage of soil that would be necessary to be excavated under 2.

And then I'd like to know what the cost differential on those two alternatives are.

And I'd like to know who makes the evaluation of what's too expensive and too costly to do.

Those are my three questions.

MR. BRODERSON: Well, I can't -- all those numbers are right in the RAW. They're in very simple tables. You can look up the tonnage. You can look up the cost numbers; and you can look up --

MR. CARMAN: You must know off the top of your head.

MR. BRODERSON: I don't off the top of my head know all those numbers.

MR. CARMAN: It's two numbers. Soil Alternative 3, Alternative 2. You must -- I mean if you've been working on this since 2007, six years, you've been running this project. It's like a really basic question.

MR. BRODERSON: So, for me, in that document there's probably 50 important numbers, not just two. Off the top of my head I don't know those numbers. But they're easily found --

MR. CARMAN: Okay.

MR. BRODERSON: The second thing, to answer your question, is I have engineers that are trained in cost estimating; and they follow the means, which is an EPA and construction guidance for costs. So those are all just industry standard costs.

MR. CARMAN: So what are they? What are the costs for excavation on Soil 3? What are the costs on soil on Alternative 2? What are the difference in costs?

And then who evaluates that this is too expensive to do -- Soil 2? I mean is that the University or is that Tetra Tech or who -- I mean that's a subjective decision. Who incorporates it's too expensive to do?

MR. SHACKLETON:

MR. BRODERSON: The document doesn't indicate too expensive. It just ranks them relative to each other.

MR. CARMAN: Okay. You haven't answered any of my questions. And you have not attempted to answer any.

MR. BRODERSON: I'm trying.

MR. CARMAN: Okay. This was the public hearing tonight, okay? This isn't like, Oh, let me ask you a question and then you go back and you look it up. I mean that's why we're here.

MR. HAGEN: I'm sorry. This is not a public hearing. This is a public meeting. And we're here to discuss what information needs to be out there; and we're here to hear your questions. There's a difference between public hearing and public meeting.

MR. CARMAN: Okay. So I'll remember that.

So next week these will all be answered?

MS. SELVA: Hello. My name is Mary Selva. I'm the president of the Richmond Annex Neighborhood Council.

Our group is just wondering why we are having a public meeting on this so early, considering this big document has just been released and especially during the holidays. This is very tough for our community because our neighborhood council is not just working on this. We're working on a total of five projects. So it's a ton of work for us to handle all at once during this period of time.

Now, typically you would receive public comments closer to the due date of the written public comment period, when that's up. We just feel that is so early that it doesn't -- we don't have too many comments unless we actually read through the 400-plus-page document. So it's hard for us to ask questions. So our advice would be to get these meetings closer and give the public time to review the document and then come to a meeting like this and you receive the public comments.

Thank you.

MR. HAGEN: I'll go ahead and respond to that, as I have already. And that is that this is, again, a public meeting and not a public hearing. The public comment period lasts until January 10th. You have until

January 10th to provide public comments. This meeting is as much as informational as anything else. By my own personal standards, as public participation, this is a difficult time to have a meeting. I appreciate that sentiment. But, given the fact of the EIR timing, the timing of the work gong on, and the impending coming of the holidays, it was felt that having a meeting at this point would be more productive for those who came to the meeting than certainly closer to the Christmas. So that's why we determined that this would be the best time for the meeting.

And I kind of apologize for that; but at the same time we have extended the public comment period all the way to January 10th.

If you feel like you need more time in the public comment period, you may send us a request for that; and we would certainly consider extending that. But more likely than not, we would not have another meeting for public comments. We're accepting public comments until January 10th and you can get them to us, either written by mail or you can send them by email to Lynn. And if you need to ask questions, you can do that by email as well.

Okay.

MS. ROBERTSON: Thank you. My name is Jean

Robertson, representing California Native Plant Society.

And we are very interested in the native coastal prairie that there are many patches of growing out on the Richmond Field Station property. It's a really valuable piece of property in terms of the native habitat values, because we don't have much coastal prairie left in Alameda and Contra Costa County. And, also, this particular site has a nice gradation of kind of wetlands and inundated areas moving up into higher elevation areas. So for low wetlands. So it's very rare that we have some of this great native coastal prairie.

So our key concerns, of course, are whether the prairie is going to be damaged by having buildings and soccer fields and stuff like that put on it.

