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Final

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16

Alameda Point
Alameda, California

July 18, 2005

Prepared for:
Base Realignment and Closure
Program Management Office West
San Diego, California

Prepared by:
SulTech, A Joint Venture of Sullivan Consulting Group and Tetra Tech EM Inc.
1230 Columbia Street, Suite 1000
San Diego, California 92101

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PREPARED FOR:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

Professional Engineer: Kevin Bricknell, P.E., SulTech Date: July 18, 2005

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§	Section
§§	Sections
µg/dL	Microgram per deciliter
µg/L	Microgram per liter
$\mu g/m^3$	Microgram per cubic meter
ARAR	Applicable or relevant and appropriate requirement
AST	Aboveground storage tank
B(a)P	Benzo(a)pyrene
Bay	San Francisco Bay
BCDC	Bay Conservation and Development Commission
BCT	Base Realignment and Closure Cleanup Team
bgs	Below ground surface
BSU	Bay Sediment Unit
CAA	Corrective action area
CCR	*California Code of Regulations*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	Chemical of concern
COPC	Chemical of potential concern
CTE	Central tendency exposure
DCA	Dichloroethane
DCB	Dichlorobenzene
DCE	Dichloroethene
DDT	Dichlorodiphenyltrichloroethane
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
ERA	Ecological risk assessment
FS	Feasibility study
FRTR	Federal Remediation Technologies Roundtable
FWBZ	First water-bearing zone
GAP	Generation accumulation point
GRA	General Response Action

HHRA	Human health risk assessment
HI	Hazard index
ISCO	In situ chemical oxidation
IT Corp.	International Technologies Corporation
LUC	Land use control
LUC RD	Land use control remedial design
MCL	Maximum contaminant level
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
MNA	Monitored natural attenuation
NAS	Naval Air Station
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFESC	Naval Facility Engineering Service Center
O&M	Operation and maintenance
OU	Operable unit
OWS	Oil-water separator
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
ppm	Part per million
PRG	Preliminary remediation goal
RACER™	Remedial Action Cost and Engineering Requirements™
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation
RME	Reasonable maximum exposure
ROD	Record of decision
Shaw	Shaw Environmental & Infrastructure, Inc.
SVOC	Semivolatile organic compound
SWBZ	Second water-bearing zone

TBC	To be considered
TCE	Trichloroethene
TDS	Total dissolved solids
Tetra Tech	Tetra Tech EM Inc.
TPH	Total petroleum hydrocarbons
USC	*United States Code*
UST	Underground storage tank
VOC	Volatile organic compound
Water Board	San Francisco Bay Regional Water Quality Control Board

EXECUTIVE SUMMARY

Under the direction of the U.S. Department of the Navy (Navy), Base Realignment and Closure Program Management Office West, and in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, SulTech conducted a feasibility study (FS) for four sites at Operable Unit (OU)-1, Sites 6, 7, 8, and 16, at Alameda Point (formerly Naval Air Station Alameda).

This FS report was prepared based on the results of a remedial investigation (RI) report conducted at OU-1, which recommended further evaluations to address potential human health risks from soil and groundwater contamination at Sites 6, 7, 8, and 16 (Tetra Tech EM Inc. 2004). No sites were identified for further action based on ecological risk. Petroleum contamination at Site 7 was recommended for further action under the Total Petroleum Hydrocarbon (TPH) Program.

REMEDIAL INVESTIGATION SUMMARY AND RECOMMENDATIONS

The RI report summarized the nature of each site, the anticipated reuse, and the chemicals of concern (COC) that the Navy intended to address. The text below provides an overview of the RI, including the recommendations, which were used to develop and evaluate remedial alternatives in this FS report.

The RI report for OU-1 concluded that groundwater contamination at Site 6 poses a possible inhalation risk to human health and that soil at Site 6 does not pose a significant risk to human health or to the environment. However, the RI did not sufficiently characterize soil adjacent to oil-water separators (OWS)-040A and -040B, which are recommended for further evaluation in this FS report. Groundwater COCs addressed in this FS report include the following volatile organic compounds (VOC): 1,2-dichloroethene (DCE), tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride. These COCs are associated with the solvents used at Site 6. Site 6 is planned for reuse in the Civic Core (recreational/commercial/residential) and Marina District (recreational/residential) land use areas.

The RI report for OU-1 concluded that soil contamination at Site 7 poses a significant risk to human health in the soil debris area and that groundwater contamination at Site 7 does not pose a significant risk to human health or to the environment. However, the RI did not sufficiently characterize soil adjacent to OWS-459, which is recommended for further evaluation in this FS report. COCs in soil addressed in this FS report include arsenic, cadmium, and lead. Site 7 is planned for reuse in the Main Street Neighborhoods (residential) land use area.

The RI report for OU-1 concluded that soil contamination at Site 8 poses a significant risk to human health in the pink background area and that groundwater contamination at Site 8 does not pose a significant risk to human health or to the environment. However, the RI did not sufficiently characterize soil adjacent to OWS-114, which is recommended for further evaluation in this FS report. COCs in soil to be addressed in this FS report include lead, Aroclor-1254, Aroclor-1260, and dieldrin. Site 8 is planned for reuse in the Civic Core (recreational/commercial/ residential) land use area.

The RI report for OU-1 concluded that groundwater contamination at Site 16 poses a significant risk to human health from exposure to VOCs and that soil contamination at Site 16 does not pose a significant risk to human health or to the environment, except for polychlorinated biphenyl (PCB) contamination that was not adequately characterized during the RI. Additionally, the RI report did not sufficiently characterize soil adjacent to OWS-808A and OWS-608B, which are recommended for further evaluation in this FS report. COCs in groundwater addressed in this FS report include 1,3-dichlorobenzene (DCB), 1,4-DCB, PCE, TCE, and vinyl chloride, which are associated with the solvents used at Site 16. Site 16 is planned for reuse in the Inner Harbor (recreational/industrial) land use area.

The RI report made the recommendations listed below for soil and groundwater at each site (Tetra Tech 2004).

Soil

- **Site 6** - Characterize potentially contaminated soil and groundwater near OWS-040A and OWS-040B.
- **Site 7** - Further characterize soil debris area and address potential site risk to residential receptors from contaminated soil in the soil debris area and from potentially contaminated soil near OWS-459.
- **Site 8** - Characterize potential site risk to commercial/industrial worker receptors from contaminated and potentially contaminated soil near OWS-114.
- **Site 16** - Address potential site risk to commercial/industrial receptors from PCB-contaminated and potentially contaminated soil near OWS-608A and OWS-608B.

Groundwater

- **Site 6** - Address potential site risk to commercial/industrial worker receptors from groundwater containing chlorinated VOCs (PCE, TCE, and vinyl chloride).
- **Site 7** - Further characterize groundwater beneath OWS-459 for metals, VOCs, semivolatile organic compounds (SVOC), and pesticides, and evaluate groundwater remediation if results indicate groundwater contamination.
- **Site 8** - Further characterize groundwater beneath OWS-114 for metals, VOCs, SVOCs, and pesticides, and evaluate groundwater remediation if results indicate groundwater contamination.
- **Site 16** - Address potential site risk to residential receptors from domestic use of groundwater containing chlorinated VOCs (such as DCB, PCE, TCE, and vinyl chloride).

FEASIBILITY STUDY APPROACH

The purpose of the FS is to develop and evaluate a range of alternatives that (1) eliminates or reduces human health exposure in soil and groundwater; (2) minimizes effects of contaminants on the environment; and (3) are feasible, implementable, and cost effective.

The typical FS process of developing and evaluating remedial actions consists of the steps below.

- Develop remedial action objectives (RAO) that specify contaminants and media of concern, exposure pathways, and remediation goals. RAOs are developed based on applicable or relevant and appropriate requirements (ARAR), results of the human health risk assessment, and results of the ecological risk assessment.
- Develop general response actions (GRA) for each medium to address the RAOs. Consider containment, treatment, removal, or other actions singly or in combination in developing GRAs.
- Identify the volume of each affected medium of concern.
- Identify and screen technologies for each GRA to eliminate technologies that cannot be implemented or are not cost effective.
- Identify and screen process options for each technology.
- Assemble retained process options into alternatives and screen the alternatives.
- Conduct a detailed analysis of the remaining alternatives in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [Title 40 *Code of Federal Regulations* Section (§) 300.430(e)(9)].

U.S. Environmental Protection Agency (EPA) guidance states that where "circumstances limit the number of available options and therefore, the number of alternatives that are developed, it may not be necessary to screen alternatives prior to the detailed analysis" (EPA 1988). Based on the contamination detected at the four sites within OU-1, the selection of alternatives in this FS report was streamlined for soil and was not streamlined for groundwater.

For soil at each of the sites, no action, institutional controls, and excavation were generally evaluated. Contamination in soil at each site is generally at shallow depths and of moderate quantity. Thus, institutional controls and excavation are the most practical and cost-effective remedial alternatives for these sites.

FEASIBILITY STUDY EVALUATION

Based on the information presented in the RI report and on the ARARs, RAOs and remedial action goals were developed for this FS report. RAOs can be achieved either by reducing COCs or eliminating the exposure pathways.

This FS evaluation considers alternatives for both approaches by media.

Remedial Action Objectives

The RAOs below were identified for soil at each site within OU-1.

- **Site 6** - Prevent human exposure to soils adjacent to OWS-040A and OWS-040B that are found to contain VOCs, SVOCs, metals, pesticides, or PCBs at concentrations exceeding their respective residential preliminary remediation goal (PRG).

- **Site 7** - For all receptors at Site 7, prevent any exposures to soil contamination located adjacent to OWS-459 that exceeds the residential PRGs. For the residential receptor at Site 7, prevent dermal contact and ingestion of soils that exceed the following concentrations: 9.1 milligrams per kilogram (mg/kg) of arsenic, 1.7 mg/kg of cadmium, and 230 mg/kg of lead

- **Site 8** - For human receptors at Site 8, prevent any exposures to soil contamination located adjacent to OWS-114 that exceeds the residential PRGs. For the potential residential receptor at Site 8, prevent dermal contact and ingestion of soils that exceed the following concentrations: 0.22 mg/kg of Aroclor-1254 or Aroclor-1260 or 1 mg/kg total PCBs, 0.03 mg/kg of dieldrin, and 230 mg/kg of lead. For the commercial/industrial receptor, prevent dermal contact and ingestion of soils that exceed the following concentrations: 0.74 mg/kg of Aroclor-1254 or Aroclor-1260, 0.11 mg/kg of dieldrin, and 3,572 mg/kg of lead.

- **Site 16** - Prevent human exposures to soils adjacent to OWS-608A and OWS-608B that are found to contain metals, VOCs, SVOCs, pesticides, or PCBs (in contaminated soil in the storage area) that exceed their respective residential PRGs concentrations.

The following RAOs were identified for groundwater at each site within OU-1.

- **Site 6** - For the potential residential receptor, prevent inhalation of VOCs in groundwater that exceed the following concentrations: 8,800 µg/L of 1,2-DCE, 20 µg/L of PCE, 1.7 µg/L of TCE, and 5.9 µg/L of vinyl chloride. For the commercial/industrial receptor, prevent inhalation of indoor air containing VOCs from the groundwater plumes that exceed the following concentrations: 420 µg/L of PCE, 37 µg/L of TCE, 121,000 µg/L of 1,2-DCE, and 240 µg/L of vinyl chloride.

- **Site 16** - For the potential residential receptor, prevent dermal contact, ingestion, and inhalation of VOCs in groundwater at concentrations above MCLs. For the commercial/industrial worker receptor, prevent inhalation of indoor air containing VOCs from the groundwater plumes that exceed the following concentrations: 420 µg/L of PCE, 37 µg/L of TCE, 18,000 µg/L of 1,3-DCB, 3,000 µg/L of 1,4-DCB, and 240 µg/L of vinyl chloride.

General Response Actions and Remedial Alternatives

GRAs and remedial alternatives for soil and groundwater were developed and evaluated to address the RAOs, as discussed below.

Soil

For soil at Sites 6, 8, and 16, the following three GRAs were identified to address known or potential soil contamination.

1. No action
2. Institutional controls
3. Excavation with off-site disposal

GRAs 2 and 3 include collection of soil samples around the OWSs at Sites 6, 8, and 16. Also, the regulatory agencies identified the need for further characterization of potential PCB contamination at Site 16; therefore, GRA 2 includes collection of additional soil samples to characterize soil for PCBs at Site 16.

For soil at Site 7, the following GRAs were identified for contaminated soils.

1. No action
2. Excavation with off-site disposal
3. Treatment

However, a debris area at Site 7 poses unacceptable risk to human health; therefore, treating soil is not practical, so only the following two GRAs were considered: (1) no action and (2) excavation with off-site disposal. Because the debris area surrounds the OWS and contamination may extend beneath or beyond Building 459 at Site 7, collection of soil samples was included in the cost of Alternative 2.

Each of the alternatives for the four sites was evaluated against the two NCP threshold criteria (overall protection of human health and the environment and compliance with ARARs) and against the following five primary balancing criteria:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Results of this evaluation were used to compare the remedial alternatives with each other. The two NCP modifying criteria (state and community acceptance) will be evaluated following public and regulatory agency comments on this FS report.

Based on the NCP threshold evaluation, Alternative 1 (no action) provides the lowest degree of protectiveness and is not acceptable at any site where evaluated, although its cost would be zero. Alternative 2 would protect human health and comply with ARARs, but not allow unrestricted use of the sites. Alternative 3 would protect human health, would comply with ARARs, and would allow unrestricted use of the sites. Details of the primary balancing criteria evaluation are provided in the text, and the supporting cost estimates are presented in Appendix C.

Groundwater

For groundwater, the three GRAs below were identified for achieving the RAOs.

1. No action
2. Land use controls (LUC), consisting of institutional controls and engineering controls
3. Active remediation

Technologies and process options for each remedial alternative (except no action) were identified and subjected to a preliminary screening at Sites 6 and 16. Monitoring and various LUCs were retained as part of the remedial alternatives. In addition, active treatment technologies were retained at Site 6, including air sparging, in situ chemical oxidation (ISCO), and enhanced bioremediation with hydrogen releasing compounds (HRC). For Site 16, retained treatment technologies were ISCO, HRC, pump and treat with air stripping, and pump and treat with chemical/ultraviolet oxidation. The retained treatment technologies were screened a second time against the following three criteria: effectiveness, implementability, and cost. Based on the second screening, ISCO and HRC were lowest in cost and were the most effective active treatment technologies that could be implemented within a reasonable timeframe

Using the two selected active treatment technologies (ISCO and HRC) in combination with other GRAs (monitoring and LUCs), the following four remedial alternatives were developed for Sites 6 and 16:

1. No action
2. Monitoring and LUCs
3. Active groundwater treatment (high target concentrations) with either ISCO (3A) or HRC (3B), monitoring, and LUCs
4. Active groundwater treatment (low target concentrations) with either ISCO (4A) or HRC (4B) and LUCs.

The no-action alternative was evaluated as a requirement of the NCP to provide a baseline for comparison; it is not considered to be an alternative that meets the RAOs.

Alternative 2 includes the key components listed below.

- No active groundwater treatment
- Monitoring for a period of 30 years to measure decreases in concentrations of COCs in groundwater until remediation goals under a commercial/industrial reuse scenario are reached
- Institutional controls to prevent domestic use of groundwater until remediation goals for domestic use are reached
- Institutional controls requiring vapor barrier/removal systems in new buildings constructed above the COC plumes until remediation goals for vapor intrusion are reached
- Engineering controls in existing buildings above plumes (necessary only if vapor monitoring indicates that TCE or vinyl chloride concentrations in indoor air exceed the remediation goal)

Alternatives 3A and 3B include the key components listed below.

- Active treatment with ISCO (Alternative 3A) or HRC (Alternative 3B) until concentrations of COCs in groundwater range from 2 to 12 μg/L
- After treatment, perform monitoring until concentrations of COCs in groundwater reach the remediation goals for domestic use (30 years predicted based on model)
- Institutional controls to prevent domestic use of groundwater until remediation goals for domestic use are reached
- Institutional controls requiring vapor barrier/removal systems in new buildings constructed above the COC plumes until remediation goals for vapor intrusion are reached (30 years predicted based on model)
- Engineering controls in existing buildings above plumes (necessary only if vapor monitoring indicates that concentrations of COCs in indoor air exceed the remediation goal)

Alternatives 4A and 4B include the key components listed below.

- Treatment with ISCO (Alternative 4A) or HRC (Alternative 4B) until all COC concentrations reach 0.5 μg/L, the remediation goal for domestic use for vinyl chloride

- Institutional controls, as described above for Alternatives 3A and 3B, until active treatment is completed

- Institutional controls requiring vapor barrier/removal systems in new buildings constructed above the COC plumes until remediation goals for vapor intrusion are reached

- Engineering controls in existing buildings above plumes (necessary only if vapor monitoring indicates that concentrations of COCs in indoor air exceed the remediation goal)

Each of the alternatives was evaluated against the NCP threshold and primary balancing criteria. The alternatives will be evaluated against the two other NCP modifying criteria, state and community acceptance, after public and regulatory agency comments on this FS report are received.

Based on the evaluation against the NCP threshold criteria, Alternative 1 (no action) provides the lowest degree of protectiveness and is not acceptable. Alternatives 2, 3A, 3B, 4A, and 4B would each protect human health, comply with ARARs, and allow unrestricted use of the sites at some point in the future.

Results of the evaluation against the NCP primary balancing criteria indicated that Alternative 2 may take 30 years to reach remediation goals for commercial/industrial use, whereas Alternatives 3A, 3B, 4A, and 4B provide active groundwater treatment to reduce concentrations of VOCs to remediation goals for domestic use within 5 to 34 years. Alternatives 2 through 4B include ICs to prevent domestic use of groundwater until remediation goals for domestic use are reached and to prevent exposure from vapor intrusion to indoor air. Alternatives 2 through 4B also provide protection against indoor vapor intrusion through deed restrictions requiring future buildings to install vapor removal systems in buildings currently located over the plume where vapor intrusion of COCs poses risk (Building 41 at Site 6 and Building 608 at Site 16). Based on modeling, the inhalation remediation goals can be achieved within a shorter timeframe than the remediation goals for domestic use. Tables 5-8 and 8-8 of the FS report summarize the evaluation against primary balancing criteria for Sites 6 and 16, respectively, and Appendix C provides the supporting costs.

The Navy will use this FS to prepare a proposed plan for public comment. The proposed plan will recommend one of the alternatives identified in this FS report. After considering regulatory agency and community acceptance, the Navy will issue a record of decision containing the selected final remedy.

1.0 INTRODUCTION

In July 1999, Naval Air Station (NAS) Alameda (now known as Alameda Point) in Alameda, California, as shown on Figure 1-1, was identified as a National Priorities List site (U.S. Environmental Protection Agency [EPA] 1999a). Accordingly, the U.S. Department of the Navy (Navy) is conducting investigations in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Title 42 *United States Code* [USC] Sections (§§) 9601-9675) at a number of sites at Alameda Point. As a management tool to accelerate site investigation, cleanup, and reuse, a comprehensive operable unit (OU) strategy was developed, which separates 35 CERCLA sites into a total of 10 OUs, numbers one through five with two units further subdivided into three subsections each (OU-1, OU-2A, OU-2B, OU-2C, OU-3, OU-4A, OU-4B, OU-4C, OU-5, and OU-6) (see Figure 1-2).

Sites 6, 7, 8, and 16 were designated as OU-1 sites because they are relatively small and have low levels of contamination related to historic use of the sites. Sites 14 and 15 are also part of OU-1, although they were put on a faster track to accelerate property transfer. A remedial investigation (RI) and feasibility study (FS) have been completed at Site 15, but Site 14 still requires a completed FS.

This FS is part of ongoing efforts by the Navy in accordance with CERCLA to address contamination at Alameda Point. Under the CERCLA process, the FS is a mechanism for developing, screening, and evaluating alternatives for remedial actions to address risk identified during an RI. In addition, the FS documents risk management decisions made by the stakeholders. As the lead agency, the Navy is working with EPA Region IX, the Department of Toxic Substances Control (DTSC), and the San Francisco Bay Regional Water Quality Control Board (Water Board) to develop and implement the remedial alternatives in this FS.

This FS report is based on the results of the RI report for OU-1 Sites 6, 7, 8, and 16 (Tetra Tech EM, Inc. [Tetra Tech] 2004) and agency comments on the RI report. The RI recommended further evaluation of these sites in an FS to address human health risks from soil contamination at Sites 6, 7, 8, and 16 and groundwater contamination at Sites 6 and 16. No remedial action was necessary based on ecological risks. The RI recommended addressing the following potential risks:

- To commercial/industrial and residential receptors from potentially contaminated soil at Site 6 near oil-water separators (OWS)-040A and OWS-040B.
- To commercial/industrial receptors from groundwater containing chlorinated compounds (tetrachloroethene [PCE], trichloroethene [TCE], and vinyl chloride) at Site 6.
- To residential receptors from arsenic-, cadmium-, and lead-contaminated soil in the soil debris area of Site 7 and potentially contaminated soil near OWS-459.

- To commercial/industrial receptors from Aroclor-1260-, dieldrin-, and lead-contaminated soil at Site 8 and potentially contaminated soil near OWS-114.

- To commercial/industrial receptors from polychlorinated biphenyl (PCB)-contaminated soil at Site 16 and potentially contaminated soil near OWS-608A and OWS-608B.

- From domestic use of groundwater containing chlorinated compounds (PCE, TCE, vinyl chloride, and dichlorobenzene [DCB]) at Site 16.

The RI report did not recommend addressing polynuclear aromatic hydrocarbons (PAH) detected in soil, although they were identified as chemical of concerns (COC). For Site 7, they are attributable primarily to the Marsh Crust. The Marsh Crust is a layer of sediment contaminated with semivolatile organic compounds (SVOC) including PAHs that resulted from direct discharges of petroleum products and wastes to the marshlands by former manufactured gas plants and an oil refinery at the site.

Section 1.1 presents a detailed description of the purpose and objectives of the FS report. Section 1.2 describes the organization of the report.

1.1 PURPOSE AND OBJECTIVES

The purpose of this FS is to develop and evaluate a range of alternatives that (1) eliminate or reduce human health exposure in soil and groundwater; (2) minimize effects of contaminants on the environment and (3) are feasible, implementable, and cost effective.

This FS report was prepared in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the EPA "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988).

EPA's guidance provides an iterative CERCLA RI/FS process that (1) characterizes threats to human health and the environment posed by hazardous substances released at a site, (2) complies with applicable or relevant and appropriate requirements (ARAR), and (3) evaluates potential remedial alternatives to mitigate those threats. Remedial alternatives evaluated in this FS vary in cost and in the level of protection afforded to human health.

The FS process used the following steps to develop and evaluate remedial alternatives.

- Develop remedial action objectives (RAO) that specify contaminants and media of concern, exposure pathways, and remediation goals. RAOs are developed based on ARARs, results of the human health risk assessment (HHRA), and results of the ecological risk assessment (ERA).

- Develop general response actions (GRA) for each medium to address the RAOs. Consider containment, treatment, removal, or other actions singly or in combination in developing GRAs.

- Identify the volume of each affected medium of concern.

- Identify and screen technologies for each general response action to eliminate technologies that are either impracticable or not cost-effective.

- Identify and screen process options for each technology.

- Assemble retained process options into alternatives and screen the alternatives.

- Conduct a detailed analysis of the remaining alternatives using the requirements specified in the NCP at Title 40 *Code of Federal Regulations (*CFR) Section (§) 300.430(e)(9).

1.2 REPORT ORGANIZATION

The organization of this report generally follows the suggested format found in the interim final EPA document "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (EPA 1988). Section 2.0 provides a summary of the Alameda Point history, geology and hydrogeology and describes the planned reuse of OU-1 Sites 6, 7, 8, and 6. Section 3.0 describes the approach followed for the RI (Tetra Tech 2004) and summarizes the nature and extent of contamination, the results of the risk assessments, and recommendations in the RI. Section 4.0 describes the approach for the FS. Section 5.0 presents the RAOs, proposed ARARs, GRAs, detailed analysis of soil alternatives and a comparative analysis of the alternatives for soil and groundwater at Site 6. Sections 6.0 and 7.0 present the RAOs, proposed ARARs, GRAs, a detailed analysis of soil alternatives and a comparative analysis of the alternatives for soil at Sites 7 and 8, respectively. Section 8.0 presents the RAOs, proposed ARARs, GRAs, a detailed analysis of alternatives and a comparative analysis of the alternatives for soil and groundwater at Site 16. Section 9.0 lists the references used to prepare this FS report.

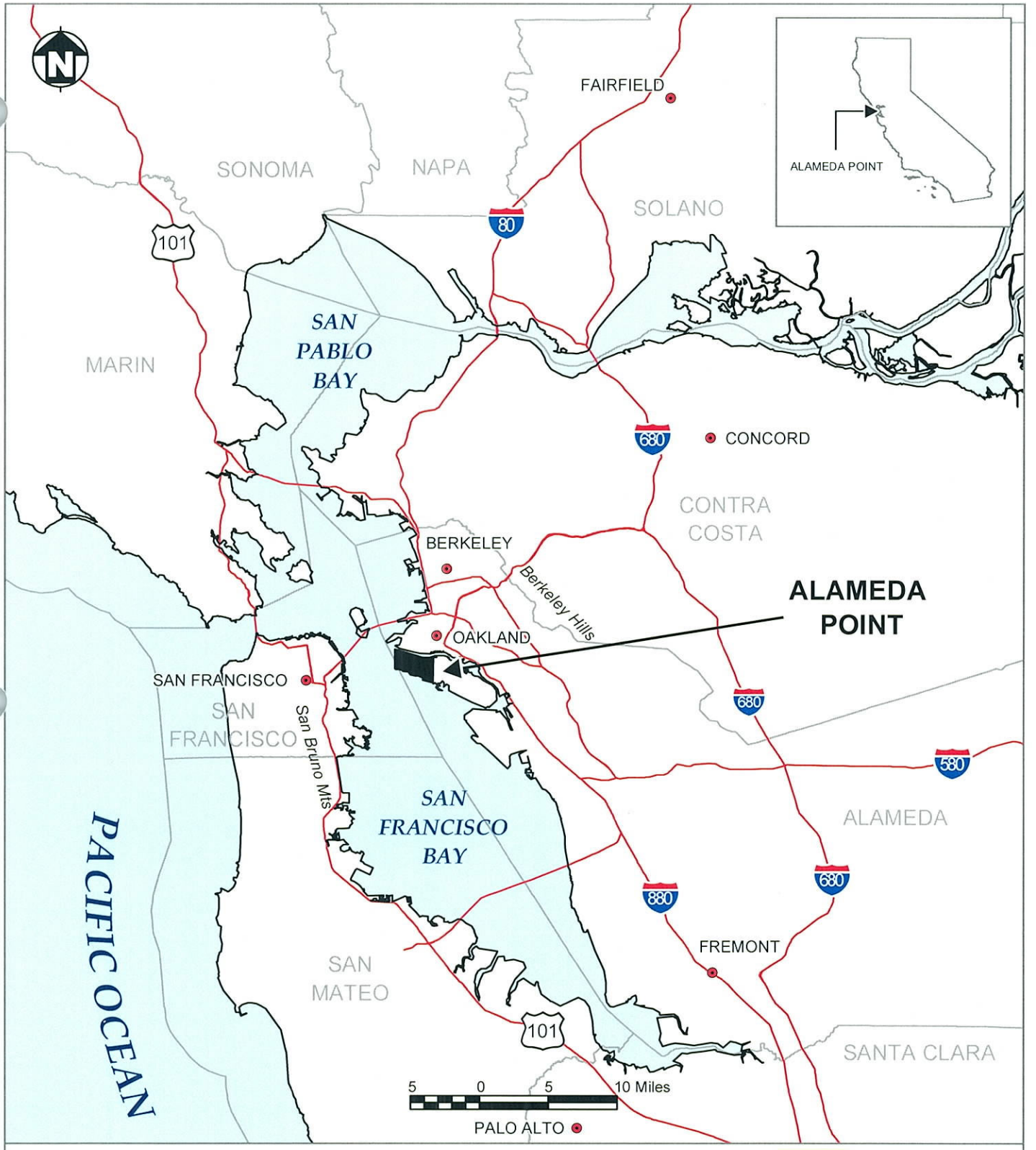
Each section of the text is followed by figures and tables cited within each section. Appendices used to prepare this FS report follow Section 9.0, References. Appendix A describes the development of the remedial goals (remediation goal) for inhalation risk, Appendix B provides an evaluation of proposed ARARs, Appendix C contains remedial action alternative cost evaluations, and Appendix D is the responses to regulatory agency comments received on the draft FS report.

N00236.003008
ALAMEDA POINT
SSIC NO. 5090.3.A.

FIGURES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005



SulTech

CITY

HIGHWAY

COUNTY BORDER

Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 1-1
ALAMEDA POINT LOCATION MAP

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, 16

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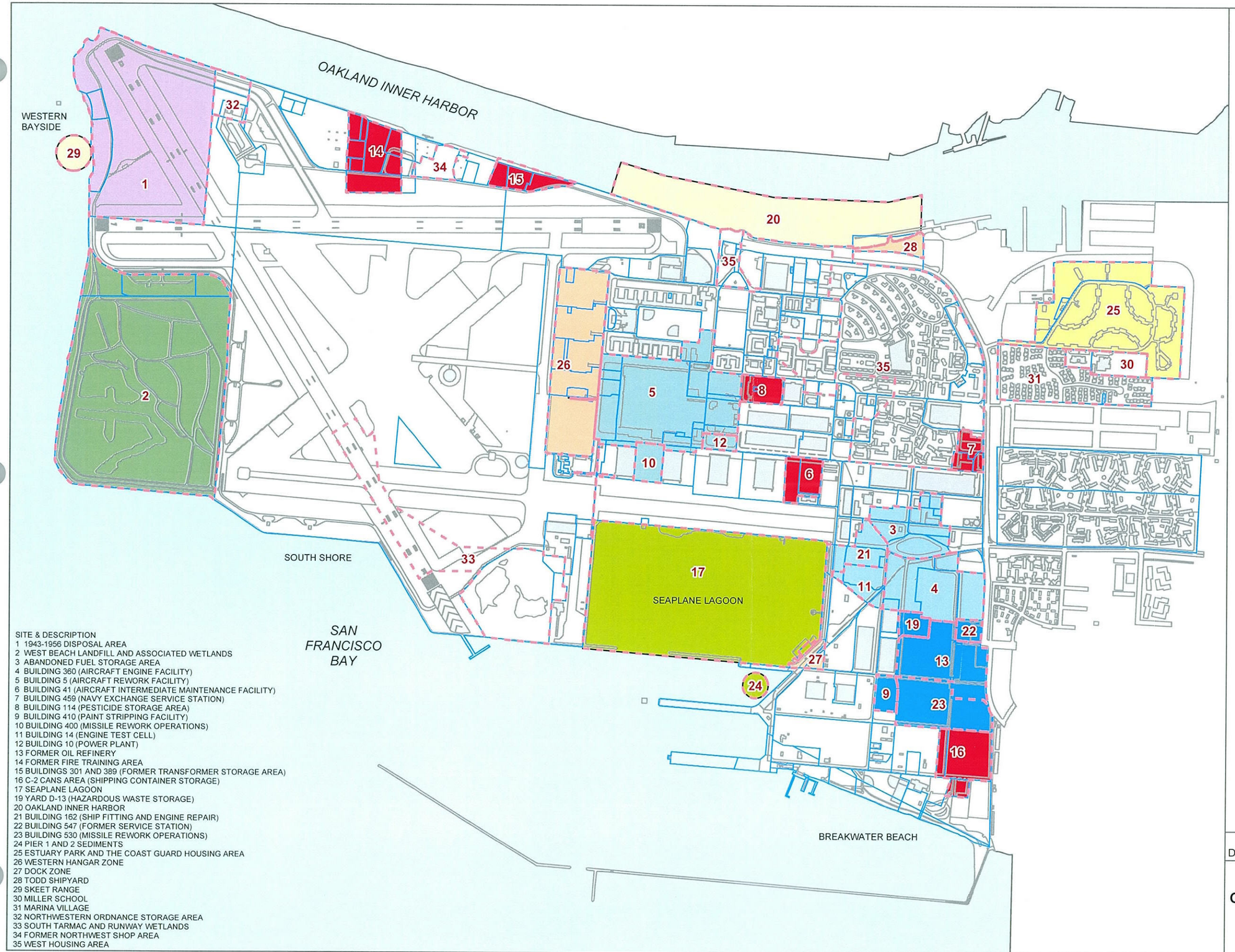

SITE & DESCRIPTION
1 1943-1956 DISPOSAL AREA
2 WEST BEACH LANDFILL AND ASSOCIATED WETLANDS
3 ABANDONED FUEL STORAGE AREA
4 BUILDING 360 (AIRCRAFT ENGINE FACILITY)
5 BUILDING 5 (AIRCRAFT REWORK FACILITY)
6 BUILDING 41 (AIRCRAFT INTERMEDIATE MAINTENANCE FACILITY)
7 BUILDING 459 (NAVY EXCHANGE SERVICE STATION)
8 BUILDING 114 (PESTICIDE STORAGE AREA)
9 BUILDING 410 (PAINT STRIPPING FACILITY)
10 BUILDING 400 (MISSILE REWORK OPERATIONS)
11 BUILDING 14 (ENGINE TEST CELL)
12 BUILDING 10 (POWER PLANT)
13 FORMER OIL REFINERY
14 FORMER FIRE TRAINING AREA
15 BUILDINGS 301 AND 389 (FORMER TRANSFORMER STORAGE AREA)
16 C-2 CANS AREA (SHIPPING CONTAINER STORAGE)
17 SEAPLANE LAGOON
19 YARD D-13 (HAZARDOUS WASTE STORAGE)
20 OAKLAND INNER HARBOR
21 BUILDING 162 (SHIP FITTING AND ENGINE REPAIR)
22 BUILDING 547 (FORMER SERVICE STATION)
23 BUILDING 530 (MISSILE REWORK OPERATIONS)
24 PIER 1 AND 2 SEDIMENTS
25 ESTUARY PARK AND THE COAST GUARD HOUSING AREA
26 WESTERN HANGAR ZONE
27 DOCK ZONE
28 TODD SHIPYARD
29 SKEET RANGE
30 MILLER SCHOOL
31 MARINA VILLAGE
32 NORTHWESTERN ORDNANCE STORAGE AREA
33 SOUTH TARMAC AND RUNWAY WETLANDS
34 FORMER NORTHWEST SHOP AREA
35 WEST HOUSING AREA

CERCLA SITE
OPERABLE UNIT 1
OPERABLE UNIT 2A
OPERABLE UNIT 2B
OPERABLE UNIT 2C
OPERABLE UNIT 3
OPERABLE UNIT 4A
OPERABLE UNIT 4B
OPERABLE UNIT 4C
OPERABLE UNIT 5
OPERABLE UNIT 6
BUILDING
LAND COVER
OPEN WATER

Notes:
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

600 0 600 1200 Feet

SulTech

Alameda Point
Department of the Navy, BRAC PMO West, San Diego, CA

FIGURE 1-2
CERCLA SITES AND OPERABLE UNITS

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

3-8-2204 U:\almda_sa\DO031\mxd\section 1\mxd TtEMI-SA T. Munley

2.0 ALAMEDA POINT HISTORY AND SETTING FOR OPERABLE UNIT 1 SITES

This section briefly summarizes the history of Alameda Point and setting for Sites 6, 7, 8, and 16. A more detailed description is provided in the RI report for OU-1 Sites 6, 7, 8, and 16 (Tetra Tech 2004).

2.1 INSTALLATION HISTORY

Originally a peninsula, Alameda Island was detached from the mainland in 1876, when a channel (the Oakland Island Inner Harbor) was cut to link the San Leandro Bay with the San Francisco Bay (Bay). The area encompassed by NAS Alameda was historically a combination of submerged lands, tideland, and dry land. The site is relatively flat, with elevations ranging from sea level to 30 feet above sea level. The property occupies the flattest portion of Alameda, reflecting its origins as diked bay lands and mud flats. Much of the land occupied by NAS Alameda was once covered by the waters of the Bay or was tidal flats. Much of the base was gradually filled using hydraulically placed dredge spoils from the surrounding Bay, the Seaplane Lagoon at NAS Alameda, and the Oakland Channel. The first documented filling of tidal and submerged land began in 1887. By 1927, the northern part of what later became NAS Alameda had been filled, chiefly with dredge materials from U.S. Army Corps of Engineers projects associated with the Oakland Harbor and other harbors throughout the East Bay.

The filled land was partially occupied by the Alameda Airport, a City of Alameda-owned facility, and Benton Field, a minor U.S. Army Air Corps facility. The U.S. Department of the Army acquired the NAS Alameda site from the City of Alameda in 1930 and began construction activities in 1931. The Navy acquired title to the land from the Army in 1936 and began building the air station in response to the military buildup in Europe before World War II. NAS Alameda was commissioned on November 1, 1940. After the 1941 entry of the United States into the war, more land was acquired adjacent to the air station. Following the end of the war, NAS Alameda returned to its original primary mission of providing facilities and support for fleet aviation activities. Following World War II, NAS Alameda served as a critical component to support Navy activities during the Korean War, the Vietnam War, and Operation Desert Storm (Kuwait). During its history, NAS Alameda housed approximately 60 military tenant commands for a combined military/civilian work force of over 18,000 personnel.

NAS Alameda was identified for closure in 1993. In April 1994, the City and County of Alameda signed a Joint Powers Agreement and established the Alameda Reuse and Redevelopment Authority. The Alameda Reuse and Redevelopment Authority was recognized by the U.S. Department of Defense as the responsible entity for submitting and completing the community reuse plan for NAS Alameda. In 1997, the base closed, and the Navy began the process of property transfer to the City of Alameda. Upon closure, NAS Alameda was renamed Alameda Point. In July 1999, Alameda Point was identified as a National Priorities List site (EPA 1999a).

One of the consequences of the operations that occurred at Alameda Point during its years of operation was the release of contamination to soil, sediments, and water. The Navy began

investigations of contaminated sites in 1982 under the auspices of the Navy Assessment and Control of Installation Pollutants Program. When NAS Alameda was listed for closure in 1993, responsibility for the environmental cleanup program at Alameda Point passed to the Base Realignment and Closure Cleanup Team (BCT). At Alameda Point, the BCT comprises representatives from Navy, EPA, Water Board, and DTSC. The BCT provides oversight of investigations. In addition to the BCT, a Restoration Advisory Board (RAB) provides community involvement in the cleanup program.

CERCLA sites and corrective action areas (CAA) were developed to assess contamination at specific areas located within Alameda Point (see Figure 2-1). In addition, the Marsh Crust was identified (see Figure 2-2). The Marsh Crust is a layer of sediment contaminated with SVOCs that is believed to have resulted from direct discharges of petroleum products and wastes from the two former manufactured gas plants and oil refinery to the marshlands. This waste migrated over much of the surface of the surrounding marshlands and was deposited through tidal actions under what would later become the Alameda Annex and the eastern portion of Alameda Point. Further west, at Alameda Point, the waste was deposited on tidal flats now known as the former subtidal area. Fill material dredged from the Oakland Inner Harbor and sediment from locations surrounding the Bay were placed on these areas from as early as 1887 to as late as 1975, encapsulating the former subtidal area and Marsh Crust.

Although Alameda Point was listed as an National Priorities List site in July 1999, this listing does not include the subsurface soil contamination layer known as the Marsh Crust and the former subtidal area. In 2001, the Navy (Tetra Tech 2001) issued a final remedial action plan and record of decision (ROD) for the Marsh Crust at Alameda Point. The Navy, with the concurrence of DTSC, EPA, and the Water Board, selected a final remedy for the Marsh Crust that implemented institutional controls. These institutional controls consisted of three tiers:

- Environmental restrictions in deeds transferring property from Navy control;
- Covenant to restrict use of property and prohibit excavation below threshold depths; and
- City of Alameda Ordinance 2824 on the Marsh Crust (hereafter referred to as the "Marsh Crust Ordinance") that limits the extent of excavations to designated threshold depths (City of Alameda 2000).

2.2 PHYSICAL SETTING

Alameda Point is located at the west end of Alameda Island, which lies at the base of a gently westward-sloping plain that extends from the Oakland-Berkeley hills on the east to the shore of the Bay on the west (see Figure 1-1). The Bay also borders the island to the south and the Oakland Inner Harbor borders the island to the north (Tetra Tech 1998b).

The Bay Area experiences a maritime climate with mild summer and winter temperatures. Prevailing winds in the Bay Area are from the west. Because of the varied topography of the Bay Area, climatic conditions vary considerably throughout the region. Heavy fogs occur on an average of 21 days per year. Rainfall occurs primarily during the months of October through April. The installation averages approximately 18 inches of rainfall a year (Air Traffic Control, NAS Alameda 1992). There are no naturally occurring surface streams or ponds on the installation, so precipitation either returns to the atmosphere by evapotranspiration, runs off in the storm drain system that discharges to the Bay, or infiltrates to the groundwater (Tetra Tech 1998b).

Physical features at Alameda Point include runways, streets, buildings, fuel lines, underground storage tanks (UST), aboveground storage tanks (AST), and utility lines (sanitary sewer, storm sewer, water, and power lines). Some fuel lines, USTs, and ASTs have been removed, while others have been closed in place.

2.3 GEOLOGY

The Bay and the surrounding area occupy a large, regional trough that extends northwest-southeast across the California Coast Ranges. In the subsurface, the Bay is approximately coincident with the axis of the bedrock trough, which was formed 1 million to 500,000 years ago by movements associated with two active faults, the Hayward Fault to the east and the San Andreas Fault west of San Francisco (Figuers 1998). The trough was filled with a sequence of coalescing alluvial fans consisting of lenses of sand, silt, and gravel eroded from the surrounding hills. The installation geology is described as follows, beginning with the uppermost soil units encountered at the surface down to bedrock.

- **Artificial Fill.** The artificial fill is the upper-most unit and underlies most of Alameda Point. It ranges in thickness from 0 to 30 feet. The artificial fill consists of sediments that were dredged from the surrounding Bay and the Oakland Inner Island Harbor.

- **Bay Sediment Unit.** The Bay Sediment Unit (BSU) is about 40-feet thick in the western portion of Alameda Point, thinning and pinching out in the southeastern region at the former shoreline of Alameda Island (see Figure 2-2). The BSU is encountered at a depth of about 25 feet below ground surface (bgs) in the western portion of Alameda Point and at a depth of about 5 feet bgs in the eastern portion of the installation. The BSU consists of gray to black silt and clay with discontinuous, poorly graded, silty and clayey sand layers. The Marsh Crust layer, which is associated with refinery and coal gasification wastes, marks the top of the BSU throughout the eastern portion of the installation. Further west, at Alameda Point, the waste was deposited on tidal flats now known as the former subtidal area. The artificial fill material dredged from the Oakland Inner Harbor and surrounding the Bay was placed on these areas from as early as 1887 to as late as 1975, encapsulating the former subtidal area and Marsh Crust under the fill.

- **Merritt Sand.** The Merritt Sand is encountered at depths ranging from 40 feet bgs in the western portion of the installation to surface outcrops in the southeastern portion of the installation. At Alameda Point, the Merritt Sand is composed of brown, fine- to medium-grained, poorly graded sand. The thickness of the Merritt Sand ranges from 8 feet to 60 feet across Alameda Point.

- **San Antonio Formation (Upper Member).** The upper member of the San Antonio Formation generally unconformably underlies the Merritt Sand and consists of interbedded layers of gray sand and clay ranging in thickness from 10 to 40 feet in the eastern portion and from 7 to 70 feet in the central portion of the installation.

- **Yerba Buena Mud (Lower San Antonio).** Yerba Buena Mud at Alameda Point reaches a maximum thickness of 50 feet at the west end and thins to the east but does not pinch out. The top of the Yerba Buena Mud occurs at elevations of 50 to 100 feet below mean sea level.

- **Alameda Formation.** The Alameda Formation underlying Alameda Point ranges in thickness from approximately 250 feet at the western edge of the installation to approximately 850 feet at the east end of the installation. In the central portion of the installation, the formation is about 600 feet thick.

- **Franciscan Complex.** Most of the installation overlies the western side of the bedrock trough. Bedrock of the Franciscan Complex underlies Alameda Point at elevations ranging from approximately 400 to 950 feet below mean sea level.

Geological conditions beneath Sites 6, 7, 8, and 16 were assessed in the RI report by reviewing logs of borings advanced at each site; results are summarized in the following sections. Further discussion is included in the RI report (Tetra Tech 2004).

2.3.1 Site 6 Geology

Two major soil groups were identified beneath Site 6: (1) artificial fill from the ground surface to approximately 9 feet bgs and (2) the BSU from approximately 9 to 15.5 feet bgs. The thickness of the fill material varied and consisted of clean, medium dense, fine-graded, well-sorted, friable, sand and silty sand. The fill material consists of sand and silty sand having less than 20 percent fines. Beneath the artificial fill material is inter-bedded clay, silty clay, or clayey sand identified as the BSU. The clay layer, thought to be consistent throughout the site, is medium dense, and moist, with trace amounts of sands and shell fragments. The thickness of the BSU is 6.5 feet on average (Tetra Tech 2004).

2.3.2 Site 7 Geology

Most of Site 7 is covered by approximately 1 foot of asphalt. Beneath this, the following four major units were identified at Site 7 (beginning with the uppermost unit).

- Artificial fill (ground surface to approximately 5 feet bgs) – Directly beneath the asphalt is an artificial fill material approximately 1 to 2 feet thick, consisting of gravelly sand with 10 to 15 percent fines and 30 to 35 percent gravel. Another artificial material is present under the base rock and consists of sand that can be 4 to 9 feet thick, with 5 to 10 percent fines and 1 to 5 percent coarse gravel.

- BSU (5 to 51 feet bgs) – The BSU is beneath the fill from approximately 5 feet to depths between 40 and 51 feet bgs and is deeper in the southern portion of Site 7. In the eastern portion of the site, a layer of peat is interbedded with clayey silt and is approximately 50 feet bgs and 5 feet thick. Beneath this layer, there is a 1-foot-thick layer of peat.

- Merritt Sand Formation (42 to 51 feet bgs) – This formation is relatively an even mixture of sand and silty fine sand and is found in the southern portion of Site 7 from 42 to 51 feet bgs.

- San Antonio Formation (underlying the BSU or Merritt Sand Formation, 40 to 57 feet bgs) – This formation consists of sand, fine to medium sand, and trace silts. This unit was encountered in the southern area from 40 to 51 feet bgs.

2.3.3 Site 8 Geology

Two major soil groups were identified beneath Site 8: artificial fill from the ground surface to approximately 9.5 feet bgs and the BSU from 9.5 to 15.5 feet bgs. The artificial fill consists of sediments that were dredged from the surrounding Bay and the Oakland Inner Harbor. It consists of clean, fine-grained, well-sorted sand with high hydraulic conductivity. In some portions of the site, there is a gravelly sand directly beneath the 1-foot layer of asphalt. This material was presumably used as a base rock foundation for the construction of roads. Beneath the fill, the BSU soil material consists of an inter-bedded clayey sand and silty clay unit and is found discontinuously throughout the site at depths from 9.5 to 15.5 feet bgs. The BSU is medium dense, wet, and consists of 15 to 80 percent fines and fine sand containing abundant shell fragments in layers.

2.3.4 Site 16 Geology

The following four major units were identified at Site 16 (beginning with the uppermost unit).

- Artificial fill (ground surface to approximately 15 feet bgs) – The fill is moist, medium dense to dense, and consists of silty fine sand with pockets of clay as well as gravel with shell and wood fragments.

- BSU (5 feet thick) – This unit underlies the fill unit, and is laterally discontinuous and consists of sandy or silty clay grading into silty sand. The BSU is thin and becomes absent north of Site 16.

- Merritt Sand Formation (in one boring beneath the fill to 64 feet bgs) – This formation underlies the BSU at approximately 17 to 24 feet bgs or the fill where the BSU is absent.

- San Antonio Formation (in one boring encountered at 64 feet bgs) – This formation consists of interbedded layers of sand and clay and is encountered at approximately 60 feet bgs.

2.4 HYDROGEOLOGY

This section describes the regional and installation hydrogeology of Alameda Point and the hydrogeology for Sites 6, 7, 8, and 16. Additional information is provided in the RI report for Sites 6, 7, 8, and 16 (Tetra Tech 2004).

2.4.1 Regional and Installation Hydrogeology

Alameda Point is near the center of the San Francisco Basin, one of three groundwater basins beneath the great Bay Area. Three primary aquifers in the east Bay Area are the Newark, Centerville, and Fremont aquifers. The Newark Aquifer is contained within sediments of the San Antonio and Merritt San Formations and is 100 to 150 feet thick in the region. It is confined to areas where the Merritt Sand is overlain by the Young Bay Mud. The Newark Aquifer is confined below by the Irvington Aquitard, which is contained in Yerba Buena Mud. This aquitard is a confining unit for the Centerville Aquifer, which is contained in the upper part of the Alameda Formation. The Fremont Aquifer is below the Centerville Aquifer, is deeper, and confined by estuarine sediments in the upper portion of the Alameda Formation (Figuers 1998).

Groundwater occurs as an unconfined aquifer within the artificial and natural unconsolidated deposits underlying Alameda Point at depths ranging from 6 to 10 feet bgs. Groundwater also occurs under semiconfined and confined conditions at Alameda Point in areas where the BSU functions as an aquitard.

The following five local hydrostratigraphic units are identified at Alameda Point.

- **First Water-Bearing Zone (FWBZ)** – The FWBZ and second water-bearing zone (SWBZ) are separated by the BSU. The water-bearing units are underlain by the Yerba Buena Aquitard (Irvington Aquitard). The FWBZ occurs within the artificial materials or within the Merritt Sand and the Upper San Antonio Formation in areas where the artificial fill and BSU are absent.

- **Bay Sediment Unit Aquitard** – The BSU functions as an aquitard or semiconfining unit in areas where it is present and consists of fine-grained, low-permeability materials. In other areas, the BSU forms the lower portion of the FWBZ.

- **Second Water-Bearing Zone** – The SWBZ is a semiconfined and confined aquifer that occurs within the Merritt Sand and the Upper San Antonio Formation. The SWBZ is found only in portions of the installation where the overlying BSU is both present and consists of low permeability materials. The SWBZ extends to the top of the Yerba Buena Mud.

- **Yerba Buena Mud Aquitard** – The Yerba Buena Mud functions as an aquitard that underlies the installation. The thickness ranges approximately from 50 to 90 feet. The aquitard is most likely continuous beneath the installation.

- **Alameda Aquifer** – The Alameda Aquifer is the third water-bearing zone and is a confined, regional drinking water aquifer that occurs in the Alameda Formation (Tetra Tech 2000). This aquifer is confined by the overlying Yerba Buena Mud Aquitard.

Alameda Point has been divided into the following three regions based on geologic and hydrogeologic similarities:

- **Southeastern Region Hydrostratigraphy** – In this region, the BSU is discontinuous, thin, or absent. Where the Bay Sediment Aquitard occurs, the FWBZ is within a thin layer of artificial fill, and the SWBZ is in the Merritt Sand and the Upper San Antonio Formation. Where the Bay Sediment Aquitard does not occur, the FWBZ is primarily in the Merritt Sand and the upper San Antonio Formation.

- **Western and Central Region Hydrostratigraphy** – In these two regions, the FWBZ occurs primarily in the artificial fill materials. The SWBZ occurs within the Merritt Sand and the Upper San Antonio Formation. The SWBZ is underlain by the Yerba Buena Mud Aquitard.

Groundwater in the FWBZ within the western and central Regions generally flows in a radial pattern toward the Bay, the Oakland Inner Harbor, and the Seaplane Lagoon. Groundwater flow directions vary through the year as a result of seasonal changes in precipitation rates and daily variations related to tidal cycles. Groundwater in the southeast region of the base generally flows from the east or northeast inland areas to the west, towards the Seaplane Lagoon and the Bay. The FWBZ is tidally influenced on the northern, western, and southern sides of Alameda Point. The SWBZ appears to be a semiconfined aquifer and is composed of the silty sands within the lower portion of the BSU, the Merritt Sand unit, and the upper unit of the San Antonio Formation. The potentiometric elevations of the SWBZ ranges from 3 to 9 feet mean low-low water. The SWBZ is believed to discharge through lateral groundwater flow to the Bay, the Oakland Inner Harbor, and the Seaplane Lagoon.

2.4.2 Site-Specific Hydrogeology

This section discusses the hydrogeology for Sites 6, 7, 8, and 16. Additional information is provided in the RI report for Sites 6, 7, 8, and 16 (Tetra Tech 2004).

2.4.2.1 Site 6 Hydrogeology

Groundwater was encountered at Site 6 at an average depth of 5 feet bgs, and groundwater elevation contours drawn in the RI report, using data collected from June and September 2002, and April 2003, indicate that groundwater flows to the southwest in both the FWBZ and the SWBZ (see Figures 2-3 and 2-4, respectively). An east-west groundwater divide north of Site 6 causes groundwater to flow generally to the north and south on either side of the divide. The hydraulic conductivity of the FWBZ had an average value of 2.37 feet per day, based on slug tests conducted in five monitoring wells. The average permeability of the FWBZ was estimated to be 0.69 feet per day from two geotechnical samples. The hydraulic gradient in the FWBZ ranged from 0.005 foot per feet in June 2002 to 0.0022 foot per feet in April 2003, with an average groundwater flow velocity of 13 feet per year. Tidal influence has not been observed at the site based on water level data collected. Site specific groundwater data was compiled from the Basewide Groundwater Monitoring Program (Shaw Environmental & Infrastructure, Inc. [Shaw] 2004).

2.4.2.2 Site 7 Hydrogeology

Groundwater was encountered at Site 7 at depths ranging from 3 to 3.5 feet bgs. Groundwater elevation contours drawn in the RI report, using data collected from June and September 2002 and April 2003, indicate that groundwater flows to the north towards the Oakland Inner Harbor in both the FWBZ and the SWBZ (see Figures 2-3 and 2-4, respectively). The hydraulic conductivity of the FWBZ had an average value of 0.122 feet per day, based on slug tests conducted in five monitoring wells. The hydraulic gradient in the FWBZ ranged from 0.0039 foot per feet in June 2002 to 0.0013 foot per feet in April 2003, with an average groundwater flow velocity of 0.4 foot per year.

2.4.2.3 Site 8 Hydrogeology

Groundwater was encountered at this site at an average depth of 5 feet bgs (with the exception of one sampling location in the central portion of the site at 9 feet bgs), and groundwater elevation contours drawn in the RI report, using data collected from June and September 2002 and April 2003, indicate that groundwater flows to the north in both the FWBZ and the SWBZ (see Figures 2-3 and 2-4, respectively). The hydraulic conductivity of the FWBZ had an average value of 1.42 feet per day, based on slug tests conducted in five monitoring wells. The hydraulic gradient in the FWBZ ranged from 0.0023 foot per feet in June 2002 to 0.0022 foot per feet in April 2003, with an average groundwater flow velocity of 4.3 feet per year. Groundwater flow is affected locally near industrial buildings by preferential flow paths such as storm water drains and underground utility conveyance structures. Site 8 is not tidally influenced.

2.4.2.4 Site 16 Hydrogeology

Groundwater was encountered at this site at an average depth of 5 feet bgs within the sandy artificial fill material. The thickness of this fill is at least 15 feet across Site 16. The water table occurs in the FWBZ at depths of approximately 4.5 to 5.5 feet bgs. Groundwater elevation

contours drawn in the RI report, using data collected from June and September 2002 and April 2003, indicate that groundwater flows to the southwest in both the FWBZ and the SWBZ (see Figures 2-3 and 2-4, respectively). The hydraulic conductivity of the artificial fill materials ranged from 0.003 to 5.6 feet per day, based on permeability tests conducted on seven geotechnical samples. The hydraulic gradient in the FWBZ was 0.0008 foot per feet in June 2002, 0.0016 foot per feet in September 2002, and 0.0014 foot per feet in April 2003, with an average groundwater flow velocity of 0.3 foot per year.

2.4.3 Groundwater Beneficial Use

Groundwater beneath Alameda Point was evaluated for potential beneficial uses in 2000 (Tetra Tech 2000) (see Table 2-1). Based on federal total dissolved solids (TDS) and yield criteria, the FWBZ in the central and southeastern portion of Alameda Point is a Class II aquifer, making it a potential drinking water source. However, in a letter from Anna-Marie Cook, EPA, to Patricia McFadden, Department of the Navy (included in Attachment B1, Appendix B) the EPA stated the following (EPA 2000):

> "Based on the shallow depth of the aquifer in this area [central portion], the likelihood of salt water intrusion (based on groundwater flow direction) if any significant pumping takes place, and the fact that no wells currently exist within or close to this area, it seems unlikely that groundwater in this area will be a potential source of drinking water in the future. EPA would concur with non-MCL [maximum contaminant level] cleanup levels for this area on condition that any contaminated groundwater beneath Sites 5, 6, 8, 10 and 12 is remediated to levels such that the threats posed by such exposures as inhalation (groundwater vapors into soils and from soils to residences), dermal contact, and those associated with irrigation use are eliminated, and any significant ongoing degradation of the groundwater from contaminant migration is prevented."

Based on the above referenced agency statement, the groundwater classification for each site is discussed below.

Site 6 –Although groundwater at Site 6 is a Class II groundwater, both the Water Board and EPA have determined that groundwater beneath Site 6 is not likely to be a potential source of drinking water.

Site 7 – At Site 7, the groundwater is Class III. Groundwater below Site 7 does not meet the EPA TDS criterion (TDS less than 10,000 milligrams per liter [mg/L]); therefore, it is not considered a drinking water source. For Class III groundwater, there is less need relative to Class II groundwater for protecting the resource. The NCP indicates that MCLs are not ARARs, and remediation goals for Class III water are based on risk. At Site 7, the groundwater does not meet EPA criteria for domestic use and cleanup criteria are primarily risk-based. Although the risk for the site exceeds the risk management range, the concentrations of risk drivers in groundwater is attributed to changes in geochemical conditions due to the release of total

petroleum hydrocarbons (TPH). Arsenic concentrations have decreased from their historical maximums and now approach the MCL.

Site 8 – The Navy does not believe there are any COCs in groundwater at Site 8. No remediation is necessary at this time. However, there is some uncertainty regarding certain features, such as OWSs, and the Navy has agreed to conduct limited sampling to determine if there are any COCs in groundwater.

Site 16 – The FWBZ in the southeastern region of Alameda Point where Site 16 is located is contiguous to a Class II groundwater aquifer (Merritt Sand) that is being used as an irrigation supply by off-base residents. There are no limitations on the use of these wells and the EPA Well Head Protection Area model indicated that plume capture at an off-base well was possible at pumping rates of 3 gallons per minute. The existence of the wells, in addition to the classification of the aquifer as Class II, indicates that the groundwater in this area is a potential and possibly current drinking water source; thus, groundwater below Site 16 is considered a potential drinking water source and will be evaluated using MCLs.

2.5 ECOLOGY

The Bay Area is situated in the California coastal chaparral forest and scrub province of the Mediterranean division and includes the discontinuous coastal plains. The coastal province has a more moderate climate than the interior and receives some moisture from fog in the summer; it is characterized by sagebrush and grassland communities. Most of the coastal plains in the Bay Area have been converted to urban use (Bailey 1995). Through literature searches, the following six major terrestrial and aquatic wildlife habitats were identified at Alameda Point (Navy 1999a).

- Open Water Area
- Grassland
- Landscaped or Developed
- Intensively Developed
- Airfield (Paved) Area
- Rock Breakwaters and Riprap

Sites 6, 7, 8, and 16 are considered intensively developed (see Figure 2-5). There is little vegetation because the sites consist primarily of asphalt and concrete, buildings, roads, and parking lots (see Sections 3.2, 3.3, 3.4, and 3.5). Typical urban wildlife, such as the California ground squirrel, scrub jays, and American robins (as well as feral cats) may be observed in the intensively developed areas, but to a lesser extent than in the landscaped or developed areas because of less foraging habitat. Currently, ecological habitat capable of supporting significant wildlife is not present at Sites 6, 7, 8, or 16. Special status species identified at Alameda Point are summarized in Table 2-2.

2.6 FUTURE LAND REUSE

According to the NAS Alameda community reuse plan, Sites 6 and 8 are located in the Civic Core land use area, and Site 6 is also partially located in the Marina District (EDAW, Inc. 1996). Site 7 is located in the Main Street Neighborhoods area, and Site 16 is located in the Inner Harbor area. Planned reuse areas are shown on Figure 2-6. The land use areas are briefly described in the list below.

- **Civic Core** – Planned to consist of approximately a 334-acre reuse area, located in the central part of Alameda Point. It currently contains a wide range of use patterns, including the central open space mall, the shoreline along the Oakland Inner Harbor, and the East Gate entrance station. Recreational, administrative, warehouse, and industrial structures also are located in this reuse area. The Civic Core reuse area would be developed as a mixed-use "flex zone" to accommodate a range of uses, which are based on the near-term reuse of existing facilities with redevelopment, additions, and demolition occurring over time. Development in the mixed-use core would emphasize international business and commerce, research and development facilities, and would support commercial uses. Potential civic uses include public recreation facilities, a museum, a library, a teen activity center, a civic auditorium, civic office space, a place of worship, and meeting spaces (Navy 1999a).