But in terms of this particular night and this particular document, we are interested in the monitoring wells on one of your other photographs. You had a series of things here. I don't know what that was. That was on another photograph. Were those monitoring wells?

MR. BRODERSON: No.

MS. ROBERTSON: Some kind of --

MR. BRODERSON: No, that's the general area. The RAW proposes up to ten monitoring wells in that area to help understand where the carbon tetrachloride is.

MS. ROBERTSON: Okay. So while the monitoring wells may not be damaging to the coastal prairie or may be minimally damaging to the coastal prairie meadows, we're concerned about careless equipment use, parking, heavy equipment, dirt storage, big dirt piles with weeds brought in and not dealt with. That would be damaging to the coastal prairie. So we want to have specific language in there that really addresses this very specific concern.

We would also like to have it clearly spelled out that things were going to be fenced off, that valuable prairie is going to be fenced off so the equipment won't accidentally be driving through it and parking on it and dumping dirt.

And then last but not least, for right now we want to know if any cleanup processes are planned for other of the meadows, not just that one big meadow in the upper corner.

MR. BRODERSON: No, none are planned.

MS. ROBERTSON: Thank you.

MS. NAKASHIMA: So the RAW is part of the Environmental Impact Report. I don't know if you've had a chance to look at the draft yet that they just put out.

MS. ROBERTSON: We've just scanned it.

MS. NAKASHIMA: If you look in the biological section of it, there's some mitigation measures to prevent damage specifically to the grasslands.

MS. ROBERTSON: Is that separate from the RAW?

MS. NAKASHIMA: Yes, it's separate from the RAW. So anything, though, that's a mitigation measure in the EIR is something that the RAW will also have to do. So you can keep that in mind. It includes things about weed control and things like that.

MR. HAGEN: Because it does sound like that is something should be a part of the environmental report, those comments will be a part of the Environmental Impact Report. But if you want to address them more specifically to the Environmental Impact Report, fill out that document and give it to Jennifer.

MS. NAKASHIMA: One other thing is that the RAW that we're looking at tonight doesn't include any excavation in the grasslands. But, as Jason said, during the next phase of investigation we are going to be looking to see if there's any contamination in those grasslands. If we have to do any work, we're going to have to come back and reevaluate and do something similar to this. So we won't do anything without telling everybody.

MR. HAGEN: Okay.

MS. ROBERTSON: When will the work be done, this RAW work be done for the grassland?

MR. BRODERSON: Following approval of the EIR, it should be late next summer.

MR. BLUM: Hi. I'm Eric Blum. I own a business nearby and work down near the Zeneca site.

And it sounds like the basic -- well, in 2002 a bunch of dirt was taken from the site here, if I understand right, and combined down on Zeneca with some stuff they had down there and then formed this big 70-acre whatever it is -- cap -- toxic-waste dump, is what the state called it. A lot of that came from here.

If you could address some of that, that what's left behind is it -- is the plan basically after what was removed is removed, what remains here is just pretty much, except for a few little spots, going to stay here. And you're going to monitor it over time to see if it just naturally goes away. That's what I heard.

So I would be curious, when you said if that level of oversight doesn't appear to be really successful, then you would reevaluate and step up to the next most stringent level after that, right? So I'd like to know what time frame that would happen in, if you're monitoring it for it to go away --

MR. BRODERSON: So let me clarify --

MR. BLUM: -- how quickly do you come up with the next evaluation?

MR. BRODERSON: So let me clarify that that comment about allowing natural processes to address the contamination is related to the carbon tetrachloride in groundwater only. And the trigger for a more aggressive remediation of the carbon tetrachloride would be evaluated likely after the first year and yearly after that by DTSC in regards to putting in something like a barrier or injecting to enhance bioremediation.

Soil does not have and wait-and-see type of activity. The soil is, if it's a problem it's being proposed to be removed and if during future construction activities they go to an area where maybe we haven't sampled in the past, we would sample beforehand. And the same holds true. The soil management plan indicates if it's a problem, it will be excavated off-site.

MR. BLUM: So how come the whole area is not completely characterized first so that you know where everything is right away and then you can form a plan to clean up the hot spots, because you know where they are?