- **Marina District** – Planned to be about 126 acres, surrounding the entire shoreline of the Seaplane Lagoon. The Navy used this area primarily for deep-water ship and seaplane berthing, equipment storage, and repair. A proposed open space promenade, extending from the Civic Core, would open into a civic plaza as it meets the water's edge in the Marina reuse area. A hotel and conference center would be built on 4 acres. Civic uses, such as office space, a cultural arts center or theater, and recreation, could front the plaza. Housing in the Marina reuse area would be limited to the eastern shores and provide opportunities for a mix of housing types and income levels. Housing could include artist lofts, apartments for low- to moderate-income families, and townhouses consistent with Measure A, which is a 1973 amendment of the Alameda City Charter that allows single-family dwelling units, but prohibits construction of multifamily dwelling units, except replacement of low-cost housing units by the Alameda Housing Authority (Navy 1999a).

- **Main Street Neighborhood** – Planned to consist of about 265 acres in the northeastern part of Alameda Point. The area is currently composed primarily of residential buildings, including 864 family housing units; a daycare facility; and Miller Elementary School. The Main Street Neighborhood would be developed to include 174 attached housing units (about 12 units per acre) and about 1,314 single-family residential units (about 6 units per acre). These new units would be developed as a mix of housing types and densities, which would be consistent with Measure A and the City Charter.

- **Inner Harbor** – Planned to be approximately 120 acres in the southeastern corner of Alameda Point. This reuse area is characterized as a combination of industrial, open space, and community support uses. The most prominent land use features are large-scale industrial buildings and shoreline recreational areas (Navy 1999a). The southern shoreline in the Inner Harbor area would be developed as a 36-acre regional park. The East Bay Regional Park District would develop and manage the regional park, which would include opportunities for shoreline access and recreation, beach uses, a dog run, and other forms of developed recreation. The existing marina, recreation center, breakwater, boathouse, and cafe would be considered for rehabilitation for public use. The intent of the regional park would be to develop a program of public service facilities that would serve international tourists, visitors, and residents. The regional park would be included in the Bay Trail System (Navy 1999a).

The most likely reuses for Sites 6, 8, and 16 include recreational and/or commercial/industrial and residential activities. The most likely reuses for Site 7 include commercial/industrial and residential activities (see Table 2-1).)

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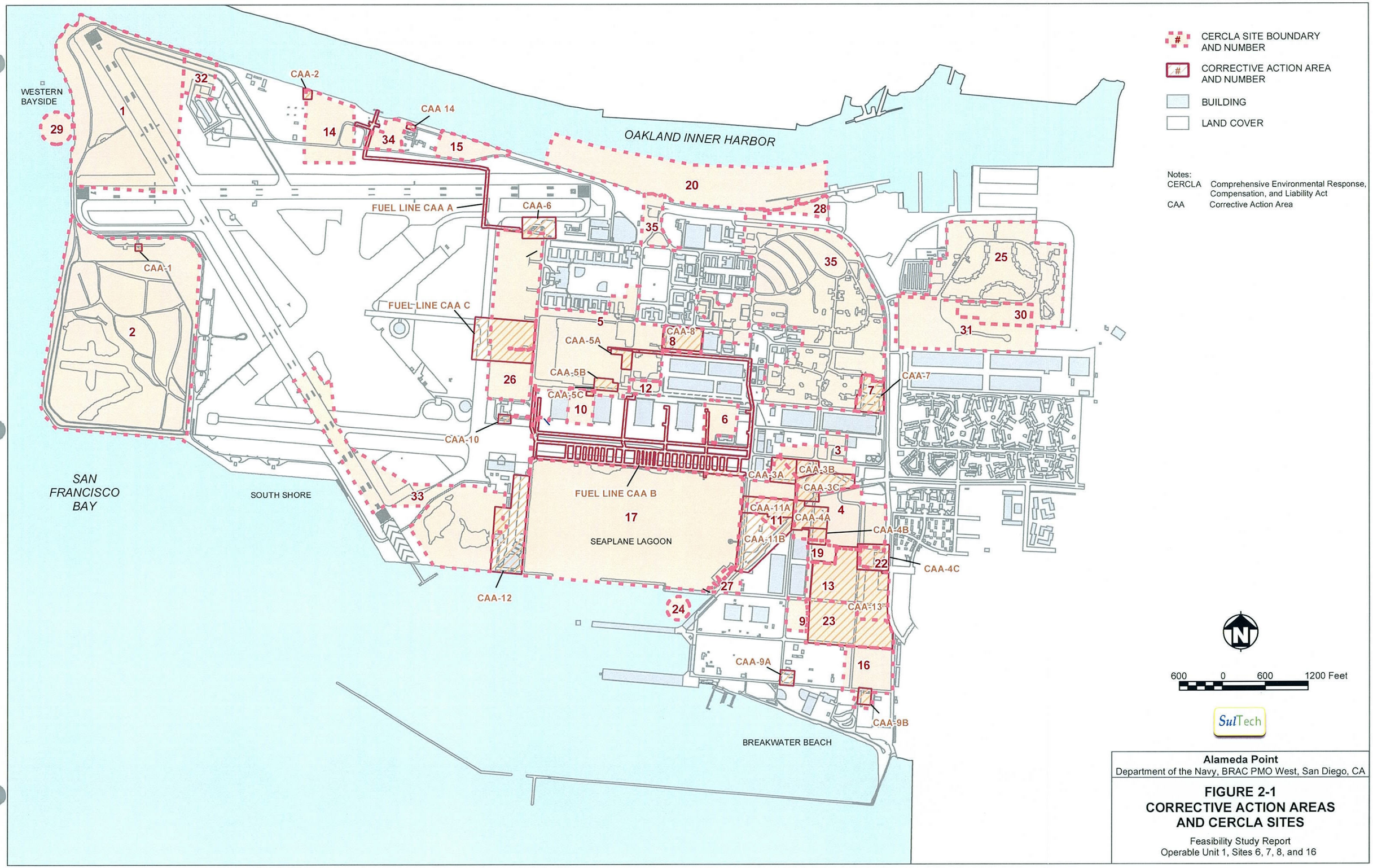
ALAMEDA POINT
SSIC NO. 5090.3.A.

FIGURES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005



Alameda Point
Department of the Navy, BRAC PMO West, San Diego, CA

FIGURE 2-1
CORRECTIVE ACTION AREAS AND CERCLA SITES

Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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EXTENT OF BAY SEDIMENT UNIT

AREA SUBJECT TO MARSH CRUST RESTRICTIONS

EXTENT OF FORMER ISLAND 1865 (RADBRUCH 1957)

CERCLA SITE

LAND COVER

Notes:

CERCLA Comprehensive Environmental Response, Compensation and Liability Act

Source: Navy 2001a

600 0 600 1200 Feet

SulTech

Alameda Point
Department of the Navy, BRAC PMO West, San Diego, CA

FIGURE 2-2
EXTENT OF BAY SEDIMENT UNIT AND MARSH CRUST AREA

Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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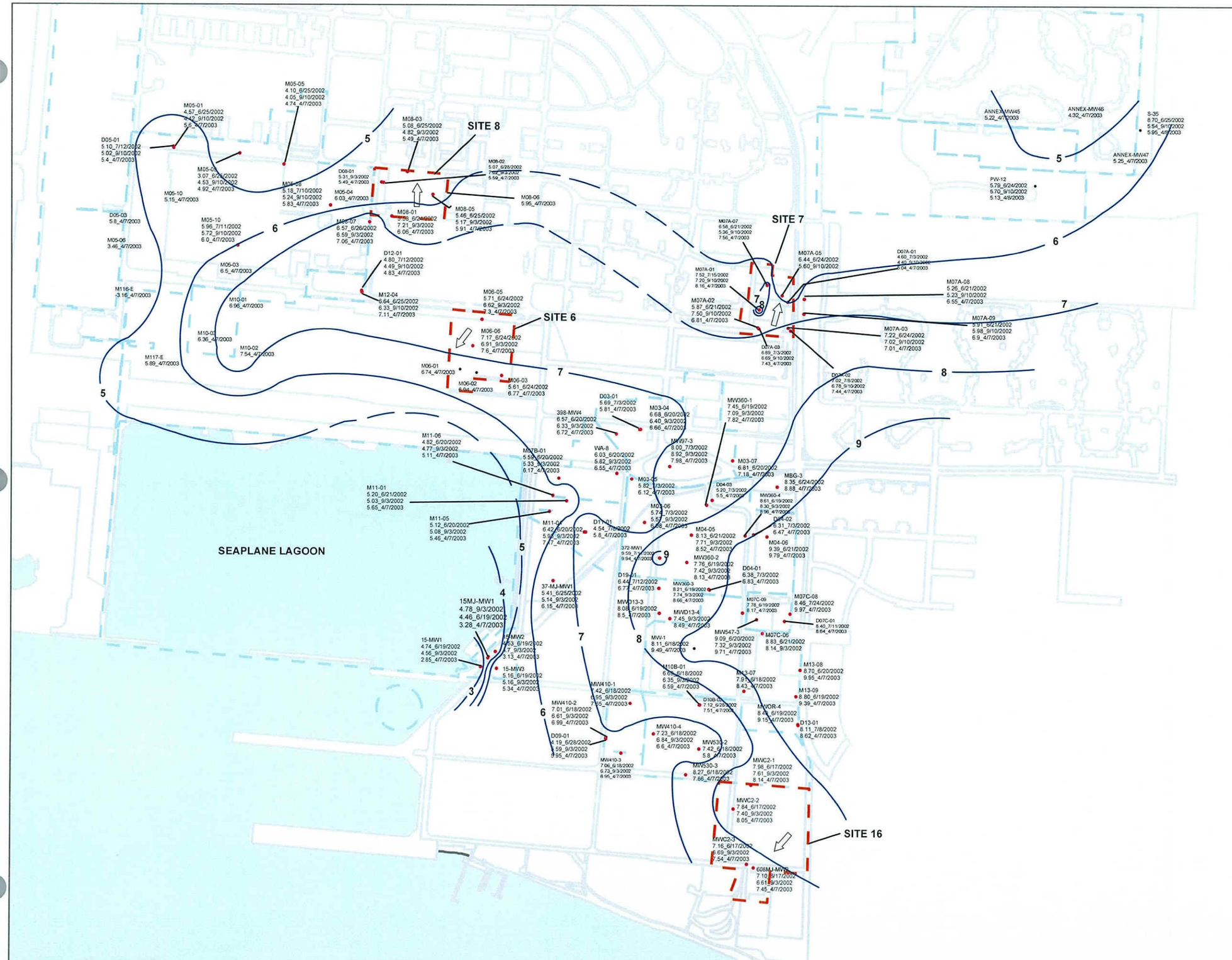

CERCLA SITE BOUNDARY

OU-1 CERCLA SITE BOUNDARIES

GROUNDWATER ELEVATION CONTOUR LINE (---- WHERE INFERRED)

● WELL

● WELLS WITH ONLY 2003 DATA

⇧ GROUNDWATER FLOW DIRECTION

Notes:
Well Name
WL FT. MLLW_Date

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

N

350 0 350 700 Feet

SulTech

Alameda Point
Department of the Navy, BRAC PMO West, San Diego, CA

FIGURE 2-3
POTENTIOMETRIC SURFACE MAP OF THE FIRST WATER-BEARING ZONE, APRIL 2003

Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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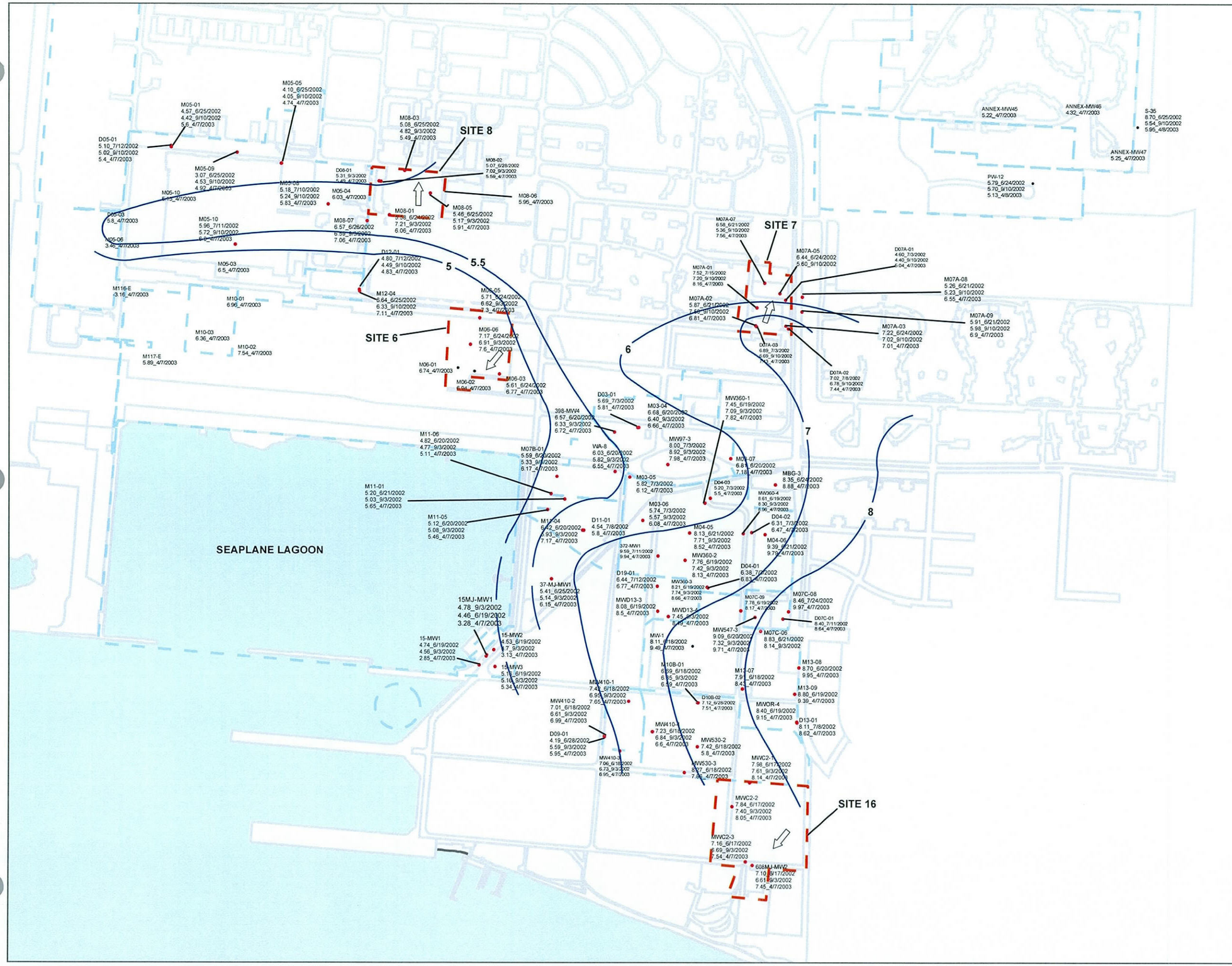

CERCLA SITE BOUNDARY

OU-1 CERCLA SITE BOUNDARIES

GROUNDWATER ELEVATION CONTOUR LINE (---- WHERE INFERRED)

WELL

WELLS WITH ONLY 2003 DATA

GROUNDWATER FLOW DIRECTION

Notes:
Well Name
WL FT. MLLW_Date

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

350 0 350 700 Feet

SulTech

Alameda Point
Department of the Navy, BRAC PMO West, San Diego, CA

FIGURE 2-4
POTENTIOMETRIC SURFACE MAP OF THE SECOND WATER-BEARING ZONE, APRIL 2003

Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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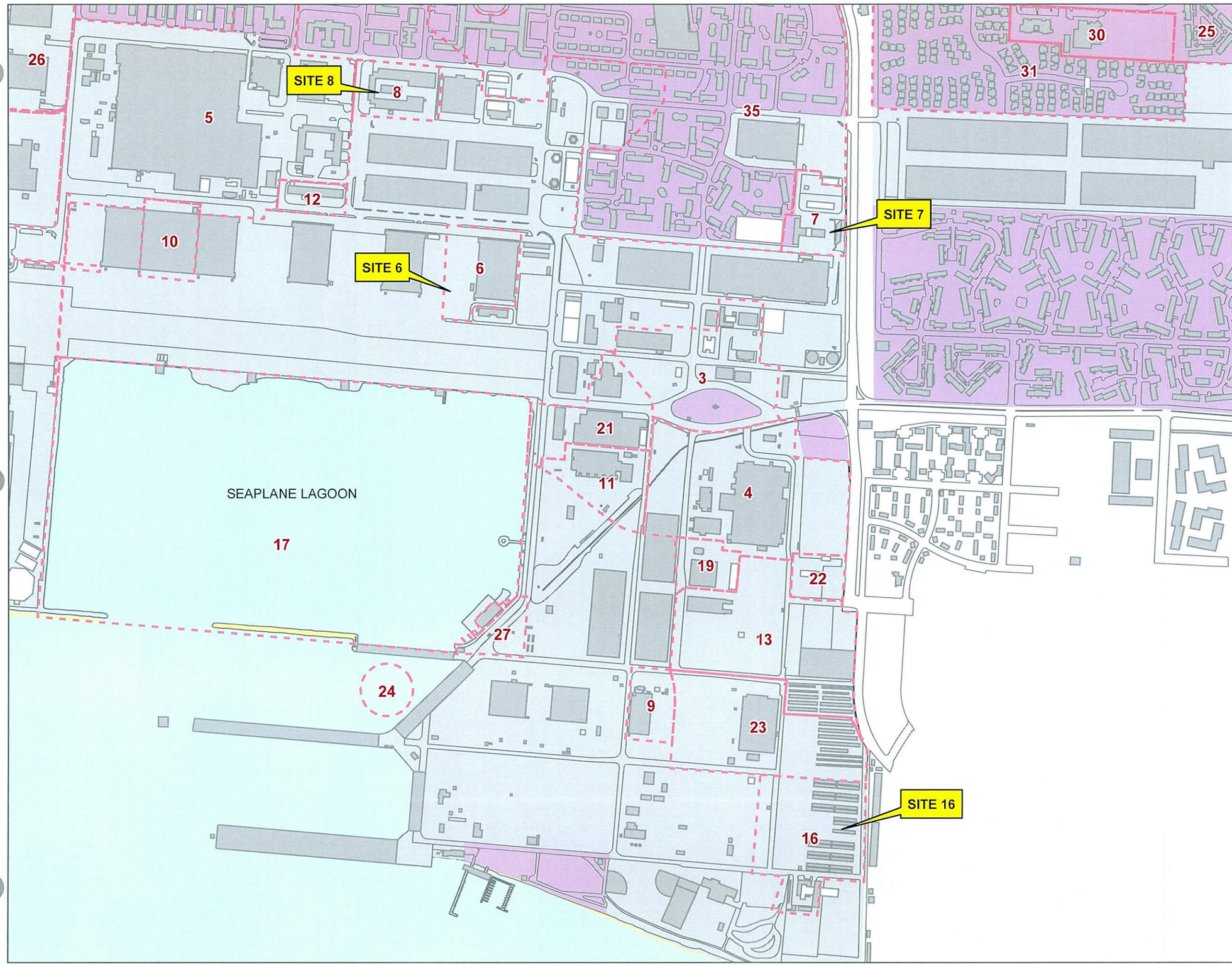

HABITAT

- Intensively Developed
- Landscaped/Developed
- Rock Breakwaters/Riprap
- CERCLA SITE

BUILDING

- Present
- Removed

Note:
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

300 0 300 600 Feet

SulTech

Alameda Point
Department of the Navy, BRAC PMO West, San Diego, CA

FIGURE 2-5
ECOLOGICAL HABITAT MAP

Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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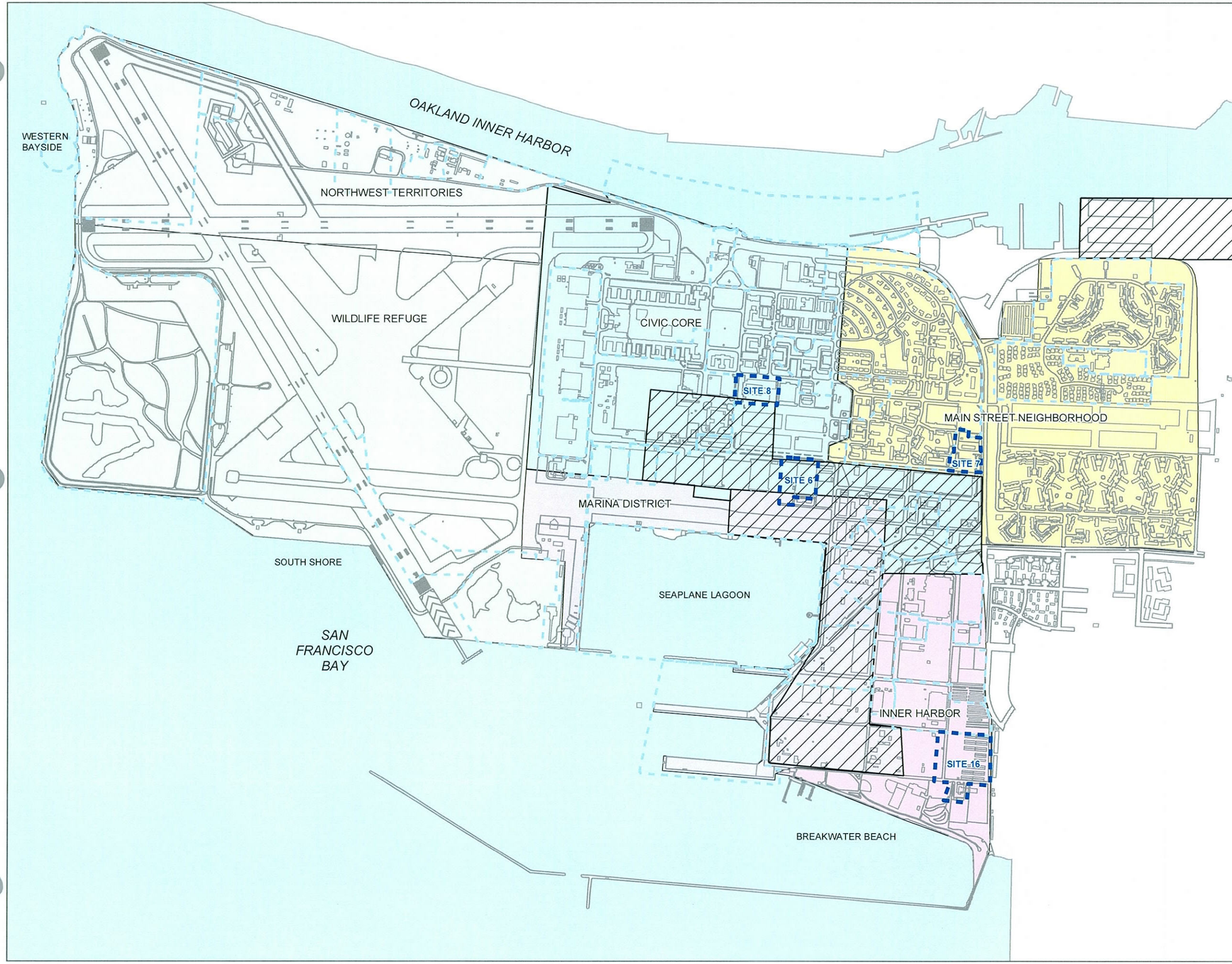

PLANNED REUSE

- Civic Core
- Inner Harbor
- Main Street Neighborhood
- Marina District
- Northwest Territories
- Wildlife Refuge
- CERCLA SITES
- OU-1 CERCLA SITES
- HOUSING OPPORTUNITIES

Note:

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

600 0 600 1200 Feet

SulTech

Alameda Point

Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 2-6
PLANNED REUSE AREAS

Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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ALAMEDA POINT
SSIC NO. 5090.3.A.

TABLES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005

TABLE 2-1: SITE HISTORY, PLANNED REUSE, AND BENEFICIAL GROUNDWATER USES
Feasibility Study Report for OU-1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Site	Site History	Beneficial Uses of Groundwater[a]	Potential Future Land Reuse[b]
Site 6	Aircraft Intermediate Maintenance Department (Building 41) 1945 – 1996	Class II Not considered a drinking water source	Commercial/Industrial Possibly Residential
Site 7	Naval Exchange Service Station Area (Building 459) 1966 – 1997	Class III Not considered a drinking water source, total dissolved solids < 10,000 milligrams per liter	Commercial/Industrial Residential
Site 8	Pesticide Storage Area (Building 114) 1944 – 1997	Class II Not considered a drinking water source	Commercial/Industrial Possibly Residential[c]
Site 16	Shipping Container Storage Area 1948 – present	Class II Potential drinking water source	Recreational (Regional Park) Commercial/Industrial Possibly Residential

Notes:

a The beneficial use evaluation indicates that groundwater in the central region of Alameda Point is unlikely to be used as a potential drinking water source. Source: Tetra Tech EM Inc. 2000. "Final Determination of Beneficial Uses of Groundwater, Alameda Point, Alameda, California." July.

b Source: EDAW, Inc. 1996. "NAS Alameda Community Reuse Plan." January 31. In addition, discussions between the Navy and the Alameda Reuse and Redevelopment Authority have contributed to the potential future land uses.

c Based on the reuse plan, portions of the Civic Core Area may be developed for residential use. The plan suggests that the Civic Core Area could accommodate approximately 2,187,000 square feet of office park/industrial flex uses, 240 housing units, and 50,000 square feet of supporting commercial uses. The plan recommends one-family and two-family dwellings (EDAW, Inc. 1996).

TABLE 2-2: SPECIAL STATUS SPECIES

Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Common Name	Scientific Name	Status
Plants		
Alkali milk-vetch	*Astragalus tener var. tener*	SC
Beach layia	*Layia carnosa*	FE, SE
Bent-flowered fiddleneck	*Amsinckia lunaris*	SC
Knot grass (Kellogg's horkelia)	*Horkelia cuneata ssp. sericea*	SC
Robust spinflower	*Chorizanthe robusta var. robusta*	FE
Rose linanthus	*Linanthus rosaceus*	SC
Round-leaved filaree	*Erodium macrophyllum*	Not listed
Saline clover	*Trifolium depauperatum var. hydrophilum*	SC
San Francisco Bay spineflower	*Chorizanthe cuspidate var. cuspidate*	SC
Santa Cruz tarplant	*Holocarpha macradenia*	FT, SE
Kellogg's horkelia	*Horkelia cuneata sericea*	SC
Point Reyes bird's beak	*Cordylanthus maritimus palustris*	FE
Birds		
California least tern[a]	*Sterna antillarum browni*	FE, SE
White-tailed kite	*Elanus leucurus*	SC
Double-crested cormorant, rookery sites	*Phalacrocorax auritus*	C
California black rail	*Laterallus jamaicensis coturniculus*	SC
California clapper rail	*Rallus longirostris obsoletus*	FE, SE
Northern harrier	*Circus cyaneus*	C
Reptiles		
California tiger salamander	*Ambystoma californiense*	FE
Fish		
Tidewater goby	*Eucyclogobius newberryi*	FE, C
Mammals		
Saltmarsh harvest mouse[b]	*Reithrodonomys raviventris*	FE, SE

Notes:

a Nesting colonies within Alameda Point, west of the sites.

b In 1995, a survey for the saltmarsh harvest mouse was conducted in the West Beach Landfill and the Runway Area Wetlands to identify potential receptors for evaluation in ecological risk assessments being conducted by the Navy for the Installation Restoration Program. No individuals were captured during these surveys of the West Beach Landfill and Runway Area Wetlands.

C State species of concern
FE Federally endangered
FT Federally threatened
SC Federal species of concern
SE State endangered

Source: California Department of Fish and Game 2003. Natural Diversity Database. Oakland West Quadrangle. October 21.

3.0 REMEDIAL INVESTIGATION SUMMARY AND RISK MANAGEMENT DECISIONS

This section presents an overview of the approach used to conduct the RI for Sites 6, 7, 8, and 16 (see Section 3.1). The site-specific RI results, recommendations, and a summary of site-specific risk management decisions are presented in the following sections (see Sections 3.2, 3.3, 3.4, and 3.5). More detailed information is provided in the RI report (Tetra Tech 2004).

3.1 REMEDIAL INVESTIGATION APPROACH

The RI was conducted under the CERCLA program, which provides the appropriate framework. The RI includes the following steps: (1) scoping, (2) environmental investigations, (3) data quality objectives, (4) data evaluation, and (5) conclusions.

During the initial scoping stage of the RI, site histories and available data were used to identify potential sources of contamination, potentially affected media, and data needs at each site. Field investigation methods were selected to meet the data needs established in the scoping process of the RI. An initial conceptual site model was refined through an iterative process that involved identifying areas of known or potential releases of chemicals to the environment, conducting environmental investigations, and filling data gaps until the quality and quantity of data for characterization of the nature and extent of contamination and evaluating risk at each site was judged to be sufficient. Overall, the data for Sites 6, 7, 8, and 16 were collected using a phased and biased sampling approach. With the phased approach, stakeholders were afforded opportunities to provide feedback on the suitability or adequacy of the collected data and the need to collect additional data to identify releases and complete the RI report. Biased sampling allowed for an educated sampling plan that chose locations based on former and present site features and activities that could be reasonably associated with soil or groundwater contamination.

The Navy conducted environmental investigations at Alameda Point in conformance with investigation work plans prepared by the Navy and reviewed by federal and state regulatory agencies. Environmental investigations were conducted under the Installation Restoration Program to meet the data needs established in the scoping process of the RI and identified to address other regulatory requirements (base closure, TPH, and Resource Conservation Recovery Act [RCRA]). Investigation activities consisted of collection of soil, groundwater, and soil gas samples at and around Sites 6, 7, 8, and 16.

Data were reviewed to ensure that they met data quality objectives identified for the RI and that adequate data were collected to characterize the nature and extent of contamination and to evaluate risk to human health and the environment at Sites 6, 7, 8, and 16.

The process used to evaluate the data in support of the CERCLA risk management process included (1) a site-specific conceptual site model, (2) background comparisons, (3) nature and extent evaluations, (4) fate and transport evaluations, (5) a HHRA, and (6) an ERA. The site-

specific conceptual site model is a result of refining the initial conceptual site model through an iterative process that involved identifying areas of known or potential releases of chemicals to the environment, conducting environmental investigations, and filling data gaps. The site-specific conceptual site model is a flow chart that presents the physical features and historical site activities considered the primary sources of contamination; primary, secondary, and tertiary release mechanisms; pathways; exposure pathways; and current and potential future receptors. The background comparisons involved a statistical process used to determine which metals in soil and groundwater are present at naturally occurring concentrations. The objectives of the nature and extent evaluations were to (1) present the concentrations of chemicals believed to be used at the site and (2) provide detailed evaluations of those chemicals that demonstrate significant risk to human health or the environment (risk drivers). Screening levels were used to help define the extent of contamination. Most screening levels were based on a risk of 1E-06, which is equivalent to the EPA Region IX residential preliminary remediation goals (PRG) (EPA 2002). Previous agreements between the Navy and agencies established an action criterion of 0.62 milligram per kilogram (mg/kg) for PAHs, so a screening level of 0.62 mg/kg was used for PAHs in soil. For metals, screening levels were based on background concentrations in ambient soil or groundwater identified during the RI. The objective of the fate and transport evaluations was to determine whether the chemicals driving risk at the sites have migrated or degraded, whether there is a continuing source of contamination, and whether there is the likelihood that groundwater or other potential pathways will distribute the contaminants. The fate and transport evaluations also were focused on the risk drivers.

The HHRA and ERA estimate potential site risks to human health and the environment associated with exposure to chemicals at the site and identified those chemicals associated with the risk. A more detailed description of the approach to the risk assessments and the background comparison is presented in Sections 3.1.1, 3.1.2, and 3.1.3. Section 3.1.4 summarizes the approach used to evaluate TPH at the sites, and Section 3.1.5 presents the basis for the conclusions of the RI report. The regulatory agencies disagree with the risk assessment results for the RI and believe risk is probably underestimated at each site.

3.1.1 Background Comparison Approach

The background comparison consisted of comparing data for metals in soil and groundwater at Alameda Point that were considered to be naturally occurring to analytical results for samples representative of current conditions at Sites 6, 7, 8, and 16. This comparison identified which metals in soil or groundwater at the sites potentially resulted from historical site activities and which metals in the soil or groundwater were naturally occurring (background). The data sets considered to represent naturally occurring metals or background conditions were selected using a series of statistical tests conducted on data sets for each media. As presented in the background comparisons report for soil (PRC Environmental Management, Inc. 1997), areas of the installation with geologically similar soils that represent a single background data set were designated as the following areas (see Figure 3-1).

- Pink Area: Runway area and central portion of installation (Fill Area 1)
- Blue Area: Southeast portion of installation (Fill Area 2)
- Yellow Area: Far west portion of the installation (Fill Area 3)

The background metals data set for the pink area was compared with metals results for Sites 6, 7, and 8, and the blue area was compared with metals results for Site 16.

As presented in the "Technical Memorandum for Estimation of Ambient Metal Concentrations in Shallow Groundwater" (Tetra Tech 1998b), 35 wells were identified and sampled by site-related groundwater contamination, and filtered metals data, analyzed using Contract Laboratory Program methodology, were used to constitute the ambient metals data set. The background groundwater comparison consisted of comparing the background groundwater data set for Alameda Point with analytical results representative of Sites 6, 7, 8, and 16.

A more detailed description of the methodologies and statistical summary results of the background comparison are presented in the OU-1 RI report for Sites 6, 7, 8, and 16 (Tetra Tech 2004).

3.1.2 Human Health Risk Assessment Approach

A baseline HHRA was conducted to estimate human health risks associated with possible exposure to site-related chemicals. These risk estimates are based on a series of conservative assumptions and were subsequently used to support informed risk management decisions regarding the need for remedial action and selection of the most appropriate remedial alternative, if necessary.

For Sites 6, 7, 8, and 16, the site boundaries were used to define the soil exposure area, and soil data for each site were aggregated in depth intervals of 0 to 2 feet bgs and 0 to 8 feet bgs to evaluate potential exposures associated with site use. Except for Site 7, groundwater data were aggregated by contaminant plume rather than site. At Site 7, although there are CERCLA constituents in groundwater, including arsenic, no plumes associated with the CERCLA constituents have been defined; therefore, the site boundaries were used to define the exposure area for the groundwater. TPH contamination present in groundwater at Site 7 is being addressed separately, and the Navy anticipates that it will address elevated arsenic concentrations present at the site. The maximum arsenic concentrations in groundwater are not associated with the soil debris area, where there is a known arsenic problem in soil. Instead, it was postulated during the preparation of the RI report that the TPH release may have changed the geochemical conditions (reducing conditions) of the shallow groundwater aquifer resulting in increased arsenic solubility. Regardless of the cause, based on current monitoring data, arsenic in groundwater is largely not detected at concentrations that are consistent with the MCL for arsenic of 10 micrograms per liter (µg/L). Soil gas data were used in the risk evaluation of subsurface vapor migration to indoor air at Sites 6, 8, and 16, thus complementing groundwater data.

Human health risk was evaluated for commercial/industrial, construction worker and residential exposures and both an adult and child are considered potential future receptors. The recreational exposure scenario was not evaluated at Site 7 because it is not designated in the reuse plan as a future recreational reuse for the site. The residential exposure scenario was evaluated because the anticipated reuse scenario is residential and because EPA risk assessment guidance (EPA 1989) includes a strong preference for evaluation of the residential pathway. The following exposure pathways were evaluated in the HHRA.

- **Residential** – ingestion of homegrown produce, soil ingestion, dermal contact with soil, inhalation of particulates from soil, inhalation of vapors in ambient air, inhalation of vapors in indoor air, domestic use of groundwater
- **Commercial/Industrial** – soil ingestion, dermal contact with soil, inhalation of particulates from soil, inhalation of volatile organic compounds (VOC) in ambient air, and inhalation of VOCs in indoor air
- **Recreational** – soil ingestion, dermal contact with soil, inhalation of particulates from soil, and inhalation of VOCs in ambient air
- **Construction Worker** – soil ingestion, dermal contact with soil, inhalation of particulates from soil, and inhalation of VOCs in ambient air

Chemicals in soil or groundwater were excluded as chemicals of potential concern (COPC) using the following screening criteria: (1) essential nutrient status, (2) frequency of detection, and (3) the EPA Region IX residential PRG or California modified (Cal-modified) residential PRG (EPA 2002) and were not evaluated in the HHRA. Chemicals considered statistically similar to background were noted as a part of the COPC selection process to underscore the contribution of background inorganic chemicals to a receptor's incremental risk. If site lead concentrations exceed the California-modified residential PRG (EPA 2002), the DTSC lead risk computer model, LeadSpread 7 was used to assess lead health risks for children (DTSC 2003).

Chemicals might present noncancer health effects in addition to cancer risks. Noncancer health hazards and cancer risks are characterized separately. The potential for noncancer health effects is expressed as a hazard index (HI). If the resulting HI is less than 1, it is assumed that there is no significant potential for noncancer health effects posed by cumulative effects. If the total HI exceeds 1, a "segregation of hazard indices" analysis is conducted. In this analysis, chemicals that have similar target organs are grouped together, and an HI is calculated for each group. If the HI for a target organ exceeds 1, there is potential for noncancer health effects.

Unlike noncancer health effects, which assume that there is no significant potential for noncancer health effects if the HI is below 1, cancer risks associated with exposure to chemicals classified as carcinogens are estimated as the incremental probability that an individual will develop cancer over a lifetime as a direct result of an exposure. Risk management decisions for chemicals with cancer effects are based on lifetime or total risk; therefore, risks for adult and child receptors are summed to obtain a total cancer risk. To aid in the interpretation of the results, EPA guidance

presents a range of goals for residual cancer risk, which is "an excess upper-bound lifetime cancer risk to an individual of between 1 in 1,000,000 to 1 in 10,000" or between 1E-06 and 1E-04. The range between 1E-06 and 1E-04 is referred to as the "risk management range."

The total cancer risk and noncancer health effects that include background chemicals are presented for all scenarios, and an incremental cancer risk (which does not include background) is also calculated for the residential scenario. Both reasonable maximum exposures (RME), which is the maximum exposure that is reasonably expected to occur at a site, and average or central tendency exposures (CTE) are presented.

There were certain limitations associated with the data set used to estimate risks for these areas. The detection limits for some of the sample analyses were set above the screening criteria. For this reason, the Navy has agreed to conduct additional site characterization during the remedial design and remedial action phases for these areas to ensure that any risks are properly estimated.

See the OU-1 RI report for Sites 6, 7, 8, and 16 for a more thorough description of the HHRA approach (Tetra Tech 2004).

3.1.3 Ecological Risk Assessment Approach

Currently, ecological habitat capable of supporting significant wildlife is not present at Sites 6, 7, 8, and 16; however, exposure pathways for terrestrial receptors were considered potentially complete to provide a conservative estimate of risk. An exposure pathway for aquatic receptors was considered complete for sites with groundwater plumes that could potentially migrate toward the Bay (including the Oakland Inner Harbor and the Seaplane Lagoon) or with broken storm-sewer lines that discharge to the Bay. The aquatic receptor pathway was considered complete for Site 6 and 16; however, storm sewer lines at Site 16 were not considered to be preferential pathways for contaminants in groundwater.

Storm sewer lines and the surrounding soil (bedding material) have been investigated previously numerous times and there is no indication that separate bedding material (other than native soil material) was used in the construction of the storm sewer lines. The hydraulic conductivity of the native soil used as bedding and backfill was essentially the same as the surrounding native soil. Storm sewers within Site 16 were determined to be in sound condition with no breaks in the lines; therefore, there is no pathway for groundwater to infiltrate into the storm sewer. They are not considered to be a possible preferential pathway for contaminants in groundwater. In addition, based on the results of the supplemental RI data gaps sampling conducted in 2001, the bedding material was not considered a preferential pathway. Storm sewers within Site 6 was considered to be a preferential pathway for contaminants in groundwater, and groundwater may migrate to the Bay because it is unknown whether the groundwater contaminant plume currently intersects the northern line; therefore groundwater was considered a complete ecological exposure pathway. Because all four sites have limited habitat, site-specific ecological sampling to support a baseline ERA is not feasible; therefore, a modified ERA was conducted for the sites. This modified ERA is intended to be a conservative estimate using more realistic exposure parameters for the ecological endpoints defined than would typically be used for a screening

ERA. This modified ERA methodology is consistent with EPA guidance for screening-level and baseline ERAs as well as Navy ERA guidance (EPA 1999b; Navy 1999b). Assessment endpoints included small mammals, passerines, raptors, and marine receptors.

The ERA process involves a large number of uncertainties and extrapolations to evaluate potential site risk to ecological receptors; however, many of the assumptions are conservative and results in overestimates of site-specific parameters. A thorough description of the ERA conducted (with corresponding uncertainties) is presented in the RI report for OU-1 Sites 6, 7, 8, and 16 (Tetra Tech 2004).

3.1.4 Total Petroleum Hydrocarbon Program and Risk Evaluation

TPH is not a CERCLA chemical; however, many of the samples collected at Sites 6, 7, 8, and 16 were analyzed for TPH. TPH contamination historically has been evaluated as a part of a program to decommission all USTs, which began in August 1994 and continues to the present day. A separate TPH evaluation for soil and groundwater was conducted at Sites 6, 7, 8, and 16 using the "Preliminary Remediation Criteria and Closure Strategy for Petroleum Contaminated Sites at Alameda Point" dated May 16, 2001 (hereinafter referred to as the TPH strategy) (Navy 2001); the evaluation was documented in Appendix F in the RI report for OU-1 Sites 6, 7, 8, and 16 (Tetra Tech 2004). The TPH strategy was developed using guidance prepared by the Water Board for low-risk fuel site closure (Water Board 1996). The TPH risk evaluation was conducted to determine whether site contamination is appropriately addressed under CERCLA or is best addressed by another Navy program, such as the Corrective Action Program for petroleum-impacted areas or the RCRA Program. This is necessary to provide the appropriate regulatory context for corrective action. The petroleum areas within each of the OU-1 sites are designated as CAAs and include Fuel Line CAA B (Site 6), CAA 7 (Site 7), CAA 8 (Site 8), and CAA 9B (Site 16) (see Figure 2-1). Site 16 is the only site with a commingled TPH and CERCLA plume and is also the only site recommended for further action. The groundwater contaminant plumes will be addressed under the CERCLA cleanup program.

3.1.5 Approach to Risk Management Decisions

The RI recommended an evaluation in this FS for any site with a total site risk (soil and groundwater) greater than 1E-06 or an HI greater than 1; also the RI recommended no further action under CERCLA for sites below these total risk levels. In addition, the RI evaluated whether or not it was necessary to address TPH contamination at each site. If no further action was required under CERCLA but it was necessary to address TPH further, such as non commingled TPH plumes, then the site was recommended for transfer to the TPH Program.

Lead is not evaluated in the same manner as other human health-related COPCs because the nature of the toxicological data for lead differs for assessment of health effects; therefore, lead is not included in the noncancer HI or cancer risk. The LeadSpread model was used to assess health risks from lead. The 95th percentile was used as the cutoff for acceptable risks. That is, acceptable lead levels are defined as those that produce a blood-lead concentration greater than 10 micrograms per deciliter (µg/dL) in no more than 5 percent of the exposed child population.

LeadSpread was used to assess risk from ingestion of site soil and groundwater and risk from ingestion of site soil and East Bay Municipal Utilities District drinking water, which has a lead concentration of 0.15 µg/L.

EPA guidance for Superfund remedy selection states that a response action is generally warranted if one or more of the following conditions are met (EPA 1991, 1999b).

- The cumulative excess cancer risk to an individual exceeds 1E-04 (based on RME assumptions for current or reasonably anticipated future land use and considering beneficial uses of groundwater).
- The noncancer HI is greater than 1 (based on RME assumptions for current or reasonably anticipated future land use and considering beneficial uses of groundwater).
- Site contaminants cause adverse environmental impacts.
- Chemical-specific standards or other measures that define acceptable risk levels are exceeded and exposure to contaminants above acceptable risk levels is predicted for the RME.

In general, action is not warranted at sites that do not meet these conditions; however, the NCP provisions state that a risk of 1E-06 should be used as the point of departure for decisions regarding the need to implement remedial action and refers to the range of cancer risks between 1E-04 and 1E-06 as the "risk management range". For sites where risks fall within the risk management range, EPA Region IX recommends a risk management evaluation during which decisions regarding the need for remedial action are made on a case-by-case basis after consideration of all factors and results. The results of the HHRA and ERA are only one component. Sections 3.2.3, 3.3.3, 3.4.3, and 3.5.3 provide recommendations for or against remedial action of various chemicals in soil and groundwater at Sites 6, 7, 8, and 16 relative to the conditions listed previously.

In addition to the risk management criteria listed above, the regulatory agency members of the BCT placed additional conditions for the evaluation of site features in the FS as potential contaminant sources. The BCT review of the draft RI report noted a lack of sampling near features such as oil-water separators, incomplete plume delineation, inadequate identification of contaminant extent in soil, and incomplete assessment of potential exposure pathways in the human health risk assessment. At the request of the BCT, a number of these data gaps have been addressed in this FS for OU-1. Although the inclusion of these data gaps is not typically a part of an FS, their inclusion represents a desire of the Navy and the regulatory agencies to advance the CERCLA cleanup process. In addition to moving the OU-1 sites forward in the remediation process, addressing the BCT data gaps in the FS also allows the community an opportunity to review the methods by which data gaps will be addressed.

3.2 SITE 6 – BUILDING 41

Site 6, also known as Building 41 (Aircraft Intermediate Maintenance Facility), is approximately 600 feet north of the Seaplane Lagoon and covers an area of approximately 5.6 acres (see Figure 1-2). Site 6 is relatively flat and is covered almost entirely with asphalt, concrete, buildings, roads, and parking lots (International Technology Corporation [IT Corp.] 2001a). There is little vegetation. Building 41, which was constructed before 1945, was used to house seaplanes and to repair aircraft components from transient and tenant aircraft. Aircraft Intermediate Maintenance Facility ceased operations in and around Building 41 in September 1996. As part of closure activities for Building 41, a site cleanup conducted between November 1996 and March 1997 involved (1) removing equipment no longer in use; (2) cleaning all equipment remaining in place; (3) high-pressure washing the walls, ceiling, and door to ensure that the building was chemically clean; and (4) improving the weather tightness of the building. Currently, Building 41 is unoccupied and not used by the Navy. Site 6 also includes the following 10 features: (1) RCRA Unit Tiered Permit Facility (TP)-01, (2) washdown areas WD-040 and 041A, (3) a concrete cleaning vat, (4) OWS-041, (5) former fuel line CAA B, (6) generator accumulation point (GAP) 25, (7) portable avionics laboratories, (7) Buildings 273 and 501, (8) fuel lines, (9) sanitary sewer lines, and (10) storm drain lines (see Figure 3-2). Two OWSs (OWS-040A and OWS-040B) and former Building 199 are associated with WD-040. OWS-040A and OWS-040B are currently located outside the site boundary; however, it is possible these OWSs are influencing contaminant levels at Site 6. As a result, these two OWSs represent data gaps and will be addressed as part of Site 6 in this FS report. No USTs are associated with Site 6 (IT Corp. 2001a).

3.2.1 Nature and Extent

The nature and extent evaluation concluded that most of the chemicals detected across Site 6 are consistent with the historical activities that occurred at the site, which includes aircraft maintenance, paint stripping, and parts cleaning.

3.2.1.1 Soil

Chemicals appear to have been released to soil in the following three principal areas: (1) near OWS-041 and the solvent dip tank associated with WD-041A, (2) between WD-040 and Building 41, and (3) near the probable location of the portable avionic laboratories (see Figure 3-2). Most of the maximum detected concentrations of those chemicals related to solvent and fuel use (dichloroethane [DCA], dichloroethene [DCE], TCE, and toluene) and were located in soil near OWS-041 and the solvent dip tank just outside the southwestern corner of Building 41. The maximum concentrations of xylene and PCE were detected north of this area, in soil collected from the probable location of the portable avionic laboratories at depths of 3.5 to 4.5 feet bgs.

Arsenic and PAHs were detected across the site. Arsenic in soil was attributed to background. PAH concentrations appear to be uniformly distributed in soil throughout the site and do not appear to be related to Navy activities at Site 6. The highest concentrations of PAHs in soil

occur along the northern border of Site 6, away from the location of historical activities. The PAH distribution most likely represents the ambient concentration of PAHs found in the fill material used to construct Alameda Point.

OWS-040A and OWS-040B are located outside the site boundary (see Figure 3-2); however, it is possible these OWSs are influencing contaminant levels at Site 6. As a result, these two OWSs represent data gaps and are addressed as part of Site 6 in this FS report at the request of the BCT.

3.2.1.2 Groundwater

Groundwater concentrations were elevated in the same areas as identified in soil at Site 6. Arsenic and manganese were detected in groundwater across Site 6 and were attributed to background. The highest concentrations of solvents and related degradation products (PCE, TCE, 1,1-DCA, 1,2-DCA, 1,1-DCE, 1,2-DCE, and vinyl chloride) were detected within groundwater in the western portion of the site, near the solvent dip tank and OWS-041, associated with WD-041 and the portable avionics laboratories. Volatile TPH components (toluene, ethylbenzene, and xylene) were detected in a different area beneath Building 41 and are believed to be the result of a fuel spill within Building 41. The maximum concentration of benzene (a TPH component and a solvent component) was detected in the southern portion of the site, near the solvent dip tank and OWS-041; therefore, benzene at this location is likely related to solvent use and not fuel. There is, however, an apparent fuel spill beneath Building 41 (Tetra Tech 2004).

Bis(2-chloroethyl)ether is believed to no longer be present in groundwater at Site 6. Out of 35 samples analyzed, bis(2-chloroethyl)ether was detected in 1 groundwater sample collected from a well in August of 1995, which is located in WD-041A,. It was not detected in groundwater samples collected from the same well in February and June 1995 and in all samples collected from another well and direct-push sample in the same vicinity. The maximum detection limit used for bis(2-chloroethyl)ether in these samples is in accordance with Contract Laboratory Program methods, and this detection limit is not below the PRG.

PCE, TCE, 1,2-DCE, and vinyl chloride likely are related to solvent use in the wash down areas (see Figures 3-3, 3-4, 3-5, and 3-6, respectively). With concentrations of all VOCs decreasing from historical maximums, there appears to be no continuing source of VOCs at Site 6. The data collected at the site indicate that groundwater plumes for these contaminants do not appear to be migrating beyond Site 6. The OU-1 RI for Sites 6, 7, 8, and 16 contains detailed information regarding the nature and extent and fate and transport of contamination at Site 6 (Tetra Tech 2004). Additional details regarding the nature and extent of the VOCs will be collected as part of remedial design at the request of the BCT.

3.2.2 Risk Assessment Results

An HHRA and ERA were conducted to evaluate risk from chemicals detected at Site 6, and a summary of the results is provided in the following text. A detailed description of the risk assessment results is provided in the RI report for OU-1 Sites 6, 7, 8, and 16 (Tetra Tech 2004).

3.2.2.1 Human Health Risk Assessment Results

The HHRA results are summarized by media in the following section. The total RME cancer risks and noncancer HIs (including background) for Site 6 are discussed along with incremental risk (excluding background) for the residential scenario. Both RME and CTE cancer risks and noncancer HIs are presented in Tables 3-1 and 3-2.

Soil

Commercial/industrial, and construction worker scenarios are considered the most likely exposure scenarios as determined from discussions between Navy and the Alameda Reuse and Redevelopment authority. For soil, the highest RME cancer risk (including background) is 2E-06 for the commercial/industrial scenario, which is within the risk management range of 1E-06 to 1E-04 (see Table 3-1). The highest RME HI (including background) is 0.03 for the construction worker scenario, which is less than 1.0.

For the residential scenario, soil data were aggregated in depth intervals of 0 to 2 feet bgs (surface soil) and 0 to 8 feet bgs (subsurface soil). For surface soil, the total RME cancer risk (including background) is 1E-05, which is within the risk management range. The RME HI for a child (including background) is 0.2, which is less than 1.0. For subsurface soil, the total RME cancer risk (including background) is 1E-05, which is within the risk management range. The RME HI for a child (including background) is 0.1, which is less than 1.0. Soil risks are attributed primarily to arsenic. Arsenic is attributed to background. Cancer risk from background metals in soil (pink background area, see Figure 3-1) is 2E-05, which is greater than the total residential site risk for surface and subsurface soil; therefore, risk from site-related activities is considered minimal.

Based on the soil samples collected at Site 6, the risk assessment did not identify any COPCs that exceed the risk management range and would require remediation in accordance with the NCP. However, the regulatory agencies have requested the Navy evaluate potential site risk associated with OWSs that were not adequately characterized during the RI that had concentrations that exceeded the interim cleanup levels.

Lead in Soil

Lead was not selected as a COPC for soil because levels are statistically similar to background; therefore, risk attributed to lead was not evaluated using LeadSpread. The maximum concentration of lead detected in surface soil is 47.4 mg/kg and in groundwater is 0.018 mg/L.

Potential site risk to human health from ingestion of lead in Site 6 soil is considered to be minimal.

Groundwater

Groundwater pathways for the recreational and construction worker receptors were not considered complete; therefore, groundwater was not evaluated for these scenarios. Groundwater was evaluated for the commercial/industrial and residential scenarios. Only inhalation of vapors from groundwater to indoor air was evaluated for the commercial/industrial scenario. The total RME cancer risk from groundwater to commercial/industrial receptors is 6E-05, which is within the risk management range (see Table 3-2). The noncancer HI is 0.04, which is below 1.0.

For groundwater, using the residential scenario, the total RME cancer risk (including background) is 5E-04, which is above the risk management range. The RME HI for a child (including background) is 9, which is above an HI of 1.0. Cancer and noncancer drivers for groundwater are arsenic, manganese, bis(2-chloroethyl)ether, PCE, TCE, and vinyl chloride. Arsenic and manganese are attributed to background. Risk attributed to bis(2-chloroethyl)ether (8E-06) is based on one groundwater sample collected in 1995; all other groundwater samples were nondetect. Risk attributed to PCE, TCE, and vinyl chloride was attributed to data for samples collected from 1995 to 2002; concentrations have decreased over time.

RME cancer risk and an HI (using the residential scenario) were also calculated for metals in the background data set for groundwater. RME cancer risk from background groundwater is 2E-04, compared to the Site 6 groundwater cancer risk of 5E-04. The HI for background groundwater is 13, compared to the Site 6 HI (child) of 9. When cancer risk from background metals is subtracted from the total site risk for groundwater, the incremental risk from groundwater is 3E-04. The HI for metals in the background data set for groundwater (13) is greater than the total HI for Site 6 (9); therefore, incremental noncancer risk is considered minimal.

3.2.2.2 Ecological Risk Assessment Results

Currently, ecological habitat capable of supporting significant wildlife is not present at Site 6; therefore, an assumption of complete exposure pathways for terrestrial receptors had to be included in the risk assessment, resulting in a conservative estimate of risk. Although the storm-sewer line in the southern portion of the site near the groundwater plume is submerged in groundwater, it is in sound condition, so it is considered an incomplete pathway. Storm sewer lines and the surrounding soil (bedding material) have been investigated previously numerous times and there is no indication that they have significantly different hydraulic properties than surrounding soil material. An exposure pathway for aquatic receptors was considered complete because groundwater potentially could migrate toward the Bay (including the Seaplane Lagoon). Potential exposure of marine and estuarine organisms to VOCs transported to surface water from groundwater was assumed, and assessment endpoints included small mammals, passerines, raptors, and marine receptors. The ERA results indicated that none of the chemicals in soil or groundwater pose significant risk to ecological receptors.

3.2.3 Risk Management Decisions

Based on the data and risks discussed previously, soil and groundwater at Site 6 are recommended for further evaluation in this FS, as defined under CERCLA, to address risks to human health under the commercial/industrial and residential reuse scenarios (see Table 3-4). COCs identified for groundwater are 1,2-DCE, TCE, PCE, and vinyl chloride. No COCs were identified for soil, however as previously stated, a data gap exists with regard to OWS-040A and OWS-040B and in this FS these OWSs are recommended for further evaluation in this FS. No action is recommended for ecological receptors based on results of the ERA. The table below and subsequent discussions summarize the risk management decisions made for risk drivers in soil and groundwater at Site 6.

RISK MANAGEMENT DECISIONS FOR RISK DRIVERS AT SITE 6

Risk Driver	Risk Contribution				Risk Management Decision
	Residential		Commercial/ Industrial[a]		
	Cancer[b]	HI	Cancer	HI	
Soil					
Arsenic	1E-05	--	1E-06	--	Not accepted as a COC; not significantly different from background
Groundwater					
Arsenic	2E-04	2	--	--	Not accepted as a COC; not significantly different from background
Manganese	--	3	--	--	Not accepted as a COC; not significantly different from background
Bis(2-chloroethyl)ether	8E-06	--	--	--	Risk attributed to one detect sample, not accepted as a COC
Tetrachloroethene	2E05	--	8E-06	---	Accepted as a COC
Trichloroethene	1E-04	3	5E-05	--	Accepted as a COC
1,2-Dichloroethene	--	--	--	--	Accepted as a COC, even though it does not present risk, because it breaks down into vinyl chloride
Vinyl chloride	6E-05	--	--	--	Accepted as a COC

Notes: The table above only lists COCs exceeding a cancer risk of 1E-06 or a noncancer HI of 1; accordingly, the sum of the risk or HI estimates shown above may not equal the results presented in the text.

a Commercial/industrial risk from groundwater is from indoor air only. Arsenic, manganese, bis(2-chloroethyl)ether, and vinyl chloride do not pose risk to indoor air based on the results of the human health risk assessment.

b Equals the combined child and adult risk.

-- Not applicable

An evaluation of TPH in soil and groundwater was conducted based on the TPH strategy for Alameda Point. On the basis of that evaluation, no further action is recommended at Site 6, including Fuel Line CAA B, under the TPH Program for TPH fractions or TPH-associated constituents. The following paragraphs present further support for decisions involving those chemicals in the above table that were not accepted as COCs.

3.2.3.1 Site 6 Soil

For the residential scenario, cancer risk from Site 6 soil is within the risk management range and the noncancer HIs are below 1.0. The principal risk driver is arsenic. Arsenic in soil was attributed to ambient conditions and not attributed to historical Navy activities at Site 6. For the residential scenario, cancer risk from exposure to arsenic in Site 6 soil is 1E-05 compared to the cancer risk of 2E-05 from arsenic in ambient soil. Therefore, no further action is recommended for arsenic in soil at Site 6 based on human health risk to residential receptors.

PAH concentrations are expressed as benzo(a)pyrene (B(a)P) equivalent concentrations, which represent their total toxicities relative to B(a)P. The highest concentration of B(a)P equivalent (0.853 mg/kg) was detected along the northern boundary of the site (sampling location C3S006B002) in a soil sample from 0 to 0.5 foot bgs. This location is in a paved parking lot and is the only location that exceeds the screening level of 0.62 mg/kg . Otherwise, PAH concentrations are lower than 0.62 mg/kg, appear to be distributed uniformly in soil throughout the site, and do not appear to be related to Navy activities at Site 6. The general PAH distribution most likely represents the concentrations of PAHs in the fill material used to construct Alameda Point and the maximum PAH concentration most likely is attributable to asphalt. Therefore, no further action is recommended for PAHs in soil at Site 6.

For the commercial/industrial scenario, cancer risk from Site 6 soil is within the risk management range and the noncancer HIs are below 1.0. The principal risk driver is arsenic. As stated above, arsenic in soil is attributed to ambient conditions and not attributed to historical Navy activities at Site 6. Therefore, no further action is recommended for arsenic in soil at Site 6 based on the risk to residential receptors.

OWS-040A and OWS-040B are located outside the Site 6 boundary; however, it is possible that these OWSs are influencing contaminant levels at Site 6; therefore, they represent data gaps for soil (and groundwater) that will be addressed in this FS.

The ERA results indicated that none of the chemicals in soil pose significant risk to ecological receptors, and Site 6 does not provide ecological habitat because it is completely covered by pavement or buildings. Land use plans for Site 6 indicate that it will retain its urban nature in the future. No further action is recommended for Site 6 soil based on potential site risk to ecological receptors.

3.2.3.2 Groundwater

For the residential scenario, cancer risk from Site 6 groundwater exceeds the risk management range, and the noncancer HI is above 1.0. Risk drivers for Site 6 groundwater are arsenic, manganese, bis(2-chloroethyl)ether, PCE, TCE, and vinyl chloride.

Arsenic and manganese concentrations in groundwater are similar to background and were attributed to ambient conditions. Although manganese in groundwater is elevated relative to

ambient conditions, this is likely because of the reducing environment in groundwater, which is caused by the natural degradation of chlorinated solvents. With a reducing environment, the contaminant precipitates out of groundwater. Because arsenic and manganese concentrations are similar to background they are recommended for no further action at Site 6.