MR. BRODERSON: It's hard for me to answer that because there are different people's definitions of characterized and how much coverage is necessary. Phases

1, 2, 3, 4, and 5 are intended to address all the data gaps that were identified in the Current Conditions Report. And we've completed three of those phases. And those targeted the main data gaps associated with the developable portion of the field station and short of, I guess, DTSC asking for more --

MS. NAKASHIMA: So as I explained before, the Regional Water Quality Control Board had done a lot of investigation at this site. So there had been work done and there had been cleanup -- excavations done and things taken away. Then we asked them to put together what they knew about the site and that identified areas that we suspect of having contamination. And that's what the Phase 1, 2, and 3 investigation did was they specifically looked at areas that we suspected there was contamination.

And then -- it's something that we typically do at sites. We don't make people look everywhere for everything, because you can't look everywhere all the time. So then, because they plan on developing the property in the future to making sure -- to ensure that there's no contamination there, they're going to go through this process of sampling and evaluating to make sure that there isn't anything that we haven't missed anything.

MR. BLUM: I don't want to hog the floor, but just a last thought: Knowing that there was the cap company, there's all the activity over the years and with Zeneca next door and the levels of pollution and all that there, doesn't it make sense to be a little bit extra-aggressive because there are areas that you don't know whether they are polluted or not? So we only went after the ones that we already suspected. But there's large areas we have no idea. So how can, in good conscience knowing the activities that went on here, we just leave it that way?

[Inaudible conversation off-mic]

MR. SCHWAB: Hello. My name is Dan Schwab, S-c-h-w-a-b. I've lived in the Richmond Annex for a long time and have been engaged in the community advisory group as part of the Zeneca property for a long time as well.

And I can really appreciate that the University of California is in a big hurry to get this concluded. This is a very major development for the City of Richmond, of which I personally am very keen about. However, tonight's presentation -- I feel like you've glossed over the very serious nature of the history and pollution of this property, making it sound a little bit like it's Disneyland and everything's going to be groovy because we have done our assessments.

Those of us in the community are quite clear that you have not done thorough assessments or taken into account the very real and very serious environmental injustice that has happened in this community in the past as a result of the actions of the Zeneca Corporation and others, which by the way is directly adjacent to the UC property. And I for one don't believe for a moment that we can address the pollution issues on the field station without at the same time addressing those of the Zeneca property.

I was really concerned, Jason, when you said that the soil removal was not recommended due to cost. Is that really the best reason why we cannot clean-up this property to residential standards -- not commercial standards?

And as my friend Eric just said, to make sure that we have completely and unequivocably addressed the current condition of the entire field station before we clean up one spot leading the public to think it's all done.

UC is the big boy here. You've got the legal clout. You have the financial standing. You have the support of the entire state government to do this once and do it right. I for one would appreciate if the

University would take a look at this current draft RAW and take a big step back and make sure all of these questions have been thoroughly addressed rather than trying to jam this through with only one month's public comment. If the pollution of this property really goes back to the 1870s, as you said, what's the big rush? What if it takes us another six months or a year or two or ten to make sure that all of the issues of this property have been thoroughly addressed and this doesn't just become another time bomb the Bay on San Francisco Bay?

Thank you.

BERYL GOLDEN: My name is Beryl Golden. And to follow up on Dan's comments and a couple of other comments, my simple question is, if cost were not an issue, if you would only consider feasibility, what would you recommend?

Thank you.

MR. HAGEN: Do you want to respond to that yet? Keep on going. Okay.

Thank you.

ANDREA KEAN: My name is Andrea Kean.

And I was curious about the movement of groundwater. I know carbon tetrachloride is a solvent; and I know solvents move. And I would assume that the water that we're talking about, the groundwater, moves too. And I know this is a hydrologically active area. And there's tides and there's drainage to the Bay. So I wonder if you could clarify those questions.

MR. BRODERSON: Actually, that's pretty easy, so I'll see if can handle that.

So carbon tetrachloride is a degreaser ;and groundwater at the field station generally moves from this side down to this side, so it moves generally to the southwest. Carbon tetrachloride, like many other organic plumes, actually stabilize. They don't just keep moving. They find a stabilization point and they stop. The carbon tetrachloride that we see up here, there are down-gradient wells that do not have carbon tetrachloride in them.

And in terms of tides, the tidal influence likely stops within a hundred feet of the marsh.