Bis(2-chloroethyl)ether was detected in one groundwater sample collected from well M06-01, which is located in WD-041A, in August of 1995. It was not detected in groundwater samples collected from well M06-01 in February and June 1995, in any samples collected from well M06-02 (which is in the same vicinity), and in a direct-push sample (DHP-S06-03). Groundwater samples collected from 2001 through 2003 during the supplemental RI data gap sampling and basewide groundwater monitoring investigations were not analyzed for SVOCs. Bis(2-chloroethyl)ether is believed to no longer be present in groundwater at Site 6 and is recommended for no further action.

Based on the residential scenario, PCE, TCE, 1,2-DCE, and vinyl chloride in groundwater pose risk from vapor intrusion to indoor air and through domestic use of groundwater (ingestion, dermal contact, and inhalation). The cancer risk from exposure to these compounds is 2E-04 at Site 6.

For the commercial/industrial scenario (exposure to vapor intrusion only), cancer risk from Site 6 groundwater is within the risk management range, and the noncancer HIs are below 1.0. The principal risk driver is TCE. Because of risk from TCE to commercial/industrial workers through the vapor intrusion pathway, groundwater was recommended for further evaluation in this FS to address TCE in groundwater.

As with soil, OWS-040A and OWS-040B are located outside the site boundary; however, it is possible that these OWSs are influencing groundwater contaminant levels at Site 6. Therefore, they represent data gaps that will be addressed in this FS.

The ERA at Site 6 evaluated groundwater because it could potentially migrate to adjacent surface water bodies such as the Seaplane Lagoon and the Bay. No ecological COCs were identified for groundwater at Site 6. No further action is recommended for Site 6 groundwater based on potential site risk to ecological receptors.

3.3 SITE 7 – BUILDING 459

Site 7, also known as the Naval Exchange Service Station area, is located along the eastern boundary of Alameda Point, approximately 1,840 feet from the Bay (see Figure 1-2). The site is approximately 5.6 acres in size, and about 70 percent is open space covered primarily with asphalt and concrete and some bare ground. Buildings and structures cover about 30 percent of the site. There is little vegetation. Site 7 was used as an automotive facility, which included Building 459 (repair shop and parts store) and Structure 284 (fuel island) (see Figure 3-7). Before Site 7 was used as an automotive facility, it was the site of an incinerator (housed in former Building 68-3) surrounded by grassy open space. A craft/hobby shop and

laundry facility (former Building 158), a maintenance building (former Building 506), and a NAS GAP 30 that stored service station waste (such as PCE, used oil filters, oil-based paints, fuel filters, and battery electrolytes) were located in the northern portion of Site 7 (IT Corp. 2001a). Site 7 also includes former UST 506-1/UST(R)-16, UST(R)-15/NAS GAP 16 (former USTs 459-7 and 459-8), former USTs 459-1 through 459-6 and associated fuel lines, OWS-459, NAS GAP 30, storm sewer lines, industrial waste sewer lines, and open space. Because of possible petroleum product contamination from automotive-related activities and USTs, Site 7 is also designated as CAA 7 (see Figure 2-1).

In addition, a debris layer, characterized by a blue metallic color, was identified in shallow soils in the parking area south of Building 459, near the footprint of former Building 68-3. This debris layer was identified during excavation activities conducted in October 2002, in accordance with the "Final Work Plan Addendum, Evaluation of Alternative Remedial Technology, Former Exchange Service Station, Building 530 and Area 37" (IT Corp. 2002). The debris layer ranges in depth from about 18 to 24 inches bgs and is about 8 to 12 inches thick. An attempt was made to remove the debris layer by excavating two small areas of surface soil; however, excavation activities were halted so that additional evaluation of the nature and extent of the debris layer could be performed. About 1,320 cubic feet of soil was removed and disposed of off site (Shaw 2003a). This area is designated as the soil debris area (see Figure 3-7).

3.3.1 Nature and Extent

The nature and extent evaluation concluded that most of the chemicals detected across Site 7 are consistent with the historical activities known to occur at the site, which includes automobile maintenance and fueling and miscellaneous hazardous waste GAPs. The majority of site contamination is associated with leaking USTs that served fueling pumps at the automotive service station. TPH components associated with these USTs are being remediated through the TPH Program and were not been evaluated in the RI report.

3.3.1.1 Soil

There are two principal areas where chemicals appear to have been released into soil, (1) the vicinity of USTs 459-1 through 459-6 and (2) the soil debris area. USTs 459-1 through 459-6 are located generally northwest of Structure 284 in the eastern portion of Site 7. Petroleum-related products; benzene, toluene, ethylbenzene, and xylene; and SVOCs (bis[2]-chloroethyl]ether) were detected in surface soil and at depth (greater than 10.5 feet bgs) near the former location of the USTs. Maximum concentrations of various metals (arsenic, cadmium, chromium, copper, lead, and mercury) were detected in soil throughout the soil debris area, which is located in the southern portion of the site near Building 68-3. PCBs (Aroclor-1254 and -1260) were also detected in a few soil samples scattered across the site. PCBs are likely from the use of PCB-containing oils for weed control and to minimize dust.

Historical Navy activities were not associated with aluminum or copper in soil, which were observed above ambient levels across the site. No former activities performed at Site 7 would have resulted in a release of aluminum or copper; instead, elevated levels of these metals may be related to natural variations in soil composition. Benzene and xylene were detected in soil samples collected outside the soil debris area below depths of 2.5 to 3 feet bgs. These VOCs in soil are related to TPH and are likely from former UST 459-6. PAH concentrations in Site 7 soil are generally low; they are generally detected at concentrations below the screening level of 0.62 mg/kg. PAHs were detected at concentrations above the screening level at three surface (above 2 feet bgs) sampling locations and at depth (greater than 2 feet bgs) at 17 locations. Detected PAH concentrations expressed as benzo(a)pyrene (B[a]P) equivalents ranged from 0.64 to 10.35 mg/kg. The maximum concentration of 10.35 mg/kg was detected at location C3S007B004 at a depth of 4 to 8 feet bgs. PAHs are likely related to the fill history of the site and concentrations exceeding the screening level of 0.62 mg/kg appear to be distributed widely throughout the site in soil between 4 to 8 feet bgs.

Most sampling locations where arsenic and cadmium concentrations exceed the maximum ambient soil concentration are within the soil debris area, generally collocated with elevated lead concentrations, and likely associated with activities around the incinerator. The vertical extent of arsenic and cadmium contamination is 5 feet bgs (see Figures 3-8 and 3-9, respectively). Lead was detected at elevated concentrations in a relatively discrete area, potentially beneath and south of Building 459 and is likely related to the location incinerator (former Building 68-3) (see Figure 3-10). Maximum concentrations of lead in the soil debris area were detected in samples collected from depths of 2 to 4 feet bgs. The vertical and horizontal boundaries of arsenic, cadmium, and lead in the soil debris area have not been defined fully.

Currently, there is insufficient information about OWS-459, which is near Building 459 (see Figure 3-7). This represents a data gap that is addressed in this FS report at the request of the BCT.

3.3.1.2 Groundwater

Chemicals appear to have been released into groundwater in the following three areas: (1) former USTs 459-1 through 459-6, (2) UST(R)-15/NAS GAP 16, and (3) near the industrial storm sewer line in the soil debris area. As with soil, TPH components (benzene, toluene, ethylbenzene, and xylenes and methyl-tertiary butyl ether) were detected in groundwater near former USTs 459-1 through 459-6. This TPH groundwater plume is currently being remediated through a removal action for TPH free product and methyl-tertiary butyl ether (IT Corp. 2001b). The maximum concentrations of four VOCs (chloroform, DCA, DCB, and TCE) were detected at scattered locations near UST(R)-15/NAS GAP 16 and the industrial storm sewer line in the soil debris area. The VOCs were detected intermittently at these scattered locations and do not indicate the presence of a plume that would be considered commingled with the TPH plume that originates from the leaking USTs. Site 7 has been sampled thoroughly for other VOCs besides those associated with TPH. Most of the other VOCs are each associated with a total of 135 samples from a number of sampling locations across the site. The data from these samples indicate only a few detected concentrations at the site. A continual source of

VOCs is not likely because the analytical results from resampling at a number of monitoring wells show that no VOC was detected more than once at the same location.

PAHs in groundwater do not appear to be related to the use patterns of Site 7 and appear to be confined to the upper FWBZ; however, even though several groundwater samples from Site 7 have been analyzed for PAHs, not enough data are available to determine if the PAH groundwater plume has been identified. PAHs will be recommended for further investigation under the Basewide Monitoring Program.

The highest concentrations of thallium were reported in samples collected near the former USTs 459-1 through 459-6 in the soil debris area. Activities at former Building 68 (the incinerator) are the most likely source of thallium contamination at Site 7, and recent data indicate thallium concentrations are decreasing to nondetectable levels. With concentrations decreasing from historical maximums, there appears to be no continuing sources of thallium in groundwater, and thallium tends to sorb to aquifer material. The groundwater plume for thallium has been defined and does not appear to be migrating off site.

Arsenic was identified as a potential COC for groundwater at Site 7. Although the background comparison did not identify arsenic as a groundwater contaminant, the risk assessment did identify significant risk. Detected concentrations of arsenic in groundwater ranged from 1.9 to 398 µg/L. The maximum concentration was observed in a sample collected from well M07A-03 in 1997. Well M07A-03 is south of the area where the gasoline pumps were located (see Figure 3-8). The most recent sample (2004) collected from this well showed arsenic was not detected at 8.4 µg/L. The soil debris area contains a shallow well (M07A-02) and a deep well (D07A-03). The maximum concentration detected in well M07A-02 was 94 µg/L in a sample collected in 1994. The most recent sample (2004) from this well indicated arsenic was not detected at 15 µg/L. The maximum arsenic concentration in well D07A-03 was 7.6 µg/L in a sample collected in 2003. The most recent sample (2004) from this well indicated arsenic was not detected at 16 µg/L. The maximum arsenic concentrations in groundwater are not associated with the soil debris area, where there is a known arsenic problem in soil. It was suggested that the TPH release may have changed the geochemical conditions of the shallow groundwater aquifer by causing reducing conditions that resulted in increased arsenic solubility. Regardless of the cause, based on current monitoring data, arsenic in groundwater is largely not detected at concentrations that are within an order of magnitude of the MCL for arsenic (10 µg/L).

3.3.2 Risk Assessment Results

An HHRA and ERA were conducted to evaluate risk from chemicals detected at Site 7, and a summary of the results is provided in the following text. A detailed description of the risk assessment results is provided in the RI report (Tetra Tech 2004).

3.3.2.1 *Human Health Risk Assessment Results*

The HHRA results are summarized by media in the following section. Because a soil debris area exists in the southern portion of the Site 7, risk from this soil debris area was calculated separately from soil at the rest of the site. The total RME cancer risks and noncancer HIs (including background) for Site 7 are discussed along with incremental risk (excluding background) for the residential scenario. Both RME and CTE cancer risks and noncancer HIs are presented in Tables 3-1 through 3-3.

Although numerous chemicals were detected at Site 7, most of these chemicals do not pose significant risk as defined by the risk assessments. Significant risk to human health at this site is potentially posed by concentrations of (1) arsenic, benzene, xylene, and PAHs in soil outside of the soil debris area; (2) arsenic and lead in the soil debris area; and (3) arsenic, thallium, and PAHs in groundwater. According to the background comparison, lead in soil and arsenic in groundwater are considered to be naturally occurring at Site 7.

Concentrations of arsenic in groundwater may have been affected by releases of TPH. TPH is being addressed under a different remedial action. However, the incremental site risk is unexpectedly elevated due to excessive variability in the data used to calculate the exposure point concentration for arsenic. Because of data variability, the maximum value of arsenic that was detected at the site was used as the exposure point concentration, rather than the 95 percent upper confidence limit of all arsenic data from the site, which normally is lower than the maximum detected value.

Soil

For soil, the highest total RME cancer risk (including background) for these scenarios is 9E-06 for the commercial/industrial scenario, which is within the risk management range of 1E-06 to 1E-04 (see Table 3-1). The RME HI (including background) for commercial/industrial receptors is 0.04, which is below 1. The RME HI (including background) for construction worker receptors is 0.1 for soil from 0 to 2 feet bgs and is 1 for soil from 0 to 8 feet bgs.

The anticipated reuse for Site 7 is residential. For the residential scenario at Site 7, the total RME cancer risk (including background) for surface soil (0 to 2 feet bgs) is 8E-05, which is within the risk management range. The RME HI for a child (including background) is 0.7, which is less than 1. Cancer risk drivers for surface soil using the residential scenario are arsenic and PAHs (B[a]P).

For subsurface soil (0 to 8 feet bgs) at Site 7, the total RME cancer risk (including background) is 2E-04, which exceeds the risk management range. The RME HI for a child (including background) is 4. Cancer risk drivers for subsurface soil are arsenic, benzene, PAHs, and ethylbenzene. Noncancer risk is attributed primarily to benzene and xylene (total) through the inhalation of ambient air pathway.

Benzene and xylene are related to TPH, and arsenic is attributed to background concentrations at Site 7. Because of the sediments used to construct the base, an ambient concentration of PAHs also exists at Alameda Point. In surface soil, cancer risk from arsenic and PAHs is 6E-05 and 6E-05, respectively. In subsurface soil, cancer risk from arsenic and PAHs is 2.8E-05 and 3.2E-05, respectively. Site 7 is within the pink soil background area. RME cancer risk from metals in soil in the pink background area is 2E-05 and the adult and child HIs are less than 1. The incremental cancer risk for surface and subsurface soil is 6E-05 and 2E-04, respectively.

Soil Debris Area

For the commercial/industrial and construction worker scenarios, the highest cancer risk from the soil debris area at Site 7 is 1E-05 for the commercial/industrial scenario, which is within the risk management range. The highest noncancer HI is 1 for the construction worker (see Table 3-3); all HIs for target organs are less than 1. The noncancer HI for the commercial/industrial receptor is 0.4, which is less than 1.

For the residential scenario, the total RME cancer risk (including background) is 1E-04, which is within the risk management range. The RME HI for a child is 6. Arsenic contributes a majority of the cancer risk (9E-05) while cadmium contributes most of the noncancer risk (4) at Site 7. Both arsenic and cadmium are likely related to site activities.

Groundwater

Groundwater pathways for construction worker receptors were not considered complete at Site 7; therefore, groundwater was not evaluated for this scenario. Groundwater was evaluated for the commercial/industrial and residential scenarios. Only inhalation of vapors from groundwater to indoor air was evaluated for the commercial/industrial scenario. The total RME cancer risk from groundwater to commercial/industrial receptors is 5E-10, which is below the risk management range, and the noncancer risk (0.000002) is below 1 (see Table 3-2).

Using the residential scenario, at Site 7 the total RME cancer risk (including background) is 3E-03, which is above the risk management range. The highest RME HI (for the child resident, including background) is 35, which is above an HI of 1. Cancer and noncancer drivers for groundwater are arsenic, thallium, and PAHs. Risk from arsenic (3E-03) is attributed to background, although concentrations may have been affected by releases of TPH. Groundwater noncancer risk attributed to a child from the background metal arsenic is 25. The HI for a child from thallium (8) is driven from a maximum groundwater concentration of 17.3 µg/L collected in 1995; more recent data indicate thallium concentrations are decreasing to nondetectable levels.

The RME cancer risk (residential) from background groundwater is 2E-04, compared to the Site 7 groundwater cancer risk of 3E-03. The child HI for background groundwater is 13, compared to the Site 7 child HI of 33. The cancer incremental risk from groundwater is 3E-03. The HI incremental risk from groundwater is 20.

Historically high concentrations of arsenic in groundwater at Site 7 led to elevated risk levels. Although the distribution of arsenic concentrations were found to be similar to background, the

high variability in concentrations led to the use of the maximum concentration, rather than the 95 percent upper confidence limit, as the arsenic exposure point concentration. Use of the maximum concentration resulted in an elevated estimate of risk, and also results in a site risk estimate that is an order of magnitude higher than the background risk estimate. The incremental site risk is unexpectedly elevated because of excessive variability in the data used to calculate the exposure point concentration for arsenic. Arsenic concentrations in groundwater may have been influenced by the release of TPH at Site 7. Thus, arsenic is considered a COC for Site 7. However, the most recent groundwater monitoring data presented in the RI report showed that the maximum arsenic concentrations was present in samples collected in the 1990s from wells located near the former gas station where the TPH release occurred and not from a well located in the soil debris area. Recent groundwater monitoring data (2003 and 2004) show that arsenic concentrations in these area have largely decreased to nondetect levels that are similar to the MCL of 10 µg/L.

Lead

Lead was selected as a COPC for the soil debris area but not for the rest of the soil at the Site 7; therefore, lead in the soil debris was evaluated by LeadSpread (DTSC 2003). The exposure point concentrations for lead are 3,640 mg/kg for the soil debris area and 0.017 mg/L for groundwater at Site 7. The model predicts that the 95th percentile estimate of blood lead is 24.6 µg/dL for a child ingesting groundwater and soil from the soil debris area at Site 7, compared to the comparison criterion of 10 µg/dL. The model predicts that the 95th percentile estimate of blood lead is 23.8 µg/dL for a child ingesting drinking water from East Bay Municipal Utility District, the local drinking water provider, and soil from the Site 7 soil debris area. The 10-µg/dL child blood lead level equates to a soil concentration of 230 mg/kg when East Bay Municipal Utility District is the drinking water source.

Based on LeadSpread results, there is potential site risk to human health from ingestion of lead in the Site 7 soil debris area.

3.3.2.2 Ecological Risk Assessment Results

Currently, ecological habitat capable of supporting significant wildlife is not present at Site 7; therefore, an assumption of complete exposure pathways for terrestrial receptors had to be included in the risk assessment, resulting in a conservative estimate of risk. Groundwater was not evaluated because the exposure pathways for aquatic receptors were considered incomplete.

Risk to ecological receptors is potentially posed by aluminum, copper, and lead in soil. Assessment endpoints include small mammals, passerines, and raptors. Copper and lead in soil were identified as a potential site risk to small mammals. Aluminum and lead were identified as a potential site risk to raptors. Risk from the soil debris area is expected to be low because of the limited area for exposure (less than 1 acre).

3.3.3 Risk Management Decisions

Based on the data and risks discussed previously, soil in the soil debris area is recommended for further evaluation, as defined under CERCLA, to address risk to human health (see Table 3-4). COCs identified for soil in the soil debris area are arsenic, cadmium, and lead. In addition, as previously stated, a data gap exists with regard to OWS-459. This OWS is recommended for further evaluation in this FS. No action is recommended for chemicals that pose a risk only to ecological receptors. The following table and discussions summarize the risk management decisions made for risk drivers in soil and groundwater at Site 7.

RISK MANAGEMENT DECISIONS FOR RISK DRIVERS AT SITE 7

	Risk Contribution				
	Residential		Commercial/ Industrial[a]		
Risk Driver	Cancer[b]	HI	Cancer	HI	Risk Management Decision
Non-Soil Debris Area					
Aluminum	--	--	--	--	Not accepted as a COC, limited ecological habitat
Arsenic	6E-05	--	7E-06	--	Not accepted as a COC, identified in concentrations exceeding risk screening criteria in both the soil debris area and the rest of Site 7
Benzene	7E-05	1	--	--	Not accepted as a COC
Copper	--	--	--	--	Not accepted as a COC, limited ecological habitat
Ethylbenzene	9E-06	--	--	--	Not accepted as a COC
Total xylenes	--	2	--	--	Not accepted as a COC
PAHs	6E-05	1	3E-06	--	Not accepted as a COC; attributable to sediment used to construct the base
Soil Debris Area					
Arsenic	9E-05	--	1E-05	--	Accepted as a COC
Cadmium	--	4	--	--	Accepted as a COC
Lead[c]	--	--	--	--	Accepted as a COC
Groundwater					
Arsenic	2E-03	25	--	--	Accepted as a COC, potentially mobilized due to TPH contamination
Antimony	--	2	--	--	Not accepted as a COC
PAHs	5E-04	--	--	--	Not accepted as a CERCLA COC, likely being mobilized due to the presence of TPH contamination which has been deferred to the TPH Program
Thallium	--	8	--	--	Not accepted as a COC, thallium concentrations are decreasing to nondetectable levels
Lead[c]	--	--	--	--	Not accepted as a COC, risk is primarily attributed to lead in soil at Site 7, in addition, groundwater is an unlikely source for a drinking water supply as it does not meet TDS criteria

Notes: The table above only lists COCs exceeding a cancer risk of 1E-06 or a noncancer HI of 1; accordingly, the sum of the risk or HI estimates shown above may not equal the results presented in the text.

a Commercial/industrial risk from groundwater is from indoor air only. Arsenic, PAHs, thallium, and lead do not pose risk to indoor air based on the HHRA results.

b Equals the combined child and adult risk.

c The screening criterion for lead is 150 mg/kg. The exposure point concentrations for lead for the soil debris area are 591 mg/kg and 0.00236 mg/L for soil and groundwater, respectively.

-- Not applicable

Site 7 was a former gas station where several USTs leaked gasoline to soil and groundwater. Consequently, Site 7 is also included within the TPH Program as a CAA. Benzene, ethylbenzene, and xylene detected in soil at Site 7 are attributed to leaking petroleum products that are not commingled with CERCLA contaminants. Consequently, they are subject to the CERCLA petroleum exclusion. The concentrations of these petroleum products exceed TPH Program screening criteria, and a corrective action plan must be prepared to address cleanup of these substances. Consequently, remedial action for these petroleum products is deferred to the TPH Program after all other CERCLA contaminants at Site 7 are addressed. The following paragraphs present further support for decisions involving those chemicals in the above table that were not accepted as COCs.

Site 7 Soil Debris Area

For the residential scenario, cancer risk from the Site 7 soil debris area is within the risk management range, which does not include risk from lead, and HIs for target organs are greater than 1. Exposure to lead concentrations in the soil debris area is predicted to cause blood lead levels in children to exceed the 10 µg/dL threshold level. Arsenic is a cancer risk driver, cadmium is a noncancer risk driver, and lead is also a risk driver, all of which exceed background concentrations. Because of these risks and because the soil debris area at Site 7 contains a blue, crystalline, and metallic layer that is attributed to Navy activities, the area was recommended for further action in this FS to address human health risks.

For commercial/industrial and construction workers, cancer risk from the soil debris area at Site 7 is within the risk management range which does not include risk from lead, and HIs for target organs are less than 1. Exposure to lead concentrations in the soil debris area is predicted to cause unacceptable blood lead levels in commercial/industrial and construction workers. The risk drivers for the soil debris area based on commercial/industrial reuse includes only lead, however, site use would need to be limited. Currently, Site 7 is slated for residential reuse; therefore, the criteria were developed to protect residential receptors.

There is insufficient information about OWS-459, which is near Building 459 within the Site 7 soil debris area. This represent a data gap that is addressed in this FS. Further action is recommended for the soil debris area. The soil debris area will be excavated and followed by confirmation sampling.

Site 7 Soil

For the residential scenario, cancer risk from Site 7 soil is within the risk management range, but the noncancer HI for subsurface soil (0 to 8 feet bgs) exceeds 1. Cancer risk drivers for soil are arsenic, benzene, and PAHs; and noncancer risk drivers are cadmium, benzene, and total xylenes. Benzene and xylene are related to TPH, and arsenic is attributed to background.

A number of Site 7 soil samples exhibited concentrations exceeding the screening level of 0.62 mg/kg established for Alameda Point. PAHs were principally detected in soil at Site 7

within 4 to 8 feet bgs. The Marsh Crust Ordinance at Site 7 addressed PAH contamination to a depth of 5 feet bgs. The PAHs present at the site to this depth are attributed to the Marsh Crust, which is already addressed in a separate ROD for all of Alameda Point (Navy 2001). Risk for soil from depths less than 5 feet was found to be within the risk management range and required no further action. The Marsh Crust ROD implements a series of institutional controls designed to prevent exposure to this soil layer. Because of this ROD, and because the listing of Alameda Point on the National Priorities List specifically excluded the Marsh Crust, no further action in the FS is required for PAHs at depths between 4 and 5 feet bgs in Site 7 soil.

In addition to the PAHs in the Marsh Crust, PAHs were detected above the screening level of 0.62 mg/kg at several locations in surface soil (0 to 0.5 foot bgs) at Site 7. These PAH detections were in samples collected adjacent to a demolished building or beneath pavement and were attributed to asphalt instead of historical Navy activities.

No further action is recommended to address risk from human exposures to soil at Site 7, because cancer risks are within the risk management range, noncancer risks are related to benzene and xylene from TPH, and elevated PAH concentrations to a depth of 5 feet are related to the Marsh Crust. Although cadmium is a noncancer risk driver, it is only a COC for the soil debris area, not for soil.

The ERA at Site 7 showed potential site risk to small mammals, passerine birds, and raptors from exposure to one or all of the following chemicals: aluminum, barium, copper, lead, manganese, nickel, vanadium, zinc, total dichlorodiphenyltrichloroethane (DDT), methoxychlor, benzene, toluene, and xylene in soil. Site 7 does not currently provide ecological habitat because it is covered by pavement, buildings, or bare ground. Land use plans for Site 7 indicate residential construction. The site will not be used as ecological habitat, and no further action is recommended for Site 7 soil based on potential site risk to ecological receptors.

Site 7 Groundwater

For the residential scenario, cancer risk from Site 7 groundwater is above the risk management range, and the noncancer HI exceeds 1. Risk drivers for Site 7 groundwater are arsenic, PAHs, thallium, and antimony in groundwater. A majority of the carcinogenic and noncancer risk is from arsenic, which is attributed to background. In addition, the noncancer HI is driven by a maximum groundwater concentration of 17.3 µg/L for thallium that was detected in 1995; more recent data indicate thallium concentrations are decreasing to nondetectable levels.

After removing risk from arsenic and thallium, the remaining cancer risk in Site 7 groundwater is attributed to PAHs from the Marsh Crust. It is believed that the PAHs have been solubilized as a consequence of the release of TPH from USTs associated with the former gas station. A removal action is underway to address the TPH in groundwater at Site 7. It is anticipated that once the removal action is completed, the PAHs will precipitate out of the groundwater because of their limited solubility.

No further action is recommended for groundwater at Site 7 based on human health, because arsenic is attributed to background, thallium concentrations are decreasing to nondetectable levels, and PAHs in groundwater are attributed to the Marsh Crust and a TPH release. Although arsenic is attributed to background, the risk to human health through the domestic use pathway was elevated because of data variability. In addition, arsenic concentrations may have been elevated because of impacts to aquifer geochemical properties associated with TPH release. Current groundwater monitoring data indicate that arsenic is not detected at concentrations that approach the current MCL for arsenic of 10 μg/L. No further action is considered for arsenic because arsenic concentrations in groundwater have significantly decreased from historical maximums and because groundwater at Site 7 is not considered a source of water for domestic use due to high TDS. Concentrations of lead and methyl-tertiary butyl ether in groundwater are attributed to TPH and are not being addressed under this remedial action for Site 7.

The ERA at Site 7 did not evaluate groundwater because the exposure pathways for aquatic receptors were considered incomplete, and no further action is required for Site 7 groundwater based on potential site risk to ecological receptors.

3.4 SITE 8 – BUILDING 114

Site 8, also known as Building 114 (the pesticide storage area), occupies a rectangular area of approximately 4.3 acres in the central portion of Alameda Point (see Figure 1-2). Approximately 80 percent of Site 8 is covered with asphalt and concrete and consists primarily of buildings, roads, and parking lots. There is little vegetation. Building 114 was constructed in 1944 and was operated by the Public Works as the center for weed and pest control. Operations ceased in April 1997 (IT Corp. 2001a). Historic activities associated with Building 114 include weed and pest control, chemical storage and mixing, and painting. PCB-containing oils were also routinely sprayed for weed control. While in operation, the Public Works Center stored pesticides in an outdoor pesticide storage shed located on the eastern side of Building 114 (see Figure 3-11). WD-114 and OWS-114 are also associated with Building 114, and a small room on the first floor of Building 114 is designated as GAP 3. Additional features at Site 8 include Buildings 391 and 191, storm sewer lines, open space, and subsurface sewage pump station 10 (see Figure 3-11). No USTs or ASTs were associated with Site 8 activities (IT Corp. 2001a). Site 8 is also designated as CAA 8 because of its proximity to Fuel Line CAA B, which is outside of the CERCLA site boundary (see Figure 2-1).

3.4.1 Nature and Extent

The nature and extent evaluation concluded that most of the chemicals detected across Site 8 are consistent with the historical activities that occurred at the Public Works Center, including pesticide storage and mixing, paint striping, and equipment cleaning.

3.4.1.1 Soil

Chemicals appear to have been released to soil at three principal areas at Site 8. First, pesticides and PCBs were detected in surface soil near OWS-114 and the hazardous chemical storage locker at Building 391, respectively. Second, VOCs and pesticides were also detected in soil at depth along the sanitary sewer line south of Building 114, likely caused by leaky lines connected to Building 114. Third, pesticides and benzene, toluene, ethylbenzene, and xylenes were detected in groundwater beneath OWS-114. In addition, VOCs in soil were widely distribution throughout the site with no discernable pattern; concentrations appear to be decreasing over time.

Although numerous chemicals were detected at Site 8, most of these chemicals do not pose significant risk as defined by the risk assessments. Significant risk to human health is potentially posed by concentrations of Aroclor-1254 (one sample point only), Aroclor-1260, arsenic, B(a)P, dieldrin and lead in soil. Lead in soil was identified as a potential site risk to small mammals, passerines, and raptors and PAHs in soil were identified as a potential site risk to passerines and raptors. Arsenic in soil at Site 8 was attributed to background. Because of the use of sediments to construct the base, an ambient concentration of PAHs also exists at Alameda Point. The highest concentrations of PAHs in soil are located in the northwestern quarter of Site 8 at C3S008B003, C3S008B004, and C3S008B007; the maximum concentration was found at the first location listed. PAHs at Site 8 are likely related to the fill history of the site and the Marsh Crust.

The highest concentrations of Aroclor-1260 and dieldrin detected in soil at Site 8 appear to be confined to surface soil in the northeastern corner of the site and along the southern side of Building 114 and in subsurface soil in the southeastern area of the site, adjacent to the sanitary sewer line south of Building 114 (see Figure 3-12 and 3-13, respectively). Aroclor-1260 in Site 8 soil likely is related to the use of oils containing PCBs to control weeds and minimize dust and a leaky sanitary sewer line. Dieldrin is likely associated with storage of pesticides at the site.

Lead concentrations above the highest concentration in ambient soils (165 mg/kg) appear to be localized within surface soil in the northeastern corner of the Site 8, with a maximum lead concentration of 774 mg/kg (see Figure 3-14). The vertical extent of lead is 1 foot bgs. Lead is likely associated with lead-based paint, which was historically used at Site 8.

Currently, there is insufficient information about OWS-114, which is near Building 114 (see Figure 3-11). This represents a data gap that is addressed in this FS report at the request of the BCT.

3.4.1.2 Groundwater

Activities at Building 114, specifically WD-114 and disposal of wastes through sinks or floor drains and leaks in sanitary sewer lines, are the likely source of benzene and TCE in groundwater. Benzene was detected in wells across the site; however, more recent data indicate benzene concentrations are decreasing from historical maximums (0.4 μg/L to nondetect). In 1994, TCE was detected in three locations at concentrations ranging from 0.8 to 8 μg/L. TCE

has not been detected in groundwater samples since 1994, and wells sampled in 2002 and 2003 contained no detectable concentrations of TCE. With concentrations decreasing, there appears to be no continuing source of benzene or TCE at Site 8. It is not known if TCE or benzene are still present in groundwater at Site 8. Soil and groundwater samples will be collected beneath the OWSs at Site 8 as stated in Section 4.0 of this FS report. The OU-1 RI report presents detailed information on the nature and extent of contamination at Site 8 (Tetra Tech 2004).

3.4.2 Risk Assessment Results

An HHRA and ERA were conducted to evaluate risk from chemicals detected at Site 8, and a summary of the results is provided in the following text. A detailed description of the risk assessment results is provided in the RI report for OU-1 Sites 6, 7, 8, and 16 (Tetra Tech 2004).

3.4.2.1 Human Health Risk Assessment

The HHRA results for Site 8 are summarized by media in the following sections. The total RME cancer risks and noncancer HIs (including background) for Site 8 are discussed along with incremental risk (excluding background) for the residential scenario. Both RME and CTE cancer risks and noncancer HIs are presented in Tables 3-1 and 3-2.

Soil

Commercial/industrial and construction worker scenarios are considered the most likely scenarios as determined from discussions between Navy and the Alameda Reuse and Redevelopment authority. For soil, the highest total RME cancer risk (including background) for these scenarios is 7E-06 for the commercial/industrial scenario, which is within the risk management range of 1E-06 to 1E-04 (see Table 3-1). The RME HI (including background) for commercial/industrial receptors is 0.04, which is below 1. The RME HI (including background) for construction worker receptors is 0.1 for both surface and subsurface soil.

For the residential scenario, soil data were aggregated in depth intervals of 0 to 2 feet bgs (surface soil) and 0 to 8 feet bgs (subsurface soil). For surface soil, the total RME cancer risk (including background) is 6E-05 for Site 8, which is within the risk management range. The RME HI for a child (including background) is 0.6 for surface soil, which is less than 1. For subsurface soil, the total RME cancer risk (including background) is 4E-05, which is within the risk management range, and the RME HI for a child (including background) is 0.5, which is less than 1.

Soil risks are attributed primarily to Aroclor-1254, Aroclor-1260, arsenic, and dieldrin and PAHs. Arsenic is attributed to background. Because of the use of sediments to construct the base, an ambient concentration of PAHs also exists at Alameda Point. Cancer risk from PAHs alone is 1E-05 in surface soil and subsurface soil at Site 8. Cancer risk from Aroclor-1254 and Aroclor-1260 are 2E-06 and 1E-05, respectively. Cancer risk from dieldrin is 1E-05 for surface soil; dieldrin is not a COC for subsurface soil.

RME cancer risk from soil in the pink background area is 2E-05. When risk from the background metals is subtracted from the total risk for surface and subsurface soil, the incremental risk for surface and subsurface soil is 1.4E-05 and 1.0E-05, respectively.

Groundwater

Because groundwater pathways for the recreational and construction worker receptors were not considered complete at Site 8, groundwater was not evaluated for these scenarios. Groundwater was evaluated for the commercial/industrial and residential scenarios. Only inhalation of indoor vapors that migrate from groundwater was evaluated for the commercial/industrial scenario. There are no inhalation carcinogenic toxicity factors for groundwater COPCs, so no cancer risk was calculated. The noncancer HI (including background) for the commercial/industrial scenario is 0.0002, which is less than 1 (see Table 3-2).

For groundwater, using the residential scenario, the total RME cancer risk (including background) is 2E-04, which is above the risk management range. The residential RME HI for a child (including background) is 3, which exceeds an HI of 1. Groundwater risk at Site 8 is attributed primarily to arsenic, benzene, and TCE. Arsenic is considered to be naturally occurring. TCE risk is based on groundwater data from 1994; TCE was not detected in subsequent groundwater monitoring data (less than 0.5 µg/L). Risk from benzene alone is 2.2E-05.

RME cancer risk from background groundwater is 2.2E-04, which is greater than the Site 8 groundwater risk of 2.1E-04; therefore, cancer risk from groundwater is considered minimal. The child HI for background groundwater is 13, which is greater than the child Site 8 HI of 3; therefore, incremental noncancer risk also is considered minimal at Site 8.

Lead

Lead was selected as a COPC in soil and groundwater at Site 8 and was evaluated using LeadSpread (DTSC 2003). The exposure point concentrations for lead are 774 mg/kg for soil and 0.017 mg/L for groundwater. Lead in soil and groundwater at Site 8 is statistically different from background. The model predicts that the 95th percentile estimate of blood lead level is 31.0 µg/dL for a child ingesting soil and groundwater at Site 8, compared to the comparison criterion of 10 µg/dL. The model predicts that the 95th percentile estimate of blood lead level is 30.9 µg/dL for a child ingesting Site 8 soil and East Bay Municipal Utility District drinking water. The 10-µg/dL child blood lead level equates to a soil concentration of 230 mg/kg when East Bay Municipal Utility District is the drinking water source. Based on LeadSpread results, there is potential site risk to human health from ingestion of lead in Site 8 soil.

3.4.2.2 Ecological Risk Assessment

Currently, ecological habitat capable of supporting significant wildlife is not present at Site 8; therefore, an assumption of complete exposure pathways for terrestrial receptors had to be included in the risk assessment, resulting in a conservative estimate of risk. Groundwater was not evaluated because the exposure pathways for aquatic receptors were considered incomplete. Assessment endpoints include small mammals, passerines, and raptors. Lead in soil was

identified as a potential site risk to small mammals, passerines, and raptors. PAHs in soil were identified as a potential site risk to passerines and raptors.

3.4.3 Risk Management Decisions

Based on the data and risks discussed previously, soil at Site 8 is recommended for further evaluation in this FS, as defined under CERCLA, to address risks to human health under the commercial industrial and residential reuse scenarios (see Table 3-4). COCs identified for soil are lead, Aroclor-1254, Aroclor-1260 and dieldrin. In addition, as previously stated, a data gap exists with regard to OWS-114. This OWS is recommended for further evaluation in this FS. No COCs were identified for groundwater and no action is recommended for chemicals that pose a risk only to ecological receptors. The following table and discussions summarize the risk management decisions made with respect to risk drivers in soil and groundwater at Site 8.

RISK MANAGEMENT DECISIONS FOR RISK DRIVERS AT SITE 8

Risk Driver	Risk Contribution				Risk Management Decision
	Residential		Commercial/ Industrial[a]		
	Cancer[b]	HI	Cancer	HI	
Soil					
Arsenic	2E-05 6.8E-06	--	--	--	Not identified as a COC, comparable to background concentrations.
Aroclor-1254	2E-06				Identified as a COC/data gap
Aroclor-1260	1E-05	--	2E-06	--	Identified as a COC
Dieldrin	1E-05			--	Identified as COC
PAHs	1E-05	--	--	--	Not accepted as a COC, concentrations attributed to sediments used to construct the base
Lead[c]	--	--	--	--	Identified as a COC
Groundwater					
4,4'-DDT	1E-06	--	--	--	Not accepted as a COC
Arsenic	2E-04	2	--	--	Not accepted as a COC, statistically similar to background
Benzene	2E-05	--	--	--	Not identified as a COC.
Lead[c]	--	--	--	--	Not identified as a COC based on Leadspread model results, risk is attributable to lead in soil
TCE	2E-05	--	--	--	Not identified as a COC because risk was based on concentrations from 1994, subsequent data indicate concentrations are less than 0.5 µg/L

Notes: The table above only lists COCs exceeding a cancer risk of 1E-06 or a noncancer HI of 1; accordingly, the sum of the risk or HI estimates shown above may not equal the results presented in the text.

a Commercial/industrial risk from groundwater is from indoor air only. Arsenic, pesticides, PAHs, and lead do not pose risk to indoor air based on the HHRA results.

b Equals the combined child and adult risk.

c The screening criterion for lead is 150 mg/kg. The exposure point concentrations for lead for the soil debris area are 591 mg/kg and 0.00236 mg/L for soil and groundwater, respectively.

-- Not applicable

An evaluation of TPH in soil and groundwater was conducted based on the TPH strategy for Alameda Point. On the basis of that evaluation, no further action is recommended for TPH at

Site 8. The paragraphs below present further support for decisions involving those chemicals in the above table that were not accepted as COCs at Site 8.

3.4.3.1 Site 8 Soil

For the residential scenario, cancer risk from Site 8 soil is within the risk management range and the noncancer HIs are below 1. Risk drivers are Aroclor-1260, arsenic, dieldrin, lead, and PAHs. Arsenic is attributed to background at Site 8 and is not recommend for further evaluation. Cancer risk from Aroclor-1260 alone is 6.8E-06 in surface and subsurface soil.

PAHs were detected above the screening level of 0.62 mg/kg for Alameda Point at three locations within Site 8. At the first location, a PAH concentration of 8.73 mg/kg B(a)P equivalent was detected in the northern part of the washdown area, at a depth of 0.5 to 2.0 feet bgs (see Figure 3-11). At the second location, PAH concentrations of 9.43 mg/kg and 1.38 mg/kg B(a)P equivalent were detected in two different depths at the northeast end of former Building 198. These levels were detected at depths of 2.0 to 4.0 feet bgs. At the third location, a PAH concentration of 1.13 mg/kg B(a)P equivalent was detected about 50 feet west of the second location at a depth of 4.0 to 8.0 feet bgs. The PAHs do not appear to be related to the use patterns of Site 8 as a Public Works Center because the location of the maximum is outside the main work area of the Public Works Center in an area used for vehicle parking. Risk in subsurface soil (0 to 8.0 feet bgs) is from B(a)P and dibenz(a,h)anthracene. Their combined total cancer risk is 9E-06. The presence of PAHs at this site is likely related to the Marsh Crust, former subtidal areas of Alameda Point, or asphalt contamination of the surface soil (0 to 0.5 foot bgs). Because much of the PAH contamination at Site 8 is likely related to the placement of fill at the site, and because the previously issued ROD for the Marsh Crust and former subtidal area already addresses the PAH contamination, this FS does not consider further actions to address PAHs.

The remaining risk drivers for Site 8 are Aroclor-1254, Aroclor-1260, lead, and dieldrin. Potential exposure to lead in soil could cause blood lead levels in children to exceed the 10 µg/dL threshold level. Dieldrin, Aroclor-1254, and Aroclor-1260 appear to be collocated with lead in soil and will be evaluated further in this FS.

The ERA at Site 8 concluded that potential site risk is posed to small mammals, passerine birds, and raptors from exposure to one or all of the following chemicals in soil: aluminum, copper, lead, manganese, selenium, vanadium, zinc, total PCBs, DDT, dieldrin, endrin ketone, and PAHs. Site 8 does not currently provide ecological habitat because it is covered by pavement, buildings, or landscaped ground. The site does not provide sufficient habitat to support populations of ecological receptors. Land use plans for Site 8 indicate residential construction; therefore, the site will not be used as ecological habitat, and no further action is required for Site 8 soil based on potential site risk to ecological receptors.

3.4.3.2 *Site 8 Groundwater*

For the residential scenario, cancer risk from Site 8 groundwater is above the risk management range, and the noncancer HI is above 1. Risk drivers are arsenic, benzene, and TCE. Arsenic is attributed to background.

The remaining two risk drivers are benzene and TCE. The combined risk for these two chemicals is 4E-05, which is within the risk management range. These risks are based on historical data in a number of wells. Although not all of the wells are included in the groundwater monitoring program, those that are in the monitoring program show declining concentration trends for these two chemicals. It is likely the calculated risk assuming domestic use of groundwater is overestimated. Because risk from arsenic is attributed to background and risk from benzene and TCE is likely overestimated, no further action is recommended for groundwater at Site 8 based on human health at this time. Since additional data will be collected during the remedial action, further evaluation will be performed.

3.5 SITE 16 – SHIPPING CONTAINER STORAGE AREA

Site 16, the shipping container storage area (also known as the CANS area), is located in the southeastern corner of Alameda Point, approximately 390 feet from the Bay (see Figure 1-2). Approximately 50 percent of about 11.1-acre site is covered with asphalt and concrete roads and parking lots, 30 percent is covered by buildings, and 20 percent is unpaved open area. There is little vegetation. Eight groups of large shipping containers located throughout the eastern portion of the site have been used to store avionic parts and test equipment, chemicals including solvents, and aircraft fabrication materials. The containers have also been used as a staging area for petroleum materials and as maintenance warehouses. Before the containers arrived at the site in 1916, Site 16 was used for aircraft parking and for the storage of paints, solvents, acids and bases, and transformers containing PCB oils (Canonie Environmental 1990). An auto-repair facility (Building 608) constructed in 1980 is located in the southern portion of the site, and the northwestern portion of the site was used as a scrap yard (Scrap Yard D-7) (IT Corp. 2001a). Other features at Site 16 include CANS 338A-338H (storage containers); structures 302E, 608, 608A, and 608B; three storage sheds, S608-1 through S608-3; former UST 608-1; former ASTs 338-A1 and 338-D4; AST 608; OWSs 608A and 608B; storm sewer lines; sanitary sewer lines; and open space (see Figure 3-15). Building 402 was formerly located at Site 16. The southern portion of Site 16 is also designated as CAA 9B (see Figure 2-1).

3.5.1 Nature and Extent

The nature and extent evaluation concluded that most of the chemicals detected across Site 16 are consistent with the historical activities that occurred in the CANS area and at the auto hobby shop, including aircraft and equipment storage and cleaning, transformer storage, and automobile servicing.

3.5.1.1 Soil

Chemicals appear to have been released to soil at two principal areas at Site 16, the CANS area and near the former location of UST 608-1. Aroclor-1260, cadmium, and copper were detected in surface soil in the CANS area.

In 1997, soil contaminated with PCBs and lead was excavated from three areas of Site 16 during a soil removal action. Aroclor-1260 in Site 16 soil likely is related to the use of oils containing PCBs to control weeds and minimize dust, and to leaking transformers stored in the northwest portion of the open space; however, the soil removal action in 1997 successfully lowered PCB concentrations in these areas below the interim action level of 1 mg/kg based on the residential remediation goal and agency recommendations.

Currently, there is insufficient information about OWS-608A and OWS-608B, which is near Building 608 at Site 16 (see Figure 3-15). This represents a data gap that is addressed in this FS report at the request of the BCT.

3.5.1.2 Groundwater

Chlorinated VOCs were detected in groundwater collected from the former UST 608-1 area (hereinafter, the former UST area) and at the scrap yard (hereinafter, the scrap yard area) at Site 16. Although the VOCs in groundwater were likely released at two separate locations, the plumes have merged to form a single plume that extends across much of Site 16. Chlorinated ethenes (PCE, TCE, 1-2-DCE, and vinyl chloride) were detected in both areas; dichlorobenzene was also detected in the scrap yard area. Based on site hydrogeology, the groundwater plume is migrating slowly to the southwest. Natural processes are slowly degrading the chlorinated VOCs. These chlorinated ethenes are often breakdown products of one another. For example, PCE can degrade into TCE, which can degrade into DCE, which can break down into vinyl chloride. The horizontal extent of the plumes has not been defined to the southern or western edges of the plumes. Chlorinated VOCs in groundwater have not been detected at depths greater than 16 to 25 feet bgs. In addition, the Yerba Buena Mud confines groundwater in the FWBZ and prevents contaminants in shallow groundwater from migrating deeper.

Pesticides (alpha-chlordane and heptachlor epoxide) and lead were detected in groundwater near the former location of UST 608-1 at Site 16. Alpha-chlordane exceeded the risk-based screening level in a single sample in 1995. In groundwater samples recently collected in 2002 and 2003 from the same well, alpha-chlordane was not detected (less than 0.05 μg/L) (Shaw 2003b). Also during the recent groundwater monitoring event, two samples contained detected concentrations of heptachlor epoxide above the risk-based screening concentration and two samples did not. The use of pesticides in and around Building 608 is the likely source of occasional pesticide detections in groundwater. Because the pesticides were detected intermittently, there does not appear to be a continuing source at Site 16.

Only one sample from Site 16, collected in 2002 (450 µg/L), exceeded the risk-based screening level of 22 µg/L for lead. Lead in groundwater appears to be limited to this single location. Between the June and December 2002 sampling events, a pilot study testing in situ chemical oxidation (ISCO) was conducted in the vicinity of this single location (Shaw 2003c). This pilot study involved the use of a modified oxidizing reagent that was intended to minimize changes in water pH, which would result in solubilization of metals. Indeed, sampling during the pilot study showed lead concentrations in monitoring wells were less than 10 µg/L; however, samples collected from one of the injection wells showed lead concentrations of 171 µg/L that decreased to 33 µg/L 4 weeks after injection. It is likely the maximum concentration of 450 µg/L observed in monitoring well 608MJ-MW2 was an artifact of the pilot study and not an accurate representation of site conditions at Site 16. In two sampling events following December 2002 event, lead concentrations in groundwater was not detected at 10 µg/L and estimated at 2.5 µg/L. See the RI report for further information regarding the nature and extent of contamination at Site 16 (Tetra Tech 2004).

3.5.2 Risk Assessment Results

An HHRA and ERA were conducted to evaluate risk from chemicals detected at Site 16, and a summary of the results is provided in the following text. A detailed description of the risk assessment results is provided in the RI report for OU-1 Sites 6, 7, 8, and 16 (Tetra Tech 2004).

3.5.2.1 Human Health Risk Assessment

The HHRA results for Site 16 are summarized by media in the following sections. The total RME cancer risks and noncancer HIs (including background) for Site 16 are discussed along with incremental risk (excluding background) for the residential scenario. Both RME and CTE cancer risks and noncancer HIs are presented in Tables 3-1 and 3-2.

Although numerous chemicals were detected at Site 16, most of these chemicals do not pose significant risk as defined by the risk assessments. Based on the HHRA, arsenic and Aroclor-1260 were identified as soil risk drivers, and 1,3-DCB and 1,4-DCB, aluminum, arsenic, cadmium, lead, manganese, PCE, TCE, vinyl chloride, and the pesticides alpha-chlordane and heptachlor epoxide were identified as groundwater risk drivers (Figures 3-16 through 3-21). According to the background comparison, arsenic in soil and aluminum, arsenic, cadmium, and manganese in groundwater are considered to be naturally occurring.

Soil

Mixed residential, which includes recreational, commercial/industrial, and construction worker scenarios are considered the most likely exposure scenarios at Site 16 as determined from discussions between Navy and the Alameda Reuse and Redevelopment authority. For these scenarios, the highest total RME cancer risk (including background) for soil is 7.7E-06 for the commercial/industrial scenario (see Table 3-1), which is within the risk management range of

1E-06 to 1E-04. The highest total RME HI (including background) is 0.2 for the construction worker scenario, which is less than 1.

For the residential scenario, soil data were aggregated in depth intervals of 0 to 2 feet bgs (surface soil) and 0 to 8 feet bgs (subsurface soil). For surface soil, the total RME cancer risk (including background) is 7E-05 at Site 16, which is within the risk management range. The total RME HI for a child (including background) from surface soil is less than 1. For subsurface soil, the total RME cancer risk (including background) is 6E-05, which is within the risk management range. The total RME HI for a child (including background) from subsurface soil is less than 1. Cancer risk drivers for surface and subsurface soil are Aroclor-1254, Aroclor-1260 and arsenic.

Cancer risk from Aroclor-1254 and Aroclor-1260 are 1E-06 and 7E-06, respectively, at Site 16. Surface and subsurface soil risks at Site 16 are attributed primarily to arsenic (6E-05 and 5E-05, respectively), which is considered background.

RME cancer risk, using the residential scenario, was also calculated for metals in soil in the blue background area. RME cancer risk from soil in the blue background area is 4E-05. The incremental risk from background metals for surface and subsurface soil is 3E-05 and 1E-05, respectively at Site 16.

Based on the soil samples collected at Site 16, the risk assessment did not identify any COPCs that exceed the risk management range and would require remediation in accordance with the NCP. However, the regulatory agencies have requested the Navy evaluate potential site risk associated with oil-water separators and PCB contaminated soil that were not adequately characterized during the RI that had concentrations that exceeded the interim cleanup levels.

Groundwater

Groundwater pathways for the recreational and construction worker receptors were not considered complete at Site 16; therefore, groundwater was not evaluated for these scenarios. Only inhalation of vapors from groundwater in indoor air was a complete exposure pathway for the commercial/industrial scenario. For the commercial/industrial scenario, the total RME cancer risk (including background) is 9.6E-06, which is within the risk management range. The total RME HI (including background) (0.04) is less than 1 (see Table 3-2).

For groundwater, using the residential scenario, the total RME cancer risk (including background) is 6.8E-04 at Site 16, which is above the risk management range. Groundwater risks are attributed primarily to 1,4-DCB, alpha-chlordane, arsenic, heptachlor epoxide, PCE, TCE, and vinyl chloride. The highest residential (child) RME HI (including background) is 14, which is above an HI of 1. Groundwater noncancer risks are attributed primarily to 1,3-DCB, aluminum, arsenic, cadmium, manganese, and TCE. Arsenic, cadmium, and manganese are attributed to background.

RME cancer risk and an HI, using the residential scenario, were also calculated for metals in the background data set for groundwater. RME cancer risk from background groundwater is 2.2E-04, and the child HI for background groundwater is 13 at Site 16.

Lead

Lead was selected as a COPC and was evaluated using LeadSpread (DTSC 2003). The exposure point concentrations for lead are 45 mg/kg for soil and 0.0938 mg/L for groundwater. Lead in soil and groundwater at the site is statistically different from background. The model predicts that the 95th percentile estimate of blood lead level is 35.3 µg/dL for a child ingesting soil and groundwater at Site 16, compared to the comparison criterion of 10 µg/dL. The model predicts that the 95th percentile estimate of blood lead is 2.9 µg/dL for a child ingesting Site 16 soil and East Bay Municipal Utility District drinking water. The 10-µg/dL child blood lead level equates to a soil concentration of 230 mg/kg when East Bay Municipal Utility District is the drinking water source.

Based on LeadSpread results, there is a minimal risk to human health from ingestion of lead in Site 16 soil; however, there is a risk from exposure to lead in groundwater.

3.5.2.2 Ecological Risk Assessment

Based on the ERA, cadmium and copper were identified as soil risk drivers, and there were no risk drivers identified for groundwater at Site 16. Currently, ecological habitat capable of supporting significant wildlife is not present at Site 6; therefore, an assumption of complete exposure pathways for terrestrial receptors had to be included in the risk assessment, resulting in a conservative estimate of risk. Storm sewers to the Bay are in good condition; therefore, the storm sewers are not considered a complete pathway. However, the exposure pathway for aquatic receptors was considered complete, because groundwater could potentially migrate toward the Bay (including the Seaplane Lagoon). The ERA concluded that no potential site risk is posed to passerines or aquatic receptors. Concentrations of cadmium and copper in Site 16 soil pose a potential site risk to small mammals, and cadmium in soil also poses a potential site risk to raptors. Based on the lack of habitat for these populations at Site 16, however, the risk of exposure to these contaminants is low.

3.5.3 Risk Management Decisions

Based on the data and risks discussed previously, soil at Site 16 is recommended for further evaluation in this FS, as defined under CERCLA, to address risks to human health under the commercial industrial and residential reuse scenarios (see Table 3-4). The only COCs identified for soil are PCBs. In addition, as previously stated, a data gap exists with regard to OWS-608A and OWS-608B. These OWSs are recommended for further evaluation in this FS. COCs identified for groundwater are PCE, TCE, 1,2-DCE, vinyl chloride, 1,3-DCB, and 1,4-DCB. Although chemicals were identified that could pose a risk to ecological receptors, there is little likelihood the site will be used for ecological habitat; therefore, no action is recommended for

chemicals that pose a risk only to ecological receptors. The following table and discussions summarize the risk management decisions made with respect to each of the chemicals detected above the PRG (or other RI screening levels presented in Section 3.1) in soil and groundwater at Site 16.

An evaluation of TPH in soil and groundwater at Site 16 was conducted based on the TPH strategy for Alameda Point. On the basis of that evaluation, further action was recommended for benzene in groundwater at Site 16; however, this was based on the assumption that the storm sewers provide a complete pathway for groundwater to surface water. The RI concluded that the storm sewers to the Bay are in good condition and do not provide a compete pathway; therefore, no further action is recommended for benzene at Site 16. The table below summarizes the risk management decisions made for risk drivers in soil and groundwater at Site 16.

RISK MANAGEMENT DECISIONS FOR RISK DRIVERS AT SITE 16

Risk Driver	Risk Contribution				Risk Management Decision
	Residential		Commercial/ Industrial[a]		
	Cancer[b]	HI	Cancer	HI	
			Soil		
Arsenic	2E-06	0.3	4E-07	0.02	Not identified as a COC
Aroclor-1254	1E-05	--	2E-06	--	Identified as a COC
Aroclor-1260	1E-05	0.05	5E-07	--	Identified as a COC
			Groundwater		
Aluminum	--	1	--	--	Not identified as a COC
Arsenic	4E-04	4	--	--	Not identified as a COC, similar to background
Cadmium	--	1	--	--	Not identified as a COC, similar to background
Manganese	--	1	--	--	Not identified as a COC, similar to background
Lead	--	--	--	--	Not identified as a COC, anomalous analytical result
1,3-DCB	--	1	--	--	Identified as a COC
1,4-DCB	2E-05	--	--	--	Identified as a COC
Alpha-chlordane	6E-05	--	--	--	Not identified as a COC
Heptachlor epoxide	2E-06	--	--	--	Not identified as a COC
PCE	1E-05	--	4E-08	--	Identified as a COC
TCE	1E-04	3	9E-06	0.01	Identified as a COC
Vinyl chloride	5E-05	--	--	--	Identified as a COC

Notes: The table above only lists COCs exceeding a cancer risk of 1E-06 or a noncancer HI of 1; accordingly, the sum of the risk or HI estimates shown above may not equal the results presented in the text.

a Commercial/industrial risk from groundwater is from indoor air only. Arsenic, pesticides, PAHs, and lead do not pose risk to indoor air based on the HHRA results.

b Equals the combined child and adult risk.

– Not applicable

3.5.3.1 Site 16 Soil

For the residential scenario, cancer risk from Site 16 soil is within the risk management range, and the noncancer HIs are below 1. Risk drivers are Aroclor-1254, Aroclor-1260, and arsenic. Arsenic is attributed to background and not historical Navy activities at Site 8.

No further action is recommended for Site 16 soil based on human health, because risks are within the risk management range, arsenic is attributed to background, and risk form Aroclor-1260 is at the lower end of the risk management range.

The ERA at Site 16 concluded that potential site risk is posed to small mammals, passerine birds, and raptors from exposure to one or all of the following chemicals in soil: barium, cadmium, copper, lead, molybdenum, nickel, selenium, zinc, chlordane, total PCBs, and pentachlorophenol. Site 16 does not currently provide ecological habitat because it is covered by pavement, buildings, or landscaped ground. Land use plans for Site 16 indicate a future commercial/industrial area with the potential for a recreation area as well. The site will not be used as ecological habitat, and no further action is required for Site 16 soil based on potential site risk to ecological receptors.

3.5.3.2 Site 16 Groundwater

For the residential scenario, cancer risk from Site 16 groundwater is above the risk management range, and the noncancer HI is above 1. Cancer risk drivers are 1,4-DCB, alpha-chlordane, arsenic, heptachlor epoxide, PCE, TCE, and vinyl chloride. Noncancer risk drivers are 1,3-DCB, aluminum, arsenic, cadmium, manganese, and TCE. Arsenic, cadmium, and manganese are attributed to background. The remaining noncancer risk drivers are TCE and 1,4-DCB, and the incremental HI for a child is below 1.

The remaining cancer risk is attributed to 1,4-DCB, chlordane, heptachlor epoxide, TCE, PCE, and vinyl chloride. Chlordane and heptachlor epoxide were evaluated in the risk assessment using historical data; however, both of these chemicals were nondetected in recent groundwater monitoring data. Therefore, no further remedial action is recommended for chlordane and heptachlor epoxide. Based on cancer risk to human receptors, further action is recommended for 1,3-DCB, 1,4-DCB, TCE, PCE, and vinyl chloride in Site 16 groundwater.

The ERA at Site 16 evaluated groundwater because it could potentially migrate to adjacent surface water bodies such as the Seaplane Lagoon and the Bay. No ecological COCs were identified for groundwater at Site 16. No further action is recommended for Site 16 groundwater based on potential site risk to ecological receptors.

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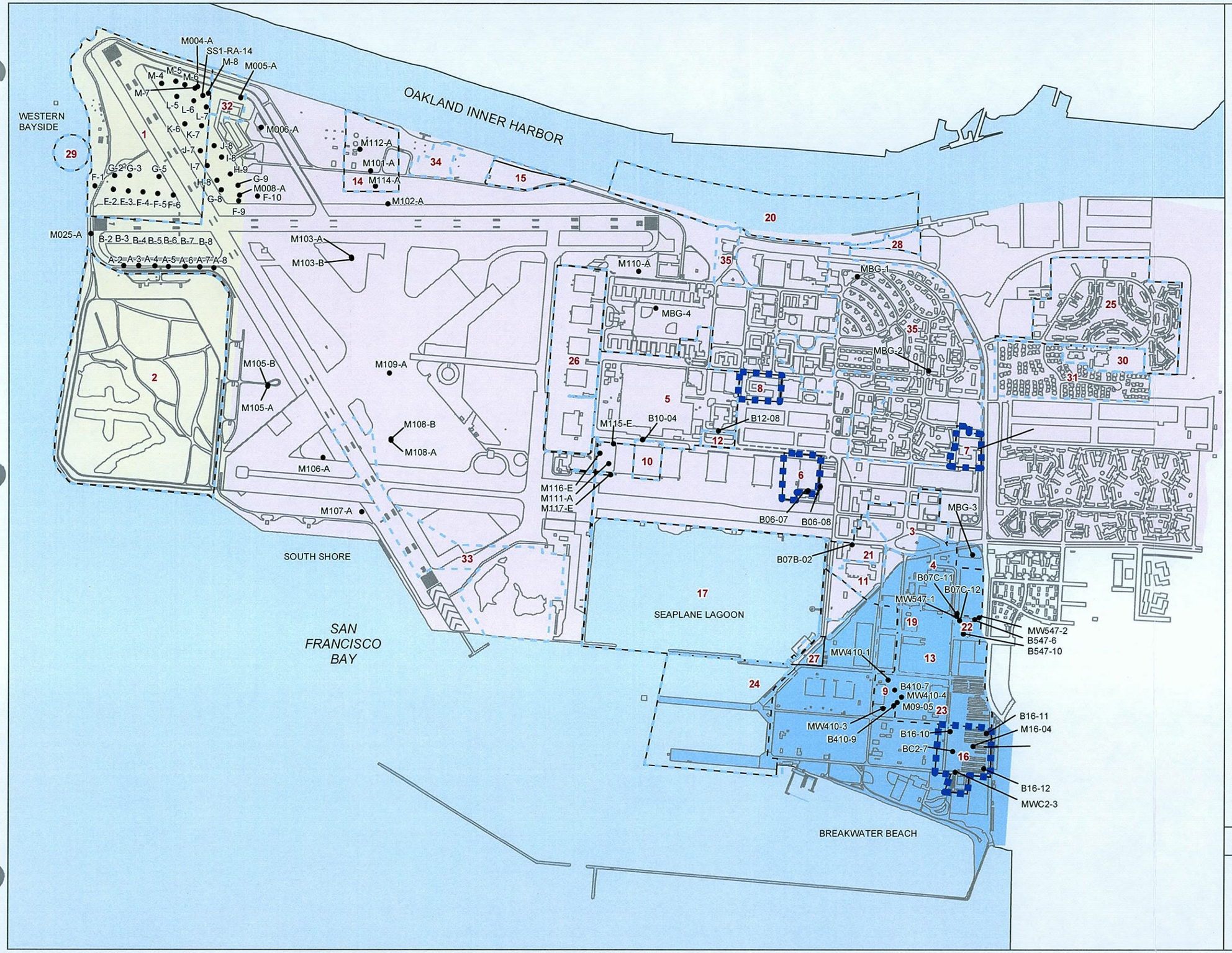
ALAMEDA POINT
SSIC NO. 5090.3.A.

FIGURES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005



- SAMPLING LOCATION
- CERCLA SITE
- OU-1 CERCLA SITE
- FILL AREA 1
- FILL AREA 2
- FILL AREA 3
- LAND COVER

Notes:
CERCLA Comprehensive Environmental Response, Compensation, and Act

600 0 600 1200 Feet

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FIGURE 3-1
SOIL BACKGROUND AREAS
PINK, BLUE, AND YELLOW

Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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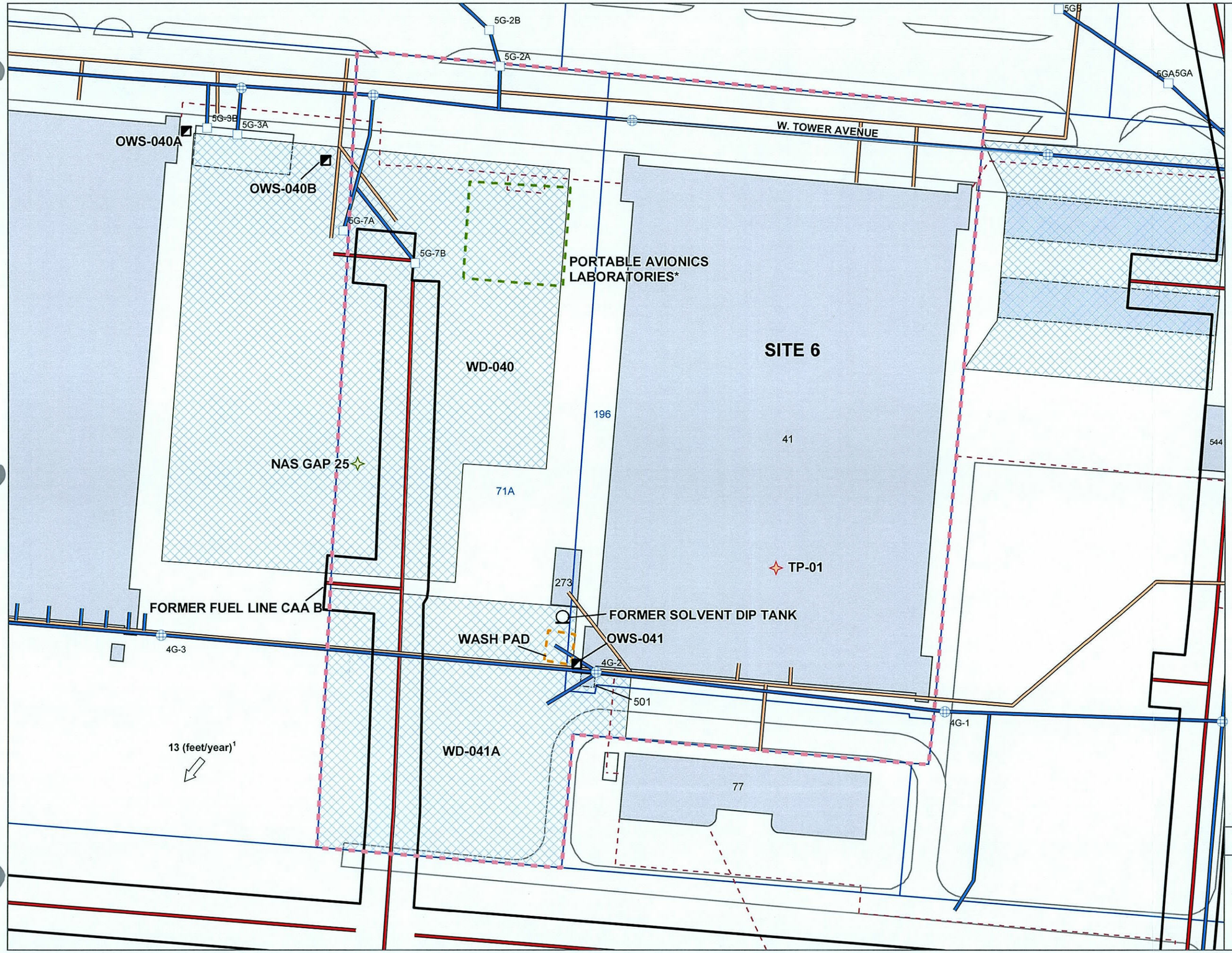

OIL WATER SEPARATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
RCRA UNIT TIERED PERMIT FACILITY (TP)
FORMER SOLVENT DIP TANK
FENCE
FUEL LINE
SANITARY SEWER LINE
STORM SEWER LINE
CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY PARCEL
CORRECTIVE ACTION AREA (CAA)
WASHDOWN AREA (WD)
WASH PAD
PORTABLE AVIONICS LABORATORIES*

BUILDING
Former
Present

LAND COVER

Notes:
CERCLA Comprehensive Environmental Response, Compensation, and Act
RCRA Resource Conservation and Recovery Act
Approximate Location based on the "Final Follow-On Remedial Investigation/Feasibility Study, Phases 2B & 3" (PRC 1994)
1 Approximate direction and velocity of groundwater movement

35 0 35 70 Feet

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FIGURE 3-2
SITE 6 FEATURES

Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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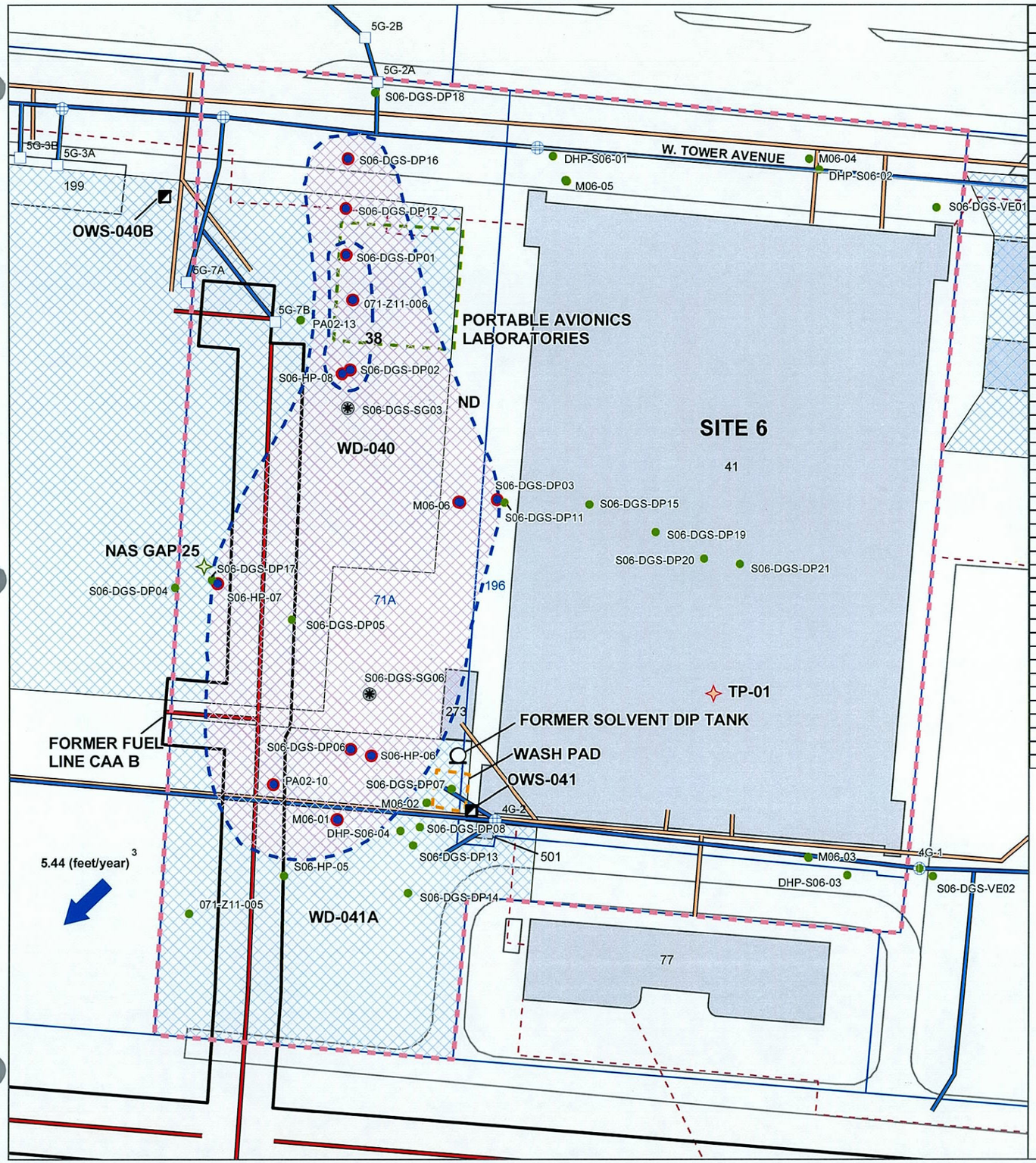

Point Name	Sample Date	Sampling Depth (feet)	Concentration (ug/L)[2]	Qualifier
071-Z11-005	10/11/95	7.5-8.5	1	U
071-Z11-006	10/11/95	7.5-8.5	**95**	J
4G-1	7/20/01	0.0-3.0	1	U
5G-1	7/20/01	0.0-3.0	2	U
5G-1	7/20/01	0.0-3.0	1	U
DHP-S06-01	8/17/94	45.0-48.0	1	U
DHP-S06-02	8/17/94	45.0-48.0	1	U
DHP-S06-03	8/18/94	27.0-30.0	2	UJ
DHP-S06-04	8/18/94	39.0-42.0	2	UJ
M06-01	8/23/91	4.0-9.0	**4.9**	
M06-01	11/11/94	4.0-9.0	**1**	
M06-01	2/8/95	4.0-9.0	1	U
M06-01	6/9/95	4.0-9.0	1	U
M06-01	8/3/95	4.0-9.0	1	U
M06-01	11/17/98	4.0-9.0	2	U
M06-01	6/18/01	4.0-9.0	0.4	J
M06-02	8/23/91	4.0-9.0	1	U
M06-02	11/29/94	4.0-9.0	1	U
M06-02	2/9/95	4.0-9.0	1	U
M06-02	6/13/95	4.0-9.0	1	U
M06-02	8/3/95	4.0-9.0	1	U
M06-02	11/17/98	4.0-9.0	2	U
M06-02	6/19/01	4.0-9.0	2	U
M06-03	8/23/91	4.0-9.0	1	U
M06-03	11/11/94	4.0-9.0	1	U
M06-03	2/9/95	4.0-9.0	1	U
M06-03	6/13/95	4.0-9.0	1	U
M06-03	8/3/95	4.0-9.0	1	U
M06-03	6/18/01	4.0-9.0	2	U
M06-03	6/24/02	4.0-9.0	0.5	U
M06-03	12/23/02	4.0-9.0	0.5	U
M06-04	8/23/91	4.0-9.0	1	U
M06-04	11/10/94	4.0-9.0	1	U
M06-04	2/9/95	4.0-9.0	1	U
M06-04	6/13/95	4.0-9.0	1	U
M06-04	8/3/95	4.0-9.0	1	U
M06-04	6/18/01	4.0-9.0	2	U
M06-05	8/23/91	4.0-9.0	1	U
M06-05	11/10/94	4.0-9.0	1	U
M06-05	2/9/95	4.0-9.0	1	U
M06-05	6/13/95	4.0-9.0	1	U
M06-05	8/4/95	4.0-9.0	1	U
M06-05	6/18/01	4.0-9.0	2	U
M06-05	6/24/02	4.0-9.0	0.5	U
M06-05	9/5/02	4.0-9.0	0.5	U
M06-05	12/23/02	4.0-9.0	0.5	U
M06-05	4/9/03	4.0-9.0	0.5	U
M06-06	11/30/94	3.0-13.0	**10**	
M06-06	2/8/95	3.0-13.0	**12**	
M06-06	6/13/95	3.0-13.0	**6**	
M06-06	8/4/95	3.0-13.0	**8**	
M06-06	11/4/97	3.0-13.0	**7**	
M06-06	2/6/98	3.0-13.0	1	U
M06-06	5/12/98	3.0-13.0	**4**	

TETRACHLOROETHENE CHLORIDE PLUME[4]
TETRACHLOROETHENE NON-DETECTED
TETRACHLOROETHENE DETECTED
EXCEEDS SCREENING LEVEL[1]
SOIL GAS SAMPLING LOCATION
OIL WATER SEPARATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
RCRA UNIT TIERED PERMIT FACILITY (TP)
FORMER SOLVENT DIP TANK
FENCE
FUEL LINE
SANITARY SEWER LINE
STORM SEWER LINE
CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
CORRECTIVE ACTION AREA (CAA)
WASHDOWN AREA (WD)
WASH PAD
PORTABLE AVIONICS LABORATORIES*

BUILDING
Former
Present
LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

* Approximate Location designated in the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

1 Bold denotes concentrations that exceeds the screening level

2 Risk based sceening level is 0.66 ug/L (Based on 1E-06)

3 Approximate direction and velocity of groundwater movement

4 Dashed line depicts inferred plume boundary

35 0 35 70 Feet

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Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-3
CONCENTRATIONS OF TETRACHLOROETHENE IN SITE 6 GROUNDWATER
PAGE 1 OF 2
Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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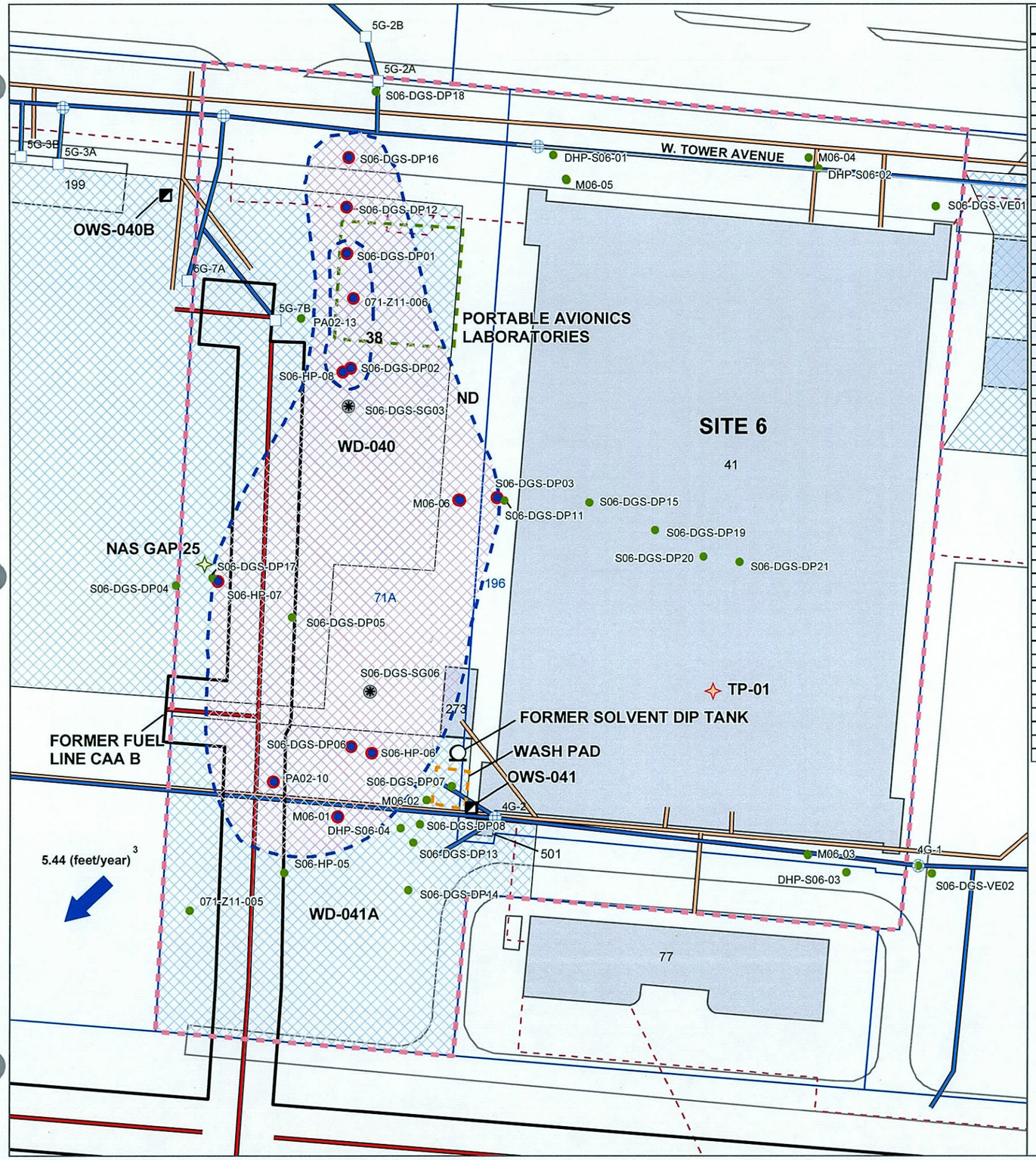

Point Name	Sample Date	Sampling Depth (feet)	Concentration (ug/L)[2]	Qualifier
M06-06	8/6/98	3.0-13.0	**8**	J
M06-06	11/17/98	3.0-13.0	**2**	
M06-06	6/18/01	3.0-13.0	**2**	J
M06-06	6/24/02	3.0-13.0	**2.8**	
M06-06	9/5/02	3.0-13.0	**4.2**	
M06-06	12/23/02	3.0-13.0	**2.8**	
M06-06	4/10/03	3.0-13.0	**1.8**	
PA02-10	5/8/00	0.0-10.0	**2.8**	
PA02-13	5/8/00	0.0-10.0	1	U
S06-DGS-DP01	7/24/01	7.0-10.0	**25**	
S06-DGS-DP01	7/26/01	12.0-14.0	1	U
S06-DGS-DP02	7/17/01	12.0-14.0	**38**	
S06-DGS-DP02	7/17/01	5.0-7.0	1	U
S06-DGS-DP03	7/24/01	7.0-9.0	**3.4**	
S06-DGS-DP03	7/26/01	12.0-14.0	2	U
S06-DGS-DP03	7/26/01	12.0-14.0	1	U
S06-DGS-DP04	7/24/01	7.0-9.0	1	U
S06-DGS-DP04	7/26/01	11.0-13.0	1	U
S06-DGS-DP05	7/16/01	23.0-25.0	1	U
S06-DGS-DP05	7/16/01	6.0-8.0	1	U
S06-DGS-DP05	7/16/01	12.0-14.0	1	U
S06-DGS-DP06	7/17/01	12.0-14.0	**2.8**	
S06-DGS-DP06	7/17/01	5.0-7.0	1	U
S06-DGS-DP07	7/17/01	23.0-25.0	1	U
S06-DGS-DP07	7/17/01	5.0-7.0	1	U
S06-DGS-DP07	7/19/01	12.0-14.0	1	U
S06-DGS-DP08	7/24/01	7.0-9.0	1	U
S06-DGS-DP08	7/24/01	14.0-16.0	1	U
S06-DGS-DP08	7/24/01	25.0-27.0	1	U
S06-DGS-DP11	7/26/01	5.0-7.0	1	U
S06-DGS-DP11	7/26/01	12.0-14.0	1	U
S06-DGS-DP12	7/26/01	5.0-7.0	**2.8**	
S06-DGS-DP12	7/26/01	12.0-14.0	1	U
S06-DGS-DP13	7/26/01	5.0-7.0	1	U
S06-DGS-DP13	7/26/01	12.0-14.0	1	U
S06-DGS-DP14	8/8/01	12.0-14.0	1	U
S06-DGS-DP14	8/8/01	5.0-7.0	1	U
S06-DGS-DP15	8/7/01	12.0-14.0	2	U
S06-DGS-DP15	8/7/01	5.0-7.0	1	U
S06-DGS-DP15	8/7/01	5.0-7.0	1	U
S06-DGS-DP16	8/8/01	12.0-14.0	**2.9**	
S06-DGS-DP16	8/8/01	5.0-7.0	1	U
S06-DGS-DP17	8/8/01	12.0-14.0	1	U
S06-DGS-DP17	8/8/01	5.0-7.0	1	U
S06-DGS-DP18	8/17/01	5.0-7.0	1	U
S06-DGS-DP19	8/16/01	5.0-7.0	1	U
S06-DGS-DP20	8/22/01	5.0-7.0	1	U
S06-DGS-DP21	9/12/01	5.0-7.0	5	UJ
S06-DGS-VE01	8/6/01	3.0-5.0	1	U
S06-DGS-VE02	8/6/01	5.4-6.9	1	U
S06-HP-05	11/17/98	5.0-7.0	2	U
S06-HP-06	11/17/98	4.0-6.0	**23**	J
S06-HP-07	11/17/98	5.0-7.0	**1**	J
S06-HP-08	11/17/98	5.0-7.0	**15**	

TETRACHLOROETHENE CHLORIDE PLUME[4]
TETRACHLOROETHENE NON-DETECTED
TETRACHLOROETHENE DETECTED
EXCEEDS SCREENING LEVEL[1]
SOIL GAS SAMPLING LOCATION
OIL WATER SEPARATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
RCRA UNIT TIERED PERMIT FACILITY (TP)
FORMER SOLVENT DIP TANK
FENCE
FUEL LINE
SANITARY SEWER LINE
STORM SEWER LINE
CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
CORRECTIVE ACTION AREA (CAA)
WASHDOWN AREA (WD)
WASH PAD
PORTABLE AVIONICS LABORATORIES*

BUILDING
Former
Present
LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

* Approximate Location designated in the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

1 Bold denotes concentrations that exceeds the screening level

2 Risk based sceening level is 0.66 ug/L (Based on 1E-06)

3 Approximate direction and velocity of groundwater movement

4 Dashed line depicts inferred plume boundary

35 0 35 70 Feet

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Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-3
CONCENTRATIONS OF TETRACHLOROETHENE IN SITE 6 GROUNDWATER
PAGE 2 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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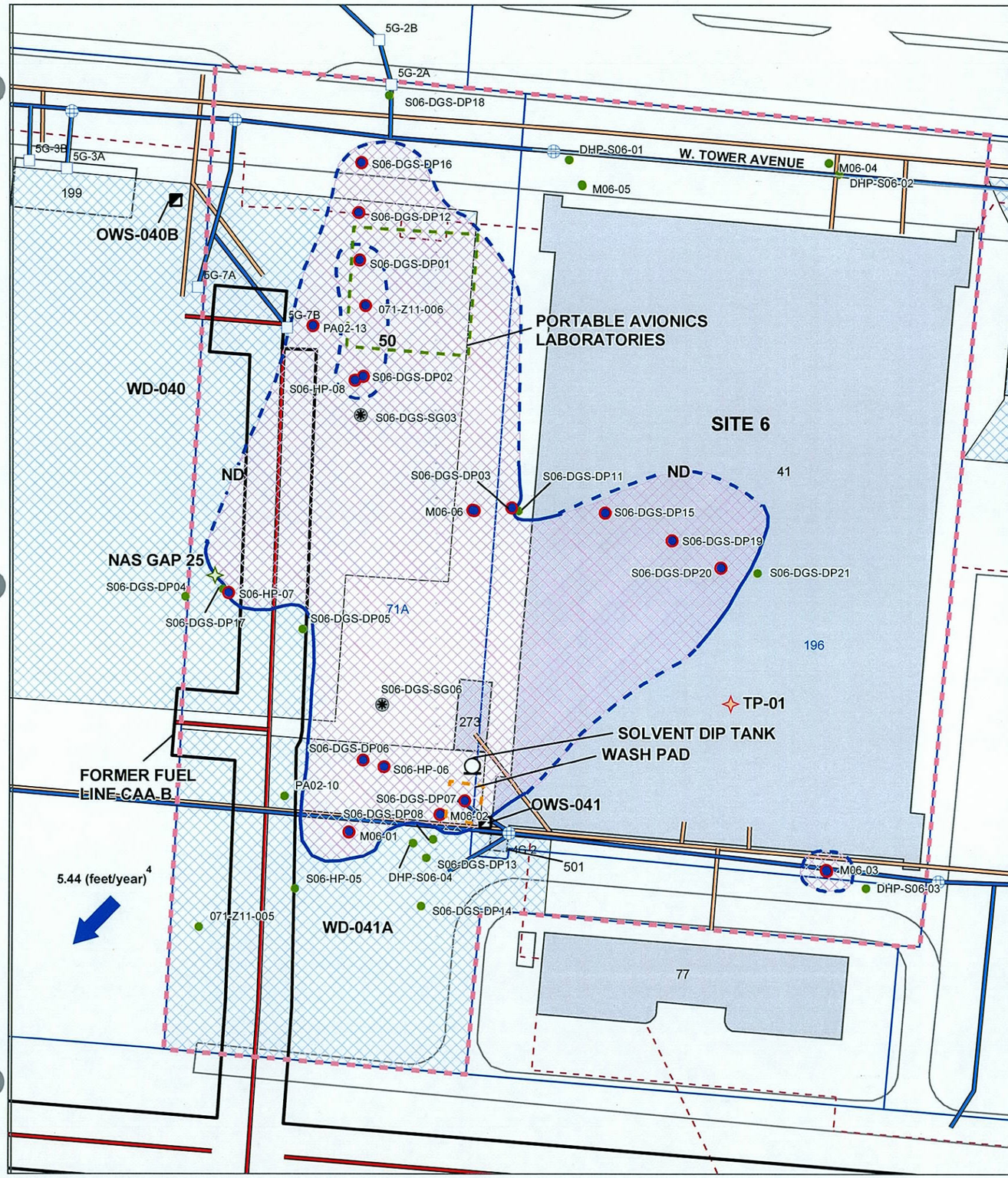

POINT NAME	Sample Date	Sampling Depth (feet)	Concentration (ug/L)[1]	QUALIFIER
071-Z11-005	10/11/95	7.5-8.5	1	U
071-Z11-006	10/11/95	7.5-8.5	**150**	J
DHP-S06-01	8/17/94	45.0-47.0	1	U
DHP-S06-02	8/17/94	45.0-47.0	1	U
DHP-S06-03	8/18/94	27.0-30.0	2	UJ
DHP-S06-04	8/18/94	39.0-41.0	2	UJ
M06-01	11/17/98	4.0-9.0	**4.3**	
M06-01	11/11/94	4.0-9.0	**7**	
M06-01	2/8/95	4.0-9.0	**6**	
M06-01	6/9/95	4.0-9.0	**3**	
M06-01	8/3/95	4.0-9.0	**4**	
M06-01	6/18/01	4.0-9.0	**4**	J
M06-01	8/23/91	4.0-9.0	**22**	
M06-02	11/17/98	4.0-9.0	**2**	J
M06-02	11/29/94	4.0-9.0	**15**	
M06-02	2/9/95	4.0-9.0	**4**	
M06-02	6/13/95	4.0-9.0	**4**	
M06-02	8/3/95	4.0-9.0	**7**	
M06-02	6/19/01	4.0-9.0	**2**	J
M06-02	8/23/91	4.0-9.0	**7.9**	
M06-03	11/11/94	4.0-9.0	1	U
M06-03	2/9/95	4.0-9.0	1	U
M06-03	6/13/95	4.0-9.0	1	U
M06-03	8/3/95	4.0-9.0	1	U
M06-03	6/18/01	4.0-9.0	**0.3**	J
M06-03	8/23/91	4.0-9.0	1	U
M06-03	6/24/02	4.0-9.0	**0.2**	J
M06-03	12/23/02	4.0-9.0	**0.3**	J
M06-04	11/10/94	4.0-9.0	1	U
M06-04	2/9/95	4.0-9.0	1	U
M06-04	6/13/95	4.0-9.0	1	U
M06-04	8/3/95	4.0-9.0	1	U
M06-04	6/18/01	4.0-9.0	2	U
M06-04	8/23/91	4.0-9.0	1	U
M06-05	11/10/94	4.0-9.0	1	U
M06-05	2/9/95	4.0-9.0	1	U
M06-05	6/13/95	4.0-9.0	1	U
M06-05	8/4/95	4.0-9.0	1	U
M06-05	6/18/01	4.0-9.0	2	U
M06-05	8/23/91	4.0-9.0	1	U
M06-05	6/24/02	4.0-9.0	0.5	U
M06-05	9/5/02	4.0-9.0	0.5	U
M06-05	12/23/02	4.0-9.0	0.5	U
M06-05	4/9/03	4.0-9.0	0.5	UJ
M06-06	11/4/97	3.0-13.0	**8**	
M06-06	2/6/98	3.0-13.0	1	U
M06-06	5/12/98	3.0-13.0	**6**	
M06-06	8/6/98	3.0-13.0	**6**	J
M06-06	11/17/98	3.0-13.0	**3**	
M06-06	11/30/94	3.0-13.0	**10**	
M06-06	2/8/95	3.0-13.0	**18**	

TRICHLOROETHENE PLUME[2]
TRICHLOROETHENE DETECTED
TRICHLOROETHENE NON-DETECTED
EXCEED SCREENING LEVEL[3]
SOIL GAS SAMPLING LOCATION
OIL WATER SEPARATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
RCRA UNIT TIERED PERMIT FACILITY (TP)
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BUILDING
Former
Present
LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

* Approximate Location based on the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

1 Bold denotes concentrations that exceed the screening level

2 Dashed line depicts inferred plume boundary

3 Risk based screening level is 0.028 ug/L (Based on 1E-06)

4 Approximate direction and velocity of groundwater movement

35 0 35 70 Feet

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Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-4
CONCENTRATIONS OF TRICHLOROETHENE IN SITE 6 GROUNDWATER
PAGE 1 OF 2
Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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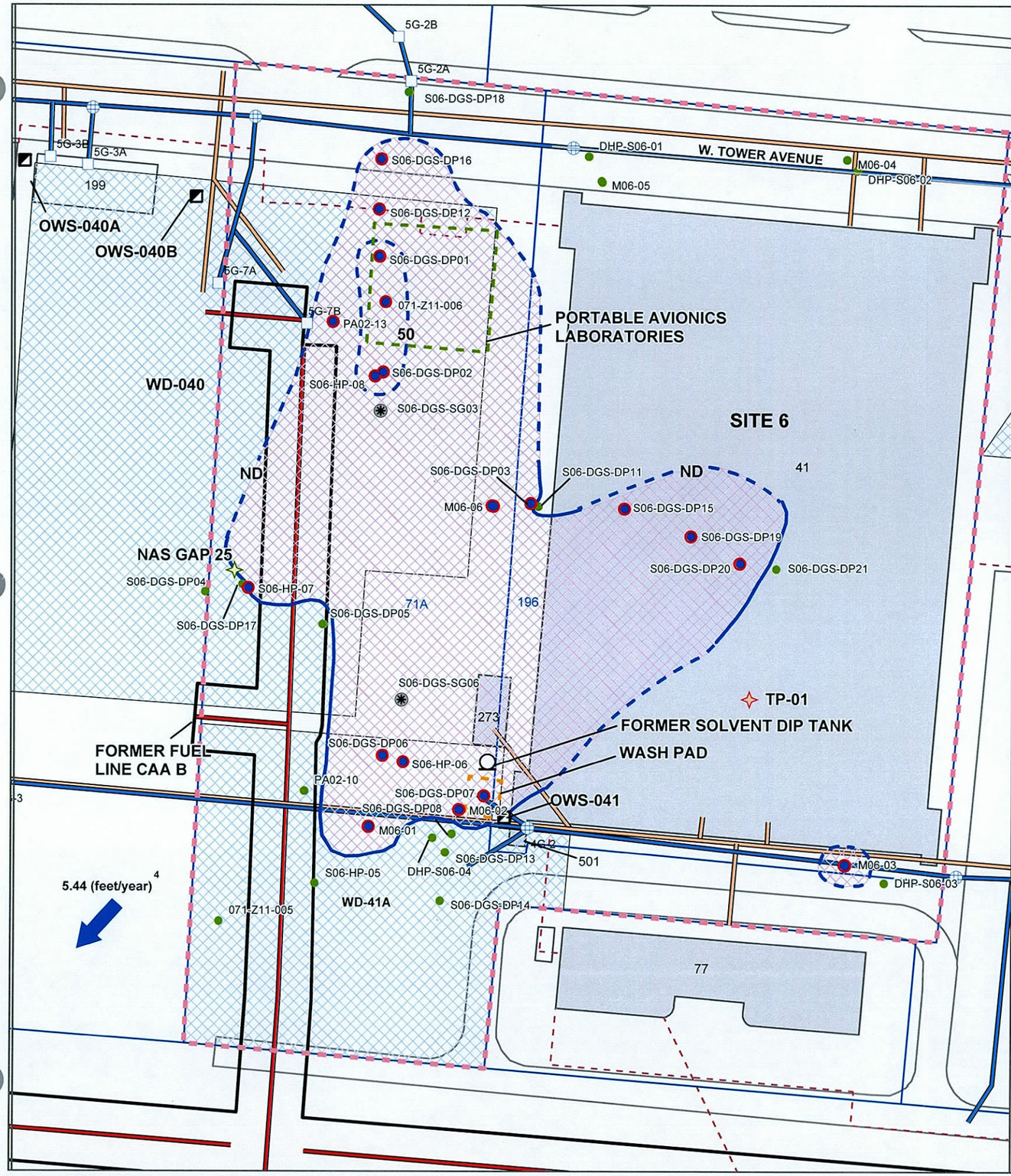

POINT NAME	Sample Date	Sampling Depth (feet)	Concentration (ug/L)[1]	QUALIFIER
M06-06	6/13/95	3.0-13.0	**19**	
M06-06	8/4/95	3.0-13.0	**17**	
M06-06	6/18/01	3.0-13.0	**4**	
M06-06	6/24/02	3.0-13.0	**4.9**	
M06-06	9/5/02	3.0-13.0	**5.8**	
M06-06	12/23/02	3.0-13.0	**2.5**	
M06-06	4/10/03	3.0-13.0	**2**	
PA02-10	5/8/00	0.0-10.0	1	U
PA02-13	5/8/00	0.0-10.0	**4.2**	
S06-DGS-DP01	7/24/01	7.0-9.0	**31**	
S06-DGS-DP01	7/26/01	12.0-14.0	1	U
S06-DGS-DP02	7/17/01	5.0-7.0	**50**	
S06-DGS-DP02	7/17/01	12.0-14.0	1	U
S06-DGS-DP03	7/24/01	7.0-9.0	**5.1**	
S06-DGS-DP03	7/26/01	12.0-14.0	1	U
S06-DGS-DP03	7/26/01	12.0-14.0	2	U
S06-DGS-DP04	7/24/01	7.0-9.0	1	U
S06-DGS-DP04	7/26/01	11.0-13.0	1	U
S06-DGS-DP05	7/16/01	6.0-8.0	1	U
S06-DGS-DP05	7/16/01	12.0-14.0	1	U
S06-DGS-DP05	7/16/01	23.0-25.0	1	U
S06-DGS-DP06	7/17/01	5.0-7.0	**8.1**	
S06-DGS-DP06	7/17/01	12.0-14.0	1	U
S06-DGS-DP07	7/17/01	5.0-7.0	**4.2**	
S06-DGS-DP07	7/17/01	12.0-14.0	1	U
S06-DGS-DP07	7/19/01	23.0-25.0	1	U
S06-DGS-DP08	7/24/01	7.0-9.0	1	U
S06-DGS-DP08	7/24/01	14.0-16.0	1	U
S06-DGS-DP08	7/24/01	25.0-27.0	1	U
S06-DGS-DP11	7/26/01	5.0-7.0	1	U
S06-DGS-DP11	7/26/01	12.0-14.0	1	U
S06-DGS-DP12	7/26/01	5.0-7.0	**12**	
S06-DGS-DP12	7/26/01	12.0-14.0	1	U
S06-DGS-DP13	7/26/01	5.0-7.0	1	U
S06-DGS-DP13	7/26/01	12.0-14.0	1	U
S06-DGS-DP14	8/8/01	5.0-7.0	1	U
S06-DGS-DP14	8/8/01	12.0-14.0	1	U
S06-DGS-DP15	8/7/01	5.0-7.0	**5.3**	
S06-DGS-DP15	8/7/01	5.0-7.0	**8**	
S06-DGS-DP15	8/7/01	12.0-14.0	1	U
S06-DGS-DP16	8/8/01	5.0-7.0	**2.6**	
S06-DGS-DP16	8/8/01	12.0-14.0	1	U
S06-DGS-DP17	8/8/01	5.0-7.0	1	U
S06-DGS-DP17	8/8/01	12.0-14.0	1	U
S06-DGS-DP18	8/17/01	5.0-7.0	1	U
S06-DGS-DP19	8/16/01	5.0-7.0	**2.8**	
S06-DGS-DP20	8/22/01	5.0-7.0	**3**	
S06-DGS-DP21	9/12/01	5.0-7.0	5	UJ
S06-HP-05	11/17/98	5.0-7.0	2	U
S06-HP-06	11/17/98	4.0-6.0	**31**	**J**
S06-HP-07	11/17/98	5.0-7.0	**8**	
S06-HP-08	11/17/98	5.0-7.0	**35**	

TRICHLOROETHENE PLUME[2]
TRICHLOROETHENE DETECTED
TRICHLOROETHENE NON-DETECTED
EXCEEDS SCREENING LEVEL[3]
SOIL GAS SAMPLING LOCATION
OIL WATER SEPARATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
RCRA UNIT TIERED PERMIT FACILITY (TP)
FORMER SOLVENT DIP TANK
FENCE
FUEL LINE
SANITARY SEWER LINE
STORM SEWER LINE
CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
CORRECTIVE ACTION AREA (CAA)
WASHDOWN AREA (WD)
WASH PAD
PORTABLE AVIONICS LABORATORIES*

BUILDING
Former
Present
LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

* Approximate Location based on the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

1 Bold denotes concentrations that exceed the screening level

2 Dashed line depicts inferred plume boundary

3 Risk based screening level is 0.028 ug/L (Based on 1E-06)

4 Approximate direction and velocity of groundwater movement

35 0 35 70 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-4
CONCENTRATIONS OF TRICHLOROETHENE IN SITE 6 GROUNDWATER
PAGE 2 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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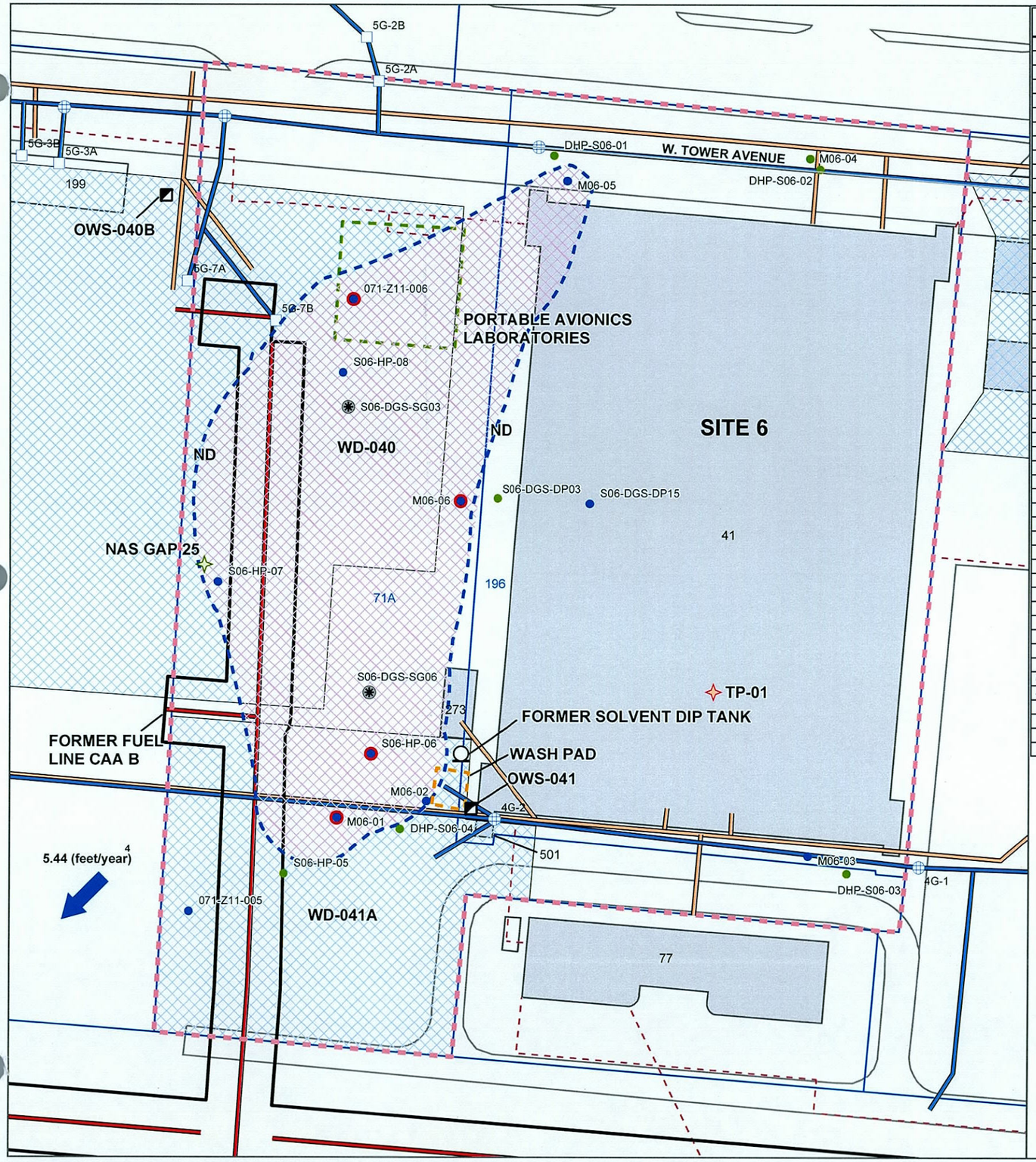

Point Name	Sample Date	Sampling Depth (feet)	Concentration (ug/L)[1]	Qualifier
071-Z11-005	10/11/95	7.5-8.5	2	
071-Z11-006	10/11/95	7.5-8.5	**83**	J
5G-1	7/20/01	0.0-3.0	2	
DHP-S06-01	8/17/94	45.0-48.0	1	U
DHP-S06-02	8/17/94	45.0-48.0	1	U
DHP-S06-03	8/18/94	27.0-30.0	2	UJ
DHP-S06-04	8/18/94	39.0-42.0	2	UJ
M06-01	8/23/91	4.0-9.0	**66**	
M06-01	11/11/94	4.0-9.0	6	
M06-01	2/8/95	4.0-9.0	5	
M06-01	6/9/95	4.0-9.0	5	
M06-01	8/3/95	4.0-9.0	5	
M06-01	11/17/98	4.0-9.0	13	
M06-01	6/18/01	4.0-9.0	16	J
M06-02	8/23/91	4.0-9.0	19	
M06-02	11/29/94	4.0-9.0	18	
M06-02	2/9/95	4.0-9.0	4	
M06-02	6/13/95	4.0-9.0	5	
M06-02	8/3/95	4.0-9.0	9	
M06-02	11/17/98	4.0-9.0	7.4	
M06-02	6/19/01	4.0-9.0	13	J
M06-03	8/23/91	4.0-9.0	1	U
M06-03	11/11/94	4.0-9.0	1	U
M06-03	2/9/95	4.0-9.0	1	U
M06-03	6/13/95	4.0-9.0	1	
M06-03	8/3/95	4.0-9.0	1	
M06-03	6/18/01	4.0-9.0	8	J
M06-04	8/23/91	4.0-9.0	1	U
M06-04	11/10/94	4.0-9.0	1	U
M06-04	2/9/95	4.0-9.0	1	U
M06-04	6/13/95	4.0-9.0	1	U
M06-04	8/3/95	4.0-9.0	1	U
M06-04	6/18/01	4.0-9.0	2	U
M06-05	8/23/91	4.0-9.0	1	U
M06-05	11/10/94	4.0-9.0	1	U
M06-05	2/9/95	4.0-9.0	1	U
M06-05	6/13/95	4.0-9.0	1	U
M06-05	8/4/95	4.0-9.0	1	U
M06-05	6/18/01	4.0-9.0	1	J
M06-06	11/30/94	3.0-13.0	**70**	
M06-06	2/8/95	3.0-13.0	58	
M06-06	6/13/95	3.0-13.0	**87**	
M06-06	8/4/95	3.0-13.0	**89**	
M06-06	11/17/98	3.0-13.0	47	
M06-06	6/18/01	3.0-13.0	14	
S06-DGS-DP03	7/26/01	12.0-14.0	2	U
S06-DGS-DP15	8/7/01	5.0-7.0	24	
S06-HP-05	11/17/98	5.0-7.0	2	U
S06-HP-06	11/17/98	4.0-6.0	**110**	J
S06-HP-07	11/17/98	5.0-7.0	27	
S06-HP-08	11/17/98	5.0-7.0	50	

1,2-DICHLOROETHENE PLUME[2]
1,2-DICHLOROETHENE NON-DETECTED
1,2-DICHLOROETHENE DETECTED
EXCEEDS SCREENING LEVEL[3]
SOIL GAS SAMPLING LOCATION
OIL WATER SEPARATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
RCRA UNIT TIERED PERMIT FACILITY (TP)
FORMER SOLVENT DIP TANK
FENCE
FUEL LINE
SANITARY SEWER LINE
STORM SEWER LINE
CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
CORRECTIVE ACTION AREA (CAA)
WASHDOWN AREA (WD)
WASH PAD
PORTABLE AVIONICS LABORATORIES*

BUILDING
Former
Present
LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

* Approximate Location based on the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

1 Bold denotes concentrations that exceeds the screening level

2 Dashed line depicts inferred plume boundary

3 Risk based screening Level is 61.0 ug/L (Based on 1E-06)

4 Approximate direction and velocity of groundwater movement

35 0 35 70 Feet

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FIGURE 3-5
CONCENTRATIONS OF 1,2-DICHLOROETHENE IN SITE 6 GROUNDWATER

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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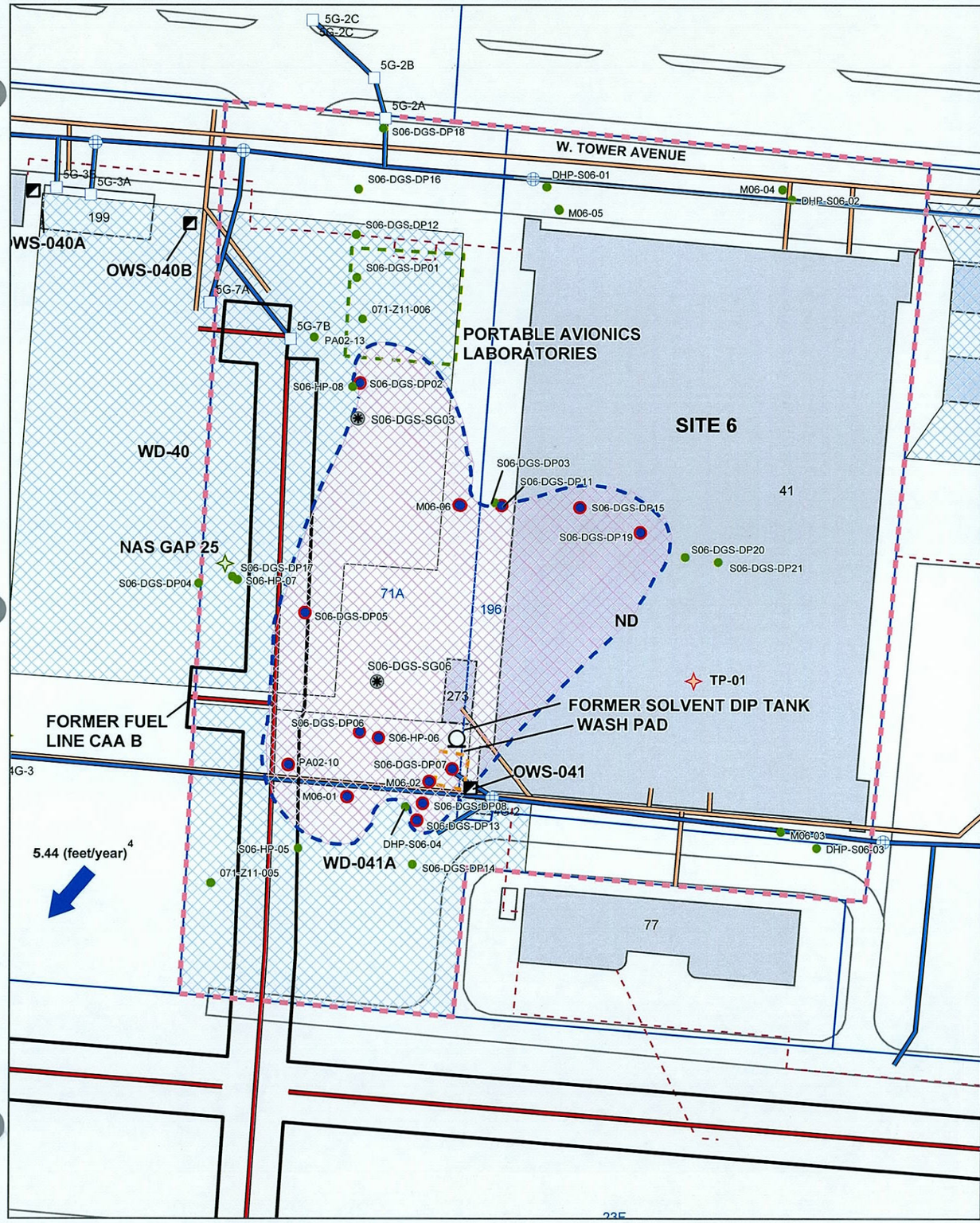

Point Name	Sample Date	Sampling Depth (feet)	Concentration (ug/L)[1]	Qualifier
071-Z11-005	10/11/95	7.5-8.5	0.5	U
071-Z11-006	10/11/95	7.5-8.5	0.5	U
4G-1	7/20/01	0.0-2.0	1.0	U
5G-1	7/20/01	0.0-2.0	0.5	U
DHP-S06-01	8/17/94	45.0-47.0	0.5	U
DHP-S06-02	8/17/94	45.0-47.0	0.5	U
DHP-S06-03	8/18/94	27.0-30.0	0.5	UJ
DHP-S06-04	8/18/94	39.0-41.0	0.5	UJ
M06-01	11/17/98	4.0-9.0	**2.5**	
M06-01	11/11/94	4.0-9.0	**2**	
M06-01	2/8/95	4.0-9.0	0.5	U
M06-01	6/9/95	4.0-9.0	**5**	
M06-01	8/3/95	4.0-9.0	**5**	
M06-01	6/18/01	4.0-9.0	3	J
M06-01	8/23/91	4.0-9.0	**7**	
M06-02	11/17/98	4.0-9.0	0.5	U
M06-02	11/29/94	4.0-9.0	**1**	
M06-02	2/9/95	4.0-9.0	0.5	U
M06-02	6/13/95	4.0-9.0	0.5	U
M06-02	8/3/95	4.0-9.0	0.5	U
M06-02	6/19/01	4.0-9.0	**1**	**J**
M06-02	8/23/91	4.0-9.0	**4.8**	
M06-03	11/11/94	4.0-9.0	0.5	U
M06-03	2/9/95	4.0-9.0	0.5	U
M06-03	6/13/95	4.0-9.0	0.5	U
M06-03	8/3/95	4.0-9.0	0.5	U
M06-03	6/18/01	4.0-9.0	0.5	U
M06-03	8/23/91	4.0-9.0	1	U
M06-03	6/24/02	4.0-9.0	0.5	U
M06-03	12/23/02	4.0-9.0	0.5	U
M06-04	11/10/94	4.0-9.0	0.5	U
M06-04	2/9/95	4.0-9.0	0.5	UJ
M06-04	6/13/95	4.0-9.0	0.5	U
M06-04	8/3/95	4.0-9.0	0.5	U
M06-04	6/18/01	4.0-9.0	0.5	U
M06-04	8/23/91	4.0-9.0	1	U
M06-05	11/10/94	4.0-9.0	0.5	U
M06-05	2/9/95	4.0-9.0	0.5	UJ
M06-05	6/13/95	4.0-9.0	0.5	U
M06-05	8/4/95	4.0-9.0	0.5	U
M06-05	6/18/01	4.0-9.0	0.5	U
M06-05	8/23/91	4.0-9.0	1	U
M06-05	6/24/02	4.0-9.0	0.5	U
M06-05	9/5/02	4.0-9.0	0.5	U
M06-05	12/23/02	4.0-9.0	0.5	U
M06-05	4/9/03	4.0-9.0	0.5	U
M06-06	11/4/97	3.0-13.0	0.5	U
M06-06	2/6/98	3.0-13.0	**2**	
M06-06	5/12/98	3.0-13.0	0.5	U
M06-06	8/6/98	3.0-13.0	0.5	UJ
M06-06	11/17/98	3.0-13.0	**1.4**	
M06-06	11/30/94	3.0-13.0	0.5	U
M06-06	2/8/95	3.0-13.0	**1**	

VINYL CHLORIDE PLUME[2]
VINYL CHLORIDE DETECTED
VINYL CHLORIDE NON-DETECTED
EXCEED SCREENING LEVEL[3]
SOIL GAS SAMPLING LOCATION
OIL WATER SEPARATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
RCRA UNIT TIERED PERMIT FACILITY (TP)
FORMER SOLVENT DIP TANK
FENCE
FUEL LINE
SANITARY SEWER LINE
STORM SEWER LINE
CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
CORRECTIVE ACTION AREA (CAA)
WASHDOWN AREA (WD)
WASH PAD
PORTABLE AVIONICS LABORATORIES*

BUILDING
Former
Present

LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

* Approximate Location based on the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

1 Bold denotes concentrations that exceeds the screening level

2 Dashed line depicts inferred plume boundary

3 Risk Based Screening Level is 0.02 ug/L (Based on 1E-06)

4 Approximate direction and velocity of groundwater movement

80 0 40 80 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-6
CONCENTRATIONS OF VINYL CHLORIDE IN SITE 6 GROUNDWATER
PAGE 1 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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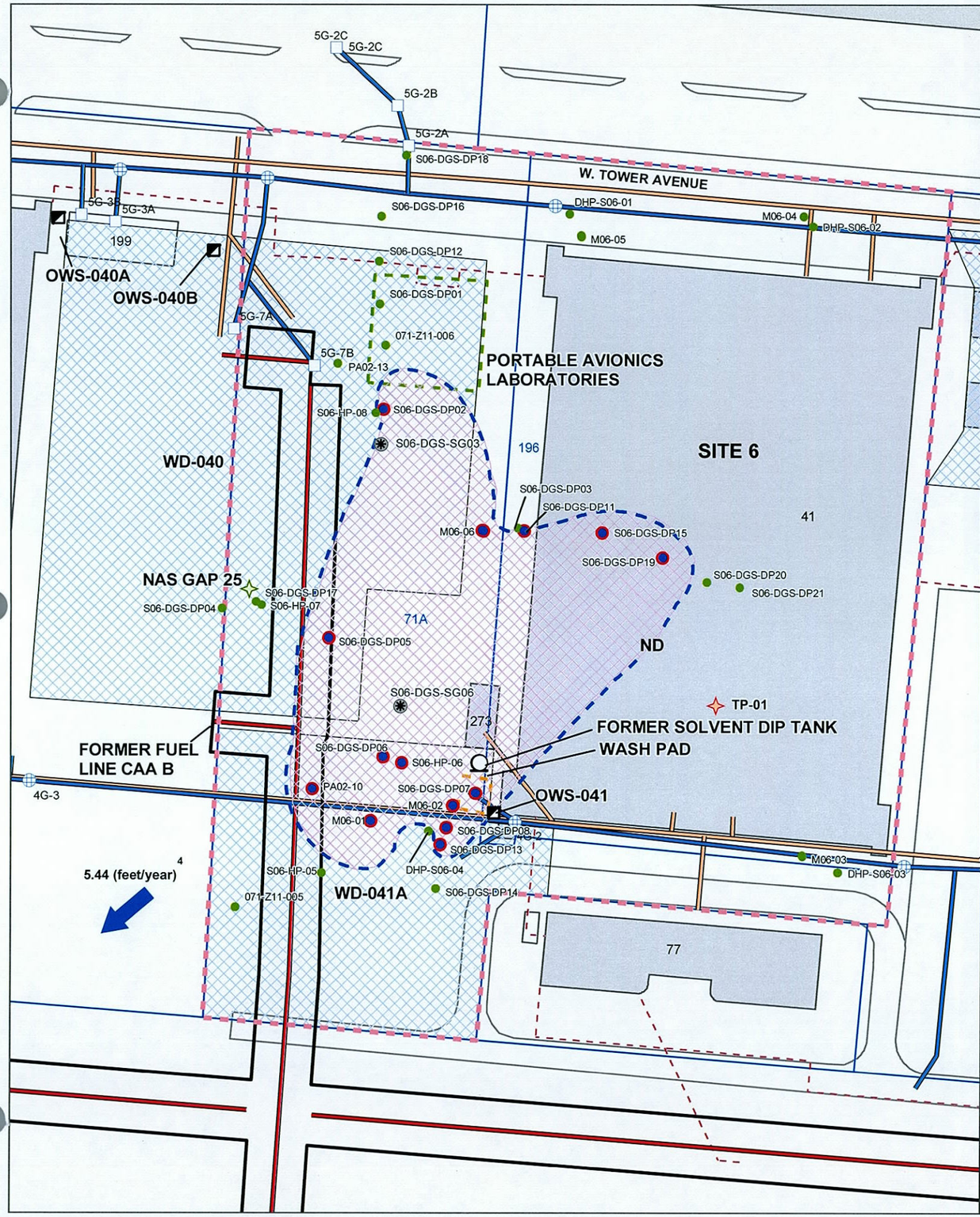