MS. KEAN: I'm just curious. Is that true also for the substantive contaminants in the ground -- soil -- as well?

MR. BRODERSON: The soil contaminants are primarily metals, although there are PCBs and other PAHs in the subsurface. PCBs do not degrade over time. They stay there pretty much forever.

MS. KEAN: Are they stable in the soil?

MR. BRODERSON: PCBs are very stable in soil. PAH can move. We had not seen PAHs or any other soil contaminants from those any deeper than two feet. Mercury we have seen deeper than two feet in the mercury fulminate area, up to ten feet.

MR. SPINNER: Hi. I'm David Spinner. And I am a Berkeley resident.

I have a question about the soil. Recently there was a report on local news about the discovery of radioactive materials, or purported radioactive materials. So I was curious about how the RAW or if the RAW has -- how flexible it is, how it can be adapted; because, if nothing else, it seems like over the years the situation just keeps evolving. There's more stuff found. And once you begin the process what if you uncover something else?

And, also, I was kind of curious about why it is that these -- why radioactive materials if they have -- I think they're been found -- haven't been included in any of this discussion. It's been mostly about the carbon tetrachloride and the heavy metals.

MS. NAKASHIMA: The RAW does have flexibility in the soil management plan portion of it in the event if there's something that is radioactive and that would fall into one of the other categories so we can cover that.

As far as any current radioactive use on the field station site, I think they're all covered under permits from the California Department of Public Health, because they're mainly tracers being used in research. And when the University stops using those tracers and they want to stop using them in the building, then they go through a process with the Department of Public Health to decontaminate buildings if it's necessary or not.

MR. SPINNER: The reason I ask is that it was my understanding that there were radioactive materials discovered further down towards I think there's that bridge. And I realize that's not part of this plan. But -- so this plan essentially doesn't have any provision to the soil --

UNIDENTIFIED SPEAKER: I don't think they've even tested for it.

MR. SPINNER: If that's correct, then if they haven't been tested for, then my comment would be, please test for them.

MR. HAGEN: Okay. Thank you.

Let me go all way to the back here and then we'll come back.

MR. LINSLEY: Stephen Linsley. I'm a

long-time employee in the city. And I have three questions about Table ES1, also found on page 25 as a table.

The first one has to do with the total polychlorinated biphenyls, why the receptor commercial worker standard is listed as 1.59, when in the text the standard is listed as 0.528 for the risk-base concentration.

The second question is with the benzoate pyrene equivalents, why the criteria that's listed is -- the remedial goal is footnoted as being from Richmond Campus Bay background concentration when in fact it is derived from some sort of a DTSC background of urban soils throughout Northern California, has nothing to do with the Campus Bay at all and Richmond Bay either. And it has, like, the 95th percentile, which means that this would be a standard that's only -- I mean only 5 percent of the soils in urban areas in Northern California would be worse than that.

And the last one is mercury, why the choice was made to use the risk-base concentration for commercial workers instead of construction workers.

MR. HAGEN: Do you want to address either of those?

MR. BRODERSON: You're right that there is a typo in that. It's not the -- the BAP is not a Campus Bay number. I'm sorry. That's a DTSC background study number. So we will fix that. Thank you.

MR. HAGEN: Also, we have a couple more people. How many other people are there that want to make public comments? We got two? Okay. We got three?

MS. LAZAR: My name is Maggie Lazar.

I'm an employee here at the Richmond Field Station and I have worked here for 23 years for a group of research engineers who study pavements and soils. And I think it's relevant to say that we were in Building 280 for a number of years and that we also -- the activities of the people that I work with include instrumentation of soils beneath roadways and we've had test roadways here.

So I feel vulnerable and I feel concerned about the safety of myself and my coworkers. And I'm looking at this document, trying to keep that worker safety in mind. And one of the things that bothers me, especially tonight when I'm hearing such incredibly valuable public comment, is that the way in which this is set up with a remedial action workplan that covers a tiny -- a tiny -- portion of a fairly large site, just a few remediations, and then a soil management plan which is intended to cover everything else that comes up for all time and eternity, it takes away the public's interaction with what's going on here.

If something is discovered and it's done through a soil management plan that is almost a self-managed thing where many of the activities could be done by the University alone without public comment or public participation, it takes away a very valuable thing that I think is necessary.