Point Name	Sample Date	Sampling Depth (feet)	Concentration (ug/L)[1]	Qualifier
M06-06	6/13/95	3.0-13.0	0.5	U
M06-06	8/4/95	3.0-13.0	0.5	U
M06-06	6/18/01	3.0-13.0	**0.8**	
M06-06	6/24/02	3.0-13.0	**1.5**	
M06-06	9/5/02	3.0-13.0	**1.4**	
M06-06	12/23/02	3.0-13.0	0.5	U
M06-06	4/10/03	3.0-13.0	0.5	U
PA02-10	5/8/00	0.0-10.0	**1.3**	
PA02-13	5/8/00	0.0-10.0	0.5	U
S06-DGS-DP01	7/24/01	7.0-9.0	1	U
S06-DGS-DP01	7/26/01	12.0-14.0	1	U
S06-DGS-DP02	7/17/01	5.0-7.0	**1**	
S06-DGS-DP02	7/17/01	12.0-14.0	1	U
S06-DGS-DP03	7/24/01	12.0-14.0	1	U
S06-DGS-DP03	7/26/01	7.0-9.0	1	U
S06-DGS-DP03	7/26/01	12.0-14.0	0.5	U
S06-DGS-DP04	7/24/01	7.0-9.0	1	U
S06-DGS-DP04	7/26/01	11.0-13.0	1	U
S06-DGS-DP05	7/16/01	6.0-8.0	0.6	J
S06-DGS-DP05	7/16/01	12.0-14.0	1	U
S06-DGS-DP05	7/16/01	23.0-25.0	1	U
S06-DGS-DP06	7/17/01	5.0-7.0	**72**	
S06-DGS-DP06	7/17/01	12.0-14.0	1	U
S06-DGS-DP07	7/17/01	5.0-7.0	1	U
S06-DGS-DP07	7/17/01	12.0-14.0	**11**	
S06-DGS-DP07	7/19/01	23.0-25.0	1	U
S06-DGS-DP08	7/24/01	7.0-9.0	**1.6**	
S06-DGS-DP08	7/24/01	14.0-16.0	**44**	
S06-DGS-DP08	7/24/01	25.0-27.0	1	U
S06-DGS-DP11	7/26/01	5.0-7.0	**1**	
S06-DGS-DP11	7/26/01	12.0-14.0	1	U
S06-DGS-DP12	7/26/01	5.0-7.0	1	U
S06-DGS-DP12	7/26/01	12.0-14.0	1	U
S06-DGS-DP13	7/26/01	5.0-7.0	1	U
S06-DGS-DP13	7/26/01	12.0-14.0	**9.8**	
S06-DGS-DP14	8/8/01	5.0-7.0	1	U
S06-DGS-DP14	8/8/01	12.0-14.0	1	U
S06-DGS-DP15	8/7/01	5.0-7.0	**2.7**	
S06-DGS-DP15	8/7/01	5.0-7.0	**5**	
S06-DGS-DP15	8/7/01	12.0-14.0	1	U
S06-DGS-DP16	8/8/01	5.0-7.0	1	U
S06-DGS-DP16	8/8/01	12.0-14.0	1	U
S06-DGS-DP17	8/8/01	5.0-7.0	1	U
S06-DGS-DP17	8/8/01	12.0-14.0	1	U
S06-DGS-DP18	8/17/01	5.0-7.0	1	U
S06-DGS-DP19	8/16/01	5.0-7.0	**1.2**	
S06-DGS-DP20	8/22/01	5.0-7.0	1	U
S06-DGS-DP21	9/12/01	5.0-7.0	10	UJ
S06-HP-05	11/17/98	5.0-7.0	0.5	U
S06-HP-06	11/17/98	4.0-6.0	**21**	**J**
S06-HP-07	11/17/98	5.0-7.0	0.5	U
S06-HP-08	11/17/98	5.0-7.0	0.5	U

VINYL CHLORIDE PLUME[2]
VINYL CHLORIDE DETECTED
VINYL CHLORIDE NON-DETECTED
EXCEED SCREENING LEVEL[3]
SOIL GAS SAMPLING LOCATION
OIL WATER SEPARATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
RCRA UNIT TIERED PERMIT FACILITY (TP)
FORMER SOLVENT DIP TANK
FENCE
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CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
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LAND COVER

Notes:

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J = Estimated
U = Non-Detected

* Approximate Location based on the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

1 Bold denotes concentrations that exceeds the screening level

2 Dashed line depicts inferred plume boundary

3 Risk Based Screening Level is 0.02 ug/L (Based on 1E-06)

4 Approximate direction and velocity of groundwater movement

80 0 40 80 Feet

SulTech

Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-6
CONCENTRATIONS OF VINYL CHLORIDE IN SITE 6 GROUNDWATER
PAGE 2 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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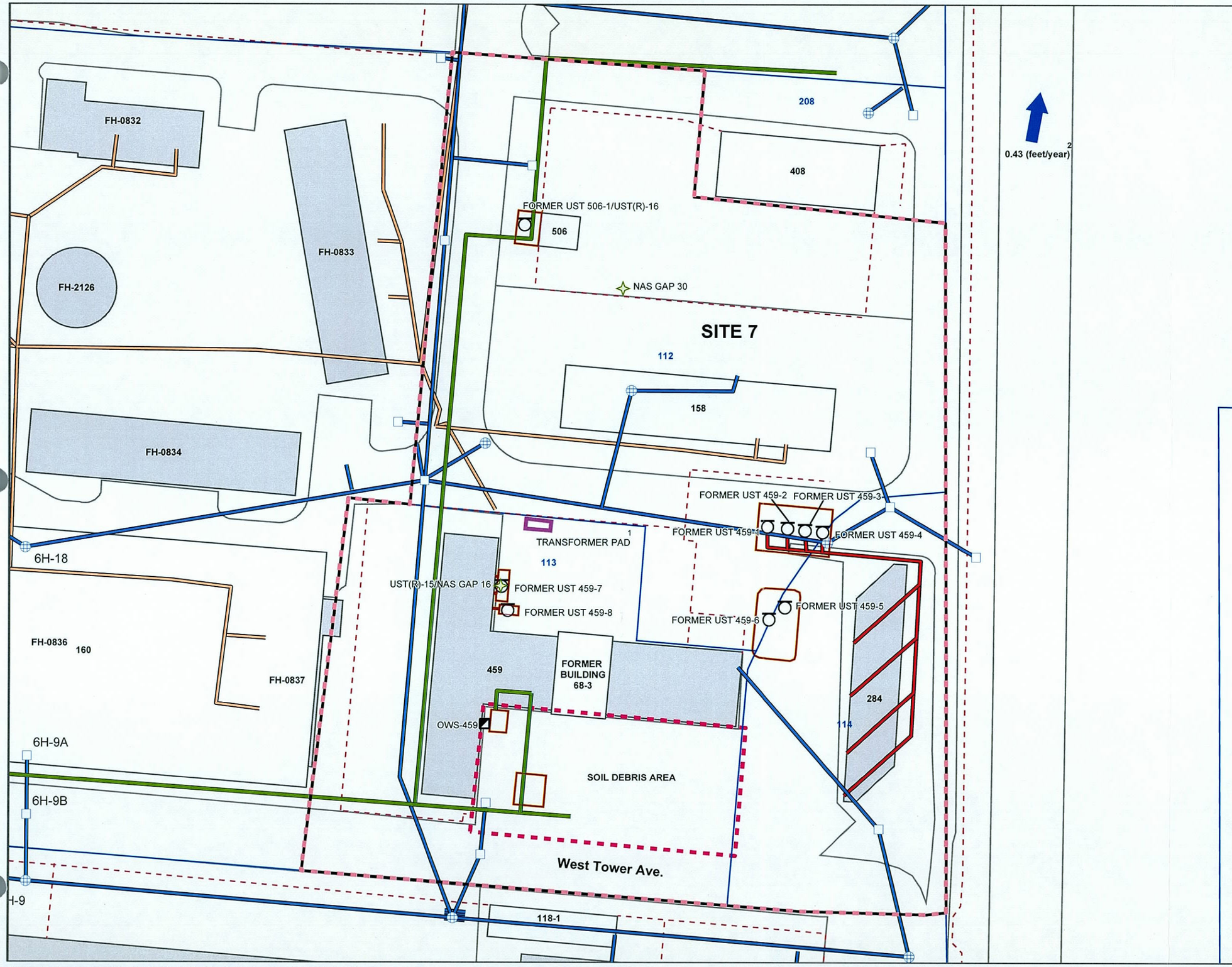

UNDERGROUND STORAGE TANK (UST)

- Removed
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- OIL WATER SEPARATOR
- FENCE
- FUEL LINE
- SANITARY SEWER LINE
- STORM SEWER LINE
- INDUSTRIAL STORM SEWER LINE
- CERCLA SITE BOUNDARY
- SOIL DEBRIS AREA
- TRANSFORMER PAD
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- CORRECTIVE ACTION AREA (CAA)

BUILDING

- Former
- Present
- EXCAVATION
- LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

1 Approximate location of Transformer Pad based on ERM-West EBS 1994

2 Approximate direction and velocity of groundwater movement

30 0 30 60 Feet

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Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-7
SITE 7 FEATURES

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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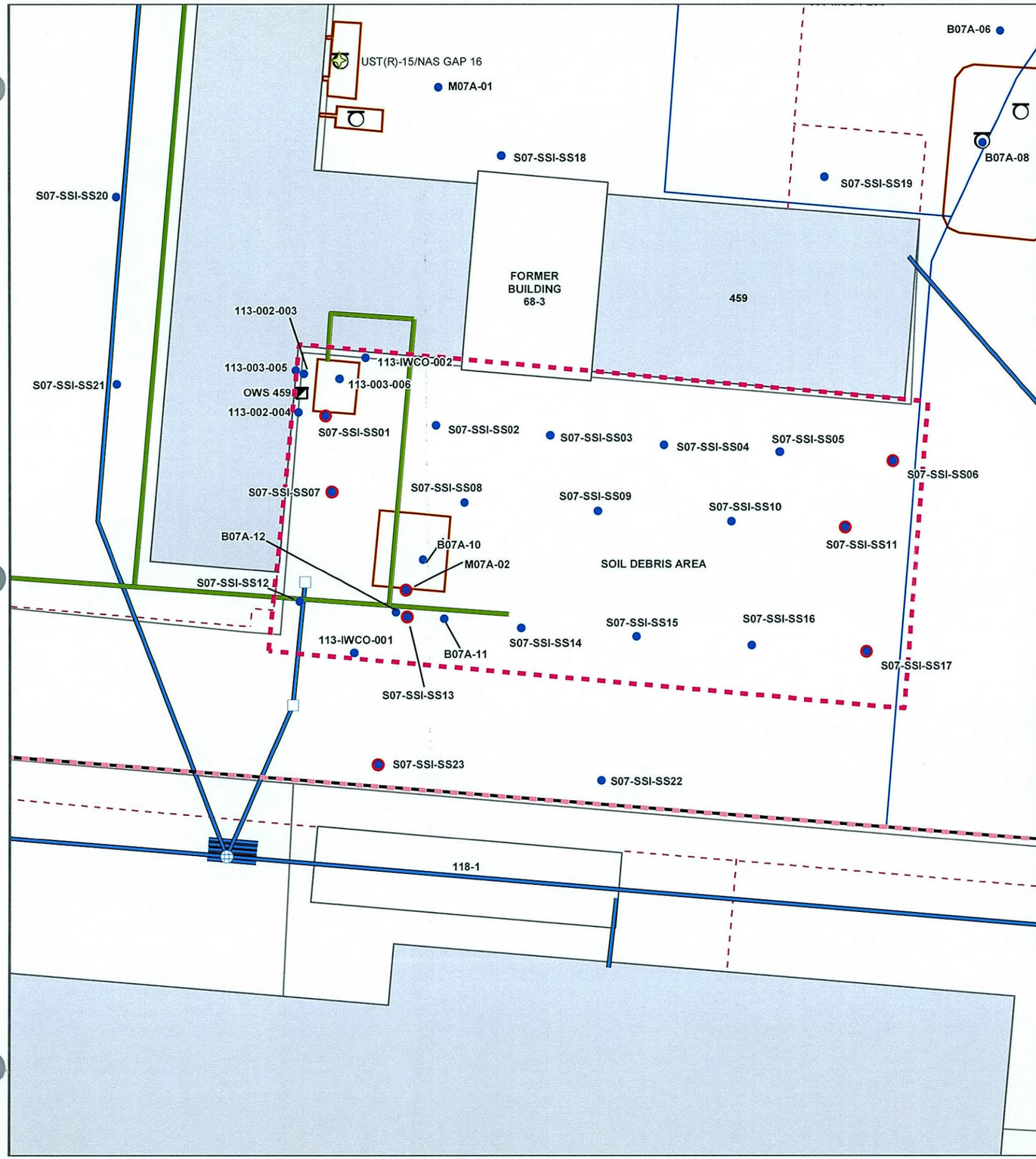

Point Name	Sample Date	Depth (Feet)	Concentration (mg/kg) [2]	Qualifier
113-002-003	6/20/95	4.0-4.5	3.7	
113-002-004	6/20/95	4.0-4.5	3.6	
113-003-006	11/6/95	0.5-1.0	7.8	
113-003-006	11/6/95	4.0-4.5	3.6	
113-IWCO-001	12/13/94	1.0-2.0	2.9	
113-IWCO-002	12/13/94	1.0-2.0	3.8	
B07A-06	6/19/91	0.0-0.5	2.24	
B07A-06	6/19/91	2.0-3.5	5.95	
B07A-06	6/19/91	9.5-11.0	10.7	
B07A-06	6/19/91	17.0-18.5	6.73	
B07A-08	5/5/94	0.5-1.0	2.7	
B07A-08	5/5/94	2.5-3.0	1.8	
B07A-08	5/5/94	5.5-6.0	2.7	
B07A-10	8/17/94	0.0-1.0	7.2	
B07A-10	8/17/94	2.0-3.0	10.9	
B07A-10	8/17/94	6.5-7.5	5.5	
B07A-10	8/17/94	13.5-14.5	6.4	
B07A-11	8/17/94	0.5-1.5	4.4	
B07A-11	8/17/94	2.0-3.0	8.8	
B07A-11	8/17/94	6.5-7.0	12	
B07A-11	8/17/94	12.5-13.5	7.6	
B07A-12	8/17/94	0.0-1.0	2.1	UJ
B07A-12	8/17/94	2.0-2.5	7.2	
B07A-12	8/17/94	6.0-7.0	6.4	
B07A-12	8/17/94	7.0-8.0	6.7	
B07A-12	8/17/94	12.5-13.5	8.4	
M07A-01	6/19/91	0.5-1.0	1.35	
M07A-01	6/19/91	1.0-1.5	3.54	
M07A-01	6/19/91	6.5-7.0	1.66	
M07A-01	6/19/91	11.5-13.0	3.73	
M07A-02	6/21/91	0.0-0.5	1.74	J
M07A-02	6/21/91	2.0-3.5	12.6	J
M07A-02	6/21/91	6.5-8.0	**17.4**	J
M07A-02	6/21/91	12.5-14.0	7.17	J
S07-SSI-SS01	10/16/03	2.0-3.0	2.7	J
S07-SSI-SS01	10/16/03	2.0-3.0	**17.6**	J
S07-SSI-SS02	10/16/03	2.0-3.0	4.9	J
S07-SSI-SS03	10/16/03	2.0-3.0	5	J
S07-SSI-SS03	10/16/03	4.0-5.0	10.3	J
S07-SSI-SS03	10/16/03	7.5-8.5	5.4	J
S07-SSI-SS04	10/16/03	2.0-3.0	6.1	J
S07-SSI-SS05	10/16/03	2.0-3.0	8.4	J
S07-SSI-SS06	10/16/03	2.0-3.0	**25.8**	J
S07-SSI-SS06	10/16/03	4.0-5.0	1.8	J
S07-SSI-SS07	10/16/03	2.0-3.0	**21.7**	J
S07-SSI-SS08	10/16/03	2.0-3.0	11.3	J
S07-SSI-SS09	10/16/03	2.0-3.0	7.5	J
S07-SSI-SS09	10/16/03	4.0-5.0	2.5	J
S07-SSI-SS09	10/16/03	7.5-8.5	9	J
S07-SSI-SS10	10/16/03	2.0-3.0	5.9	J
S07-SSI-SS10	10/16/03	2.0-3.0	5.1	J
S07-SSI-SS11	10/16/03	2.0-3.0	**112**	J
S07-SSI-SS12	10/17/03	2.0-3.0	1.7	J
S07-SSI-SS13	10/17/03	2.0-3.0	8.4	J
S07-SSI-SS13	10/17/03	4.0-5.0	**25.9**	J
S07-SSI-SS14	10/17/03	2.0-3.0	7.1	J
S07-SSI-SS15	10/16/03	2.0-3.0	5.3	J
S07-SSI-SS16	10/16/03	2.0-3.0	1.7	J
S07-SSI-SS17	10/16/03	2.0-3.0	**60.9**	J
S07-SSI-SS17	10/16/03	4.0-5.0	1.1	J
S07-SSI-SS17	10/16/03	7.5-8.5	4	J
S07-SSI-SS18	10/16/03	2.0-3.0	11.6	J
S07-SSI-SS19	10/16/03	2.0-3.0	5.8	J
S07-SSI-SS20	10/16/03	2.0-3.0	7.9	J
S07-SSI-SS20	10/16/03	2.0-3.0	5.2	J
S07-SSI-SS21	10/16/03	2.0-3.0	2.6	J
S07-SSI-SS22	10/17/03	2.0-3.0	1.6	J
S07-SSI-SS23	10/17/03	2.0-3.0	**15.7**	J

ARSENIC DETECTED

EXCEEDS SCREENING LEVEL[1]

UNDERGROUND STORAGE TANK (UST)

Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

OIL WATER SEPARATOR (OWS)

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

INDUSTRIAL STORM SEWER LINE

CERCLA SITE BOUNDARY

SOIL DEBRIS AREA

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL

CORRECTIVE ACTION AREA (CAA)

BUILDING

Former

Present

EXCAVATION

LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Screening level based on maximum ambient concentration of 15.6 mg/kg

2 Bold denotes concentrations that exceed the screening level

15 0 15 30 Feet

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Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-8
CONCENTRATIONS OF ARSENIC IN SITE 7 SOIL DEBRIS AREA

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8 and 16

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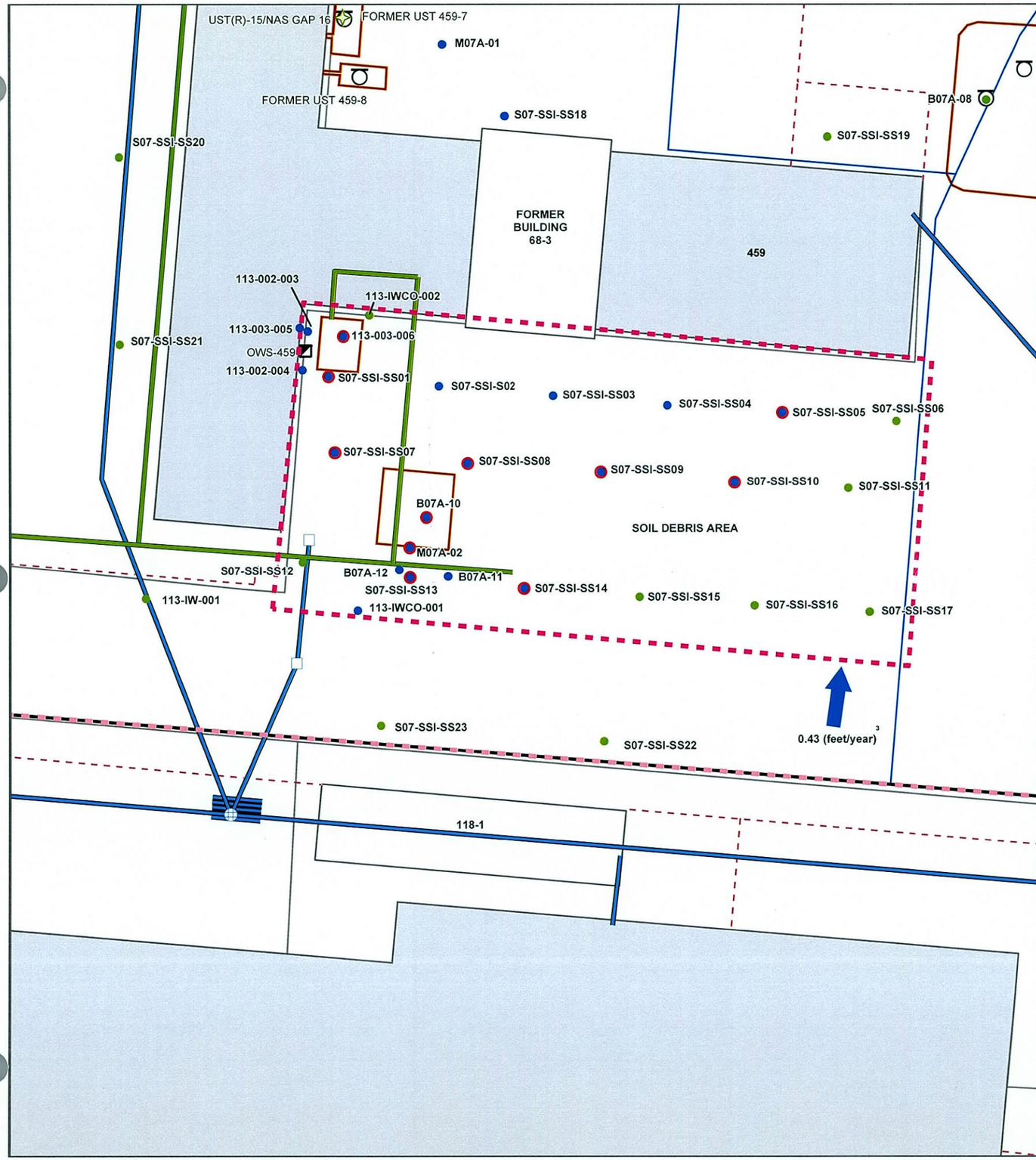

Point Name	Sample Date	Sample Depth (Feet)	Concentration (mg/kg)[2]	Qualifier
113-002-003	6/20/95	4.0-4.5	2.6	
113-002-004	6/20/95	4.0-4.5	1.9	
113-003-005	11/6/95	1.0-1.5	1.2	
113-003-005	11/6/95	4.5-5.0	0.68	U
113-003-006	11/6/95	0.5-1.0	**56.6**	
113-003-006	11/6/95	4.0-4.5	0.55	U
113-IW-001	1/5/95	4.0-5.0	25	U
113-IWCO-001	12/13/94	1.0-2.0	25	U
113-IWCO-001	12/13/94	1.0-2.0	2.1	
113-IWCO-002	12/13/94	1.0-2.0	25	U
113-IWCO-002	12/13/94	1.0-2.0	0.28	U
B07A-08	5/5/94	0.5-1.0	0.02	U
B07A-08	5/5/94	5.5-6.0	0.02	U
B07A-08	5/5/94	2.5-3.0	0.02	U
B07A-09	5/5/94	10.0-10.5	0.02	U
B07A-10	8/17/94	2.0-3.0	0.28	J
B07A-10	8/17/94	0.0-1.0	**33.4**	J
B07A-11	8/17/94	0.5-1.5	0.19	J
B07A-11	8/17/94	6.5-7.0	0.17	J
B07A-12	8/17/94	0.0-1.0	0.25	J
B07A-12	8/17/94	6.0-7.0	0.61	J
B07A-12	8/17/94	7.0-8.0	0.43	J
M07A-01	6/19/91	0.5-1.0	0.318	U
M07A-01	6/19/91	6.5-7.0	0.355	U
M07A-01	6/19/91	11.5-13.0	0.581	U
M07A-01	6/19/91	1.0-1.5	0.41	
M07A-02	6/21/91	2.0-3.5	**82**	
M07A-02	6/21/91	12.5-14.0	0.573	U
M07A-02	6/21/91	0.0-0.5	0.304	U
M07A-02	6/21/91	6.5-8.0	1.03	
S07-SSI-SS01	10/16/03	2.0-3.0	**4.9**	J
S07-SSI-SS01	10/16/03	2.0-3.0	**89.2**	J
S07-SSI-SS02	10/16/03	2.0-3.0	0.68	J
S07-SSI-SS03	10/16/03	2.0-3.0	0.75	J
S07-SSI-SS03	10/16/03	4.0-5.0	0.15	UJ
S07-SSI-SS03	10/16/03	7.5-8.5	0.056	UJ
S07-SSI-SS04	10/16/03	2.0-3.0	2.9	J
S07-SSI-SS05	10/16/03	2.0-3.0	**9.1**	J
S07-SSI-SS06	10/16/03	2.0-3.0	0.11	UJ
S07-SSI-SS06	10/16/03	4.0-5.0	0.064	UJ
S07-SSI-SS07	10/16/03	2.0-3.0	**43.1**	J
S07-SSI-SS08	10/16/03	2.0-3.0	**13.3**	J
S07-SSI-SS09	10/16/03	2.0-3.0	**8.7**	J
S07-SSI-SS09	10/16/03	4.0-5.0	0.038	UJ
S07-SSI-SS09	10/16/03	7.5-8.5	0.17	UJ
S07-SSI-SS10	10/16/03	2.0-3.0	2.9	J
S07-SSI-SS10	10/16/03	2.0-3.0	**7.4**	
S07-SSI-SS11	10/16/03	2.0-3.0	0.28	UJ
S07-SSI-SS12	10/17/03	2.0-3.0	0.04	U
S07-SSI-SS13	10/17/03	2.0-3.0	0.18	UJ
S07-SSI-SS13	10/17/03	4.0-5.0	**125**	
S07-SSI-SS14	10/17/03	2.0-3.0	**44.2**	
S07-SSI-SS15	10/16/03	2.0-3.0	0.31	UJ
S07-SSI-SS16	10/16/03	2.0-3.0	0.042	UJ
S07-SSI-SS17	10/16/03	2.0-3.0	0.16	UJ
S07-SSI-SS17	10/16/03	4.0-5.0	0.04	U
S07-SSI-SS17	10/16/03	7.5-8.5	0.052	U
S07-SSI-SS18	10/16/03	2.0-3.0	1.2	J
S07-SSI-SS19	10/16/03	2.0-3.0	0.092	UJ
S07-SSI-SS20	10/16/03	2.0-3.0	0.27	UJ
S07-SSI-SS20	10/16/03	2.0-3.0	0.27	UJ
S07-SSI-SS21	10/16/03	2.0-3.0	0.039	U
S07-SSI-SS22	10/17/03	2.0-3.0	0.038	U
S07-SSI-SS23	10/17/03	2.0-3.0	0.055	UJ

CADMIUM NON-DETECTED
CADMIUM DETECTED
EXCEEDS SCREENING LEVEL[1]

UNDERGROUND STORAGE TANK (UST)
Removed
CATCH BASIN
OIL WATER SEPARATOR (OWS)
MANHOLE
FENCE
STORM SEWER LINE
INDUSTRIAL STORM SEWER LINE
CERCLA SITE BOUNDARY
SOIL DEBRIS AREA
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
CORRECTIVE ACTION AREA (CAA)

BUILDING
Former
Present
EXCAVATION
LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Screening level based on maximum ambient concentration of 3.2 mg/kg

2 Bold denotes concentrations that exceed the screening level

3 Approximate direction and velocity of groundwater movement

15 0 15 30 Feet

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FIGURE 3-9
CONCENTRATIONS OF CADMIUM IN SITE 7 SOIL DEBRIS AREA

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Operable Unit 1 Sites 6, 7, 8 and 16

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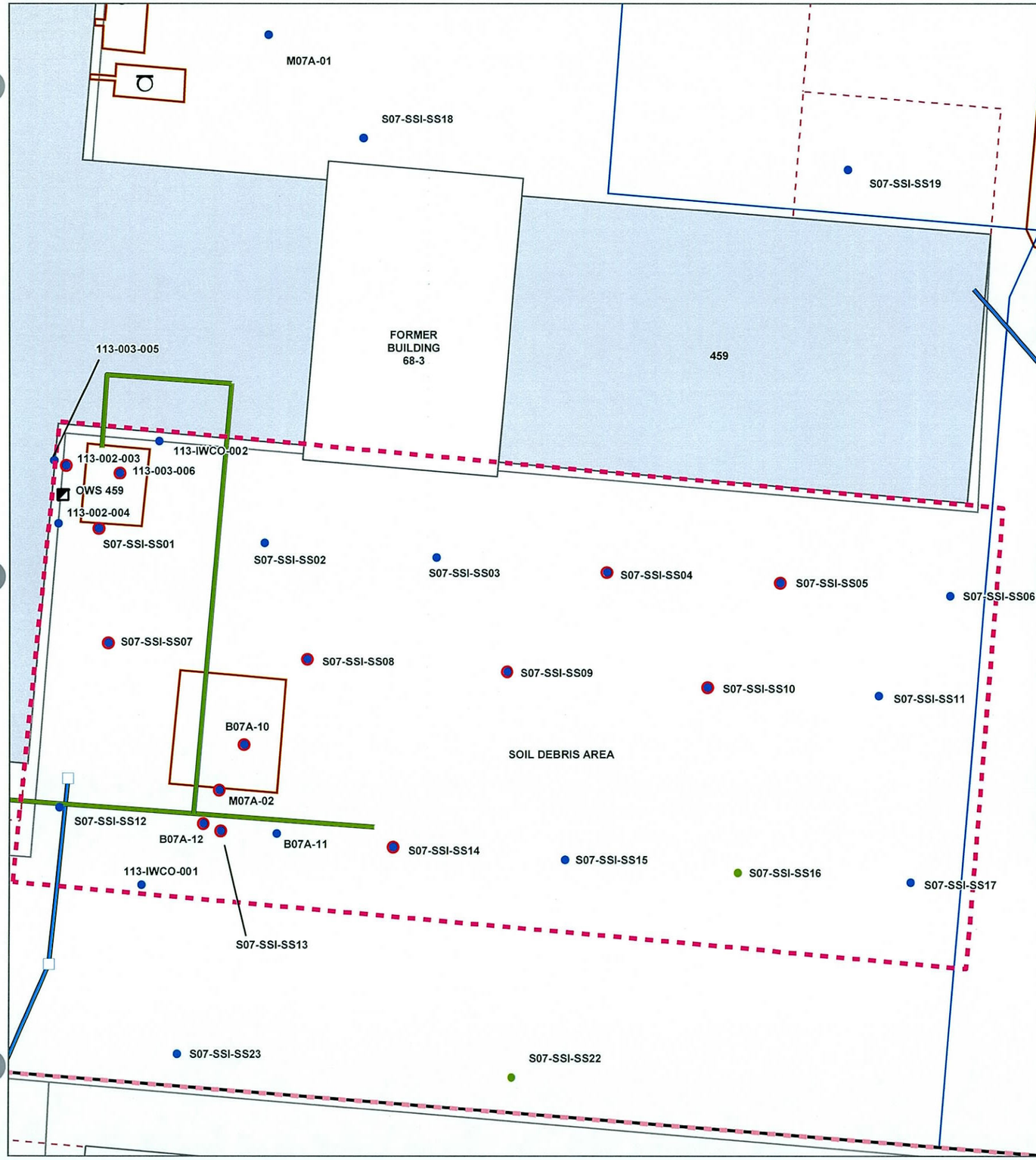

Point Name	Sample Date	Depth (Feet)	Concentration (mg/kg) [2]	Qualifier
113-002-003	06/20/95	4.0-4.5	**166**	
113-002-004	06/20/95	4.0-4.5	43	
113-003-005	11/06/95	4.5-5.0	39.7	
113-003-005	11/06/95	1.0-1.5	52	
113-003-006	11/06/95	4.0-4.5	24.6	
113-003-006	11/06/95	0.5-1.0	**2460**	
113-IWCO-001	12/13/94	1.0-2.0	25	U
113-IWCO-001	12/13/94	1.0-2.0	36.7	
113-IWCO-002	12/13/94	1.0-2.0	10.1	
113-IWCO-002	12/13/94	1.0-2.0	30	
B07A-10	08/17/94	13.5-14.5	8.7	
B07A-10	08/17/94	2.0-3.0	19.4	
B07A-10	08/17/94	6.5-7.5	46.4	
B07A-10	08/17/94	0.0-1.0	**2180**	
B07A-11	08/17/94	12.5-13.5	9.1	
B07A-11	08/17/94	0.5-1.5	30.9	
B07A-11	08/17/94	2.0-3.0	31.8	
B07A-11	08/17/94	6.5-7.0	35.1	
B07A-12	08/17/94	0.0-1.0	0.68	UJ
B07A-12	08/17/94	12.5-13.5	14.6	
B07A-12	08/17/94	0.0-2.5	32.5	
B07A-12	08/17/94	6.0-7.0	45.4	
B07A-12	08/17/94	7.0-8.0	**223**	
M07A-01	06/19/91	11.5-13.0	4.79	J
M07A-01	06/19/91	0.5-1.0	6.91	J
M07A-01	06/19/91	1.0-1.5	21.4	
M07A-01	06/19/91	6.5-7.0	23.8	
M07A-02	06/21/91	0.0-0.5	7.76	J
M07A-02	06/21/91	12.5-14.0	9.57	J
M07A-02	06/21/91	6.5-8.0	61.4	
M07A-02	06/21/91	2.0-3.5	**6760**	
S07-SSI-SS01	10/16/03	2.0-3.0	**313**	**J**
S07-SSI-SS01	10/16/03	2.0-3.0	**6210**	**J**
S07-SSI-SS02	10/16/03	2.0-3.0	36.1	J
S07-SSI-SS03	10/16/03	4.0-4.5	33.3	J
S07-SSI-SS03	10/16/03	7.5-8.5	36.8	J
S07-SSI-SS03	10/16/03	2.0-3.0	38.4	J
S07-SSI-SS04	10/16/03	2.0-3.0	**340**	**J**
S07-SSI-SS05	10/16/03	2.0-3.0	**566**	**J**
S07-SSI-SS06	10/16/03	4.0-4.5	5.8	J
S07-SSI-SS06	10/16/03	2.0-3.0	20.3	J
S07-SSI-SS07	10/16/03	2.0-3.0	**2970**	**J**
S07-SSI-SS08	10/16/03	2.0-3.0	**1340**	**J**
S07-SSI-SS09	10/16/03	4.0-4.5	4.2	J
S07-SSI-SS09	10/16/03	7.5-8.5	34	J
S07-SSI-SS09	10/16/03	2.0-3.0	**492**	**J**
S07-SSI-SS10	10/16/03	2.0-3.0	**287**	**J**
S07-SSI-SS10	10/16/03	2.0-3.0	**333**	
S07-SSI-SS11	10/16/03	2.0-3.0	56.3	
S07-SSI-SS12	10/17/03	2.0-3.0	3.7	
S07-SSI-SS13	10/17/03	2.0-3.0	55.1	
S07-SSI-SS13	10/17/03	4.0-4.5	**2550**	
S07-SSI-SS14	10/17/03	2.0-3.0	**1200**	
S07-SSI-SS15	10/16/03	2.0-3.0	27.9	
S07-SSI-SS16	10/16/03	2.0-3.0	3.2	UJ
S07-SSI-SS17	10/16/03	4.0-4.5	3.3	UJ
S07-SSI-SS17	10/16/03	2.0-3.0	18.8	
S07-SSI-SS17	10/16/03	7.5-8.5	27.8	
S07-SSI-SS18	10/16/03	2.0-3.0	**173**	**J**
S07-SSI-SS19	10/16/03	2.0-3.0	17.7	J
S07-SSI-SS22	10/17/03	2.0-3.0	3.1	UJ
S07-SSI-SS23	10/17/03	2.0-3.0	85	

LEAD DETECTED
LEAD NON-DETECTED
EXCEEDS SCREENING LEVEL[1]

UNDERGROUND STORAGE TANK (UST)
Removed
GENERATOR ACCUMULATION POINT (GAP)
CATCH BASIN
MANHOLE
OIL WATER SEPARATOR (OWS)
FENCE
STORM SEWER LINE
INDUSTRIAL STORM SEWER LINE
CERCLA SITE BOUNDARY
SOIL DEBRIS AREA
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
CORRECTIVE ACTION AREA (CAA)

BUILDING
Former
Present
EXCAVATION
LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Screening level based on maximum ambient concentration of 15.6 mg/kg

2 Bold denotes concentrations that exceed the screening level

N

10 0 10 20 Feet

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FIGURE 3-10
CONCENTRATIONS OF LEAD IN SITE 7 SOIL DEBRIS AREA

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Operable Unit 1 Sites 6, 7, 8 and 16

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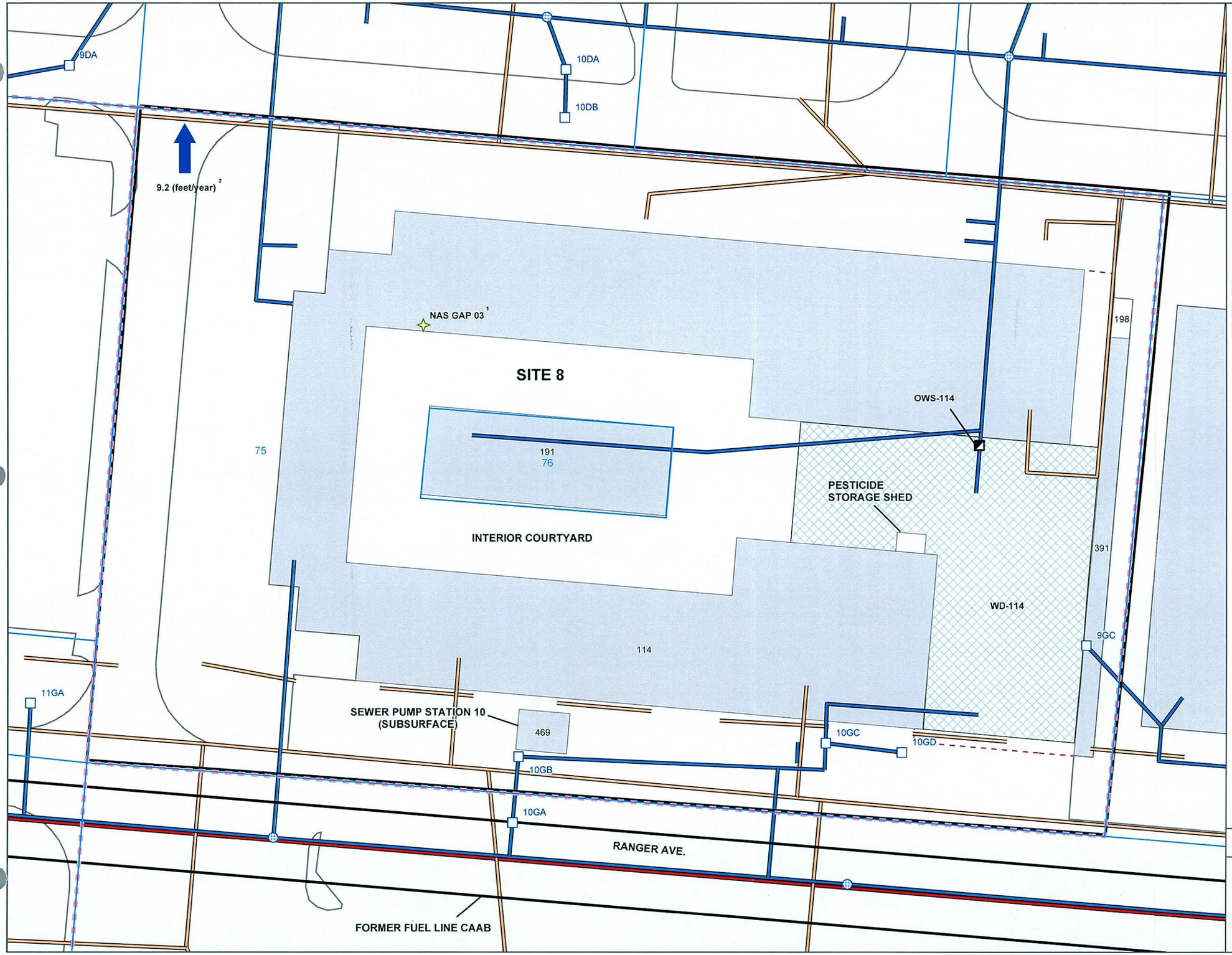

CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
OIL WATER SEPERATOR (OWS)
FENCE
FUEL LINE
SANITARY SEWER LINE
STORM SEWER LINE
CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
CORRECTIVE ACTION AREA (CAA) BOUNDARY
WASHDOWN AREA (WD)

BUILDING
Former
Present
LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

1 Location designated in the RCRA Facility Assessment (DTSC 1992), exact location unkown

2 Approximate direction and velocity of groundwater flow

N

25 0 25 50 Feet

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FIGURE 3-11
SITE 8 FEATURES

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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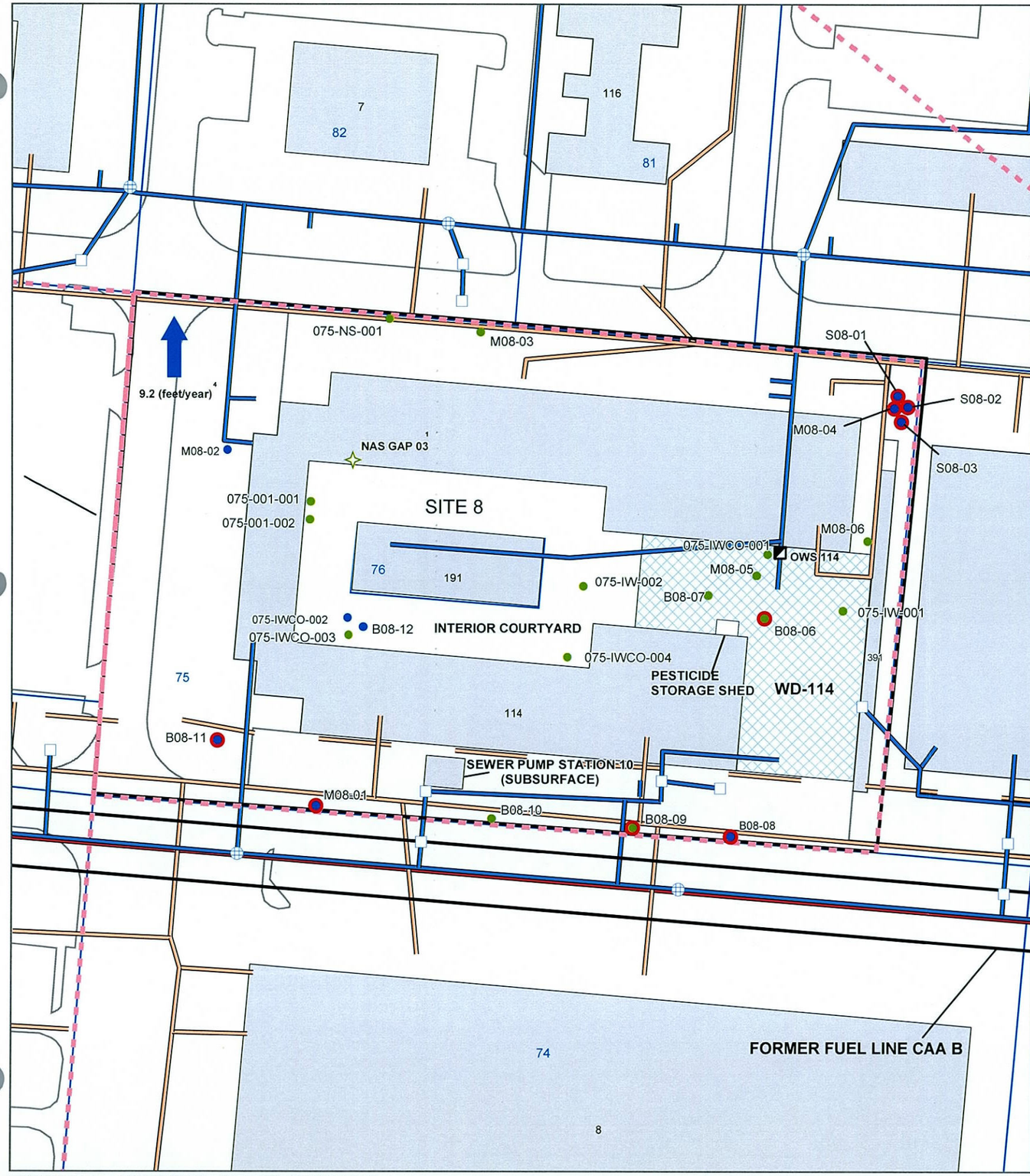

Point Name	Sample Date	Sample Depth (feet)	Concentration (µg/Kg)	Qualifier
075-001-001	5/12/95	0.5-1.0	38	U
075-001-002	5/12/95	0.5-1.0	39	U
075-IW-001	1/26/95	5.0-9.0	39	U
075-IW-002	12/22/94	4-4.8	37	U
075-IWCO-001	12/15/94	0.5-1.0	78	U
075-IWCO-002	12/15/94	1.0-2.0	52	J
075-IWCO-003	12/15/94	1.0-2.0	36	U
075-IWCO-004	12/15/94	1.5-2.0	37	U
075-SN-001	2/23/95	9.5-10.0	42	U
B08-06	8/7/91	3.5-4.8	37	U
B08-06	8/7/91	8.0-9.5	48	U
B08-06	8/7/91	14.0-15.3	40	U
B08-06	8/7/91	0.5-1.0	360	U
B08-07	8/13/91	2.0-3.0	35	U
B08-07	8/13/91	5.0-6.0	40	U
B08-07	8/13/91	12.5-14.0	40	U
B08-07	8/13/91	0.5-1.0	37	U
B08-08	8/6/91	14-15.5	530	U
B08-08	8/6/91	2.0-3.0	36	U
B08-08	8/6/91	11-12.5	**260**	
B08-08	8/6/91	8-9.5	41	U
B08-08	8/6/91	0.5-1.0	340	U
B08-09	8/7/91	8.0-9.5	39	U
B08-09	8/7/91	14.0-15.3	470	U
B08-09	8/7/91	0.5-1.0	350	U
B08-09	8/7/91	5-6.3	37	U
B08-10	8/7/91	8.0-9.5	39	U
B08-10	8/7/91	14-15.5	40	U
B08-10	8/7/91	5.0-6.5	38	U
B08-10	8/7/91	0.5-1.0	35	U
B08-11	7/30/91	0.5-1.0	**240**	
B08-11	7/30/91	14-15.5	42	U
B08-11	7/30/91	9.5-11.0	42	U
B08-11	7/30/91	4.0-5.0	36	U
B08-12	8/13/91	0.5-1.0	160	
B08-12	8/13/91	8.0-9.5	40	U
B08-12	8/13/91	5.0-6.5	36	U
B08-12	8/13/91	14.0-15.5	40	U
M08-01	7/30/91	3.5-4.5	37	U
M08-01	7/30/91	9.5-11.0	42	U
M08-01	7/30/91	0.5-1.0	**270**	
M08-01	7/30/91	14-15.3	41	U
M08-02	8/6/91	0.0-0.5	67	
M08-02	8/6/91	8-9.3	39	U
M08-02	8/6/91	2.0-3.5	35	U
M08-02	8/6/91	14.0-15.5	44	U
M08-03	7/29/91	2.0-3.5	36	U
M08-03	7/29/91	8.0-9.5	42	U
M08-03	7/29/91	14.0-15.5	44	U
M08-03	7/29/91	0.5-1.0	35	U
M08-04	7/29/91	0.0-.05	**1500**	
M08-04	7/29/91	2.0-3.5	36	U
M08-04	7/29/91	14-15.5	56	U
M08-04	7/29/91	8.0-9.0	43	U
M08-05	7/30/91	0.5-1.0	36	U
M08-05	7/30/91	2-3.5	35	U
M08-05	7/30/91	8-9.5	40	U
M08-05	7/30/91	14-15.5	40	U
M08-06	3/31/94	4.5-5.3	39	UJ
M08-06	3/31/94	2.5-3.0	37	UJ
S08-01	3/8/94	0.5-1.0	**550**	J
S08-02	3/8/94	0.5-1.0	**230**	J
S08-03	3/8/94	0.5-1.0	**380**	

- AROCLOR 1260 DETECTED
- AROCLOR 1260 NON-DETECTED
- EXCEED SCREENING LEVEL[2]
- OIL WATER SEPERATOR (OWS)
- CATCH BASIN
- MANHOLE
- GENERATOR ACCUMULATION POINT (GAP)
- WASHDOWN AREA (WD)
- FENCE
- FUEL LINE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CERCLA SITE BOUNDARY
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- CORRECTIVE ACTION AREA (CAA)

BUILDING

- Former
- Present
- LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

U = Non-detected
J = Estimated

1 Location designated in the RCRA Facility Assessment (DTSC 1992), exact location unknown

2 Risk based level is 220 µg/kg (Based on 1E-06)

3 Bold denotes maximum concentration

4 Approximate direction and velocity of groundwater movement

40 0 40 80 Feet

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FIGURE 3-12
CONCENTRATIONS OF AROCLOR 1260 IN SITE 8 SOIL

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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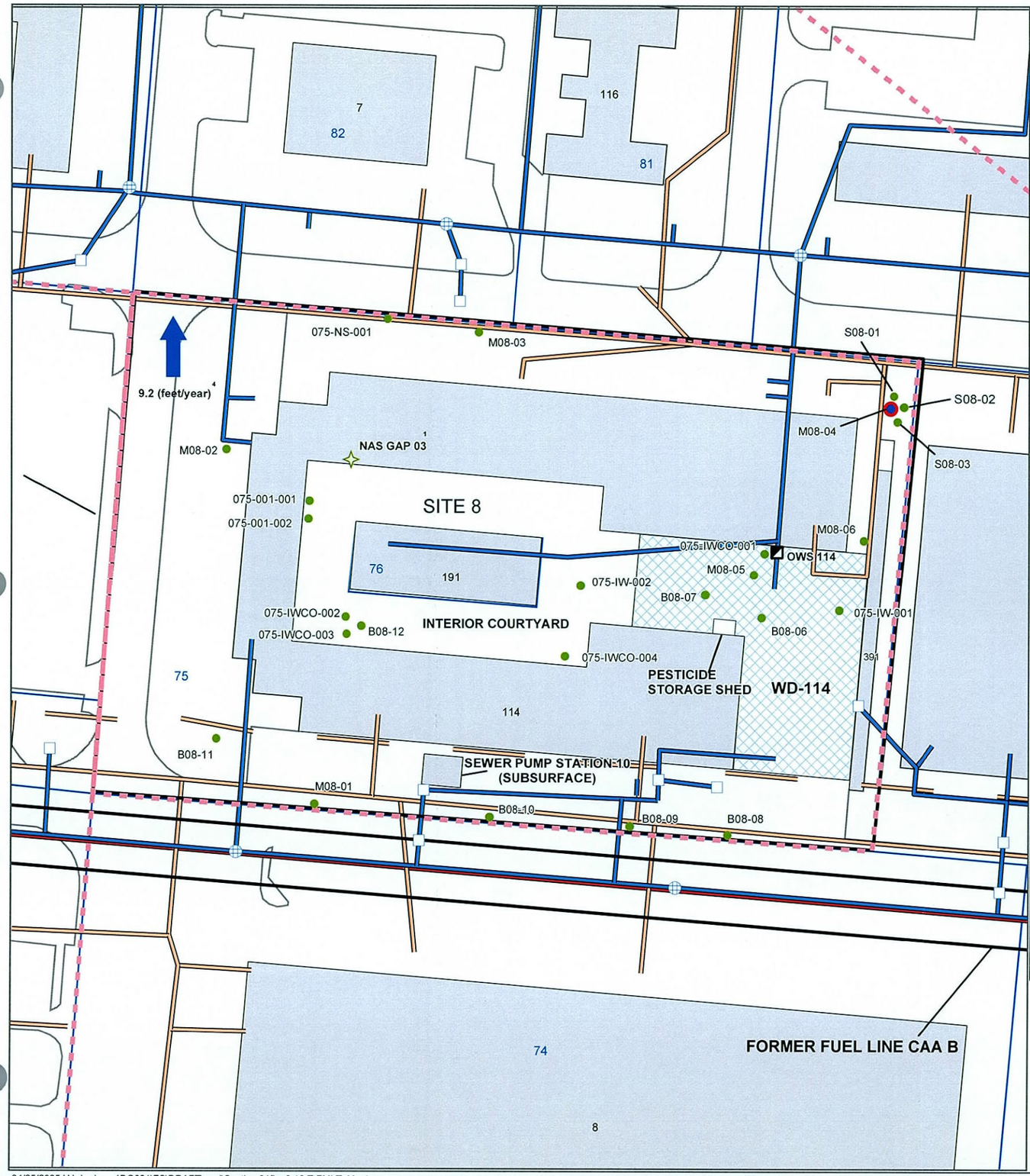

Point Name	Sample Date	Sample Depth (feet)	Concentration (µg/kg)[3]	Qualifer
075-001-001	5/12/95	0.5-1.0	3.8	UJ
075-001-002	5/12/95	0.5-1.0	3.9	U
075-IW-001	1/26/95	5.0-9.0	3.9	U
075-IW-002	12/22/94	4.0-4.8	3.7	U
075-IWCO-001	12/15/94	0.5-1.0	7.8	U
075-IWCO-002	12/15/94	1.0-2.0	3.7	U
075-IWCO-003	12/15/94	1.0-2.0	3.6	U
075-IWCO-004	12/15/94	1.5-2.0	3.7	U
075-SN-001	2/23/95	9.5-10.0	4.2	U
B08-06	8/7/91	3.5-4.8	3.67	U
B08-06	8/7/91	8.0-9.5	4.84	U
B08-06	8/7/91	14.0-15.3	3.99	U
B08-06	8/7/91	0.5-1.0	35.6	U
B08-07	8/13/91	2.0-3.0	3.49	U
B08-07	8/13/91	5.0-6.0	4.03	U
B08-07	8/13/91	12.5-14.0	4.02	U
B08-07	8/13/91	0.5-1.0	3.65	U
B08-08	8/6/91	14.0-15.5	53.1	U
B08-08	8/6/91	2.0-3.0	3.57	U
B08-08	8/6/91	11.0-12.5	4.98	U
B08-08	8/6/91	8.0-9.5	4.07	U
B08-08	8/6/91	0.5-1.0	34.4	U
B08-09	8/7/91	8.0-9.5	3.95	U
B08-09	8/7/91	14.0-15.3	46.7	U
B08-09	8/7/91	0.5-1.0	35.1	U
B08-09	8/7/91	5.0-6.3	3.71	U
B08-10	8/7/91	8.0-9.5	3.89	U
B08-10	8/7/91	14.0-15.5	4.02	U
B08-10	8/7/91	5.0-6.5	3.75	U
B08-10	8/7/91	0.5-1.0	3.49	U
B08-11	7/30/91	0.5-1.0	3.57	U
B08-11	7/30/91	14.0-15.5	4.16	U
B08-11	7/30/91	9.5-11.0	4.24	U
B08-11	7/30/91	4.0-5.0	3.64	U
B08-12	8/13/91	0.5-1.0	3.62	U
B08-12	8/13/91	8.0-9.5	3.98	U
B08-12	8/13/91	5.0-6.5	3.62	U
B08-12	8/13/91	14.0-15.5	4.04	U
M08-01	7/30/91	3.5-4.5	3.75	U
M08-01	7/30/91	9.5-11.0	4.19	U
M08-01	7/30/91	0.5-1.0	3.42	U
M08-01	7/30/91	14.0-15.3	4.12	U
M08-02	8/6/91	0.0-0.5	3.45	U
M08-02	8/6/91	8.0-9.3	3.94	U
M08-02	8/6/91	2.0-3.5	3.45	U
M08-02	8/6/91	14.0-15.5	4.43	U
M08-03	7/29/91	2.0-3.5	3.62	U
M08-03	7/29/91	8.0-9.5	4.2	U
M08-03	7/29/91	14.0-15.5	4.4	U
M08-03	7/29/91	0.5-1.0	3.52	U
M08-04	7/29/91	0.0-0.5	**52.6**	
M08-04	7/29/91	2.0-3.5	3.57	U
M08-04	7/29/91	14.0-15.5	5.56	U
M08-04	7/29/91	8.0-9.0	4.28	U
M08-05	7/30/91	0.5-1.0	3.58	U
M08-05	7/30/91	2.0-3.5	3.51	U
M08-05	7/30/91	8.0-9.5	4.01	U
M08-05	7/30/91	14.0-15.5	3.98	U
M08-06	3/31/94	4.5-5.3	3.9	UJ
M08-06	3/31/94	2.5-3.0	3.7	UJ
S08-01	3/8/94	0.0-0.5	3.7	UJ
S08-02	3/8/94	0.0-0.5	3.9	UJ
S08-03	3/8/94	0.0-0.5	3.8	U

DIELDRIN DETECTED
DIELDRIN NON-DETECTED
EXCEED SCREENING LEVEL[2]
OIL WATER SEPERATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
WASHDOWN AREA (WD)
FENCE
FUEL LINE
SANITARY SEWER LINE
STORM SEWER LINE
CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
CORRECTIVE ACTION AREA (CAA)

BUILDING
Former
Present
LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

U = Non-detected
J = Estimated

1 Location designated in the RCRA Facility Assessment (DTSC 1992), exact location unknown

2 Risk based level is 30.0 µg/kg (Based on 1E-06)

3 Bold denotes concentration that exceed the screening level

4 Approximate direction and velocity of groundwater movement

40 0 40 80 Feet

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FIGURE 3-13
CONCENTRATIONS OF DIELDRIN IN SITE 8 SOIL

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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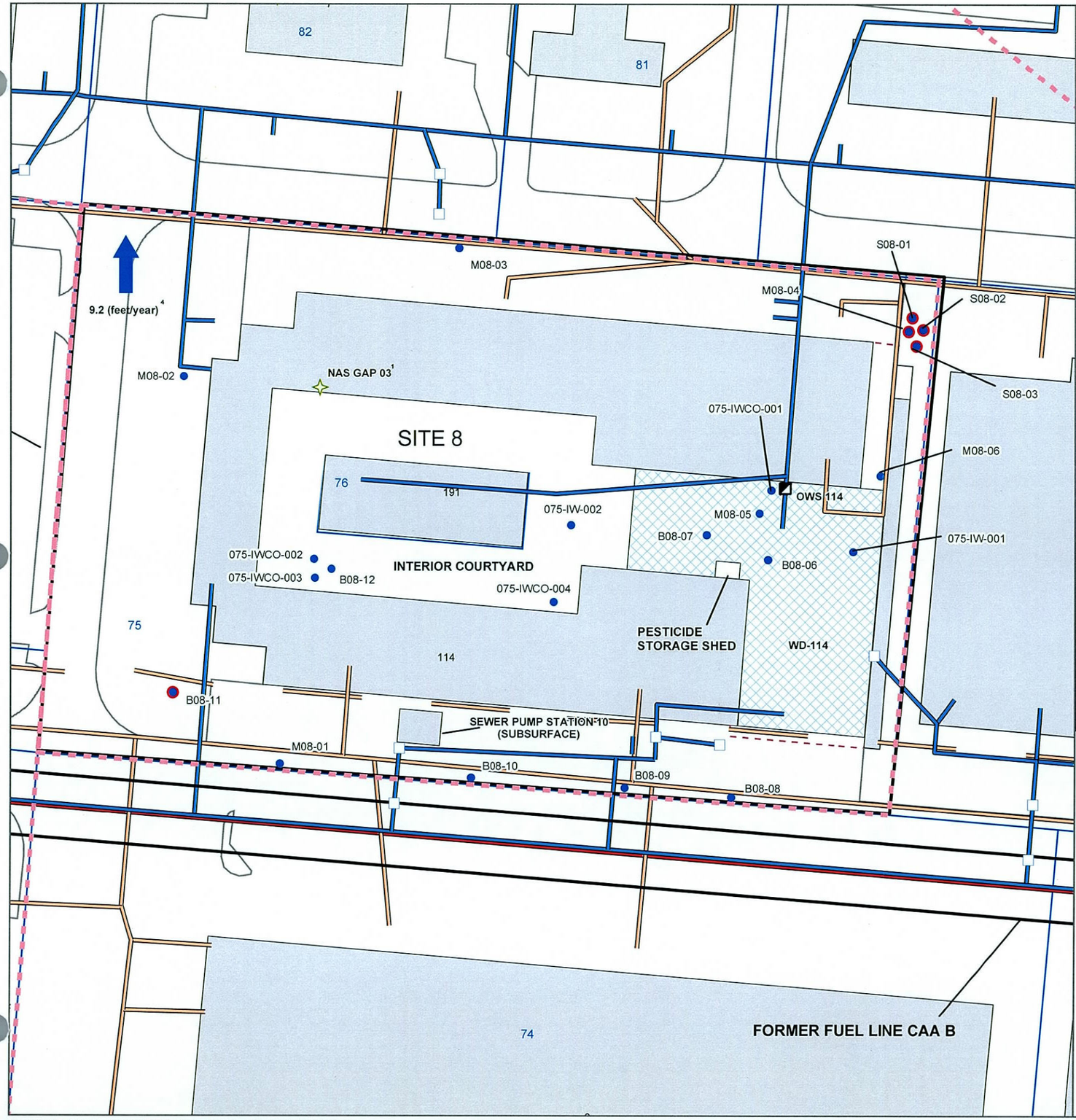