I really believe that the public should be able to review all proposed actions and be informed of all the relevant details, such as the chemicals of concern, the source, the scope of the pollution, and the risk to health and habitat before the work takes place. And I don't think that those protections are maintained by what has been proposed.

MR. HAGEN: Do you want to address that?

MS. NAKASHIMA: I think that's a really good comment. And that we will consider and think about what kind of public-participation activities we could maybe incorporate into the soil management plan.

So thank you.

MR. HAGEN: I appreciate it too. And one of the things that I asked Lynn was how much of that work -- I mean -- and a lot of people here get often the work notices that we send out for various activities that are done and the follow-up activities that are being done; the investigation activities. And so that is at least -- and we attempt to send those out a week before anything happens so people have a chance to respond. So that's just one activity, though. We can incorporate others.

I would like to clarify one thing. Dan called this a 30-day public comment period. It's actually 45 days, from the 26th to January 10th. I do recognize that that includes Christmas and New Year's, so totally useless days in terms of public comment.

MR. SCHWAB: I think my point is well-taken.

MR. HAGEN: It is well-taken and it's well-taken because of the holidays.

[Cross-talk]

MR. HAGEN: I really do appreciate that in terms of strict numbers.

MR. SCHWAB: Thanks for correcting my math. I needed that.

MS. PADGETT: I'm going to walk up here just for a minute. My name is Sherry Padgett. I live right here and I own a business and I employ ten right here. [indicating] I'm a member of the Richmond Southeast Shoreline Area Community Advisory Group. I am one of its founding members; and I'm a member of its toxics committee.

I didn't have time to complete my formal comments. Before I start, I want to answer one of the gentleman's questions from earlier. He wanted to know about the cost of the different alternatives for soil. One of the cost alternatives for removing from the MFA area is $7,000,541 -- $7,541,000. And Alternative 3 for that soil removal is one million one fifty-eight. I think that's the one that was chosen. So that gives you a comparison. So it's seven million five to 1.1 million. That's on one area.

On another it is, for soil, the S-2 alternative was 257,957. So about 260,000 compared to 160.

And on another, for groundwater it was a million two versus 300,000. And it is here in the document. I got an extra copy if you want one. I'll make copies for anyone who will read it.

So I have some random comments and I'll try to go through them quickly.

Overall and in general, I recommend that the cleanup level be changed to an unrestricted standard to allow children to be safe on the site. This is a school, after all.

Fully characterize the site to fill in serious data gaps, as we noted in 2007.

Prepare a health risk assessment that includes the entire site. Do not piecemeal the health risk assessment by carving out some of the highest level of risk in the open-area carbon tetrachloride hot spot.

And this goes to your concern about the grasslands. And I'm really sorry for the conflict here, but I think we really need to remove the carbon tetrachloride source, which is in -- likely, in that open area where the grasslands are. So there's a hot spot out there that right now you're going to leave as is. So we have a conflict surfacing, as that open area is going to be kept an open area. Then that means we can't go in and clean it up because it's an open area. So I'm not sure how to get through that closed loop.

Let's see -- health risk assessment. By carving out some of the highest levels of risk in the open-area carbon tetrachloride hot spot, the uncharacterized bulb and the 2,500-foot section of the property along South 46th Street. So if you look at that red line that runs on the right side from the north to the south, that's South 46th Street; and that's the common property line with Zeneca. And in essence that has been eliminated from this remedial action plan -- remedial action workplan.

I do not attempt to become quasi-professional hazardous waste landfill experts with a badly conceived soil management plan in Appendix C [sic]. Leave the job to those with the state-mandated DTSC.

You can tell I'm really thirsty here.

Do not follow through with the open-seed proposal to dig up contaminated soil from one part of the property to relocate and bury elsewhere. The community has very current and fresh experiences with the field station forgetting about and overlooking piles and piles of dug-up, uncovered contaminated soil until we asked about them. We have the same experience repeated again and again on the Zeneca site, including mountains of soil dug up from one place, located at another, with hazardous-waste levels of arsenic.

Revise the document to include removal -- complete and total removal -- of VOCs and other groundwater-recontamination source material.

Earlier we saw a slide that said the site has been under investigation since 2000. But, contrary to that or in addition to that, the site's been under investigation since 1981 by what was then the California Department of Health Services. And that was the prior name for DTSC. And those samples completely missed the off-the-chart levels of mercury and PCBs -- hot spots that we know about today -- as well as the contamination surrounding the forest products labs and a host of others extending from the Stauffer Chemical plant.

One investigation after another with an endless list of recommendations for site cleanup accumulated between the mid-1980s through today. So we have been at this for 30 years. The community has been witness to the merry-go-round of consultants and generally well-meaning bureaucrats move through -- move the target down the road to the next generation for cleanup.

More recently, in response to DTSC's 2006 site investigation remediation, where UC prepared a current conditions report prepared by Tetra Tech in 2008. The current conditions report was rejected in whole by the Community Advisory Group as a do-over in January 2007 -- this was before Tetra Tech finalized it in 2008 -- because the data gaps were significantly omitted, under-reported, and under-described. The CAG made significant detailed written comments outlining their concerns, all of which DTSC subsequently ignored.

The phased field-sampling workplans were then developed on that flawed current conditions report. One of the opening comments that the CAG made about the current conditions report is -- was -- overall, the report is inadequate; in some cases inaccurate; and generally incomplete. The report does not deliver the same quality, depth, and insight as previous UC Richmond Field Station environmental reports written by Jonas and Associates, Blaslyn and Fogg [phonetic spelling], and the URS Corporation, as well as CH2M Hill. The report's summary of the site description and history is incomplete and in some cases inaccurate. The report's review of toxics issues is incomplete and provides conflicting statements. And it goes on for 27 pages.

One of the points I wanted to make from that summary that we made back then was that, as the proposal was made tonight to do a soil management plan going forward and looking at history of the site, one of the points we made in the report was that the history of the site is incomplete. Therefore, it is impossible to know what really happened at these areas without further sampling.

The report didn't identify the history or the current use of at least two concrete ponds, one north of Building 277 west of Owl Way and one west of Building 276 south of Lark Drive. It didn't include or describe waste-treatment practices for a large above-ground fuel-storage tank north of Building 277. It didn't include or describe the locations of three underground diesel fuel-storage tanks removed in 1986. It didn't describe the ongoing need to sample and evaluate facilities which have used historically or are being used currently to store hazardous materials or radioactive materials. It doesn't describe practices in place to check aging transformers mounted high on old poles. And it doesn't describe the pattern of dead and dying trees in an area previously remediated. There's a long list here. You get the idea.

More importantly, we are concerned about the removal action workplan piecemealing the health risk assessment. And by just including about half of the property, we have left off some of the most highly contaminated parts of the property. So we aren't fully evaluating the risk. We don't know what the risk is.

The Site Characterization Report is the basis of the RAW that we are reviewing tonight, which applies the same extreme resource constraints. In other words, it was strict budget; therefore, they did the best they could with limited funds and reducing a cleanup to less than $2 million when it was originally projected to be 20 to 30 million, including the open space and marsh.

The Human Health Risk Assessment was developed similarly. The UC Richmond Field Station has extensive contamination outside the scope of the remedial action plan. It is nearly incomprehensible how a risk assessment could be developed excluding all of the hazards yet to be characterized and remediated in any area of the marsh and the entire north -- south -- section of South 46th Street. The Human Health Risk Assessment written for the Zeneca property, Lots 1, 2, and 3, has significant risk identified for a host of compounds not included in this RAW. Many of those chemicals of concern are present on the UC property at high levels extending from the field station entrance all the way down to the marsh.

That means that the Human Health Risk Assessment exposure assessment is incomplete because it does not include all of the human toxic load for commercial workers, future construction workers, or future maintenance workers. The site cleanup goals are not set for the cleanest unrestricted standards of a school but rather for commercial standards. And those commercial standards allow a host of remediation tricks.

Choosing the commercial standard instead of a school standard, in my opinion, is the height of institutional hypocrisy when counting the number of times "school" and "education" and "university" are used in all of the site documents and everything related to the field station and the development, including the draft environmental impact report that references and depends on approval of the RAW.

The RAW does not address constant earth movement that takes place on the campus, especially one of this size and this complex. And the risk needs to be reduced to unrestricted standards to keep future generations healthy.

I've got one -- oh -- UC is extended broad privilege because it is a school and a teaching institution with students. Protecting those students from future exposure and potential harm should be paramount among its priorities.