Point Name	Sample Date	Sample Depth (feet)	Concentration (mg/kg)[3]	Qualifer
075-IW-001	1/26/95	5.0-9.0	2.7	
075-IW-001	1/26/95	5.0-6.0	25	U
075-IW-002	12/22/94	4.0-4.8	25	U
075-IW-002	12/22/94	4.0-4.8	1.6	
075-IWCO-001	12/15/94	0.5-1.0	25	U
075-IWCO-001	12/15/94	0.5-1.0	4.7	
075-IWCO-002	12/15/94	1.0-2.0	14.6	
075-IWCO-002	12/15/94	1.0-2.0	25	U
075-IWCO-003	12/15/94	1.0-2.0	25	U
075-IWCO-003	12/15/94	1.0-2.0	3.4	
075-IWCO-004	12/15/94	1.5-2.0	7.6	
075-IWCO-004	12/15/94	1.5-2.0	26	
B08-06	8/7/91	8.0-9.5	4.36	J
B08-06	8/7/91	3.5-4.8	3.22	J
B08-06	8/7/91	14-15.3	7.06	J
B08-06	8/7/91	0.5-1.0	7.97	J
B08-07	8/13/91	0.5-1.0	20.6	J
B08-07	8/13/91	2.0-3.0	1.97	J
B08-07	8/13/91	12.5-14.0	10.4	J
B08-07	8/13/91	5.0-6.0	2.19	J
B08-08	8/6/91	2.0-3.0	1.8	J
B08-08	8/6/91	11.0-12.5	8.78	J
B08-08	8/6/91	8.0-9.5	1.68	J
B08-08	8/6/91	0.5-1.0	28.4	J
B08-08	8/6/91	14-15.5	21.4	J
B08-09	8/7/91	8.0-9.5	2.15	J
B08-09	8/7/91	5.0-6.3	6.93	J
B08-09	8/7/91	14-15.3	13.6	J
B08-09	8/7/91	0.5-1.0	4.46	J
B08-10	8/7/91	0.5-1.0	1.09	J
B08-10	8/7/91	5.0-6.5	4.12	
B08-10	8/7/91	8.0-9.5	1.77	
B08-10	8/7/91	14-15.5	4.03	
B08-11	7/30/91	4.0-5.0	3.31	J
B08-11	7/30/91	9.5-11.0	2.78	J
B08-11	7/30/91	0.5-1.0	159	
B08-11	7/30/91	14-15.5	3.87	J
B08-12	8/13/91	5.0-6.5	1.8	J
B08-12	8/13/91	8.0-9.5	2.1	J
B08-12	8/13/91	0.5-1.0	18.5	J
B08-12	8/13/91	14.0-15.5	18.7	J
M08-01	7/30/91	0.5-1.0	31.8	
M08-01	7/30/91	9.5-11.0	2.47	
M08-01	7/30/91	14.0-15.3	3.27	
M08-01	7/30/91	3.5-4.5	1.93	
M08-02	8/6/91	8.0-9.3	1.95	J
M08-02	8/6/91	14-15.5	5.77	J
M08-02	8/6/91	2.0-3.5	1.52	J
M08-02	8/6/91	0.0-0.5	111	J
M08-03	7/29/91	2.0-3.5	2.3	J
M08-03	7/29/91	14.0-15.5	5.07	J
M08-03	7/29/91	0.5-1.0	3.81	J
M08-03	7/29/91	8.0-9.5	5.29	J
M08-04	7/29/91	2.0-3.5	3.71	J
M08-04	7/29/91	0.5-1.0	774	
M08-04	7/29/91	8.0-9.0	2.44	J
M08-04	7/29/91	14.0-15.5	29	
M08-05	7/30/91	0.5-1.0	19.5	
M08-05	7/30/91	14.0-15.5	11.6	J
M08-05	7/30/91	2.0-3.5	2.02	J
M08-05	7/30/91	8.0-9.5	1.96	J
M08-06	3/31/94	4.5-5.3	17.6	J
M08-06	3/31/94	2.5-3.0	11.7	J
S08-01	3/8/94	0.5-1.0	**301**	
S08-02	3/8/94	0.0-0.5	123	
S08-03	3/8/94	0.5-1.0	363	

- LEAD DETECTED
- LEAD NON-DETECTED
- EXCEEDS SCREENING LEVEL[2]
- CATCH BASIN
- MANHOLE
- GENERATOR ACCUMULATION POINT (GAP)
- OIL WATER SEPERATOR (OWS)
- FENCE
- FUEL LINE
- SANITARY SEWER LINE
- STORM SEWER LINE
- WASHDOWN AREA (WD)
- CERCLA SITE BOUNDARY
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- CORRECTIVE ACTION AREA (CAA)

BUILDING

- Former
- Present
- LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-detected

1 Location designated in the RCRA Facility Assessment (DTSC 1992), exact location unknown

2 Screening level based on maximum ambient concentration of 165 mg/kg

3 Bold denotes concentrations that exceed the screening level

4 Approximate direction and velocity of groundwater movement

35 0 35 70 Feet

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FIGURE 3-14
CONCENTRATIONS OF LEAD IN SITE 8 SOIL

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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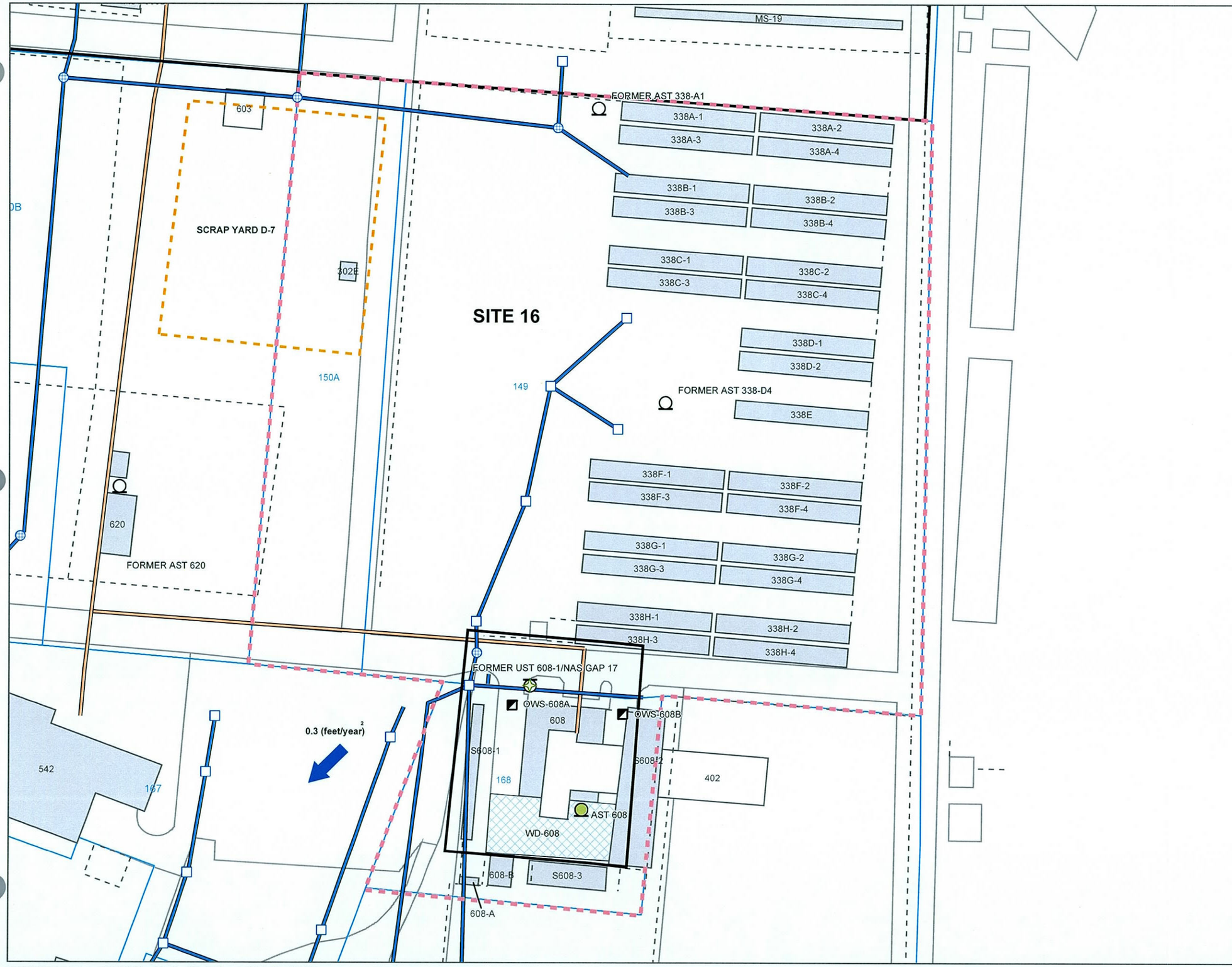

ABOVEGROUND STORAGE TANK (AST)

- Present
- Removed

UNDERGROUND STORAGE TANK (UST)

- Removed
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- OIL WATER SEPARATOR
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CORRECTIVE ACTION AREA (CAA)
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[1]
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- LAND COVER
- WASHDOWN AREA (WD)

BUILDING

- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

1 Depicted in EBS CERFA (ERM West 1994)

2 Approximate direction and velocity of groundwater movement

50 0 50 100 Feet

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FIGURE 3-15
SITE 16 FEATURES

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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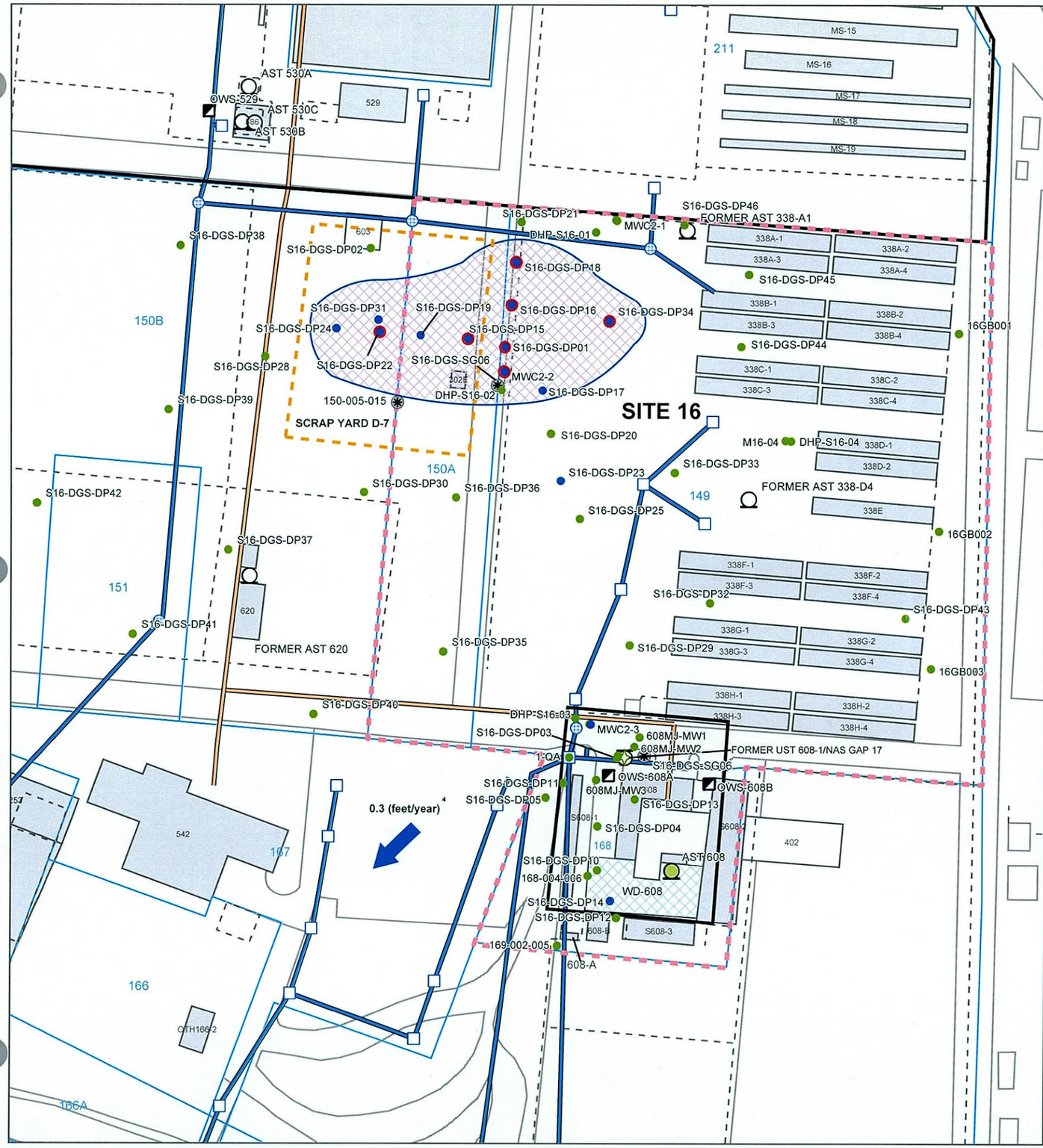

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[3]	Qualifier
168-004-006	11/29/95	9.0-10.0	10	U
169-002-005	11/9/95	8.0-9.0	10	U
16GB001	8/9/94	5.0-6.0	5	U
16GB002	8/9/94	5.0-6.0	5	UJ
16GB003	8/9/94	5.0-6.0	5	U
1-QA	7/23/01	0.0-1.0	2	U
608MJ-MW1	6/22/01	NA	2	U
608MJ-MW2	6/22/01	NA	2	U
608MJ-MW2	6/17/02	NA	0.5	U
608MJ-MW2	12/24/02	NA	0.5	UJ
608MJ-MW3	6/22/01	NA	2	U
DHP-S16-01	7/22/94	36.0-39.0	5	U
DHP-S16-02	7/21/94	26.8-29.8	5	U
DHP-S16-03	7/22/94	24.5-27.5	5	U
DHP-S16-04	8/26/94	21.0-24.0	5	U
M16-04	12/1/94	3.0-13.0	5	U
M16-04	2/28/95	3.0-13.0	5	U
M16-04	6/28/95	3.0-13.0	5	U
M16-04	8/18/95	3.0-13.0	5	U
M16-04	11/11/97	3.0-13.0	1	U
M16-04	2/6/98	3.0-13.0	1	U
M16-04	10/11/01	3.0-13.0	2	U
MWC2-1	8/29/90	5.0-15.0	10	U
MWC2-1	10/21/94	5.0-15.0	5	U
MWC2-1	2/28/95	5.0-15.0	5	U
MWC2-1	6/28/95	5.0-15.0	5	U
MWC2-1	8/17/95	5.0-15.0	5	U
MWC2-1	7/6/01	5.0-15.0	2	U
MWC2-1	7/6/01	5.0-15.0	5	U
MWC2-1	6/17/02	5.0-15.0	0.5	U
MWC2-1	9/4/02	5.0-15.0	0.5	U
MWC2-1	12/24/02	5.0-15.0	0.5	U
MWC2-1	4/11/03	5.0-15.0	0.5	U
MWC2-2	10/18/90	5.0-15.0	10	U
MWC2-2	10/24/94	5.0-15.0	**3700**	
MWC2-2	2/28/95	5.0-15.0	**1200**	
MWC2-2	6/28/95	5.0-15.0	300	
MWC2-2	8/18/95	5.0-15.0	**620**	
MWC2-2	6/21/00	5.0-15.0	362	
MWC2-2	6/22/01	5.0-15.0	120	
MWC2-2	6/17/02	5.0-15.0	240	
MWC2-2	9/4/02	5.0-15.0	200	
MWC2-2	12/26/02	5.0-15.0	**1800**	
MWC2-2	4/10/03	5.0-15.0	170	
MWC2-3	8/30/90	5.0-15.0	10	U
MWC2-3	10/24/94	5.0-15.0	5	U
MWC2-3	2/28/95	5.0-15.0	5	U
MWC2-3	6/29/95	5.0-15.0	5	U
MWC2-3	8/18/95	5.0-15.0	5	U
MWC2-3	6/22/01	5.0-15.0	2	J
MWC2-3	6/17/02	5.0-15.0	0.5	U
MWC2-3	9/4/02	5.0-15.0	0.5	U
MWC2-3	12/24/02	5.0-15.0	0.5	UJ
MWC2-3	4/11/03	5.0-15.0	0.5	U
OUTFALL Q	7/23/01	0.0-0.0	2	U
S16-DGS-DP01	7/27/01	8.0-10.0	**13000**	
S16-DGS-DP01	7/27/01	8.0-10.0	**5200**	
S16-DGS-DP01	7/27/01	11.0-13.0	7.3	
S16-DGS-DP01	7/27/01	13.0-15.0	2300	
S16-DGS-DP01	8/16/01	18.0-20.0	1	U
S16-DGS-DP01	8/16/01	25.0-27.0	1	
S16-DGS-DP01	7/27/01	56.0-58.0	3	
S16-DGS-DP02	7/17/01	7.0-9.0	1	U
S16-DGS-DP03	7/17/01	5.5-7.5	2	U
S16-DGS-DP03	7/17/01	5.5-7.5	1	U
S16-DGS-DP04	7/25/01	8.0-10.0	1	U

- 1,2-DICHLOROBENZENE DETECTED
- 1,2-DICHLROBENZENE NON-DETECTED
- EXCEEDS SCREENING LEVEL[1]
- 1,2-DICHLOROBENZENE

ABOVEGROUND STORAGE TANK (AST)
- Present
- Removed

UNDERGROUND STORAGE TANK (UST)
- Present
- Removed
- SOIL GAS SAMPLING LOCATION
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- OIL WATER SEPARATOR
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CORRECTIVE ACTION AREA (CAA)
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[2]
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- LAND COVER
- WASHDOWN AREA (WD)

BUILDING
- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Risk Based Screening Level is 370.0 ug/L (Based on 1E-06)

2 Depicted in EBS CERFA (ERM West 1994)

3 Bold denotes concentrations that exceed the screening level

4 Approximate direction and velocity of groundwater flow

65 0 65 130 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-16
CONCENTRATIONS OF 1,2-DICHLOROBENZENE IN SITE 16 GROUNDWATER
PAGE 1 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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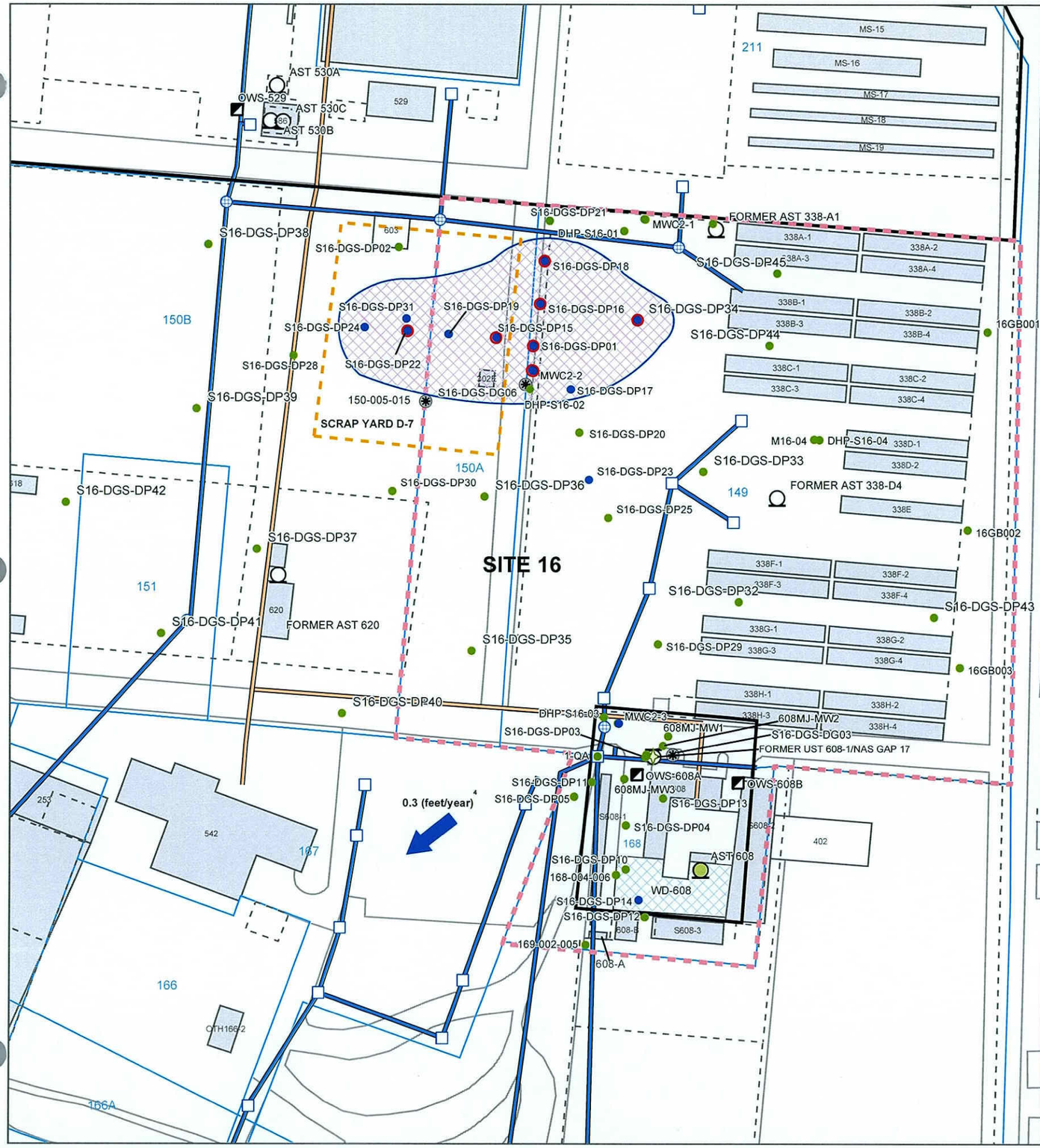

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[3]	Qualifier
S16-DGS-DP05	7/17/01	5.5-7.5	1	U
S16-DGS-DP10	8/13/01	5.0-7.0	1	U
S16-DGS-DP11	8/13/01	5.0-7.0	1	U
S16-DGS-DP12	8/16/01	5.0-7.0	2	U
S16-DGS-DP12	8/16/01	5.0-7.0	1	U
S16-DGS-DP13	9/12/01	5.0-7.0	5	U
S16-DGS-DP14	8/23/01	5.0-7.0	1.2	
S16-DGS-DP15	8/23/01	12.0-14.0	**1100**	
S16-DGS-DP15	8/23/01	16.0-18.0	4.6	
S16-DGS-DP16	8/23/01	8.0-10.0	**5100**	
S16-DGS-DP16	8/23/01	12.0-14.0	28	
S16-DGS-DP16	8/23/01	16.0-18.0	8.5	
S16-DGS-DP17	8/23/01	8.0-10.0	72	
S16-DGS-DP17	8/23/01	12.0-14.0	2	
S16-DGS-DP17	8/23/01	16.0-18.0	1.4	
S16-DGS-DP18	9/10/01	8.0-10.0	**380**	
S16-DGS-DP18	9/10/01	12.0-14.0	0.3	J
S16-DGS-DP19	9/10/01	8.0-10.0	320	J
S16-DGS-DP19	9/10/01	12.0-14.0	17	
S16-DGS-DP20	9/10/01	8.0-10.0	2	U
S16-DGS-DP21	9/21/01	8.0-10.0	0.5	UJ
S16-DGS-DP22	9/21/01	8.0-10.0	74	J
S16-DGS-DP22	9/21/01	12.0-14.0	1300	
S16-DGS-DP22	9/21/01	16.0-18.0	0.5	U
S16-DGS-DP23	9/21/01	8.0-10.0	0.9	
S16-DGS-DP24	10/8/01	8.0-10.0	74	
S16-DGS-DP24	10/8/01	12.0-14.0	1.7	
S16-DGS-DP24	10/8/01	16.0-18.0	0.5	U
S16-DGS-DP25	10/8/01	8.0-10.0	0.5	U
S16-DGS-DP28	10/18/01	8.0-10.0	2	U
S16-DGS-DP28	10/18/01	12.0-14.0	2	U
S16-DGS-DP28	10/18/01	16.0-18.0	2	U
S16-DGS-DP29	10/18/01	8.0-10.0	2	UJ
S16-DGS-DP29	10/18/01	12.0-14.0	2	U
S16-DGS-DP30	10/18/01	8.0-10.0	2	U
S16-DGS-DP30	10/18/01	12.0-14.0	2	U
S16-DGS-DP31	10/18/01	8.0-10.0	15	
S16-DGS-DP31	10/18/01	12.0-14.0	0.4	J
S16-DGS-DP32	4/22/02	8.0-10.0	2	U
S16-DGS-DP32	4/22/02	12.0-14.0	2	U
S16-DGS-DP33	4/22/02	8.0-10.0	2	U
S16-DGS-DP33	4/22/02	12.0-14.0	2	U
S16-DGS-DP34	4/22/02	8.0-10.0	**16000**	
S16-DGS-DP34	4/22/02	12.0-14.0	2	
S16-DGS-DP35	4/22/02	8.0-10.0	2	U
S16-DGS-DP35	4/22/02	12.0-14.0	2	U
S16-DGS-DP36	4/22/02	8.0-10.0	2	U
S16-DGS-DP36	4/22/02	12.0-14.0	10	U
S16-DGS-DP37	4/22/02	8.0-10.0	2	U
S16-DGS-DP37	4/22/02	12.0-14.0	10	U
S16-DGS-DP37	5/9/02	20.0-22.0	2	U
S16-DGS-DP38	4/19/02	8.0-10.0	2	U
S16-DGS-DP38	4/19/02	12.0-14.0	2	U
S16-DGS-DP39	4/19/02	8.0-10.0	2	U
S16-DGS-DP39	4/19/02	12.0-14.0	2	U
S16-DGS-DP40	5/9/02	8.0-10.0	2	U
S16-DGS-DP40	5/9/02	12.0-14.0	2	U
S16-DGS-DP41	5/9/02	8.0-10.0	2	U
S16-DGS-DP41	5/9/02	12.0-14.0	2	U
S16-DGS-DP42	5/9/02	8.0-10.0	2	U
S16-DGS-DP42	5/9/02	12.0-14.0	2	U
S16-DGS-DP43	5/9/02	8.0-10.0	2	U
S16-DGS-DP44	5/10/02	8.0-10.0	2	U
S16-DGS-DP45	5/9/02	8.0-10.0	2	U
S16-DGS-DP46	5/10/02	8.0-10.0	2	U
S16-DGS-VE02	8/6/01	5.0-7.0	1	U

- 1,2-DICHLOROBENZENE DETECTED
- 1,2-DICHLROBENZENE NON-DETECTED
- EXCEEDS SCREENING LEVEL[1]
- 1,2-DICHLOROBENZENE

ABOVEGROUND STORAGE TANK (AST)
- Present
- Removed

UNDERGROUND STORAGE TANK (UST)
- Present
- Removed
- SOIL GAS SAMPLING LOCATION
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- OIL WATER SEPARATOR
- FENCE
- SANITARY SEWER LINE
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BUILDING
- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Risk Based Screening Level is 370.0 ug/L (Based on 1E-06)

2 Depicted in EBS CERFA (ERM West 1994)

3 Bold denotes concentrations that exceed the screening level

4 Approximate direction and velocity of groundwater movement

65 0 65 130 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-16
CONCENTRATIONS OF 1,2-DICHLOROBENZENE IN SITE 16 GROUNDWATER
PAGE 2 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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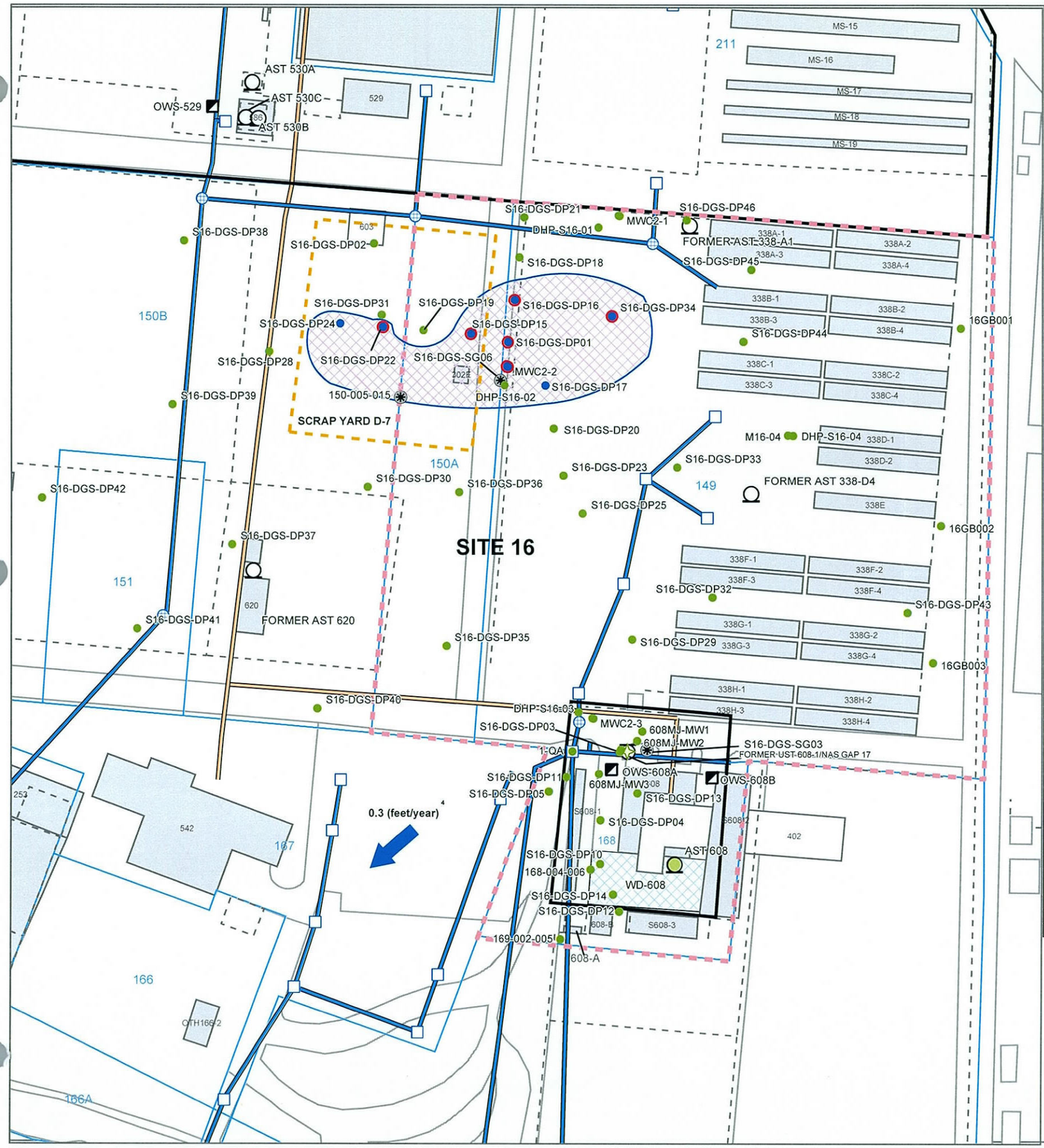

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[3]	Qualifier
168-004-006	11/29/95	9.0-10.0	10	U
169-002-005	11/9/95	8.0-9.0	10	U
16GB001	8/9/94	5.0-6.0	5	U
16GB002	8/9/94	5.0-6.0	5	UJ
16GB003	8/9/94	5.0-6.0	5	U
1-QA	7/23/01	0.0-0.0	2	U
608MJ-MW1	6/22/01	NA	2	U
608MJ-MW2	6/22/01	NA	2	U
608MJ-MW2	6/17/02	NA	0.5	U
608MJ-MW2	12/24/02	NA	0.5	UJ
608MJ-MW3	6/22/01	NA	2	U
DHP-S16-01	7/22/94	36.0-39.0	5	U
DHP-S16-02	7/21/94	26.8-29.8	5	U
DHP-S16-03	7/22/94	24.5-27.5	5	U
DHP-S16-04	8/26/94	21.0-24.0	5	U
M16-04	12/1/94	3.0-13.0	5	U
M16-04	2/28/95	3.0-13.0	5	U
M16-04	6/28/95	3.0-13.0	5	U
M16-04	8/18/95	3.0-13.0	5	U
M16-04	11/11/97	3.0-13.0	1	U
M16-04	2/6/98	3.0-13.0	1	U
M16-04	10/11/01	3.0-13.0	2	U
MWC2-1	8/29/90	5.0-15.0	10	U
MWC2-1	10/21/94	5.0-15.0	5	U
MWC2-1	2/28/95	5.0-15.0	5	U
MWC2-1	6/28/95	5.0-15.0	5	U
MWC2-1	8/17/95	5.0-15.0	5	U
MWC2-1	7/6/01	5.0-15.0	2	U
MWC2-1	7/6/01	5.0-15.0	5	U
MWC2-1	6/17/02	5.0-15.0	0.5	U
MWC2-1	9/4/02	5.0-15.0	0.5	U
MWC2-1	12/24/02	5.0-15.0	0.5	U
MWC2-1	4/11/03	5.0-15.0	0.5	U
MWC2-2	10/18/90	5.0-15.0	10	U
MWC2-2	10/24/94	5.0-15.0	**79**	
MWC2-2	2/28/95	5.0-15.0	**8**	
MWC2-2	6/28/95	5.0-15.0	4	J
MWC2-2	8/18/95	5.0-15.0	**7**	
MWC2-2	6/21/00	5.0-15.0	5	J
MWC2-2	6/22/01	5.0-15.0	2	U
MWC2-2	6/17/02	5.0-15.0	**11**	
MWC2-2	9/4/02	5.0-15.0	**12**	
MWC2-2	12/26/02	5.0-15.0	**55**	
MWC2-2	4/10/03	5.0-15.0	**9.6**	
MWC2-3	8/30/90	5.0-15.0	10	U
MWC2-3	10/24/94	5.0-15.0	5	U
MWC2-3	2/28/95	5.0-15.0	5	U
MWC2-3	6/29/95	5.0-15.0	5	U
MWC2-3	8/18/95	5.0-15.0	5	U
MWC2-3	6/22/01	5.0-15.0	2	U
MWC2-3	6/17/02	5.0-15.0	0.5	U
MWC2-3	9/4/02	5.0-15.0	0.5	U
MWC2-3	12/24/02	5.0-15.0	0.5	UJ
MWC2-3	4/11/03	5.0-15.0	0.5	U
OUTFALL Q	7/23/01	0.0-0.0	2	U
S16-DGS-DP01	7/27/01	8.0-10.0	**700**	
S16-DGS-DP01	7/27/01	8.0-10.0	2	U
S16-DGS-DP01	7/27/01	11.0-13.0	1	U
S16-DGS-DP01	7/27/01	13.0-15.0	130	
S16-DGS-DP01	8/16/01	18.0-20.0	1	U
S16-DGS-DP01	8/16/01	25.0-27.0	1	U
S16-DGS-DP01	7/27/01	56.0-58.0	1	U
S16-DGS-DP02	7/17/01	7.0-9.0	1	U
S16-DGS-DP03	7/17/01	5.5-7.5	1	U
S16-DGS-DP03	7/17/01	5.5-7.5	2	U
S16-DGS-DP04	7/25/01	8.0-10.0	1	U
S16-DGS-DP05	7/17/01	5.5-7.5	1	U

- 1,3-DICHLOROBENZENE DETECTED
- 1,3-DICHLROBENZENE NON-DETECTED
- EXCEEDS SCREENING LEVEL[1]
- 1,3-DICHLOROBENZENE PLUME

ABOVEGROUND STORAGE TANK (AST)
- Present
- Removed

UNDERGROUND STORAGE TANK (UST)
- Present
- Removed
- SOIL GAS SAMPLING LOCATION
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- OIL WATER SEPARATOR
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CORRECTIVE ACTION AREA (CAA)
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[2]
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- LAND COVER
- WASHDOWN AREA (WD)

BUILDING
- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Risk Based Screening Level is 5.5 ug/L (Based on 1E-06)

2 Depicted in EBS CERFA (ERM West 1994)

3 Bold denotes concentrations that exceed the screening level

4 Approximate direction and velocity of groundwater movement

65 0 65 130 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-17
CONCENTRATIONS OF 1,3-DICHLOROBENZENE IN SITE 16 GROUNDWATER
PAGE 1 OF 2

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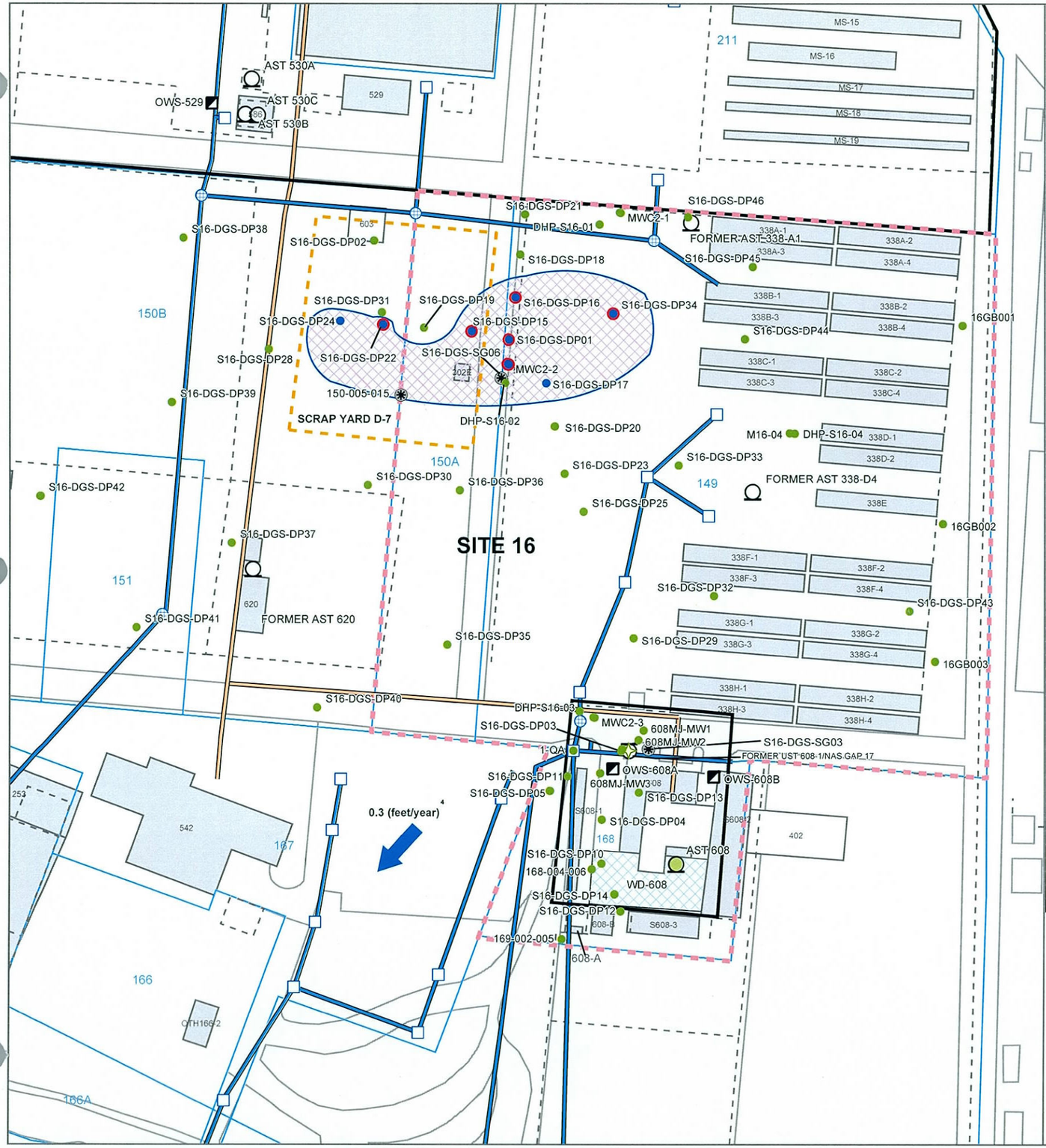

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[3]	Qualifier
S16-DGS-DP10	8/13/01	5.0-7.0	1	U
S16-DGS-DP11	8/13/01	5.0-7.0	1	U
S16-DGS-DP12	8/16/01	5.0-7.0	1	U
S16-DGS-DP13	9/12/01	5.0-7.0	5	U
S16-DGS-DP14	8/23/01	5.0-7.0	1	U
S16-DGS-DP15	8/23/01	8.0-10.0	**40**	
S16-DGS-DP15	8/23/01	12.0-14.0	3.5	
S16-DGS-DP15	8/23/01	16.0-18.0	1	U
S16-DGS-DP16	8/23/01	8.0-10.0	**100**	
S16-DGS-DP16	8/23/01	12.0-14.0	1	U
S16-DGS-DP16	8/23/01	16.0-18.0	1	U
S16-DGS-DP17	8/23/01	8.0-10.0	2.5	
S16-DGS-DP17	8/23/01	12.0-14.0	1	U
S16-DGS-DP17	8/23/01	16.0-18.0	1	U
S16-DGS-DP18	9/10/01	8.0-10.0	10	U
S16-DGS-DP18	9/10/01	12.0-14.0	2	U
S16-DGS-DP19	9/10/01	8.0-10.0	10	UJ
S16-DGS-DP19	9/10/01	12.0-14.0	2	U
S16-DGS-DP20	9/10/01	8.0-10.0	2	U
S16-DGS-DP21	9/21/01	8.0-10.0	0.5	UJ
S16-DGS-DP22	9/21/01	8.0-10.0	2.6	J
S16-DGS-DP22	9/21/01	12.0-14.0	30	J
S16-DGS-DP22	9/21/01	16.0-18.0	0.5	U
S16-DGS-DP23	9/21/01	8.0-10.0	0.5	U
S16-DGS-DP24	10/8/01	8.0-10.0	1.9	
S16-DGS-DP24	10/8/01	12.0-14.0	0.5	U
S16-DGS-DP24	10/8/01	16.0-18.0	0.5	U
S16-DGS-DP25	10/8/01	8.0-10.0	0.5	U
S16-DGS-DP28	10/18/01	8.0-10.0	2	U
S16-DGS-DP28	10/18/01	12.0-14.0	2	U
S16-DGS-DP28	10/18/01	16.0-18.0	2	U
S16-DGS-DP29	10/18/01	8.0-10.0	2	UJ
S16-DGS-DP29	10/18/01	12.0-14.0	2	U
S16-DGS-DP30	10/18/01	8.0-10.0	2	U
S16-DGS-DP30	10/18/01	12.0-14.0	2	U
S16-DGS-DP31	10/18/01	8.0-10.0	2	U
S16-DGS-DP31	10/18/01	12.0-14.0	2	U
S16-DGS-DP32	4/22/02	8.0-10.0	2	U
S16-DGS-DP32	4/22/02	12.0-14.0	2	U
S16-DGS-DP33	4/22/02	8.0-10.0	2	U
S16-DGS-DP33	4/22/02	12.0-14.0	2	U
S16-DGS-DP34	4/22/02	8.0-10.0	**1000**	
S16-DGS-DP34	4/22/02	12.0-14.0	2	U
S16-DGS-DP35	4/22/02	8.0-10.0	2	U
S16-DGS-DP35	4/22/02	12.0-14.0	2	U
S16-DGS-DP36	4/22/02	8.0-10.0	2	U
S16-DGS-DP36	4/22/02	12.0-14.0	10	U
S16-DGS-DP37	4/22/02	8.0-10.0	2	U
S16-DGS-DP37	4/22/02	12.0-14.0	10	U
S16-DGS-DP37	4/22/02	20.0-22.0	2	U
S16-DGS-DP38	4/19/02	8.0-10.0	2	U
S16-DGS-DP38	4/19/02	12.0-14.0	2	U
S16-DGS-DP39	4/19/02	8.0-10.0	2	U
S16-DGS-DP39	4/19/02	12.0-14.0	2	U
S16-DGS-DP40	5/9/02	8.0-10.0	2	U
S16-DGS-DP40	5/9/02	12.0-14.0	2	U
S16-DGS-DP41	5/9/02	8.0-10.0	2	U
S16-DGS-DP41	5/9/02	12.0-14.0	2	U
S16-DGS-DP42	5/9/02	8.0-10.0	2	U
S16-DGS-DP42	5/9/02	12.0-14.0	2	U
S16-DGS-DP43	5/9/02	8.0-10.0	2	U
S16-DGS-DP44	5/10/02	8.0-10.0	2	U
S16-DGS-DP45	5/9/02	8.0-10.0	2	U
S16-DGS-DP46	5/10/02	8.0-10.0	2	U
S16-DGS-VE02	8/6/01	5.0-7.0	1	U

- 1,3-DICHLOROBENZENE DETECTED
- 1,3-DICHLROBENZENE NON-DETECTED
- EXCEEDS SCREENING LEVEL[1]
- 1,3-DICHLOROBENZENE PLUME

ABOVEGROUND STORAGE TANK (AST)
- Present
- Removed

UNDERGROUND STORAGE TANK (UST)
- Present
- Removed
- SOIL GAS SAMPLING LOCATION
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- OIL WATER SEPARATOR
- FENCE
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- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[2]
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- LAND COVER
- WASHDOWN AREA (WD)

BUILDING
- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Risk Based Screening Level is 5.5 ug/L (Based on 1E-06)

2 Depicted in EBS CERFA (ERM West 1994)

3 Bold denotes concentrations that exceed the screening level

4 Approximate direction and velocity of groundwater movement

65 0 65 130 Feet

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FIGURE 3-17
CONCENTRATIONS OF 1,3-DICHLOROBENZENE IN SITE 16 GROUNDWATER
PAGE 2 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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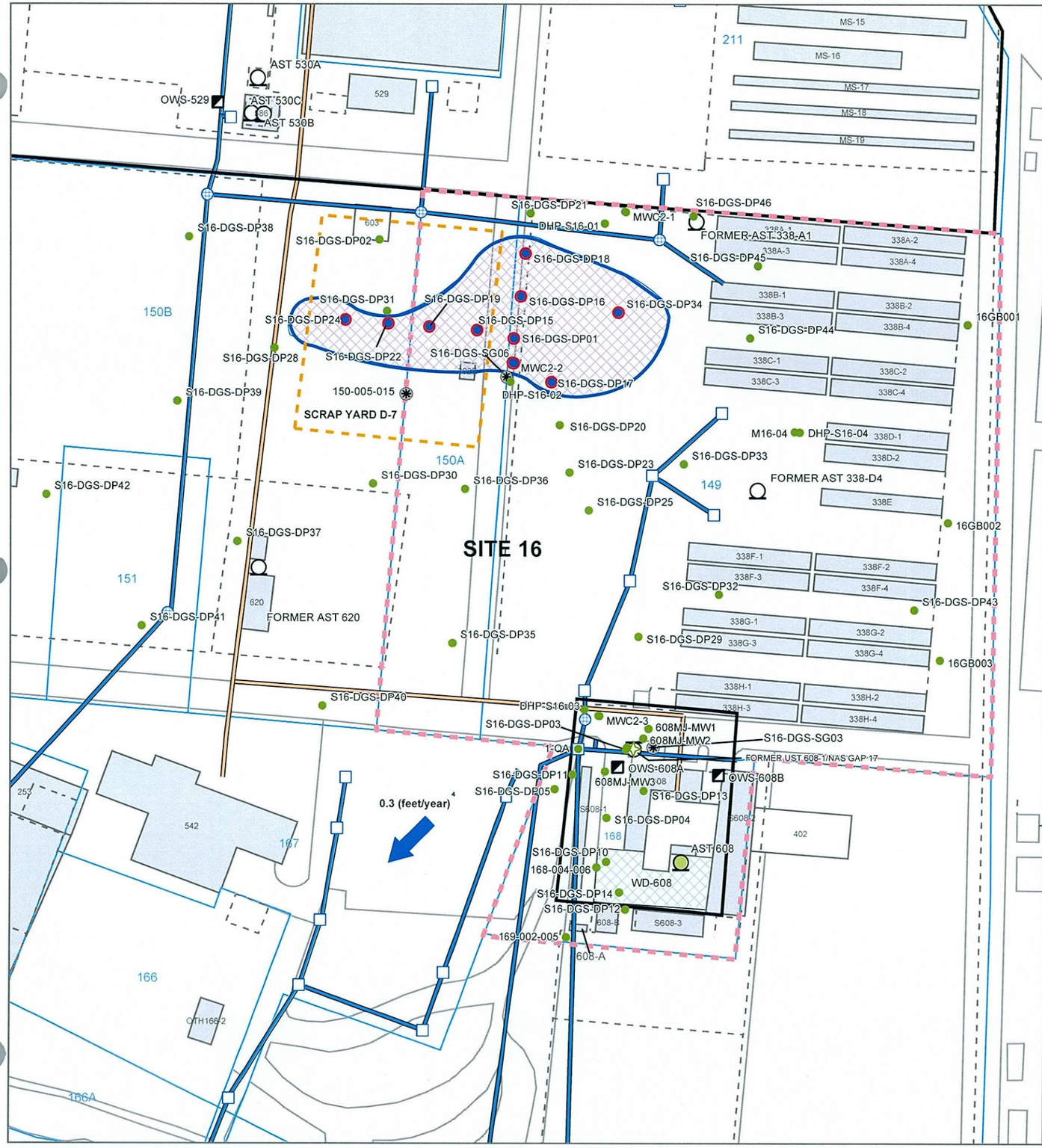

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[3]	Qualifier
168-004-006	11/29/95	9.0-10.0	10	U
169-002-005	11/9/95	8.0-9.0	10	U
16GB001	8/9/94	5.0-6.0	5	U
16GB002	8/9/94	5.0-6.0	5	UJ
16GB003	8/9/94	5.0-6.0	5	U
1-QA	7/23/01	0.0-0.0	2	U
608MJ-MW1	6/22/01	NA	2	U
608MJ-MW2	6/22/01	NA	2	U
608MJ-MW2	6/17/02	NA	0.5	U
608MJ-MW2	12/24/02	NA	0.5	UJ
608MJ-MW3	6/22/01	NA	2	U
DHP-S16-01	7/22/94	36.0-39.0	5	U
DHP-S16-02	7/21/94	26.8-29.8	5	U
DHP-S16-03	7/22/94	24.5-27.5	5	U
DHP-S16-04	8/26/94	21.0-24.0	5	U
M16-04	12/1/94	3.0-13.0	5	U
M16-04	2/28/95	3.0-13.0	5	U
M16-04	6/28/95	3.0-13.0	5	U
M16-04	8/18/95	3.0-13.0	5	U
M16-04	11/11/97	3.0-13.0	1	U
M16-04	2/6/98	3.0-13.0	1	U
M16-04	10/11/01	3.0-13.0	2	U
MWC2-1	8/29/90	5.0-15.0	10	U
MWC2-1	10/21/94	5.0-15.0	5	U
MWC2-1	2/28/95	5.0-15.0	5	U
MWC2-1	6/28/95	5.0-15.0	5	U
MWC2-1	8/17/95	5.0-15.0	5	U
MWC2-1	7/6/01	5.0-15.0	2	U
MWC2-1	7/6/01	5.0-15.0	5	U
MWC2-1	6/17/02	5.0-15.0	0.5	U
MWC2-1	9/4/02	5.0-15.0	0.5	U
MWC2-1	12/24/02	5.0-15.0	0.5	U
MWC2-1	4/11/03	5.0-15.0	0.5	U
MWC2-2	10/18/90	5.0-15.0	10	U
MWC2-2	10/24/94	5.0-15.0	**300**	
MWC2-2	2/28/95	5.0-15.0	**25**	
MWC2-2	6/28/95	5.0-15.0	**15**	
MWC2-2	8/18/95	5.0-15.0	**31**	
MWC2-2	6/21/00	5.0-15.0	**20**	
MWC2-2	6/22/01	5.0-15.0	**32**	
MWC2-2	6/17/02	5.0-15.0	**48**	
MWC2-2	9/4/02	5.0-15.0	**54**	
MWC2-2	12/26/02	5.0-15.0	**280**	
MWC2-2	4/10/03	5.0-15.0	**40**	
MWC2-3	8/30/90	5.0-15.0	10	U
MWC2-3	10/24/94	5.0-15.0	5	U
MWC2-3	2/28/95	5.0-15.0	5	U
MWC2-3	6/29/95	5.0-15.0	5	U
MWC2-3	8/18/95	5.0-15.0	5	U
MWC2-3	6/22/01	5.0-15.0	2	U
MWC2-3	6/17/02	5.0-15.0	0.5	U
MWC2-3	9/4/02	5.0-15.0	0.5	U
MWC2-3	12/24/02	5.0-15.0	0.5	UJ
MWC2-3	4/11/03	5.0-15.0	0.5	U
OUTFALL Q	7/23/01	0.0-0.0	2	U
S16-DGS-DP01	7/27/01	8.0-10.0	**3100**	
S16-DGS-DP01	7/27/01	8.0-10.0	1000	
S16-DGS-DP01	7/27/01	11.0-13.0	2.2	
S16-DGS-DP01	7/27/01	13.0-15.0	660	
S16-DGS-DP01	8/16/01	18.0-20.0	1	U
S16-DGS-DP01	8/16/01	25.0-27.0	1	U
S16-DGS-DP01	7/27/01	56.0-58.0	1	U
S16-DGS-DP02	7/17/01	5.0-7.0	1	U
S16-DGS-DP03	7/17/01	5.0-7.0	1	U
S16-DGS-DP04	7/25/01	5.0-7.0	1	U
S16-DGS-DP05	7/17/01	5.0-7.0	1	U

1,4-DICHLOROBENZENE DETECTED
1,4-DICHLROBENZENE NON-DETECTED
EXCEEDS SCREENING LEVEL[1]
1,4-DICHLOROBENZENE PLUME

ABOVEGROUND STORAGE TANK (AST)
Present
Removed

UNDERGROUND STORAGE TANK (UST)
Removed
SOIL GAS SAMPLING LOCATION
GENERATOR ACCUMULATION POINT (GAP)
CATCH BASIN
MANHOLE
OIL WATER SEPARATOR
FENCE
SANITARY SEWER LINE
STORM SEWER LINE
CORRECTIVE ACTION AREA (CAA)
CERCLA SITE BOUNDARY
SCRAP YARD D-7 APPROXIMATE LOCATION[2]
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
LAND COVER
WASHDOWN AREA (WD)

BUILDING
Present
Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Risk Based Screening Level is 0.5 ug/L (Based on 1E-06)

2 Depicted in EBS CERFA (ERM West 1994)

3 Bold denotes concentrations that exceed the screening level

4 Approximate direction and velocity of groundwater movement

65 0 65 130 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-18
CONCENTRATIONS OF 1,4-DICHLOROBENZENE IN SITE 16 GROUNDWATER
PAGE 1 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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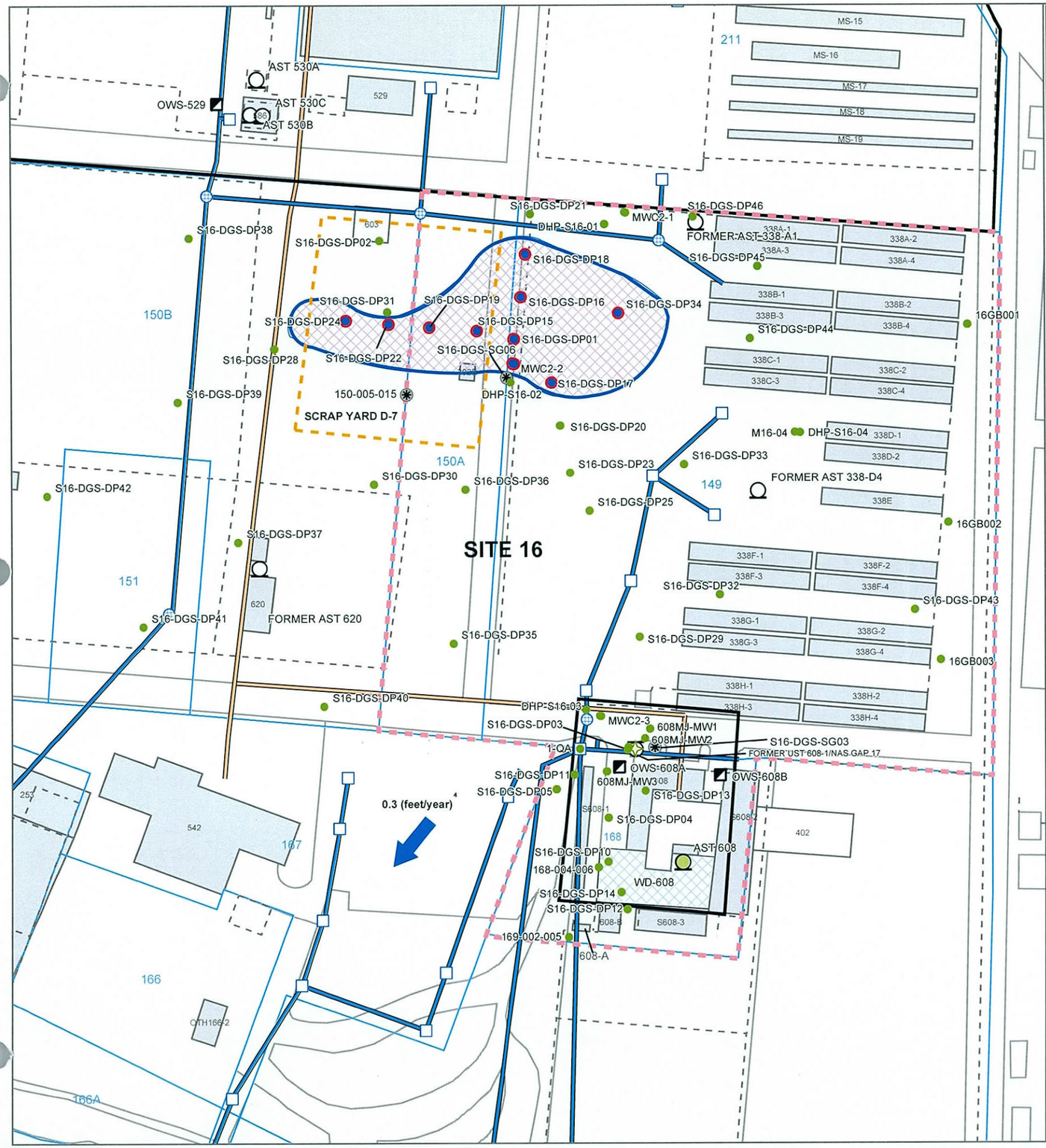

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[3]	Qualifier
S16-DGS-DP10	8/13/01	5.0-7.0	1	U
S16-DGS-DP11	8/13/01	5.0-7.0	1	U
S16-DGS-DP12	8/16/01	5.0-7.0	1	U
S16-DGS-DP13	9/12/01	5.0-7.0	5	U
S16-DGS-DP14	8/23/01	5.0-7.0	1	U
S16-DGS-DP15	8/23/01	8.0-10.0	**170**	
S16-DGS-DP15	8/23/01	12.0-14.0	49	
S16-DGS-DP15	8/23/01	16.0-18.0	1	
S16-DGS-DP16	8/23/01	8.0-10.0	**1400**	
S16-DGS-DP16	8/23/01	12.0-14.0	8.5	
S16-DGS-DP16	8/23/01	16.0-18.0	1.9	
S16-DGS-DP17	8/23/01	8.0-10.0	**13**	
S16-DGS-DP17	8/23/01	12.0-14.0	1	U
S16-DGS-DP17	8/23/01	16.0-18.0	1	U
S16-DGS-DP18	9/10/01	8.0-10.0	**35**	
S16-DGS-DP18	9/10/01	12.0-14.0	2	U
S16-DGS-DP19	9/10/01	8.0-10.0	**96**	J
S16-DGS-DP19	9/10/01	12.0-14.0	6	
S16-DGS-DP20	9/10/01	8.0-10.0	2	U
S16-DGS-DP21	9/21/01	8.0-10.0	0.5	UJ
S16-DGS-DP22	9/21/01	8.0-10.0	**13**	J
S16-DGS-DP22	9/21/01	12.0-14.0	180	
S16-DGS-DP22	9/21/01	16.0-18.0	0.5	U
S16-DGS-DP23	9/21/01	8.0-10.0	0.5	U
S16-DGS-DP24	10/8/01	8.0-10.0	**9.7**	
S16-DGS-DP24	10/8/01	12.0-14.0	0.5	U
S16-DGS-DP24	10/8/01	16.0-18.0	0.5	U
S16-DGS-DP25	10/8/01	8.0-10.0	0.5	U
S16-DGS-DP28	10/18/01	8.0-10.0	2	U
S16-DGS-DP28	10/18/01	12.0-14.0	2	U
S16-DGS-DP28	10/18/01	16.0-18.0	2	U
S16-DGS-DP29	10/18/01	8.0-10.0	2	UJ
S16-DGS-DP29	10/18/01	12.0-14.0	2	U
S16-DGS-DP30	10/18/01	8.0-10.0	2	U
S16-DGS-DP30	10/18/01	12.0-14.0	2	U
S16-DGS-DP31	10/18/01	8.0-10.0	2	U
S16-DGS-DP31	10/18/01	12.0-14.0	2	U
S16-DGS-DP32	4/22/02	8.0-10.0	2	U
S16-DGS-DP32	4/22/02	12.0-14.0	2	U
S16-DGS-DP33	4/22/02	8.0-10.0	2	U
S16-DGS-DP33	4/22/02	12.0-14.0	2	U
S16-DGS-DP34	4/22/02	8.0-10.0	**2700**	
S16-DGS-DP34	4/22/02	12.0-14.0	2	U
S16-DGS-DP35	4/22/02	8.0-10.0	2	U
S16-DGS-DP35	4/22/02	12.0-14.0	2	U
S16-DGS-DP36	4/22/02	8.0-10.0	2	U
S16-DGS-DP36	4/22/02	12.0-14.0	10	U
S16-DGS-DP37	4/22/02	8.0-10.0	2	U
S16-DGS-DP37	5/9/02	8.0-10.0	2	U
S16-DGS-DP37	4/22/02	12.0-14.0	10	U
S16-DGS-DP38	4/19/02	8.0-10.0	2	U
S16-DGS-DP38	4/19/02	12.0-14.0	2	U
S16-DGS-DP39	4/19/02	8.0-10.0	2	U
S16-DGS-DP39	4/19/02	12.0-14.0	2	U
S16-DGS-DP40	5/9/02	8.0-10.0	2	U
S16-DGS-DP40	5/9/02	12.0-14.0	2	U
S16-DGS-DP41	5/9/02	8.0-10.0	2	U
S16-DGS-DP41	5/9/02	12.0-14.0	2	U
S16-DGS-DP42	5/9/02	8.0-10.0	2	U
S16-DGS-DP42	5/9/02	12.0-14.0	2	U
S16-DGS-DP43	5/9/02	8.0-10.0	2	U
S16-DGS-DP44	5/10/02	8.0-10.0	2	U
S16-DGS-DP45	5/9/02	8.0-10.0	2	U
S16-DGS-DP46	5/10/02	8.0-10.0	2	U
S16-DGS-VE02	8/6/01	8.0-10.0	1	U

- 1,4-DICHLOROBENZENE DETECTED
- 1,4-DICHLROBENZENE NON-DETECTED
- EXCEEDS SCREENING LEVEL[1]
- 1,4-DICHLOROBENZENE PLUME

ABOVEGROUND STORAGE TANK (AST)
- Present
- Removed

UNDERGROUND STORAGE TANK (UST)
- Removed
- SOIL GAS SAMPLING LOCATION
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- OIL WATER SEPARATOR
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CORRECTIVE ACTION AREA (CAA)
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[2]
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- LAND COVER
- WASHDOWN AREA (WD)

BUILDING
- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
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2 Depicted in EBS CERFA (ERM West 1994)

3 Bold denotes concentrations that exceed the screening level

4 Approximate direction and velocity of groundwater movement

65 0 65 130 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-18
CONCENTRATIONS OF 1,4-DICHLOROBENZENE IN SITE 16 GROUNDWATER
PAGE 2 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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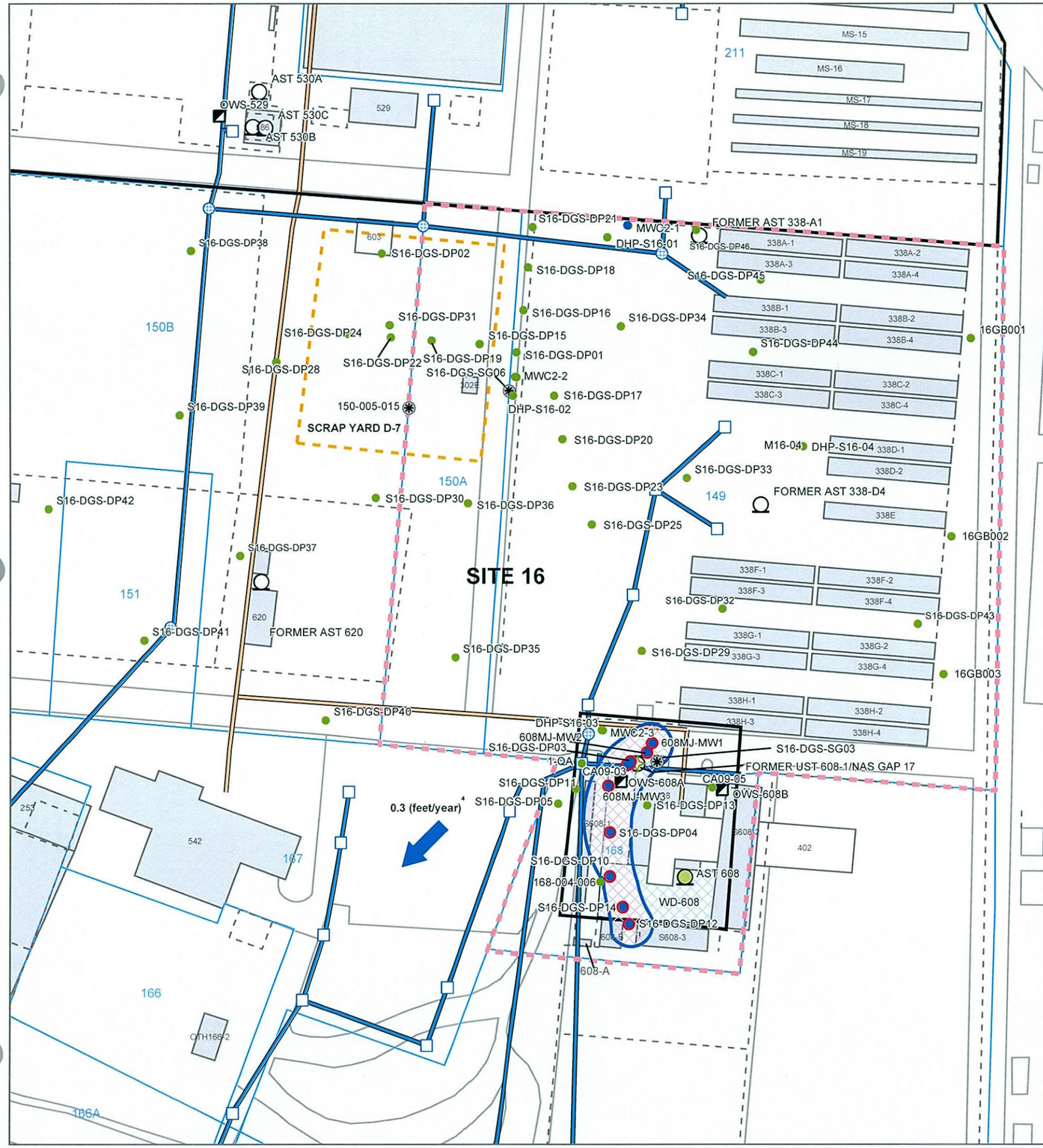

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[3]	Qualifier
168-004-006	11/29/95	9.0-10.0	1	U
16GB001	8/9/94	5.0-6.0	1	U
16GB002	8/9/94	5.0-6.0	1	U
16GB003	8/9/94	5.0-6.0	1	U
1-QA	7/23/01	0.0-0.0	2	U
608MJ-MW1	6/22/01	NA	**10**	
608MJ-MW2	6/22/01	NA	**35**	
608MJ-MW2	6/17/02	NA	**10**	
608MJ-MW2	12/24/02	NA	**59**	
608MJ-MW3	6/22/01	NA	**4**	
CA09-03	4/26/00	0.0-10.0	**9.8**	
CA09-05	4/24/00	3.0-8.0	1	U
DHP-S16-01	7/22/94	36.0-38.0	1	U
DHP-S16-02	7/21/94	26.8-28.8	1	U
DHP-S16-03	7/22/94	24.5-26.5	1	U
DHP-S16-04	8/26/94	21.0-24.0	1	U
M16-04	12/1/94	3.0-13.0	1	U
M16-04	2/28/95	3.0-13.0	1	U
M16-04	6/28/95	3.0-13.0	1	U
M16-04	8/18/95	3.0-13.0	1	U
M16-04	11/11/97	3.0-13.0	1	U
M16-04	2/6/98	3.0-13.0	1	U
M16-04	10/11/01	3.0-13.0	2	U
MWC2-1	8/29/90	5.0-15.0	5	U
MWC2-1	10/21/94	5.0-15.0	1	U
MWC2-1	2/28/95	5.0-15.0	1	U
MWC2-1	6/28/95	5.0-15.0	1	U
MWC2-1	8/17/95	5.0-15.0	1	U
MWC2-1	7/6/01	5.0-15.0	2	U
MWC2-1	6/17/02	5.0-15.0	0.5	U
MWC2-1	9/4/02	5.0-15.0	0.5	U
MWC2-1	12/24/02	5.0-15.0	0.2	J
MWC2-1	4/11/03	5.0-15.0	0.5	U
MWC2-2	10/18/90	5.0-15.0	5	U
MWC2-2	10/24/94	5.0-15.0	100	U
MWC2-2	2/28/95	5.0-15.0	1	U
MWC2-2	6/28/95	5.0-15.0	1	U
MWC2-2	8/18/95	5.0-15.0	1	U
MWC2-2	6/21/00	5.0-15.0	5	U
MWC2-2	6/22/01	5.0-15.0	2	U
MWC2-2	6/17/02	5.0-15.0	1	U
MWC2-2	9/4/02	5.0-15.0	0.5	U
MWC2-2	12/26/02	5.0-15.0	3.1	U
MWC2-2	4/10/03	5.0-15.0	0.5	U
MWC2-3	8/30/90	5.0-15.0	5	U
MWC2-3	10/24/94	5.0-15.0	1	U
MWC2-3	2/28/95	5.0-15.0	1	U
MWC2-3	6/29/95	5.0-15.0	1	U
MWC2-3	8/18/95	5.0-15.0	1	U
MWC2-3	6/22/01	5.0-15.0	2	U
MWC2-3	6/17/02	5.0-15.0	0.5	U
MWC2-3	9/4/02	5.0-15.0	0.5	U
MWC2-3	12/24/02	5.0-15.0	0.5	U
MWC2-3	4/11/03	5.0-15.0	0.5	U
OUTFALL Q	7/23/01	0.0-0.0	2	U
S16-DGS-DP01	7/27/01	8.0-10.0	1	U
S16-DGS-DP01	7/27/01	11.0-13.0	1	U
S16-DGS-DP01	7/27/01	13.0-15.0	100	U
S16-DGS-DP01	8/16/01	18.0-20.0	1	U
S16-DGS-DP01	8/16/01	25.0-27.0	1	U
S16-DGS-DP01	7/27/01	56.0-58.0	1	U
S16-DGS-DP02	7/17/01	7.0-9.0	1	U
S16-DGS-DP03	7/17/01	5.5-7.5	**2.5**	
S16-DGS-DP04	7/25/01	8.0-10.0	**2.6**	

TETRACHLOROETHENE DETECTED
TETRACHLOROETHENE NON-DETECTED
EXCEEDS SCREENING LEVEL[1]
TETRACHLOROETHENE PLUME[5]

ABOVEGROUND STORAGE TANK (AST)
Present
Removed

UNDERGROUND STORAGE TANK (UST)
Removed
SOIL GAS SAMPLING LOCATION
GENERATOR ACCUMULATION POINT (GAP)
CATCH BASIN
MANHOLE
OIL WATER SEPARATOR
FENCE
SANITARY SEWER LINE
STORM SEWER LINE
CORRECTIVE ACTION AREA (CAA)
CERCLA SITE BOUNDARY
SCRAP YARD D-7 APPROXIMATE LOCATION[2]
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
LAND COVER
WASHDOWN AREA (WD)

BUILDING
Present
Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Risk Based Screening Level is 0.66 ug/L (Based on 1E-06)

2 Depicted in EBS CERFA (ERM West 1994)

3 Bold denotes concentrations that exceed the screening level

4 Approximate direction and velocity of groundwater movement

5 Dashed lines depicts inferred plume boundary

65 0 65 130 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-19
CONCENTRATIONS OF TETRACHLOROETHENE IN SITE 16 GROUNDWATER
PAGE 1 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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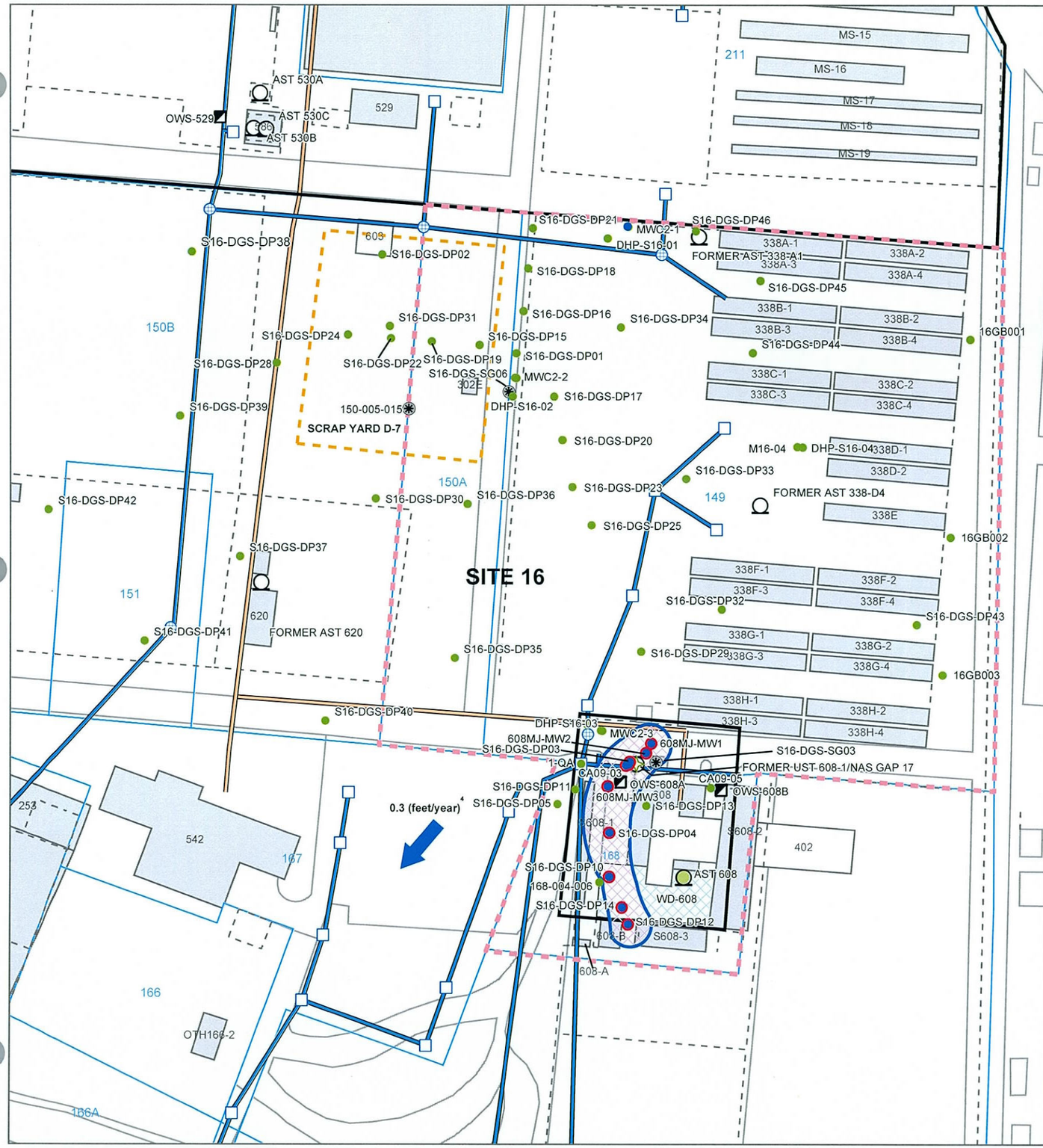

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[3]	Qualifier
S16-DGS-DP05	7/17/01	5.5-7.5	1	U
S16-DGS-DP10	8/13/01	5.0-7.0	**2.9**	
S16-DGS-DP11	8/13/01	5.0-7.0	1	U
S16-DGS-DP12	8/16/01	5.0-7.0	**1.6**	
S16-DGS-DP13	9/12/01	5.0-7.0	5	U
S16-DGS-DP14	8/23/01	5.0-7.0	**2.3**	
S16-DGS-DP15	8/23/01	8.0-10.0	1	U
S16-DGS-DP15	8/23/01	12.0-14.0	1	U
S16-DGS-DP15	8/23/01	16.0-18.0	1	U
S16-DGS-DP16	8/23/01	8.0-10.0	1	U
S16-DGS-DP16	8/23/01	12.0-14.0	1	U
S16-DGS-DP16	8/23/01	16.0-18.0	1	U
S16-DGS-DP17	8/23/01	8.0-10.0	1	U
S16-DGS-DP17	8/23/01	12.0-14.0	1	U
S16-DGS-DP17	8/23/01	16.0-18.0	1	U
S16-DGS-DP18	9/10/01	8.0-10.0	10	U
S16-DGS-DP18	9/10/01	12.0-14.0	2	U
S16-DGS-DP19	9/10/01	8.0-10.0	10	UJ
S16-DGS-DP19	9/10/01	12.0-14.0	2	U
S16-DGS-DP20	9/10/01	8.0-10.0	2	U
S16-DGS-DP21	9/21/01	8.0-10.0	0.5	UJ
S16-DGS-DP22	9/21/01	8.0-10.0	0.5	UJ
S16-DGS-DP22	9/21/01	12.0-14.0	0.5	UJ
S16-DGS-DP22	10/8/01	16.0-18.0	0.5	U
S16-DGS-DP23	9/21/01	8.0-10.0	0.5	U
S16-DGS-DP24	10/8/01	8.0-10.0	0.5	U
S16-DGS-DP24	10/8/01	12.0-14.0	0.5	U
S16-DGS-DP24	10/8/01	16.0-18.0	0.5	U
S16-DGS-DP25	10/8/01	8.0-10.0	0.5	U
S16-DGS-DP28	10/18/01	8.0-10.0	2	U
S16-DGS-DP28	10/18/01	12.0-14.0	2	U
S16-DGS-DP28	10/18/01	16.0-18.0	2	U
S16-DGS-DP29	10/18/01	8.0-10.0	2	UJ
S16-DGS-DP29	10/18/01	12.0-14.0	2	U
S16-DGS-DP30	10/18/01	8.0-10.0	2	U
S16-DGS-DP30	10/18/01	12.0-14.0	2	U
S16-DGS-DP31	10/18/01	8.0-10.0	2	U
S16-DGS-DP31	10/18/01	12.0-14.0	2	U
S16-DGS-DP32	4/22/02	8.0-10.0	2	U
S16-DGS-DP32	4/22/02	12.0-14.0	2	U
S16-DGS-DP33	4/22/02	8.0-10.0	2	U
S16-DGS-DP33	4/22/02	12.0-14.0	2	U
S16-DGS-DP34	4/22/02	8.0-10.0	500	U
S16-DGS-DP34	4/22/02	12.0-14.0	2	U
S16-DGS-DP35	4/22/02	8.0-10.0	2	U
S16-DGS-DP35	4/22/02	12.0-14.0	2	U
S16-DGS-DP36	4/22/02	8.0-10.0	2	U
S16-DGS-DP36	4/22/02	12.0-14.0	10	U
S16-DGS-DP37	4/22/02	8.0-10.0	2	U
S16-DGS-DP37	4/22/02	12.0-14.0	10	U
S16-DGS-DP37	4/22/02	20.0-22.0	2	U
S16-DGS-DP38	4/19/02	8.0-10.0	2	U
S16-DGS-DP38	4/19/02	12.0-14.0	2	U
S16-DGS-DP39	4/19/02	8.0-10.0	2	U
S16-DGS-DP39	4/19/02	12.0-14.0	2	U
S16-DGS-DP40	5/9/02	8.0-10.0	2	U
S16-DGS-DP40	5/9/02	12.0-14.0	2	U
S16-DGS-DP41	5/9/02	8.0-10.0	2	U
S16-DGS-DP41	5/9/02	12.0-14.0	2	U
S16-DGS-DP42	5/9/02	8.0-10.0	2	U
S16-DGS-DP42	5/9/02	12.0-14.0	2	U
S16-DGS-DP43	5/9/02	8.0-10.0	2	U
S16-DGS-DP44	5/10/02	8.0-10.0	2	U
S16-DGS-DP45	5/9/02	8.0-10.0	2	U
S16-DGS-DP46	5/10/02	8.0-10.0	2	U
S16-DGS-VE02	8/6/01	5.0-7.0	1	U

TETRACHLOROETHENE DETECTED
TETRACHLOROETHENE NON-DETECTED
EXCEEDS SCREENING LEVEL[1]
TETRACHLOROETHENE PLUME[5]

ABOVEGROUND STORAGE TANK (AST)
Present
Removed

UNDERGROUND STORAGE TANK (UST)
Removed
SOIL GAS SAMPLING LOCATION
GENERATOR ACCUMULATION POINT (GAP)
CATCH BASIN
MANHOLE
OIL WATER SEPARATOR
FENCE
SANITARY SEWER LINE
STORM SEWER LINE
CORRECTIVE ACTION AREA (CAA)
CERCLA SITE BOUNDARY
SCRAP YARD D-7 APPROXIMATE LOCATION[2]
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
LAND COVER
WASHDOWN AREA (WD)

BUILDING
Present
Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Risk Based Screening Level is 0.66 ug/L (Based on 1E-06)

2 Depicted in EBS CERFA (ERM West 1994)

3 Bold denotes concentrations that exceed the screening level

4 Approximate direction and velocity of groundwater movement

5 Dashed lines depicts inferred plume boundary

65 0 65 130 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-19
CONCENTRATIONS OF TETRACHLOROETHENE IN SITE 16 GROUNDWATER
PAGE 2 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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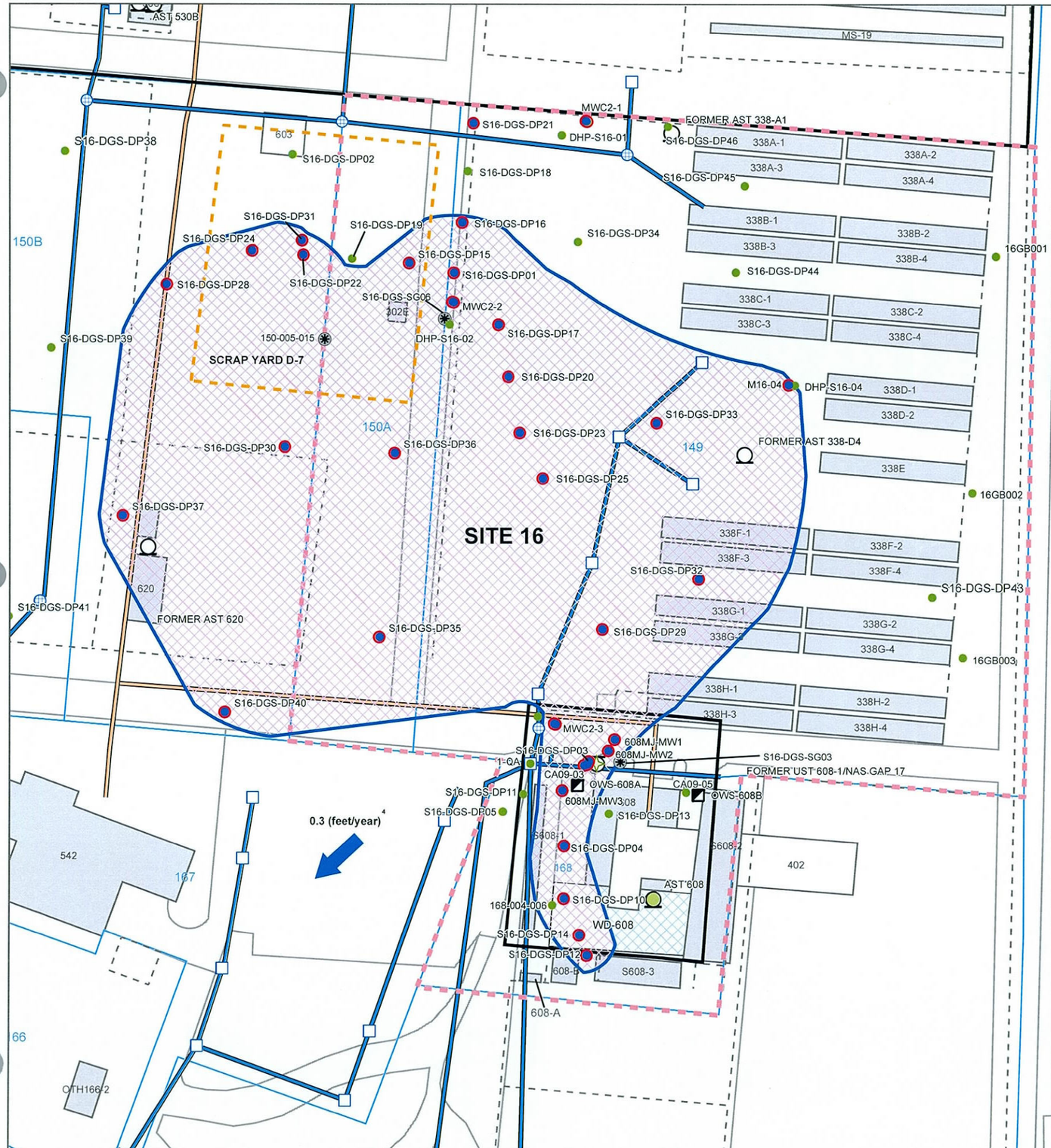

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[3]	Qualifier
168-004-006	11/29/95	9.0-10.0	1	U
16GB001	8/9/94	5.0-6.0	1	U
16GB002	8/9/94	5.0-6.0	1	U
16GB003	8/9/94	5.0-6.0	1	U
1-QA	7/23/01	NA	2	U
608MJ-MW1	6/22/01	NA	**1**	J
608MJ-MW2	6/22/01	NA	**10**	
608MJ-MW2	6/17/02	NA	**4.2**	
608MJ-MW2	12/24/02	NA	**34**	
608MJ-MW3	6/22/01	NA	**4**	
CA09-03	4/26/00	0.0-10.0	**5.4**	
CA09-05	4/24/00	3.0-8.0	1	U
DHP-S16-01	7/22/94	36.0-41.0	1	U
DHP-S16-02	7/21/94	26.8-31.8	1	U
DHP-S16-03	7/22/94	24.5-29.5	1	U
DHP-S16-04	8/26/94	21.0-24.0	1	U
M16-04	12/1/94	3.0-13.0	**1**	
M16-04	2/28/95	3.0-13.0	1	U
M16-04	6/28/95	3.0-13.0	**1**	
M16-04	8/18/95	3.0-13.0	**1**	
M16-04	11/11/97	3.0-13.0	1	U
M16-04	2/6/98	3.0-13.0	1	U
M16-04	10/11/01	3.0-13.0	**0.4**	J
MWC2-1	8/29/90	5.0-15.0	5	U
MWC2-1	10/21/94	5.0-15.0	1	U
MWC2-1	2/28/95	5.0-15.0	1	U
MWC2-1	6/28/95	5.0-15.0	1	U
MWC2-1	8/17/95	5.0-15.0	1	U
MWC2-1	7/6/01	5.0-15.0	2	U
MWC2-1	6/17/02	5.0-15.0	0.5	U
MWC2-1	9/4/02	5.0-15.0	0.5	U
MWC2-1	12/24/02	5.0-15.0	0.2	J
MWC2-1	4/11/03	5.0-15.0	0.5	U
MWC2-2	10/18/90	5.0-15.0	**7**	
MWC2-2	10/24/94	5.0-15.0	100	U
MWC2-2	2/28/95	5.0-15.0	**10**	
MWC2-2	6/28/95	5.0-15.0	**17**	
MWC2-2	8/18/95	5.0-15.0	**15**	
MWC2-2	6/21/00	5.0-15.0	**3**	J
MWC2-2	6/22/01	5.0-15.0	**3**	
MWC2-2	6/17/02	5.0-15.0	**3.8**	
MWC2-2	9/4/02	5.0-15.0	**4.4**	
MWC2-2	12/26/02	5.0-15.0	**3.4**	
MWC2-2	4/10/03	5.0-15.0	**2.9**	
MWC2-3	8/30/90	5.0-15.0	5	U
MWC2-3	10/24/94	5.0-15.0	1	U
MWC2-3	2/28/95	5.0-15.0	1	U
MWC2-3	6/29/95	5.0-15.0	1	U
MWC2-3	8/18/95	5.0-15.0	**0.7**	J
MWC2-3	6/22/01	5.0-15.0	2	U
MWC2-3	6/17/02	5.0-15.0	**0.4**	J
MWC2-3	9/4/02	5.0-15.0	**0.3**	J
MWC2-3	12/24/02	5.0-15.0	**0.3**	J
MWC2-3	4/11/03	5.0-15.0	0.5	UJ
OUTFALL Q	7/23/01	0.0-0.0	2	U
S16-DGS-DP01	7/27/01	8.0-10.0	**1.7**	
S16-DGS-DP01	7/27/01	8.0-10.0	**2**	J
S16-DGS-DP01	7/27/01	11.0-13.0	1	U
S16-DGS-DP01	7/27/01	13.0-15.0	100	U
S16-DGS-DP01	7/27/01	11.0-13.0	1	U
S16-DGS-DP01	8/16/01	18.0-20.0	1	U
S16-DGS-DP01	8/16/01	25.0-27.0	1	U
S16-DGS-DP02	7/17/01	7.0-9.0	1	U
S16-DGS-DP03	7/17/01	5.5-7.5	**1.7**	
S16-DGS-DP03	7/17/01	5.5-7.5	**1**	J
S16-DGS-DP04	7/25/01	8.0-10.0	**1.6**	
S16-DGS-DP05	7/17/01	5.5-7.5	1	U

TRICHLOROETHENE DETECTED
TRICHLOROETHENE NON-DETECTED
EXCEEDS SCREENING LEVEL[1]
TRICHLOROETHENE PLUME[5]

ABOVEGROUND STORAGE TANK (AST)
Present
Removed

UNDERGROUND STORAGE TANK (UST)
Removed
SOIL GAS SAMPLING LOCATION
GENERATOR ACCUMULATION POINT (GAP)
CATCH BASIN
MANHOLE
OIL WATER SEPARATOR
FENCE
SANITARY SEWER LINE
STORM SEWER LINE
CORRECTIVE ACTION AREA (CAA)
CERCLA SITE BOUNDARY
SCRAP YARD D-7 APPROXIMATE LOCATION[2]
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
LAND COVER
WASHDOWN AREA (WD)

BUILDING
Present
Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Risk Based Screening Level is 0.028 ug/L (Based on 1E-06)

2 Depicted in EBS CERFA (ERM West 1994)

3 Bold denotes concentrations that exceed the screening level

4 Approximate direction and velocity of groundwater movement

5 Dashed lines depicts inferred plume boundary

55 0 55 110 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-20
CONCENTRATIONS OF TRICHLOROETHENE IN SITE 16 GROUNDWATER
PAGE 1 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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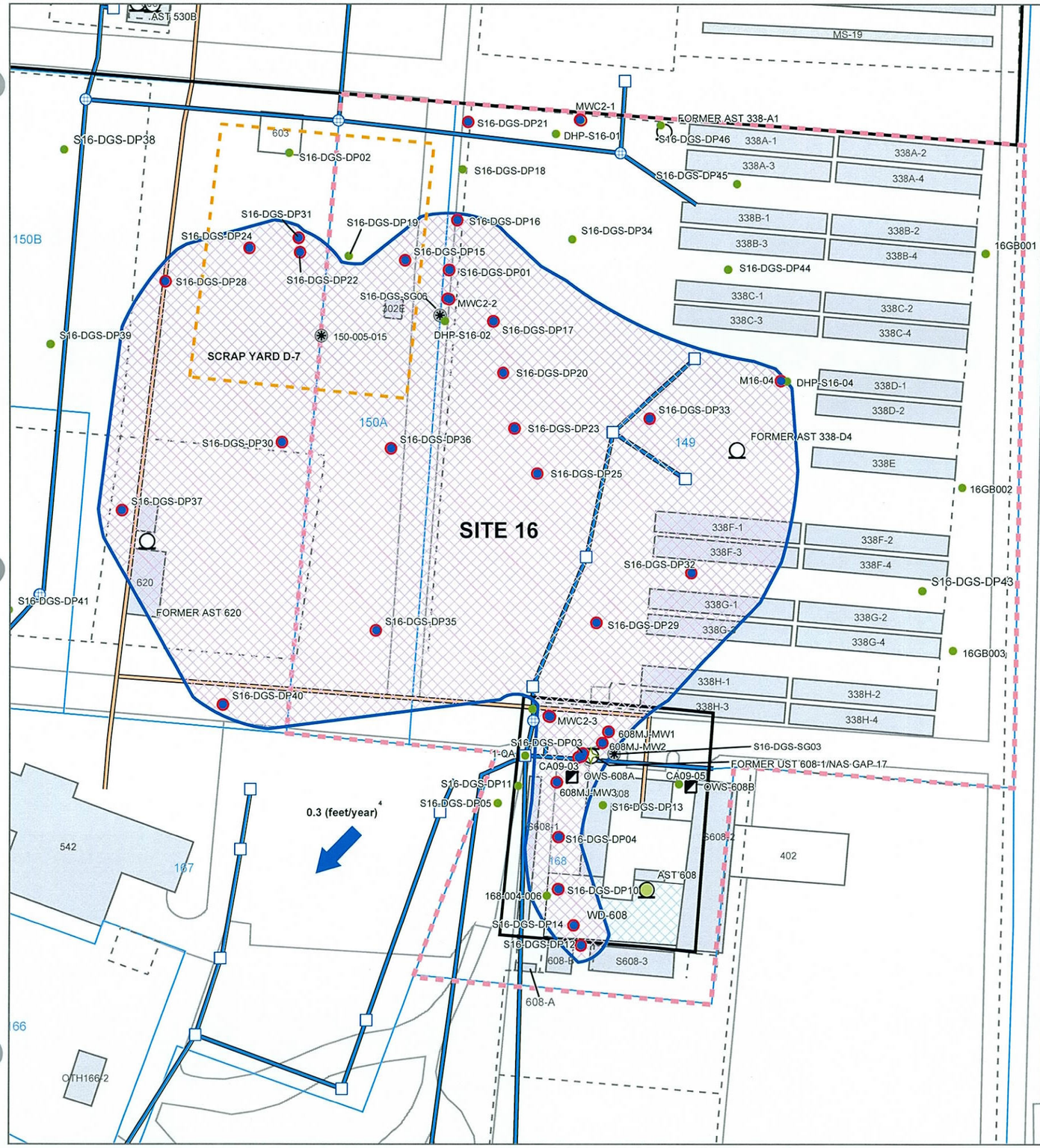

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[3]	Qualifier
S16-DGS-DP10	8/13/01	5.0-7.0	**2.1**	
S16-DGS-DP11	8/13/01	5.0-7.0	1	U
S16-DGS-DP12	8/16/01	5.0-7.0	1	U
S16-DGS-DP12	8/16/01	5.0-7.0	**0.4**	J
S16-DGS-DP13	9/12/01	5.0-7.0	5	U
S16-DGS-DP14	8/23/01	5.0-7.0	**1.5**	
S16-DGS-DP15	8/23/01	8.0-10.0	**2.2**	
S16-DGS-DP15	8/23/01	12.0-14.0	1	U
S16-DGS-DP15	8/23/01	16.0-18.0	1	U
S16-DGS-DP16	8/23/01	8.0-10.0	**1.9**	
S16-DGS-DP16	8/23/01	12.0-14.0	1	U
S16-DGS-DP16	8/23/01	16.0-18.0	1	U
S16-DGS-DP17	8/23/01	8.0-10.0	**7.1**	
S16-DGS-DP17	8/23/01	12.0-14.0	1	U
S16-DGS-DP17	8/23/01	16.0-18.0	1	U
S16-DGS-DP18	9/10/01	8.0-10.0	10	U
S16-DGS-DP18	9/10/01	12.0-14.0	2	U
S16-DGS-DP19	9/10/01	8.0-10.0	10	UJ
S16-DGS-DP19	9/10/01	12.0-14.0	2	U
S16-DGS-DP20	9/10/01	8.0-10.0	**4**	
S16-DGS-DP21	9/21/01	8.0-10.0	**0.7**	J
S16-DGS-DP22	9/21/01	8.0-10.0	**2.3**	J
S16-DGS-DP22	9/21/01	12.0-14.0	**0.9**	J
S16-DGS-DP22	10/8/01	16.0-18.0	0.5	U
S16-DGS-DP23	9/21/01	8.0-10.0	**5.9**	
S16-DGS-DP24	10/8/01	8.0-10.0	**3.7**	
S16-DGS-DP24	10/8/01	12.0-14.0	0.5	U
S16-DGS-DP24	10/8/01	16.0-18.0	0.5	U
S16-DGS-DP25	10/8/01	8.0-10.0	**0.5**	
S16-DGS-DP28	10/18/01	8.0-10.0	**0.7**	J
S16-DGS-DP28	10/18/01	12.0-14.0	2	U
S16-DGS-DP28	10/18/01	16.0-18.0	2	U
S16-DGS-DP29	10/18/01	8.0-10.0	**2**	J
S16-DGS-DP29	10/18/01	12.0-14.0	2	U
S16-DGS-DP30	10/18/01	8.0-10.0	**6**	
S16-DGS-DP30	10/18/01	12.0-14.0	2	U
S16-DGS-DP31	10/18/01	8.0-10.0	**2**	J
S16-DGS-DP31	10/18/01	12.0-14.0	2	U
S16-DGS-DP32	4/22/02	8.0-10.0	**2**	J
S16-DGS-DP32	4/22/02	12.0-14.0	2	U
S16-DGS-DP33	4/22/02	8.0-10.0	**0.3**	J
S16-DGS-DP33	4/22/02	12.0-14.0	2	U
S16-DGS-DP34	4/22/02	8.0-10.0	500	U
S16-DGS-DP34	4/22/02	12.0-14.0	2	U
S16-DGS-DP35	4/22/02	8.0-10.0	**0.8**	J
S16-DGS-DP35	4/22/02	12.0-14.0	2	U
S16-DGS-DP36	4/22/02	8.0-10.0	**1**	J
S16-DGS-DP36	4/22/02	12.0-14.0	10	U
S16-DGS-DP37	4/22/02	8.0-10.0	**3**	
S16-DGS-DP37	4/22/02	12.0-14.0	10	U
S16-DGS-DP37	5/9/02	20.0-22.0	2	U
S16-DGS-DP38	4/19/02	8.0-10.0	2	U
S16-DGS-DP38	4/19/02	12.0-14.0	2	U
S16-DGS-DP39	4/19/02	8.0-10.0	2	U
S16-DGS-DP39	4/19/02	12.0-14.0	2	U
S16-DGS-DP40	5/9/02	8.0-10.0	**5**	
S16-DGS-DP40	5/9/02	12.0-14.0	2	U
S16-DGS-DP41	5/9/02	8.0-10.0	2	U
S16-DGS-DP41	5/9/02	12.0-14.0	2	U
S16-DGS-DP42	5/9/02	8.0-10.0	2	U
S16-DGS-DP42	5/9/02	12.0-14.0	2	U
S16-DGS-DP43	5/9/02	8.0-10.0	2	U
S16-DGS-DP44	5/10/02	8.0-10.0	2	U
S16-DGS-DP45	5/9/02	8.0-10.0	2	U
S16-DGS-DP46	5/10/02	8.0-10.0	2	U
S16-DGS-VE02	8/6/01	5.0-7.0	1	U

TRICHLOROETHENE DETECTED
TRICHLOROETHENE NON-DETECTED
EXCEEDS SCREENING LEVEL[1]
TRICHLOROETHENE PLUME[5]

ABOVEGROUND STORAGE TANK (AST)
Present
Removed

UNDERGROUND STORAGE TANK (UST)
Removed
SOIL GAS SAMPLING LOCATION
GENERATOR ACCUMULATION POINT (GAP)
CATCH BASIN
MANHOLE
OIL WATER SEPARATOR
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SANITARY SEWER LINE
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SCRAP YARD D-7 APPROXIMATE LOCATION[2]
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BUILDING
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55 0 55 110 Feet

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Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-20
CONCENTRATIONS OF TRICHLOROETHENE IN SITE 16 GROUNDWATER
PAGE 2 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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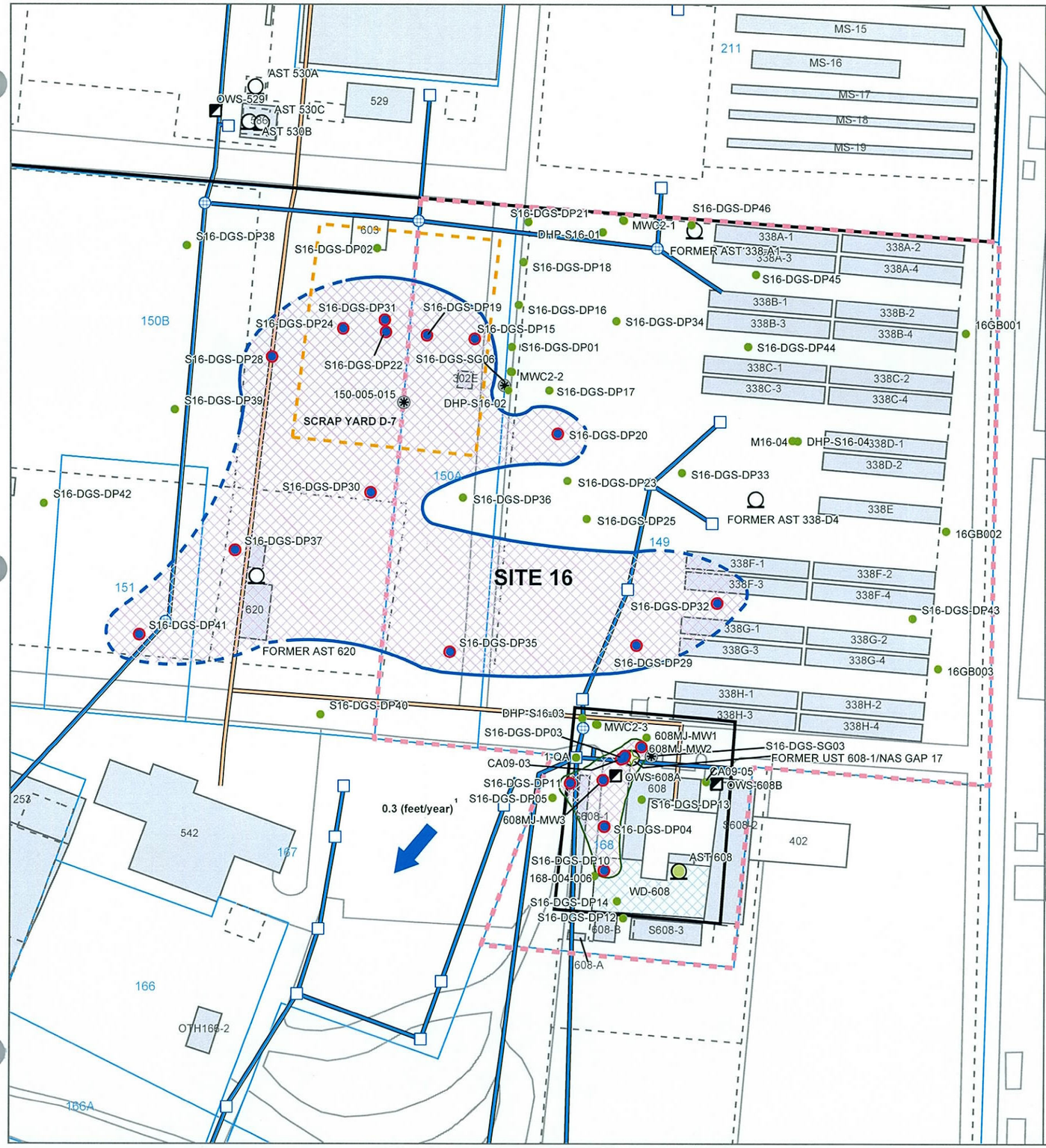

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[2]	Qualifier
168-004-006	11/29/95	9.0-10.0	0.5	U
16GB001	8/9/94	5.0-6.0	0.5	U
16GB002	8/9/94	5.0-6.0	0.5	U
16GB003	8/9/94	5.0-6.0	0.5	U
1-QA	7/23/01	0.0-0.0	0.5	U
608MJ-MW1	6/22/01	NA	0.5	U
608MJ-MW2	6/22/01	NA	**4**	
608MJ-MW2	6/17/02	NA	**4.3**	
608MJ-MW2	12/24/02	NA	**0.5**	
608MJ-MW3	6/22/01	NA	**4**	
CA09-03	4/26/00	0.0-10.0	**21**	
CA09-05	4/24/00	3.0-8.0	0.5	U
DHP-S16-01	7/22/94	36.0-41.0	0.5	U
DHP-S16-02	7/21/94	26.8-31.8	0.5	U
DHP-S16-03	7/22/94	24.5-29.5	0.5	U
DHP-S16-04	8/26/94	21.0-24.0	0.5	U
M16-04	12/1/94	3.0-13.0	0.5	U
M16-04	2/28/95	3.0-13.0	0.5	U
M16-04	6/28/95	3.0-13.0	0.5	U
M16-04	8/18/95	3.0-13.0	0.5	UJ
M16-04	11/11/97	3.0-13.0	0.5	U
M16-04	2/6/98	3.0-13.0	0.5	U
M16-04	10/11/01	3.0-13.0	0.5	U
MWC2-1	8/29/90	5.0-15.0	10	U
MWC2-1	10/21/94	5.0-15.0	0.5	U
MWC2-1	2/28/95	5.0-15.0	0.5	U
MWC2-1	6/28/95	5.0-15.0	0.5	U
MWC2-1	8/17/95	5.0-15.0	0.5	U
MWC2-1	7/6/01	5.0-15.0	0.5	U
MWC2-1	6/17/02	5.0-15.0	0.5	U
MWC2-1	9/4/02	5.0-15.0	0.5	U
MWC2-1	12/24/02	5.0-15.0	0.5	U
MWC2-1	4/11/03	5.0-15.0	0.5	U
MWC2-2	10/18/90	5.0-15.0	10	U
MWC2-2	10/24/94	5.0-15.0	50	U
MWC2-2	2/28/95	5.0-15.0	0.6	U
MWC2-2	6/28/95	5.0-15.0	0.5	U
MWC2-2	8/18/95	5.0-15.0	0.5	U
MWC2-2	6/21/00	5.0-15.0	5	U
MWC2-2	6/22/01	5.0-15.0	0.5	U
MWC2-2	6/17/02	5.0-15.0	1	U
MWC2-2	9/4/02	5.0-15.0	0.5	U
MWC2-2	12/26/02	5.0-15.0	3.1	U
MWC2-2	4/10/03	5.0-15.0	0.5	U
MWC2-3	8/30/90	5.0-15.0	10	U
MWC2-3	10/24/94	5.0-15.0	0.5	U
MWC2-3	2/28/95	5.0-15.0	0.5	U
MWC2-3	6/29/95	5.0-15.0	0.5	U
MWC2-3	8/18/95	5.0-15.0	0.5	U
MWC2-3	6/22/01	5.0-15.0	0.5	U
MWC2-3	6/17/02	5.0-15.0	0.5	U
MWC2-3	9/4/02	5.0-15.0	0.5	U
MWC2-3	12/24/02	5.0-15.0	0.5	U
MWC2-3	4/11/03	5.0-15.0	0.5	U
S16-DGS-DP01	7/27/01	8.0-10.0	1	U
S16-DGS-DP01	7/27/01	11.0-13.0	1	U
S16-DGS-DP01	7/27/01	13.0-15.0	100	U
S16-DGS-DP01	8/16/01	18.0-20.0	1	U
S16-DGS-DP01	8/16/01	25.0-27.0	1	U
S16-DGS-DP01	7/27/01	56.0-58.0	1	U
S16-DGS-DP02	7/17/01	7.0-9.0	1	U
S16-DGS-DP03	7/17/01	5.5-7.5	**11**	
S16-DGS-DP04	7/25/01	8.0-10.0	**4.7**	
S16-DGS-DP05	7/17/01	5.5-7.5	1	U

- VINYL CHLORIDE DETECTED
- VINYL CHLORIDE NON-DETECTED
- EXCEEDS SCREENING LEVEL[3]
- VINYL CHLORIDE PLUME[4]

ABOVEGROUND STORAGE TANK (AST)
- Present
- Removed

UNDERGROUND STORAGE TANK (UST)
- Present
- Removed
- SOIL GAS SAMPLING LOCATION
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BAIN
- MANHOLE
- OIL WATER SEPARATOR
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CORRECTIVE ACTION AREA (CAA)
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[5]
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- LAND COVER
- WASHDOWN AREA (WD)

BUILDING
- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
U = Non-Detected

1 Approximate direction and velocity of groundwater movement

2 Bold denotes concentrations that exceed the screening level

3 Risk Based Screening Level is 0.02 ug/L (Based on 1E-06)

4 Dashed lines depicts inferred plume boundary

5 Depicted in EBS CERFA (ERM West 1994)

65 0 65 130 Feet

SulTech

Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-21
CONCENTRATIONS OF VINYL CHLORIDE IN SITE 16 GROUNDWATER
PAGE 1 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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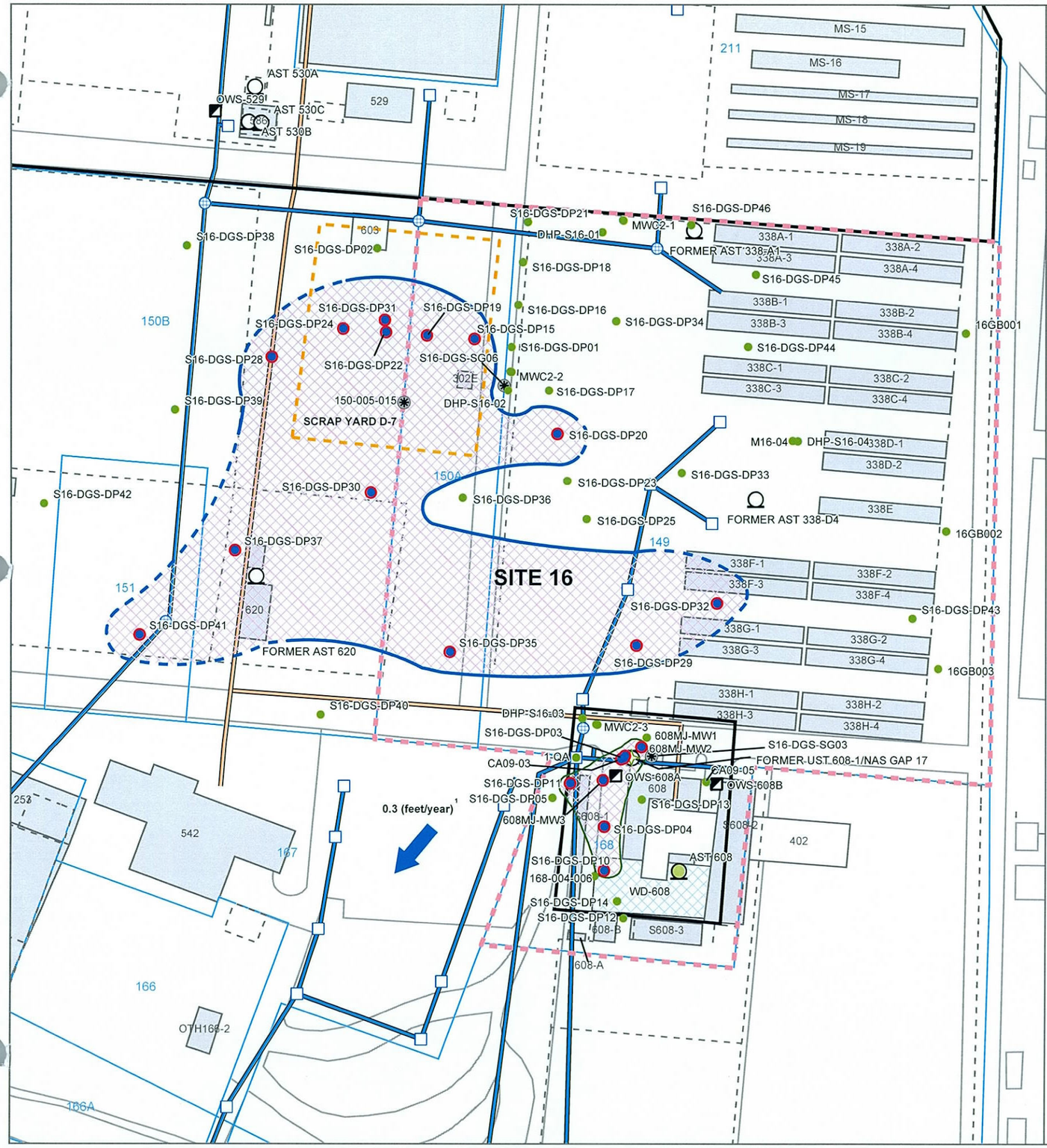

04/24/2005 U:\almda_sa\DO031\FS\mxd\Section 3\fig_3-18.mxd TtEMI-SA T. Munley

Point Name	Sample Date	Sample Depth (feet)	Concentration (ug/L)[2]	Qualifier
S16-DGS-DP10	8/13/01	5.0-7.0	**2.1**	
S16-DGS-DP11	8/13/01	5.0-7.0	**0.7**	J
S16-DGS-DP12	8/16/01	5.0-7.0	1	U
S16-DGS-DP13	9/12/01	5.0-7.0	10	U
S16-DGS-DP14	8/23/01	5.0-7.0	1	U
S16-DGS-DP15	8/23/01	8.0-10.0	1	U
S16-DGS-DP15	8/23/01	12.0-14.0	**1.7**	
S16-DGS-DP15	8/23/01	16.0-18.0	1	U
S16-DGS-DP16	8/23/01	8.0-10.0	1	U
S16-DGS-DP16	8/23/01	12.0-14.0	1	U
S16-DGS-DP16	8/23/01	16.0-18.0	1	U
S16-DGS-DP17	8/23/01	8.0-10.0	1	U
S16-DGS-DP17	8/23/01	12.0-14.0	1	U
S16-DGS-DP17	8/23/01	16.0-18.0	1	U
S16-DGS-DP18	9/10/01	8.0-10.0	3	U
S16-DGS-DP18	9/10/01	12.0-14.0	0.5	U
S16-DGS-DP19	9/10/01	8.0-10.0	3	UJ
S16-DGS-DP19	9/10/01	12.0-14.0	**0.9**	
S16-DGS-DP20	9/10/01	8.0-10.0	**0.3**	J
S16-DGS-DP21	9/21/01	8.0-10.0	0.5	UJ
S16-DGS-DP22	9/21/01	8.0-10.0	0.5	UJ
S16-DGS-DP22	9/21/01	12.0-14.0	**1.1**	J
S16-DGS-DP22	10/8/01	16.0-18.0	0.5	U
S16-DGS-DP23	9/21/01	8.0-10.0	0.5	U
S16-DGS-DP24	10/8/01	8.0-10.0	0.5	U
S16-DGS-DP24	10/8/01	12.0-14.0	**1.1**	
S16-DGS-DP24	10/8/01	16.0-18.0	0.5	U
S16-DGS-DP25	10/8/01	8.0-10.0	0.5	U
S16-DGS-DP28	10/18/01	8.0-10.0	**1**	
S16-DGS-DP28	10/18/01	12.0-14.0	**0.4**	J
S16-DGS-DP28	10/18/01	16.0-18.0	0.5	U
S16-DGS-DP29	10/18/01	8.0-10.0	0.5	UJ
S16-DGS-DP29	10/18/01	12.0-14.0	**2**	
S16-DGS-DP30	10/18/01	8.0-10.0	**0.4**	J
S16-DGS-DP30	10/18/01	12.0-14.0	**1**	
S16-DGS-DP31	10/18/01	8.0-10.0	**0.5**	J
S16-DGS-DP31	10/18/01	12.0-14.0	**0.7**	
S16-DGS-DP32	4/22/02	8.0-10.0	**0.6**	
S16-DGS-DP32	4/22/02	12.0-14.0	0.5	U
S16-DGS-DP33	4/22/02	8.0-10.0	0.5	U
S16-DGS-DP33	4/22/02	12.0-14.0	0.5	U
S16-DGS-DP34	4/22/02	8.0-10.0	130	U
S16-DGS-DP34	4/22/02	12.0-14.0	0.5	U
S16-DGS-DP35	4/22/02	8.0-10.0	0.5	U
S16-DGS-DP35	4/22/02	12.0-14.0	0.3	J
S16-DGS-DP36	4/22/02	8.0-10.0	0.5	U
S16-DGS-DP36	4/22/02	12.0-14.0	3	U
S16-DGS-DP37	4/22/02	8.0-10.0	**2**	
S16-DGS-DP37	5/9/02	12.0-14.0	**2**	J
S16-DGS-DP37	5/9/02	20.0-22.0	0.5	U
S16-DGS-DP38	4/19/02	8.0-10.0	0.5	U
S16-DGS-DP38	4/19/02	12.0-14.0	0.5	U
S16-DGS-DP39	4/19/02	8.0-10.0	0.5	U
S16-DGS-DP39	4/19/02	12.0-14.0	0.5	U
S16-DGS-DP40	5/9/02	8.0-10.0	0.5	U
S16-DGS-DP40	5/9/02	12.0-14.0	0.5	U
S16-DGS-DP41	5/9/02	8.0-10.0	0.5	U
S16-DGS-DP41	5/9/02	12.0-14.0	**2**	
S16-DGS-DP42	5/9/02	8.0-10.0	0.5	U
S16-DGS-DP42	5/9/02	12.0-14.0	0.5	U
S16-DGS-DP43	5/9/02	8.0-10.0	0.5	U
S16-DGS-DP44	5/10/02	8.0-10.0	0.5	U
S16-DGS-DP45	5/9/02	8.0-10.0	0.5	U
S16-DGS-DP46	5/10/02	8.0-10.0	0.5	U

- VINYL CHLORIDE DETECTED
- VINYL CHLORIDE NON-DETECTED
- EXCEEDS SCREENING LEVEL[3]
- VINYL CHLORIDE PLUME[4]

ABOVEGROUND STORAGE TANK (AST)
- Present
- Removed

UNDERGROUND STORAGE TANK (UST)
- Present
- Removed
- SOIL GAS SAMPLING LOCATION
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- OIL WATER SEPARATOR
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CORRECTIVE ACTION AREA (CAA)
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[5]
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- LAND COVER
- WASHDOWN AREA (WD)

BUILDING
- Present
- Removed

Notes:
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

J = Estimated
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1 Approximate direction and velocity of groundwater movement

2 Bold denotes concentrations that exceed the screening level

3 Risk Based Screening Level is 0.02 ug/L (Based on 1E-06)

4 Dashed lines depicts inferred plume boundary

5 Depicted in EBS CERFA (ERM West 1994)

65 0 65 130 Feet

SulTech

Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 3-21
CONCENTRATIONS OF VINYL CHLORIDE IN SITE 16 GROUNDWATER
PAGE 2 OF 2

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

N00236.003008
ALAMEDA POINT
SSIC NO. 5090.3.A.