The RAW omits the recent confirmation of volatile organic compound hot spots extending from Zeneca in and around the 20-foot concrete barrier at the South 46th Street -- I'm going to walk up here and show this on the map.

[Indicating] There is a removal -- a biologically active permeable barrier that extends through the Zeneca property, comes around here along South 46th Street, and extends into the UC Richmond Field Station about here over to about this area. Extends right about here. And there is a 20-foot-deep -- 20-foot-high buried concrete dam that extends from about here all the way up South 46th Street to about here. So I'm thinking it's about 350, 400 feet long. And you can't see it aboveground, but it's underground about 20 feet. So it's supposed to act as a barrier. And the volatile organic compounds are extending over this property line all through here, but recent reports confirm that it's on the south side of the biologically active permeable barrier here. It's also on the north side and it's also on the other side of the concrete dam.

The RAW separates the areas along South 46th Street seat from the remainder of the property as though the area is owned by Zeneca and not UC and it's though none of the contaminants in the area are UC's responsibility. If DTSC does not order Zeneca to remove all of the source soil causing down-gradient volatile organic compound and other chemical-of-concern soil, gas, and groundwater plumes, then UC will forever be on the receiving end of ongoing contamination.

If the Zeneca site source soil is removed, there remains decades of groundwater remedial injections ahead to mitigate the control of the hazards that cannot be dug out as they seep out at low to moderate levels. If Zeneca site-source soil is removed -- is not removed -- then the Richmond Bay Campus Human Health Risk Assessment must include the full range of potential exposures.

In the big picture you see us proposing to continue the practice of spot cleanups. The predictable outcome will be observed brown spots in areas we all can see now. And they'll remain uncharacterized and unremediated.

As stated in 2007 regarding the Current Conditions Report, the draft RAW is based on incomplete data. The remediation goals are not protective of human health and, especially, children. And we'd really, really appreciate it if you would go back to the drawing board.

Thank you very much.

MR. HAGEN: Thank you, Sharon.

Is there anybody else besides Carolyn at this point?

MS. GRAVES: I'll just start talking since we're limited on time.

Carolyn Graves.

Why only look for toxics in areas where they are expected to be? And why only look for some toxics?

As others have commented, the Zeneca site was in the area, a working industrial-research facility for over a hundred years. They did pesticides, fungicides, wartime testing. We now know it included uranium testing. And if they have contaminated other neighbors, why not the property that UC is now on?

We think that they should search not only for the list of things that Zeneca is searching for, but also look for radioactivity. UC has its own dumpsite that it established itself which is generally called "the bulb." They've done very limited testing, probably because they don't want to hit something. A UC worker from the '50s and '60s there got classic symptoms of radiological poisoning when they were dumping barium barrels there.

Another comment is the marsh cleanup that they're so proud of talking about. They dug it up, but they had to bury it back in before they were done because of the bird season coming in. And recent testing -- well, testing since the 2000s found that the toxics are back at even higher levels. So don't call it a cleanup. It's not clean.

The RAW includes sampling that was done by the Water Board. We in the community have good reason to know that the Water Board was not the best oversight available. We're very happy to have DTSC. But we still think that they should be very aggressive given the history -- the long history of contamination of this site.

The RAW describes UC RFS staff taking over the primary role of oversight and DTSC only approving documents. This is really wrong. DTSC has the expertise on testing for toxics, not UC. In addition, there is a major problem with transparency. UC is a secretive society. I am sorry. They are. I lived in Berkeley for ten years. I felt very happy to be in a university town. But as far as toxics go, they don't want people to know about it. And this is a problem. It should be independent review by a state agency, not UC.

Thank you.

MR. HAGEN: Thank you, Carolyn.

Does anybody have a yellow card that has spoke and not given me the yellow card yet?

MS. GILBERT: My name is Jaine Gilbert. And I live in Berkeley. My sister lives in the Marina Bay; and she can't be here tonight.

But my main concern is about -- actually, about habitat for -- wetland habitat and coastal prairie habitat and clapper rails that I know are in some of the wetlands there.

And I'm mainly concerned about the open space and how much of that is going to be ecologically -- you know -- helpful for the ecology in the watershed of the area.

And, also, one other question I had about soil. There's been a lot of talk about excavation as the main way to clean up contaminated soils. But I'm interested in whether or not -- I'm not an expert and I don't know -- but if techniques such as micro-remediation has been considered or other techniques that use plants that absorb toxics from the soil so that there's less disturbance of the soil, which, obviously, when you disturb the soil that causes problems for humans as well as wildlife.

MR. SCHNEPF: A quick comment.

MR. HAGEN: Okay.

MR. SCHNEPF: I have noticed, on the part of the University, a lack of ethical treatment, including their contractors. They are scientific and technical people, but they need some ethics training, I think.

MR. HAGEN: Okay. We've got nine minutes here.

MS. HUNTER: As a resident of Marina Bay, I have to say that I was, up until quite recently, fairly ignorant about all of this going on. And I frankly don't know if I would have moved into Marina Bay had I known about all of this. And I do live there now and there are lots of kids and animals and adults. We all want to live there and not have to move.

I understand why Marina Bay isn't currently included in the RAW. However -- well, for obvious reasons, that would cost a ton of money to be able to soil-test. And what if they found something? What are they -- going to level all the buildings and we transplant everybody? However, they do have to test.

And, you know, I'm not an expert. I don't have fancy paperwork, although I really appreciated everybody speaking today, because I feel really edified. I'm just a person that lives there. And I'm really impassioned about the community and the wetlands and the wildlife and the plants and the humans. I'm not as concerned about UC Berkeley spending the money. I feel that they have to spend the money to do it right; and they're not doing that right now.

I met with somebody today -- and, actually, there's a community out by ShImada Park and they're finding now that there's an underground plume that has now seeped through the foundations of many of the people that own those homes there. And it's just a rumor, but I've heard that they're considering some kind of a class-action lawsuit because now they have to remediate all of that and they're taking -- this is all very new information, but I got it from a resident, so I don't know how much of it is true. But if there's a plume that's gone all the way out to ShImada Park, then there's got to be something that's happened at Marina Bay and I really feel strongly that that should be included in the testing. I don't feel that it's complete at all.

Thank you.

MR. HAGEN: Is there anything -- I was going to ask if --

MS. NAKASHIMA: So Marina Bay was actually a separate cleanup that was overseen by the department many years ago. And so there's actually -- how Wayne showed the EnviroStor site for UC, you can do the same thing, but look for -- put in "Marina Bay" or look for "Marina Bay." And that's part of the reason it's not included, because it's considered a separate site.

MR. HAGEN: I don't know if it's on that same slide -- but, yeah, for all of the sites here in Richmond, if you go to EnviroStor, you can find out the status and you can get information about all of the sites and the information there is public.

Is there anything that either, Jason, you or Lynn want to say in conclusion?

Eric has something to say? Okay.

MR. BLUM: Just one sentence, that's all.

I'd just like to say, going forward, as a member of the community here, I would love to support the project. And I hope you're willing to work with us. And I hope that you've heard tonight that a lot of people would really like to see better characterization and a more aggressive cleanup and then we can get behind your project.

Thank you.

MR. HAGEN: Thank you.

I want to thank all you for giving up your valuable time to be here. It shows the passion of the community and it shows how much the community cares about what is happening here and around them. We really appreciate that.

Just personally, sometimes I have public meetings where I have neither none or a couple of people show up. And to me it's always a lot better and it says to me a lot about the community when we have people show up who care about what's going on.

I want to remind you that this is not your only chance to provide public comment. Please, if there's something you've thought about and you want to let us know, go ahead -- and at any time. You don't have to give all your public comments in one piece of paper. If you think about something the next week, go ahead and send it in to Lynn at any time, all the way until January 10th. We'd be happy to hear from you.

Don't forget the EIR meeting next week on the 11th. That's there for comment as well. So, please, pay attention to that. It's a big project. That's at City Hall. It's in the City Council chambers from 7:00 to 9:00; is that correct? Yeah. From 7:00 to 9:00 on the 11th.

Again, thank you very much, everybody.

[The meeting ended at 8:26 p.m.]

CERTIFICATE OF REPORTER

I, FREDDIE REPPOND, a duly authorized Shorthand Reporter and licensed Notary Public, do hereby certify that on the date indicated herein that the above proceedings were taken down by me in stenotype and thereafter transcribed into typewriting and that this transcript is a true record of the said proceedings.

IN WITNESS WHEREOF I have hereunto set my hand on this 15th day of December, 2013.

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FREDDIE REPPOND

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