TABLES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005

TABLE 3-1: HUMAN HEALTH RISK ASSESSMENT SUMMARY BY MEDIA - SOIL

Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Exposure Scenario			SITE 6[a]		SITE 7[a]		SITE 8[a]		SITE 16[a]	
			Cancer	Noncancer	Cancer	Noncancer	Cancer	Noncancer	Cancer	Noncancer
Residential										
0-2 feet bgs	RME	Adult	8E-06	<1	4E-05	<1	4E-05	<1	4E-05	<1
		Child	6E-06	<1	3E-05	1	2E-05	<1	3E-05	1
		Total Risk	1E-05	NA	8E-05	NA	6E-05	NA	7E-05	NA
	CTE	Adult	6E-07	<1	2E-07	<1	1E-06	<1	3E-06	<1
		Child	2E-06	<1	7E-06	<1	4E-06	<1	8E-06	<1
		Total Risk	3E-06	NA	7E-06	NA	5E-06	NA	1E-05	NA
0-8 feet bgs	RME	Adult	7E-06	<1	1E-04	2	2E-05	<1	3E-05	<1
		Child	5E-06	<1	9E-05	4	2E-05	<1	2E-05	1
		Total Risk	1E-05	NA	2E-04	NA	4E-05	NA	6E-05	NA
	CTE	Adult	6E-07	<1	4E-06	<1	9E-07	<1	2E-06	<1
		Child	2E-06	<1	2E-05	1	3E-06	<1	7E-06	<1
		Total Risk	2E-06	NA	2E-05	NA	4E-06	NA	9E-06	NA
Commercial/Industrial										
0-2 feet bgs	RME	Adult	2E-06	<1	9E-06	<1	7E-06	<1	8E-06	<1
		Total Risk	2E-06	NA	9E-06	NA	7E-06	NA	8E-06	NA
	CTE	Adult	9.E-08	<1	3.E-07	<1	2.E-07	<1	3.E-07	<1
		Total Risk	9.E-08	NA	3.E-07	NA	2.E-07	NA	3.E-07	NA
Recreational										
0-2 feet bgs	RME	Adult	5.E-07	<1	NA	NA	2.E-06	<1	2.E-06	<1
		Child	9.E-07	<1	NA	NA	5.E-06	<1	5.E-06	<1
		Total Risk	1.E-06	NA	NA	NA	7.E-06	NA	7.E-06	NA
	CTE	Adult	2.E-08	<1	NA	NA	4.E-08	<1	9.E-08	<1
		Child	1.E-07	<1	NA	NA	2.E-07	<1	5.E-07	<1
		Total Risk	1.E-07	NA	NA	NA	3.E-07	NA	6.E-07	NA
Construction Worker										
0-2 feet bgs	RME	Adult	2.E-07	<1	1.E-06	<1	7.E-07	<1	9.E-07	<1
		Total Risk	2.E-07	NA	1.E-06	NA	7.E-07	NA	9.E-07	NA
	CTE	Adult	1.E-08	<1	4.E-08	<1	2.E-08	<1	5.E-08	<1
		Total Risk	1.E-08	NA	4.E-08	NA	2.E-08	NA	5.E-08	NA
0-8 feet bgs	RME	Adult	2.E-07	<1	3.E-06	1	6.E-07	<1	8.E-07	<1
		Total Risk	2.E-07	NA	3.E-06	NA	6.E-07	NA	8.E-07	NA
	CTE	Adult	1.E-08	<1	8.E-08	<1	2.E-08	<1	4.E-08	<1
		Total Risk	1.E-08	NA	8.E-08	NA	2.E-08	NA	4.E-08	NA

TABLE 3-1: HUMAN HEALTH RISK ASSESSMENT SUMMARY BY MEDIA - SOIL (Continued)

Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

a	Includes risk from background
bgs	Below ground surface
CTE	Central tendency exposure
NA	Not applicable
RME	Reasonable maximum exposure

TABLE 3-2: HUMAN HEALTH RISK ASSESSMENT SUMMARY BY MEDIA - GROUNDWATER

Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Exposure Scenario			SITE 6[a]		SITE 7[a]		SITE 8[a]		SITE 16[a]	
			Cancer	Noncancer	Cancer	Noncancer	Cancer	Noncancer	Cancer	Noncancer
Residential										
Groundwater	RME	Adult	3.E-04	4	9.E-04	9	1.E-04	1	4.E-04	6
		Child	2.E-04	9	6.E-04	21	8.E-05	3	3.E-04	14
		Total Risk	5.E-04	NA	2.E-03	NA	2.E-04	NA	7.E-04	NA
	CTE	Adult	6.E-05	1	1.E-04	3	2.E-05	<1	8.E-05	1
		Child	1.E-04	4	2.E-04	9	4.E-05	1	9.E-05	3
		Total Risk	2.E-04	NA	3.E-04	NA	6.E-05	NA	2.E-04	NA
Commercial/Industrial										
Groundwater	RME	Adult	6.E-05	<1	2.E-11	<1	0.E+00	<1	1.E-05	<1
		Total Risk	6.E-05	NA	2.E-11	NA	0.E+00	NA	1.E-05	NA
	CTE	Adult	9.E-06	<1	5.E-12	<1	0.E+00	<1	2.E-06	<1
		Total Risk	9.E-06	NA	5.E-12	NA	0.E+00	NA	2.E-06	NA

Notes:

a	Includes risk from background
CTE	Central tendency exposure
NA	Not applicable
RME	Reasonable maximum exposure

TABLE 3-3: HUMAN HEALTH RISK ASSESSMENT SUMMARY BY MEDIA - SOIL DEBRIS AREA AT SITE 7

Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Exposure Scenario			SITE 7 DEBRIS LAYER[a]	
			Cancer	Noncancer
Residential				
0-8 feet bgs	RME	Adult	6.E-05	5
		Child	3.E-05	6
		Total Risk	1.E-04	NA
	CTE	Adult	4.E-06	<1
		Child	1.E-05	1
		Total Risk	1.E-05	NA
Commercial/Industrial				
0-8 feet bgs	RME	Adult	1.E-05	<1
		Total Risk	1.E-05	NA
	CTE	Adult	5.E-07	<1
		Total Risk	5.E-07	NA
Construction Worker				
0-8 feet bgs	RME	Adult	1.E-06	1
		Total Risk	1.E-06	NA
	CTE	Adult	7.E-08	<1
		Total Risk	7.E-08	NA

Notes:

a	Includes risk from background
bgs	Below ground surface
CTE	Central tendency exposure
NA	Not applicable
RME	Reasonable maximum exposure

TABLE 3-4: REMEDIAL INVESTIGATION SUMMARY

Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

CERCLA Site	Medium	Human Health Incremental Cancer Risk			Human Health Incremental Noncancer Risk		Ecological Risk			PAHs (mg/kg)			Elevated Lead Concentrations?	Recommend for Further Ation in an FS?
		$<10^{-06}$	10^{-06} to 10^{-04}	$>10^{-04}$	<1.0	≥1.0	No	Low	High	<0.62	0.62 to 1.0	>1.0		
6	Soil		X		X		X				X		No	No
	Groundwater			X	X		X				NA		No	Yes
7	Soil		X			X		X				X	No	No
	Debris Area		X			X	X				NA		Yes	Yes
	Groundwater			X		X		NA			NA		No	No
8	Soil		X		X			X				X	Yes	Yes
	Groundwater	X			X			NA			NA		No	No
16	Soil		X		X			X			X		No	No
	Groundwater			X	X		X				NA		Yes	Yes

Notes:

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
FS	Feasibility study
HHRA	Human health risk assessment
mg/kg	Milligram per kilogram

4.0 FEASIBILITY STUDY APPROACH

The purpose of this FS is to identify, screen, and evaluate potential remedial alternatives to address soil contamination at, Site 7 (lead, cadmium, and arsenic in the debris area), Site 8 (lead and pesticides in the northeastern corner of Site 8), and Site 16 (pesticides in the northernmost interim removal action excavation area), and to address groundwater contamination (chlorinated compounds) at Sites 6 and 16.

Additionally the following data gaps for the OWSs were identified in the RI report and are addressed in this FS. Groundwater samples will be collected beneath all OWSs.

- **Site 6** – Soil contamination beneath and adjacent to OWS-040A and OWS-040B, the potential presence of 1,4-dioxane in soil and groundwater, and the vertical and horizontal extent of the groundwater VOC plume.
- **Site 7** – Soil contamination near OWS-459.
- **Site 8** – Soil contamination near OWS-114, and the potential presence of 1,4-dioxane, TCE, and benzene in soil and groundwater near solvent use areas.
- **Site 16** – Soil contamination near OWS-608A and OWS-608B, the vertical and horizontal extent of contamination in the former PCB excavation area, the potential presence of 1,4-dioxane in soil and groundwater, and the vertical and horizontal extent of the groundwater VOC plume.

The typical FS process of developing and evaluating remedial alternatives consists of the following steps:

- Develop RAOs that specify contaminants and media of concern, exposure pathways, and remediation goals. RAOs are developed on the basis of ARARs, HHRA results, and ERA results.
- Develop GRAs for each medium to address the RAOs. Consider containment, treatment, removal, or other actions singly or in combination in developing GRAs.
- Identify the volume of each affected medium of concern.
- Identify and screen technologies for each general response action to eliminate technologies that technically cannot be implemented or are not cost-effective.
- Identify and screen process options for each technology.
- Assemble retained process options into alternatives and screen the alternatives.

- Conduct a detailed evaluation and comparative analysis of the remaining alternatives identified in the NCP at Title 40 CFR 300.430(e)(9).

EPA guidance points out that where "circumstances limit the number of available options and therefore the number of alternatives that are developed, it may not be necessary to screen alternatives prior to the detailed analysis" (EPA 1988). Based on the contamination detected at the OU-1 sites, the FS has been streamlined in accordance with EPA guidance as follows:

> For soil at each of the sites, no action, ICs and excavation are generally evaluated. Contamination in soil at each site is generally shallow depth and of moderate quantity. Thus, ICs and excavation are the most practical and cost effective remedial alternatives for these sites.

In the last step of the FS process described in the previous list, each remedial alternative is evaluated individually and then all the remedial alternatives are evaluated together according to the nine criteria described in the bulleted list that follows. The purpose of this analysis is to identify the relative advantages and disadvantages of each alternative. The first two criteria relate directly to the statutory requirements each remedial alternative must meet and are categorized as threshold criteria. The next five criteria are the primary balancing criteria upon which the preliminary selection of the remedy is based. Together, these first seven criteria are considered the evaluation criteria. The remaining two criteria, state and community acceptance, are modifying criteria that are applied after receiving comments on the proposed alternatives from state agencies and the public.

- Overall protection of human health and the environment – Involves an assessment based on a composite of factors addressed under other evaluation criteria, including long-term effectiveness, short-term effectiveness, and compliance with ARARs.

  A determination and declaration that this criterion will be met by the proposed remedial alternative is required for the site; therefore, this is a threshold criterion that must be met by the selected remedial alternative. Ordinarily, this criterion is satisfied if the potential site risks posed by the site are eliminated, reduced, or controlled through treatment, engineering, or land use controls (LUC).

- Compliance with ARARs – Assesses the compliance of an alternative with all chemical-specific, action-specific, and location-specific ARARs. This is also a threshold criterion that must be met by the selected remedial alternative.

- Long-term effectiveness and permanence – Examines the protection of human health and the environment after construction and implementation of the remedial alternative. This criterion addresses the long-term adequacy, reliability, and permanence of the remedial alternative.

- Components of this analysis include the following:
  - The expected long-term reduction in risk posed by the site
  - The level of effort needed to maintain the remedy and monitor the area for changes in site conditions
  - The compatibility of the remedy with planned future use of the site
- Reduction of toxicity, mobility, and volume through treatment – Examines the effectiveness of the remedial alternative in reducing the toxicity, mobility, and volume of contaminants through treatment. The following factors are considered:
  - The amount of hazardous materials destroyed or treated
  - The degree of expected reduction in toxicity, mobility, or volume
  - The degree to which the benefits of the remedial alternative are irreversible
  - The types and quantities of treatment residuals that remain following treatment
- Short-term effectiveness – Examines the protection of community and worker health, as well as the protection of environment during construction and implementation of the remedial alternative. The following factors are considered:
  - Protection of the community during the remedial alternative, including the effects of potential releases from the site, transportation of contaminated materials, and air-quality impacts from on-site treatment
  - Protection of workers during the remedial alternative
  - Environmental impacts of the remedial alternative
  - Time required to achieve RAOs
- Implementability – Considers the technical and administrative feasibility of each alternative as well as the availability of required resources. Factors considered in assessing this criterion include construction and operation and maintenance (O&M) of the remedial alternative; required approvals and permits from regulatory agencies; availability of required off-site treatment or disposal services; and availability of necessary equipment, materials, personnel, and time for implementation.
- Cost – Involves the development and evaluation of the capital cost of construction, equipment, land, buildings, engineering services, and project administration as well as O&M costs for labor, spare parts, materials, and administration activities. In this FS, the present worth of each alternative is calculated using a discount rate of 3.5 percent with an implementation time of up to 65 years (Office of Management and Budget, http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html). Costs are then compared on a common, present-worth basis in terms of 2004 dollars. The level of detail employed in developing these estimates is considered appropriate for making choices between alternatives, but the estimates are not intended for use in detailed budgetary planning. The expected accuracy ranges for development of costs for detailed analysis alternative phase of the FS are –30 to 50 percent (EPA 2000).

- State acceptance – Identifies the State's apparent preferences or concerns about alternatives. This criterion will be evaluated following comments on this FS.

- Community acceptance – Identifies the community's apparent preferences or concerns about alternatives. This criterion will be evaluated following comments on this FS.

5.0 SITE 6 FEASIBILITY STUDY EVALUATION

The following sections describe the development and analysis of alternatives for remediation of soil and groundwater at Site 6. Section 5.1 describes soil and groundwater RAOs. Section 5.2 discusses the GRAs and screening of technologies. Section 5.3 describes the remedial alternatives for soil and groundwater. Section 5.4 compares each of the soil alternatives with the requirements of the NCP and Section 5.5 compares all of the soil alternatives with each other. Section 5.6 compares each of the groundwater alternatives with the requirements of the NCP and Section 5.7 compares all of the groundwater alternatives with each other.

5.1 REMEDIAL ACTION OBJECTIVES FOR SOIL AND GROUNDWATER AT SITE 6

RAOs are medium-specific goals for protecting human health and the environment. Each RAO should specify (1) the contaminants of concern, (2) the exposure routes and receptors, and (3) acceptable contaminant concentrations for each exposure pathway. RAOs can be achieved by either reducing COCs or eliminating the exposure pathways. This FS evaluation considers alternatives for both approaches.

General response objectives are discussed below followed by the remaining criteria that were used to develop the RAOs for soil and groundwater including: objectives for soil and groundwater (see Sections 5.1.1 and 5.1.2), the COCs identified for soil and groundwater (see Section 5.1.3), and the potential receptors and exposure pathways (see Section 5.1.4). The potential ARARs, remediation goals, and RAOs identified for Site 6 are presented in Sections 5.1.5, 5.1.6, and 5.1.7, respectively.

The general response objectives for Site 6 soil and groundwater are as follows:

5.1.1 Soil

The RI for OU-1 concluded that soil at Site 6 does not pose a significant risk to human health or to the environment; however, the RI did not include a sufficient characterization of the soil adjacent to OWS-040A and OWS-040B. Therefore, the general response objectives for soil at Site 6 are to determine whether soil beneath and adjacent to OWS-040A and OWS-040B contains VOCs, SVOCs, 1,4-dioxane, metals, pesticides, PCBs, or TPH at concentrations that exceed their respective residential PRG concentrations; to prevent human exposures to any such soils; and to prevent any such soils from acting as a continuing source of contaminants to groundwater.

5.1.2 Groundwater

The RI for OU-1 concluded that groundwater at Site 6 poses a significant risk to human health from exposure to VOCs. Therefore, the general response objectives for groundwater include preventing human exposure to VOCs in the groundwater plumes that pose risk to human health.

In addition, the general response objectives include additional sampling of groundwater to fully delineate the plumes of VOCs that were identified during the RI.

The development of RAOs, including a discussion of the COCs, exposure pathways and receptors, and remediation goals, is presented in the following sections.

5.1.3 Chemicals of Concern

COCs for soil and groundwater at Site 6 are provided below.

5.1.3.1 Soil

Based on the RI at Site 6, a total of 9 COPCs were identified, two of which (arsenic and PAHs) are not evaluated further in this FS. The RI found that arsenic concentrations are comparable to background at the site, and that PAH concentrations are most likely due to the fill material used to construct Alameda Point.

The remaining 7 COPCs that were identified during the RI are related to solvents and fuels associated with aircraft maintenance, paint stripping, and parts cleaning activities previously conducted in and around Building 41, near OWS-041, the solvent dip tank associated with WD-041A, the probable location of the portable avionics laboratories, and the areas surrounding and adjacent to OWS-040A and OWS-040B. These COPCs (DCA, DCE, TCE, benzene, toluene, ethylbenzenes, and total xylenes) do not pose a significant risk to human health as indicated by the results of the risk assessments conducted at the site. However, little information is known about potential contamination adjacent to OWS-040A and OWS-040B. Therefore, the soil adjacent to OWS-040A and OWS-040B will require additional sampling for VOCs, SVOCs, and pesticides, PCBs, metals, and TPH to determine the extent of any contamination.

5.1.3.2 Groundwater

Based on results of the RI, a total of seven COPCs were identified in groundwater at Site 6, three of which (arsenic, manganese, and bis[2-chloroethyl]ether) are not evaluated further in this FS. The RI found that arsenic and manganese concentrations are similar to background and are attributable to ambient conditions at the site, and that bis(2-chloroethyl)ether is no longer present in groundwater at the site; it was detected in one groundwater sample collected from well M06-01 in August of 1995 and not detected more recent samples collected from 2001 to 2003.

Levels of the remaining four COPCs that were identified during the RI (PCE, TCE, 1,2-DCE, and vinyl chloride) present significant risk to human health or to the environment and will likely require remedial action. For these reasons, the four chemicals have been identified as COCs. PCE, TCE, 1,2-DCE, and vinyl chloride are associated with the solvents used at the site and their degradation products, particularly near the solvent dip tank at the site associated

with WD-041, the portable avionics laboratory, and OWS-41. These four COCs are evaluated further in this FS report.

5.1.4 Potential Receptors and Exposure Pathways

The sources, affected media, and exposure point components of the exposure pathways for Site 6 all involve the soil or dust particles for soil exposures, and groundwater or vapors from groundwater for groundwater exposures. Potential receptors and exposure routes for soil and groundwater at Site 6 are provided in Table 5-1.

5.1.5 Applicable or Relevant and Appropriate Requirements for Soil and Groundwater

Section (§)121(d)(l) of CERCLA states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environment standards, requirements, criteria, or limitations that are determined to be ARARs.

The identification of ARARs is a site-specific determination and involves a two-part analysis: first, a determination of whether a given requirement is applicable; then, if it is not applicable, a determination of whether it is relevant and appropriate. A requirement is deemed applicable if the specific terms of the law or regulation directly address the chemical of concern, remedial action, or site location. If the jurisdictional prerequisites of the law or regulation are not met, a legal requirement may nonetheless be relevant and appropriate if the site's circumstances are sufficiently similar to circumstances in which the law otherwise applies and it is well suited to the conditions of the site. An evaluation of the relevance and appropriateness of a requirement is site specific, and must be based on best professional judgment. A requirement may be relevant, but not appropriate, for the specific site. In Title 40 CFR § 300.400(g)(2), the NCP lists factors to consider in evaluating relevance and appropriateness. Only requirements determined to be both relevant and appropriate must be followed. Portions of a requirement may be relevant and appropriate even if a requirement in its entirety is not. A requirement must be substantive in order to constitute an ARAR for activities conducted on site. Procedural or administrative requirements such as permits and reporting are not ARARs.

In addition to ARARs, the preamble to the NCP provides agency advisories, criteria, or other "to-be-considered (TBC) guidance in helping to determine what is protective at a site or how to carry out certain actions or requirements" (Title 55 *Federal Register* §§ 8666 and 8745, March 9, 1990). The preamble to the NCP states, however, that provisions in the TBC category "should not be required as cleanup standards because they are, by definition, generally neither promulgated nor enforceable, so they do not have the same status under CERCLA as do ARARs."

As the lead federal agency, the Navy has primary responsibility for identifying federal ARARs for remediation at Site 6. State agencies are responsible for identifying state ARARs; the lead state agency in California is the DTSC. In a letter submitted to DTSC dated March 8, 2004, the Navy

requested the state to identify chemical-, location-, and action-specific ARARs for Sites 6, 7, 8, and 16 (Navy 2004). No response has been received to date. The Navy has reviewed and identified the state ARARs that apply to Site 6 according to a letter received from DTSC on November 13, 1996 (DTSC 1996).

ARARs and TBCs are generally divided into three categories: chemical-specific, location-specific, and action-specific. The evaluation of ARARs for this FS is presented in Appendix B. The potential chemical- and location-specific ARARs having implications for this FS are summarized below. Action-specific ARARs are identified and discussed following development and screening of site-specific remedial alternatives.

5.1.3.1 Chemical

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 that may be found in or discharged to the ambient environment that is protective of human health and the environment.

Soil

The only federal chemical-specific ARARs for soil are the RCRA hazardous waste and land disposal restrictions and the Toxic Substance Control Act PCB remediation waste requirements for PCB-contaminated soil.

The applicability of RCRA requirements depends on whether the excavated soil contains listed or characteristic RCRA waste, whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement, and whether the activity at the site constitutes generation, treatment, storage or disposal as defined by RCRA. Excavation of soil containing RCRA hazardous waste constitutes generation of waste to which RCRA requirements apply. To the extent the excavated soil contains RCRA hazardous wastes the Navy will comply with RCRA.

The following RCRA requirements are potential ARARs because they define RCRA hazardous wastes:

- Title 22 California Code of Regulations (CCR) § 66261.21
- Title 22 CCR § 66261.22(a)(1)
- Title 22 CCR § 66261.23
- Title 22 CCR § 66261.24(a)(1)
- Title 22 CCR § 66261.100

RCRA land disposal restrictions at Title 22 CCR § 66268.1(f) are potential ARARs for discharging waste to land.

The federal chemical-specific ARARs for PCBs are in regulations adopted pursuant to Toxic Substances Control Act. In 1998, EPA established cleanup goals for PCB remediation waste in low occupancy and high occupancy areas, 40 CFR § 761.61(a)(4) sets forth the substantive cleanup levels and is relevant and appropriate to PCB contaminated soil. These requirements are:

- 40 CFR § 761.61(a)(4)(I)(A): cleanup level for bulk PCB remediation waste in high-occupancy areas is less than or equal to 1 part per million (ppm) without further conditions;
- 40 CFR § 761.61(a)(4)(I)(B)(1): cleanup level for bulk PCB remediation waste in low-occupancy areas is less than or equal to 25 ppm

The Navy also considered state requirements and determined that the requirements of CCR, Title 27, §§ 20210 and 20220 are potential ARARs. The Navy will determine whether any waste generated is a designated waste or nonhazardous waste pursuant to Title 27 CCR §§ 20210 and 20220.

Groundwater

Federal MCLs and maximum contaminant level goals developed by EPA under the Safe Drinking Water Act are potential relevant and appropriate requirements for aquifers with Class I and Class II characteristics. Although groundwater at Site 6 is Class II, both the Water Board and EPA have determined that groundwater beneath Site 6 is not likely to be a potential source of drinking water. The point of compliance for maximum contaminant level goals and MCLs under the Safe Drinking Water Act is at the tap; therefore, the MCLs and maximum contaminant level goals are not "applicable" ARARs for this Navy site.

In addition, the Navy has determined that the following state requirements are potential ARARs:

- Comprehensive Water Quality Control Plan for the San Francisco Bay (Basin Plan) (*California Water Code* § 13240)
- State Water Resources Control Board Resolution 88-63 (Sources of Drinking Water Policy)

Air

There are no chemical-specific ARARs for the vapor intrusion pathway. The Navy has derived the risk-based remediation goals for vapor, which are included in Section 5.1.6.

Table 5-2 summarizes the chemical-specific ARARs associated with Site 6.

5.1.3.2 Location

Location-specific ARARs are restrictions placed on the concentrations of hazardous substances or on the conduct of activities solely because of the specific qualities of some locations. Specific locations include flood plains, wetlands, historic places, and sensitive ecosystems or habitats. Based on the location of Sites 6, 7, 8 and 16 and their proximity to the Oakland Inner Harbor, the Navy identified the following location-specific ARARs.

- The Endangered Species Act (Title 16 USC §§ 1531 through 1543) (requires that federal agencies not jeopardize the continued existence of a listed species of cause the destruction or adverse modification of critical habitat)
- The California Endangered Species Act (*California Fish and Game Code* § 2080)
- Coastal Zone Management Act (Title 16 USC § 1456[c]) (requires that activities near a coastal zone be conducted in a manner consistent with approved state management programs)

Table 5-3 summarizes the location-specific ARARs associated with Site 6.

5.1.6 Remediation Goals

The remediation goals for soil and groundwater at Site 6 are based on the general remedial action objective, the chemicals of concern, and federal and state ARARs.

5.1.6.1 Soil

Currently, there are no remediation goals for Site 6 soil because the COPCs identified during the RI do not pose significant risk to human health or the environment. The remediation goals for any COCs that are identified during sampling adjacent to OWS-040A and OWS-040B will be based on residential PRGs.

5.1.6.2 Groundwater

Two sets of groundwater remediation goals were developed for Site 6 groundwater to allow the consideration of two different site reuse scenarios. One set of remediation goals requires cleanup to allow commercial/industrial reuse of the site, and the other set requires cleanup to allow unrestricted reuse of the site. The concentrations of COCs that are associated with each set of remediation goals for the Site 6 are as follows:

COC	Remedial Goals for Commercial/Industrial Reuse		Remedial Goals for Unrestricted Reuse	
	Inhalation Criteria		Inhalation Criteria	
	Inhalation of Indoor Air (µg/m^3)	Corresponding Concentration in Groundwater (µg/L)	Inhalation of Indoor Air (µg/m^3)	Corresponding Concentration in Groundwater(µg/L)
PCE	0.69	420	0.33	20
TCE	0.036	35	0.017	1.7
1,2-DCE	51	121,000	37	8,800
Vinyl Chloride	0.89	240	0.22	5.9

Source:

EPA. 2002. "Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)." *Draft Federal Register.* November 29. Volume 67, Number 230, pages 71169-71172.

For both reuses, the indoor vapor intrusion pathway, site-specific remediation goals based on Johnson & Ettinger model calculations were identified for PCE, TCE, 1,2-DCE, and vinyl chloride (see Appendix A). These site-specific remediation goals are vapor concentrations that correspond to a 10E-6 excess cancer risk from inhalation of TCE and PCE.

5.1.7 Remedial Action Objectives

The following RAOs were developed for soil and groundwater at Site 6 based on the identified COCs, potential receptors and exposure pathways, ARARs, and remediation goals:

Soil

- Prevent human exposures to soil adjacent to OWS-040A and OWS-040B that are found to contain VOC, SVOC, metals, pesticides, or PCBs at concentrations that exceed their respective residential PRG concentrations.

Groundwater

- For the potential residential receptor, prevent inhalation of VOCs in groundwater that exceed the following concentrations: 8,800 µg/L of 1,2-DCE, 20 µg/L of PCE, 1.7 µg/L of TCE, and 5.9 µg/L of vinyl chloride.

- For the commercial/industrial receptor, prevent inhalation of indoor air containing VOCs from the groundwater plumes that exceed the following concentrations: 420 µg/L of PCE, 37 µg/L of TCE, 121,000 µg/L of 1,2-DCE, and 240 µg/L of vinyl chloride.

The RAOs are summarized in Table 5-4.

5.2 GENERAL RESPONSE ACTIONS AND PRELIMINARY SCREENING OF TECHNOLOGIES

The table below presents the GRAs that were identified to meet RAOs for soil and groundwater at Site 6.

Soil GRAs for Site 6	Groundwater GRAs for Site 6
No action	No action
One-time soil sampling adjacent to OWS-040A and OWS-040B	Plume boundary delineation
ICs	LUCs
Excavation and off-site disposal	Active groundwater remediation

The following sections present the results of a preliminary screening evaluation that was conducted on these GRAs and on the technologies that were identified under the GRA for active groundwater remediation at Site 6. However, it should be noted that one-time soil sampling and plume boundary delineation were not included in the screening process, because the Navy and regulatory agencies previously agreed that these activities are necessary at Site 6. Section 5.2.1 presents the screening criteria. Section 5.2.2 describes and screens each GRA, technology, and process option. Section 5.2.3 summarizes the retained GRAs, remedial technologies and process options.

Information about the various treatment technologies discussed in this section were obtained from the following sources:

- EPA guidance on presumptive remedies for contaminated groundwater (EPA 1996)
- Federal Remediation Technologies Roundtable (FRTR) screening matrix on remediation technologies (FRTR 2002)
- Naval Facility Engineering Service Center (NFESC) environmental restoration website (NFESC 2002)
- Office of Solid Waste and Emergency Response publication on LUCs (EPA 2000).
- Treatability studies conducted previously at Alameda Point
- Remedial Action Cost Engineering and Requirements™ (RACER™) (Earth Tech 2003)

5.2.1 Screening Criteria

Various treatment technologies were evaluated during the initial screening for their ability to address groundwater contamination at Site 6. All treatment technologies identified by EPA as

presumptive remedies for groundwater contaminated by VOCs (EPA 1996) were considered in the preliminary screening of treatment technologies for groundwater at Site 6. Other treatment technologies were also considered. The screening evaluations focused on each technology's effectiveness in removing contamination, implementability, and cost at Site 6.

5.2.1.1 Effectiveness

The evaluation of effectiveness focused on (1) the ability of the technology to address contaminants of interest, (2) the ability of the technology to meet the remediation goals within a reasonable timeframe, and (3) the reliability of the technology. The ability of a technology to achieve the remediation goals within a reasonable timeframe is an important factor in the evaluation of effectiveness because the Navy has set a 5-year timeframe to transfer the sites for redevelopment. In terms of remediation timeframe, a technology is classified as short-term (achieving the remediation goals after less than 3 years of implementation), medium-term (achieving the remediation goals after 3 to 10 years of implementation), or long-term (requiring more than 10 years of implementation to achieve the remediation goals) (FRTR 2002).

5.2.1.2 Implementability

The evaluation of implementability encompasses both the technical and the administrative feasibility of implementing a treatment technology. 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 capabilities to design, construct, and maintain the system. Administrative feasibility includes the ease of completing permitting processes and obtaining approvals from authorities.

5.2.1.3 Cost

The evaluation of cost addresses direct and indirect capital costs and annual O&M costs. When the information is available, the cost range is presented quantitatively. Otherwise, qualitative descriptions of low, moderate, and high are used. The terms low, moderate, and high cost describe a unit cost for treatment that is less than $3 per 1,000 gallons, $3 to $10 per 1,000 gallons, and more than $10 per 1,000 gallons, respectively (FRTR 2002). The cost ranges are based on a review of the literature, vendor quotations, and data prepared for other studies.

5.2.2 Screening of GRAs and Technologies for Soil and Groundwater

The GRAs and technologies are described and evaluated with respect to the three preliminary screening criteria described in this section. A summary of the preliminary screening process for soil and groundwater treatment technologies is presented in Table 5-5.

Technologies and GRAs were retained based on their demonstration of acceptable levels of effectiveness in treating halogenated VOCs, implementability, and cost. The no-action and LUCs GRAs are discussed first followed by a discussion of groundwater treatment technologies

that were considered under the GRA for active groundwater remediation. The following sections identify and present screening rationale for each of the options that were considered for Site 6.

5.2.2.1 No Action

Under the no action GRA, no remedial action would be conducted on site and there would be no LUCs, containment, removal, treatment, or other mitigating actions. This GRA would not be effective in reducing potential site risks to human health that may result from soil and groundwater exposures under unrestricted land use. Because no action is taken, no cost is associated with this option. The NCP requires evaluation of the no-action response in every FS (Title 40 CFR 300.430[e][6]). The no-action alternative provides a baseline for comparison to the other remedial response actions.

5.2.2.2 Land Use Controls

LUCs comprise institutional controls and engineering controls. Institutional controls are defined as "non-engineering measures designed to prevent or limit exposure to hazardous substances left in place at a site, or assure effectiveness of a selected remedy." There are four general categories of institutional controls: governmental controls, proprietary controls, enforcement and permit tools with institutional control components, and informational tools. LUCs are often more effective if they are layered or implemented in series. Layering means using different categories of LUCs concurrently to enhance the protectiveness of the remedy. Implementation of LUCs in series may be applied to ensure both the short- and long-term effectiveness of the remedy. As a single remedy, LUCs are typically implemented as a long-term approach. Pursuant to Navy guidance, the specific substance of the anticipated LUCs will be determined during the remedial design stage after submittal of the ROD (U.S. Department of Defense 2003).

For vapor intrusion, institutional controls should include a component that requires all future buildings located above VOC plumes to have a vapor barrier/removal system.

The following subsections describe and evaluate LUCs that could be applied at Site 6.

Governmental Controls

Governmental controls use the regulatory authority of a government entity to impose restrictions on citizens or property under its jurisdictions. Examples of government controls include zoning restrictions and groundwater use restrictions.

A zoning restriction is a common land use restriction specifying allowed land uses for certain areas. Zoning can be used to prevent certain exposures not otherwise prevented under a remedy. Examples of zoning restrictions include (1) prohibition of a site for residential development or (2) restriction of excavation at sites to specific depths where contamination is present. Although the zoning restrictions are typically issued by a local government, they are not necessarily permanent. They can be repealed, or local governments can grant exceptions after public

hearings. For a long-term remedy, therefore, the implementation of zoning restrictions are usually layered with other LUC tools. Zoning restrictions are readily implementable at low cost and, therefore, are retained for further evaluation.

Groundwater use restrictions are typically directed at limiting or prohibiting certain uses of groundwater, which may include limitations or prohibitions on well drilling in a certain area or groundwater extraction from a certain aquifer. Groundwater use restrictions also may prevent the installation of drinking water wells without regulatory approval or prohibit residential use where groundwater use is prohibited. The effectiveness of the groundwater use restrictions depends on the willingness and ability of local governments to monitor compliance and take enforcement action. Similar to zoning restrictions, groundwater use restrictions are typically layered with the implementation of other LUC tools. Groundwater use restrictions are readily implementable, potentially effective, and low cost; therefore, they are retained for further evaluation.

Proprietary Controls

Proprietary controls involve legal instruments placed in the chain of title of the site property. Proprietary controls can be implemented without the intervention of any federal, state, or local regulatory authority. Proprietary controls include easements and covenants.

An easement typically provides access rights to a property so the facility owner or regulatory agency may inspect and monitor the effectiveness of a remediation system. Because long-term monitored natural attenuation (MNA) is a critical component to assess the effectiveness of the LUC approach, an easement is retained for further evaluation. Its implementation will be layered with other LUC tools.

A covenant is an agreement between one landowner to another made in connection with a conveyance of property to use or refrain from using the property in a certain manner. A major benefit of a covenant is that it can be used in cases where unremediated property is being transferred from the current owner to another party. Because of the possibility of potential property transfer in the future, implementation of a covenant is retained for further evaluation.

Enforcement Tools with Institutional Control Components

Enforcement tools are defined as tools, such as administrative orders or consent decrees, available under CERCLA and RCRA that can be used to restrict the use of land. Enforcement authority can be used to either (1) prohibit a party from using land in a certain way or from carrying out certain activities at a specified property or (2) require a settling party to put in place some other form of control, such as a proprietary control.

These tools are eliminated from further evaluation because they are more difficult to implement than governmental controls and are less appropriate as a long-term solution.

Informational Tools

Informational tools provide information or notification that residual contamination may remain on site. Common examples include state registries of contaminated properties, deed notices, and advisories. The most commonly used are deed notices, which refers to a nonenforceable, purely informational document filed in public land records that alerts anyone searching the records. Because they are nonenforceable, informational devices are most likely to be used as a secondary layer to enhance the overall reliability of other LUCs. Deed notice will be retained for further evaluations.

Engineering Controls

Engineering controls reduce or eliminate potential exposures of human and ecological receptors to contamination by preventing contact with contaminated media. The most common methods to control vapor from entering a building are by installing a vapor barrier or removal system beneath the building.

Vapor barriers are a passive approach typically employed during construction. Vapor barrier construction consists of installation of the vapor barrier (6-mil polyethylene or equivalent) sealing plumbing penetrations, mixing of floor slab concrete with superplasticizers, reinforcing of slab at reentrant corners, and proper slab curing and loading.

Vapor removal systems take an active approach, such as a depressurization fan, to lower the pressure below the slab and create a sink for vapors. Vapors in the sink are often collected using perforated piping. A fan or blower extracts vapors from the perforated pipe and diverts it to ambient air.

5.2.2.3 Excavation and Off-Site Disposal

Excavation and off-site disposal would be effective in the treatment of soil at Site 6 because the source area would be removed. This GRA would be effective in reducing potential site risks to human health that may result from soil exposures under unrestricted land use. Excavation and off-site disposal is effective in the treatment of soil contamination at Site 6.

5.2.2.4 Active Remediation

This section presents the technologies that were considered during the preliminary screening process as primary options for the active cleanup of the contaminated groundwater at Site 6. Pumping and treatment technologies were not considered at Site 6, because the saturated zone at this site is only 5 feet thick, and because the effectiveness of such options could be limited by

low permeability. The primary technologies discussed below include air sparging, biosparging, ISCO, thermal flushing, passive treatment wall, enhanced in situ bioremediation, and MNA.

Air Sparging

Air sparging is an in situ treatment technology that is implemented by injecting pressurized air into a contaminated aquifer so that air streams traverse horizontally and vertically through the soil column, stimulating volatilization of VOCs, which become entrained in the injected air. The injected air and entrained contaminants are removed from the subsurface by a vapor extraction system. This technology is designed to operate at high flow rates to strip the VOCs from groundwater. In addition to removing contaminants the injected air enhances aerobic biodegradation of the contaminants by increasing dissolved oxygen concentrations in the subsurface. Air sparging is effective in the treatment of halogenated compounds and is retained for Site 6.

Biosparging

Biosparging is similar to air sparging except that air is injected at a much lower flow rate, and vapor collection is not needed. The application of this technology relies on adequate distribution of air through the subsurface. Biosparging is not retained for application to Site 6, because it has limited effectiveness for the treatment of TCE and PCE, two of the major groundwater contaminants at the site.

In Situ Chemical Oxidation

ISCO involves injecting chemical oxidants into the vadose zone and/or groundwater to oxidize contaminants to carbon dioxide, water, and chloride ions. ISCO would effectively degrade the halogenated compounds of concern at the site. The chemical oxidants most commonly employed to date include peroxide, ozone, permanganate, Fenton's reagent (hydrogen peroxide with iron catalyst), modified Fenton's reagent (chelated organometallic catalyst), and stabilized peroxide. The main difference between Fenton's reagent and modified Fenton's reagent is that that with the modified Fenton's reagent, hydroxyl radical can be generated under neutral subsurface conditions, and the catalyst resists precipitation and soil adsorption for more efficient hydroxyl radical distribution.

ISCO is effective for the treatment of halogenated VOCs in groundwater, and treatability studies conducted at Site 16 were successful. Pilot-scale tests for ISCO have recently been conducted at Site 16 in the southern and northern portions using modified Fenton's reagent-based oxidation chemistry. Based on information provided at the RAB meeting by the remedial action contractor on February 10, 2004, the injections achieved a radius of influence of 15 to 30 feet and a 90 percent reduction in chlorinated compound concentrations in groundwater. Based on the results of the pilot-scale test, the remedial action contractor recommended full-scale application of ISCO at Site 16. Based on its effectiveness and the relatively short time frame to implement this technology (less than 3 years); ISCO is retained for further evaluation for Site 6.

Thermal Treatment (Steam Flushing)

Steam flushing is implemented by forcing steam into an aquifer through injection wells to vaporize VOCs and SVOCs. Vaporized components rise to the unsaturated (vadose) zone, where they are removed by vacuum extraction and then treated. Hot water or steam flushing/stripping is a pilot-scale technology. In situ biological treatment may be applied after steam flushing and is continued until groundwater contaminant concentrations achieve the remediation goals. SVOCs and fuels are the target contaminant groups for steam flushing. VOCs also can be treated by this technology, but there are more cost-effective processes for sites contaminated with VOCs. Furthermore, steam flushing is not recommended for treatment of low permeability soils. Treatment costs typically range from $2,000 to $6,000 per 1,000 gallons of groundwater treated based on a 70 percent on-line efficiency (FRTR 2002). Because more cost-effective methods are available for VOC removal, thermal treatment using steam flushing was eliminated from further consideration for Site 6.

Passive Treatment Wall

Implementation of this technology involves installing a permeable reaction wall across the flow path of a contaminant plume, allowing the water portion of the plume to move passively through the wall. These barriers allow the passage of water while prohibiting the movement of contaminants by employing such agents as zero-valent metals, chelators (ligands selected for their specificity for a given metal), sorbents, microbes, and others. The contaminants will either be degraded or retained in a concentrated form by the barrier material.

A common treatment barrier configuration is the funnel-and-gate system. The funnel-and-gate system for in situ treatment of contaminated plumes consists of low hydraulic conductivity (for example, 10^{-6} centimeters per second) cutoff walls (the funnel) with a gate that contains reactive porous media. The reactive media removes contaminants by physical, chemical, or biological processes as the groundwater passes through the gate. The types of cutoff walls most likely to be used are slurry walls or sheet piles.

The time required to achieve remediation goals using passive treatment walls typically ranges from 3 to 30 years. An average implementation cost ranges from $300 to $1,500 per square foot of reactive barrier installed (assuming a barrier thickness of 2 to 4 feet) (FRTR 2002).

A funnel-and-gate system using in situ reactive iron remediated halogenated VOCs such as those found at Site 6 during tests that were conducted at CERCLA Site 1 (Tetra Tech 1998a). However, a passive treatment wall would treat only water moving through the wall, but not the source area, resulting in a prolonged implementation time. Therefore, this technology is eliminated from further consideration at the site.

Enhanced In Situ Bioremediation

Hydrogen release compounds and oxygen releasing compounds were both considered as options for enhancing in-situ bioremediation at Site 6.

Hydrogen Release Compounds. Hydrogen release compound is a proprietary polyacetate ester formulated for slow release of lactic acid upon hydration. The hydrogen release compound is applied to the subsurface via push-point injection or within dedicated wells. The hydrogen release compound is then left in place where it passively stimulates rapid contaminant degradation. Hydrogen release compound is injected directly into the aquifer matrix in a grid pattern over the aerial extent and across the vertical zone of the contaminant plume. Because of the time-released characteristic of hydrogen release compounds, one round of hydrogen release compounds injection will provide the dissolved hydrogen continually for 6 to 12 months, at which time reapplication may be needed. Enhanced in situ bioremediation using hydrogen release compounds is effective for halogenated VOCs and is retained for Site 6.

Oxygen Releasing Compounds Oxygen Release Compound® is a patented formulation of magnesium peroxide that produces a slow and sustained release of molecular oxygen when in contact with soil moisture or groundwater. The introduction of additional oxygen provides an aerobic environment for naturally occurring microorganisms that aerobically degrade pollutants into less-toxic by-products, ultimately to carbon dioxide and water. Oxygen release compounds may be used directly in the contaminant plume area to treat the contaminants dissolved in groundwater or contaminants sorbed to soil below the water table. Since aerobic bioremediation is at least 10 to 100 times faster than anaerobic bioremediation, the oxygen release compounds application stimulates much faster contaminant reduction rates when compared to unamended natural attenuation, which is generally oxygen deficient. Oxygen-releasing compounds are typically evaluated in tandem with other technologies, such as in situ bioremediation, for addressing contaminants. Similar to hydrogen release compounds application, oxygen release compounds are injected directly into the aquifer matrix in a grid pattern over the aerial extent and across the vertical zone of the contaminant plume. Enhanced in situ bioremediation using oxygen release compounds is effective for treating vinyl chloride and 1,2-DCE but would not reduce TCE and PCE concentrations. Therefore, it was not retained.

Monitored Natural Attenuation

This response action involves natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials that are allowed to reduce contaminant concentrations to acceptable levels. Consideration of this option usually requires modeling and evaluation of contaminant degradation rates and pathways and predicting contaminant concentrations at downgradient receptor points, if the plume is still expanding and migrating. The primary objective of site modeling is to demonstrate that natural processes of contaminant degradation will reduce contaminant concentrations to levels below regulatory standards or risk-based levels before potential exposure pathways are completed. Long-term MNA must be conducted to confirm that degradation is proceeding at rates consistent with meeting remediation goals.

A number of factors may limit the applicability and effectiveness of MNA: (1) extensive amounts of data must be collected and analyzed to determine plume behavior, (2) MNA should be used only where there are no impacts on potential receptors, and (3) subsurface conditions may not allow for MNA of the contaminant. MNA is not sufficiently effective as a single remediation approach to achieve the RAO (it may take 25 to 50 years, as discussed in Appendix D). If LUCs are implemented, however, and/or other remedial actions are undertaken to reduce contamination in the source area, MNA is likely to be an effective tool to confirm the decrease in residual contamination; therefore, it was retained for further consideration in this FS.

5.2.3 Summary of Retained GRAs and Remedial Technologies

All of the GRAs that were considered for soil (no action, selected LUCs, and excavation with off-site disposal) and groundwater (no action, selected LUCs, active groundwater treatment, and MNA) were accepted for use in developing remedial alternatives at Site 6. However, further screening was required to evaluate specific technologies that were retained for active groundwater treatment and MNA at Site 6. The active groundwater treatment technologies that required further evaluation include:

- Air sparging
- ISCO
- Enhanced in-situ bioremediation using hydrogen release compounds

Although MNA is not sufficiently effective as a single remediation approach to achieve the RAOs (concentrations may not reach remediation goals in the assumed 30-year timeframe), MNA is likely to be an effective tool to confirm the decrease in residual contamination if other remedial actions are undertaken to reduce contamination in the source area.

The active treatment alternatives from the preliminary screening were screened a second time against the criterion discussed below.

5.2.4 Evaluation of Groundwater Treatment Technologies Retained from the Preliminary Screening

As discussed in Section 5.2.3, the technologies retained from the preliminary screening are as follows:

Active Technology Retained from Preliminary Screening			
Site	Air Sparging	ISCO	Hydrogen Release Compounds
Site 6 Groundwater	X	X	X

These three active groundwater treatment options were evaluated and compared using the criteria in effectiveness, implementability, and cost. A summary of this comparison is presented in Table 5-6. Costs were calculated for each of the retained technologies assuming treatment to domestic use remediation goals.

Based on the evaluation presented in the following sections, the preferred technologies Site 6 groundwater are hydrogen release compounds and ISCO. The following sections present the evaluation of each of the technologies.

5.2.4.1 Enhanced Bioremediation Using Hydrogen Releasing Compounds

This section discusses the effectiveness, implementability, and cost of remediating Site 6 groundwater by hydrogen release compounds.

Effectiveness

Enhanced bioremediation using hydrogen release compounds was successfully tested at a pilot test conducted at Site 4 (Battelle Memorial Institute 2000) to treat chlorinated hydrocarbons. Hydrogen release compound is expected to reduce COC concentrations to below domestic use remediation goals within 3 years. A treatability study should be conducted before full-scale operation.

Implementability

Hydrogen release compound is implementable at Site 6. Implementation would require application of the treatment agent through push points across the plume. Follow-up treatment would likely be required. The remediation timeframe is approximately 3 years. Access restriction during treatment is not required because hydrogen release compounds do not require any aboveground structures. Hydrogen release compound treatment agents are not hazardous, are relatively easy to apply, and do not require special personal protection.

Cost

The estimated cost of treating groundwater at Site 6 using hydrogen release compounds until domestic use remediation goals are reached is $1.7 million. Calculations of these costs are provided in Appendix C.

5.2.4.2 In Situ Chemical Oxidation

This section discusses the effectiveness, implementability, and cost of remediating groundwater at Site 6 using ISCO.

Effectiveness

ISCO using a Modified Fenton's reagent has been demonstrated in several treatability studies at Alameda Point sites, including Site 16. Treatability study results for Site 16 showed 89 to 95 percent reductions in COC concentrations after 4 weeks, following application of treatment agent. Based on the Site 16 results and vendor information, ISCO is expected to reduce COC concentrations to below domestic use remediation goals within 2 years. While pilot-scale tests have been conducted at Site 16, a treatability study should be conducted prior to application at Site 6.

Implementability

ISCO is implementable at Site 6. Implementation would require application of the treatment agent through injection points at Sites 6. For the primary treatment, three injection events would be required and the treatment time for those first three events would be 6 months to 1 year. Follow-up treatment will require three additional injection events and will take approximately 6 months to a year to complete. Access restriction is required during injection because of the hazardous nature of the oxidants. Workers completing injections will require that Level C personal protection.

Cost

The estimated cost of treating groundwater using ISCO until domestic use remediation goals are reached is $1.9 million for Site 6. Calculations of these costs are provided in Appendix C.

5.2.4.3 Air Sparging

This section discusses the effectiveness, implementability, and cost of remediating Site 6 groundwater by air sparging.

Effectiveness

Air sparging is expected to be effective for reducing Site 6 COC concentrations. It is technology with proven success in many applications under conditions similar to those at Site 6. Effectiveness may be limited by the low permeability of the aquifer zone to be treated. Air sparging is expected to reduce COC concentrations to below domestic use remediation goals within 2 years. A treatability study should be conducted prior to full-scale application.

Implementability

Air sparging is likely implementable at Site 6, although the shallow water table could cause difficulty if the water table rises excessively. Implementation would require installation of over air sparging wells and soil vapor extraction wells throughout the Site 6 plume. Access to the site

would have to be restricted during the treatment period because of the presence of numerous wells and aboveground piping associated with the air sparging system.

Cost

The estimated cost of treating groundwater at Site 6 with air sparging until domestic use remediation goals are reached is $4.6 million. Calculations of these costs are provided in Appendix C.

5.2.5 Comparative Analysis of Groundwater Treatment Technologies Retained from the Preliminary Screening

This section compares the three treatment technologies retained from the preliminary screening for each of the three technology evaluation criteria. A summary of the comparative analysis is presented in Table 5-6.

5.2.5.1 Effectiveness

ISCO and hydrogen release compounds are expected to require up to 3 years. Hydrogen release compounds may also be highly effective with a similar remediation time to ISCO, but a treatability study should be conducted to confirm its effectiveness. The effectiveness of air sparging may be limited by low permeability soil at Site 6.

5.2.5.2 Implementability

ISCO and hydrogen release compounds are both implementable, and neither option would restrict access to the site because no surface structures are required. ISCO treatment agents, however, are hazardous, while hydrogen release compounds treatment agents are not. Air sparging is likely to be implementable at Site 6, but the shallow water table could be a problem if water levels rise excessively. Air sparging at Site 6 should be tested before full-scale implementation. Air sparging would restrict access to the site because of aboveground structures.

5.2.5.3 Cost

Hydrogen release compounds would have the lowest cost of all the treatment options and is approximately 1.5 to 2 times lower than the ISCO and air sparging.

5.2.6 Overall Evaluation

Based on the comparison of groundwater treatment technologies, ISCO and hydrogen release compounds are the most preferable treatment technologies. These technologies were carried forward and are included in a number of remedial alternatives for groundwater.

5.3 REMEDIAL ALTERNATIVES

The retained GRAs and soil and groundwater treatment technologies were assembled into a number of specific remedial alternatives that would satisfy RAOs for soil and groundwater at Site 6. Section 5.3.1 identifies remedial alternatives for soil at Site 6 and identifies the maximum volume of contaminated soil that may require excavation and off-site disposal. Section 5.3.2 identifies remedial alternatives for groundwater at Site 6, and Section 5.3.3 identifies the volumes of groundwater that were considered for each general response action.

5.3.1 Remedial Alternatives for Soil

The following remedial alternatives were identified to address contaminated soils at Site 6: (1) no action, (2) one-time soil sampling with possible institutional controls, and (3) one-time soil sampling with possible excavation and off-site disposal.

5.3.1.1 Alternative 1: No Action for Soil

A no-action response provides the baseline assessment for comparison with other remedial alternatives. A no-action alternative may be considered appropriate if an alternative response action would cause a greater environmental or health danger than the no-action alternative. The NCP requires evaluation of the no-action response as part of the FS process.

5.3.1.2 Alternative 2: One-Time Soil Sampling and Institutional Controls

Alternative 2 involves a one-time sampling event to delineate the nature and extent of soil contamination adjacent to OWS-040A and OWS-040B. The sampling event will entail collecting one groundwater sample and soil samples at eight locations based on historical site activities, at depths of 2.5 and 5 feet bgs. If COCs are present in soil above their PRGs, institutional controls would be applied to prevent contact through inhalation and ingestion of contaminated soil by prohibiting excavation without regulatory approval. ICs would be in place indefinitely; however, for the purpose of cost comparison, ICs are assumed to last 100 years.

5.3.1.3 Alternative 3: One-Time Soil Sampling, Excavation, and Off-Site Disposal

Alternative 3 involves a one-time sampling event to delineate the nature and extent of soil contamination adjacent to OWS-040A and OWS-040B. The sampling event will entail collecting groundwater and soil samples at eight locations based on historical site activities, at depths of 2.5 and 5 feet bgs. If COCs are present in soil above their PRG, the contaminated soil would be excavated and disposed at an appropriate off-site facility.

Excavation would be accomplished with conventional heavy construction equipment, including backhoes, cranes, bulldozers, loaders, scrapers, and haulers. This alternative is applicable to almost all site conditions, although it may become cost-prohibitive at great depths or in complex hydrologic environments (Wagner and others 1986).

Disposal refers to the impoundment of excavated materials at a facility that is approved to accept them. Soils classified as hazardous waste under state and federal laws would be transported to an appropriate facility for treatment, if necessary, and disposal. Soils classified as nonhazardous would be transported to an appropriate facility for disposal.

The anticipated volume of soil to be removed at the area associated with OWS-040A and OWS-040B is approximately 42 cubic yards. This volume is based on a preliminary excavation boundary of 15-feet by 15-feet and a depth of 5 feet bgs, which is presented on Figure 5-1. The boundary is based on the estimated size of the OWS, allowing for some overexcavation of soil. This volume may change depending on excavation boundaries being revised based on additional sampling in this area and/or contamination encountered during field activities. Excavation limits will be based on PRGs for COCs to be identified at this area.

5.3.2 Remedial Alternatives for Groundwater

The following remedial alternatives were identified for contaminated groundwater at Site 6: (1) no action, (2) plume boundary delineation, MNA, and LUCs; (3A and 3B) plume boundary delineation, active remediation of the plumes to commercial/industrial reuse criteria, and LUCs; and (4A and 4B) plume boundary delineation and active remediation to unrestricted reuse criteria. Groundwater modeling presented in Attachment C1 of Appendix C was used for cost estimating purposes in this FS report.

5.3.2.1 Alternative 1: No Action for Groundwater

A no-action response provides the baseline assessment for comparison with other remedial alternatives. A no-action alternative may be considered appropriate if an alternative response action would cause a greater environmental or health danger than the no-action alternative. The NCP requires evaluation of the no-action response as part of the FS process.

5.3.2.2 Alternative 2 – Plume Boundary Delineation, MNA, and LUCs

Under Alternative 2 for groundwater, sampling would be required to further delineate the boundaries of the VOC plumes. In addition, the VOC plumes at Site 6 would be monitored for the COCs identified in Section 5.1.3 for a period of 30 years to measure decrease in concentrations to reach remediation goals under a commercial/industrial reuse scenario, specified in Section 5.1.6, for the vapor intrusion pathway. LUCs would be required to prevent the use of groundwater for drinking water and to prevent installation of drinking water wells without regulatory approval. Additionally, LUCs require installation of a vapor barrier/removal technology in new buildings until remediation goals have been reached over plume areas, and require vapor removal systems in existing buildings above plumes where vapor monitoring indicates that COCs identified in groundwater exceed indoor-air remediation goals.

5.3.2.3 *Alternative 3A and 3B – Plume Boundary Delineation, Active Groundwater Treatment to Commercial/industrial Reuse Criteria, MNA, and LUCs*

Alternatives 3A and 3B would require sampling to further delineate the boundaries of the VOC plumes. In addition, the alternative requires active groundwater treatment of TCE alone because it is the only COC present in groundwater at Site 6 at concentrations exceeding the commercial/industrial remedial goals. Active groundwater treatment would involve either ISCO (Alternative 3A) or hydrogen release compounds (Alternative 3B). Active groundwater treatment would be followed by MNA for a period of 30 years to confirm COCs continue to meet remedial goals and decrease in concentration. ICs would be required to prevent the use of groundwater for drinking water and to prevent installation of drinking water wells without regulatory approval. Additionally, LUCs require installation of a vapor barrier/removal technology in new buildings until remediation goals have been reached over plume areas. LUCs also require vapor removal systems in existing buildings above plumes where vapor monitoring indicates that COCs identified in groundwater exceed indoor air remediation goals.

5.3.2.4 *Alternatives 4A and 4B – Plume Boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, MNA, and LUCs*

Alternatives 4A and 4B would require sampling to further delineate the boundaries of the VOC plumes. In addition, the alternative would require active groundwater treatment of VOC concentrations greater than remediation goals for unrestricted reuse. Active groundwater treatment would use either ISCO (Alternative 4A) or hydrogen release compounds (Alternative 4B) and monitored natural attenuation to establish trends and to assess if COC concentrations continue to meet criteria that allow unrestricted reuse of Site 6. LUCs would be required to prevent the use of groundwater for drinking water and to prevent installation of drinking water wells without regulatory approval. LUCs require installation of a vapor barrier/removal technology in new buildings until remediation goals have been reached over plume areas. LUCs also require vapor removal systems in existing buildings above plumes where vapor monitoring indicates that COCs identified in groundwater exceed indoor air remediation goals.

5.3.3 Volumes of Contaminated Groundwater

The volume of contaminated groundwater requiring treatment under Alternatives 3A and 3B is lower than the volume that would be treated under Alternatives 4A and 4B. Figure 5-2 shows the extent of the TCE plume at Site 6 that would require remediation under Alternatives 4A and 4B. Figure 5-3 shows a plan view of the treatment area based on commercial/industrial reuse. Figures 5-4 through 5-6 are groundwater plume maps for the all of the individual Site 6 COCs. The groundwater concentration contour on each of the figures corresponds to the chemical's unrestricted reuse remediation goal. Figure 5-7 shows a plan view of the treatment area based on unrestricted reuse.

The volumes of contaminated groundwater based on commercial/industrial and unrestricted reuse were calculated using the following formula:

$$V_{gw} = 7.48\,A\,T\,n$$

where

V_{gw} is the volume of contaminated groundwater in gallons

A is the area of the contamination based on domestic remediation goal in square feet

T is the thickness of the contaminated area in feet

n is the aquifer porosity

The estimated areas of contamination that were used in the formula are as follows:

Plume	Area (square feet)
Commercial/Industrial Reuse Plume	2,000
Unrestricted Reuse Plume	80,000

An aquifer thickness of 5 feet was estimated for both reuses at Site 6 based on the aquitard located from 10 to 15 feet bgs. Assuming an aquifer porosity of 0.3, the estimated volumes of contaminated groundwater for the plumes at each site are as follows:

Plume	Volume of Contaminated Groundwater	
	cubic feet	gallons
Commercial/Industrial Reuse Plume	3,000	22,440
Unrestricted Reuse Plume	120,000	897,600

5.4 DETAILED ANALYSIS OF ALTERNATIVES FOR SOIL

The following sections present a detailed analysis of each soil alternative. The no-action alternative is evaluated in Section 5.4.1. Alternative 2 is evaluated in Section 5.4.2 and Alternative 3 is evaluated in Section 5.4.3.

5.4.1 Detailed Analysis of Alternative 1: No Action for Soil

Under this alternative, no efforts would be made to treat the contaminated soil at Site 6. An evaluation of the no-action alternative provides a baseline against which other alternatives can be measured.

5.4.1.1 Overall Protection of Human Health and the Environment

The no-action alternative provides little or no decrease in the risk associated with potentially contaminated soil in proximity to OWS-040A and OWS-040B. Because the no-action

alternative does not prevent contact resulting from intrusive activities, it is not protective of human health.

5.4.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Leaving potentially contaminated soil undisturbed would not trigger ARARs. Section 121(d)(2) of CERCLA indicates that ARARs apply only to on-site response actions. If there is no response action, then no ARARs were identified.

5.4.1.3 Long-Term Effectiveness and Permanence

The no-action alternative would not reduce potential exposures and associated health risks. The no-action alternative does not include using controls to manage potentially contaminated soil that remains at the site. In summary, the no-action alternative is not considered an effective or permanent alternative.

5.4.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Because no active treatment or removal of potentially contaminated soil occurs under this alternative, the no-action alternative is not effective in reducing the toxicity, mobility, or volume of potential contaminants.

5.4.1.5 Short-Term Effectiveness

Because the no-action alternative for soil involves no remedial action or construction, the alternative would not pose additional health risks to the community, workers, or the environment.

5.4.1.6 Implementability

With respect to technical feasibility, this alternative does not require construction, continuous MNA, O&M activities, or replacement of equipment, and is, therefore, easy to implement. In terms of administrative feasibility, implementing this alternative would not require coordination with other agencies. The availability of services and materials is not applicable to this alternative. No technical or administrative difficulties are associated with implementing the no-action alternative.

5.4.1.7 Cost

No capital or O&M costs are associated with this alternative.

5.4.2 Detailed Analysis of Alternative 2: One-Time Soil Sampling and Institutional Controls

Under this alternative, soil would be sampled adjacent to OWS-040A and OWS-040B to determine the extent of contamination remaining at the site. Institutional controls protecting human health would be implemented based on results of the additional sampling. Institutional controls will be implemented to prohibit the excavation of soil adjacent to OWS-040A and OWS-040B without regulatory approval. Additional details for the institutional controls include:

- Implementing excavation restrictions for any purpose until EPA, DTSC, and the Water Board concur that there is no unacceptable risk from exposure to soil;
- Entry of the DTSC into a land use covenant restricting future occupants from excavating, and the land use covenant would provide assurances for its future enforcement; and
- Recording of a deed restriction prohibiting excavation.

5.4.2.1 Overall Protection of Human Health and the Environment

Alternative 2 protects human health by identifying the nature and extent of contamination present in soil at OWS-040A and OWS-040B and prevents further contact by instituting an institutional control on potential exposure areas that contain at COC concentrations below risk-based concentrations. The institutional control will be a prohibition on excavation without regulatory approval. If chemicals are found at concentrations exceeding risk-based screening levels, then additional action may be warranted to protect human health and the environment.

5.4.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

This alternative would comply with chemical and location-specific ARARs that were identified in Sections 5.1.3.1 and 5.1.3.2. This section identifies action-specific ARARs for implementing Alternative 2 at the site. The following subsections present a summary of the action-specific ARARs that are included in Alternative 2 and how they will comply with ARARs.

Potential Action

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken. These requirements are triggered by the particular remedial activities selected. Action-specific ARARs indicate how each alternative must be conducted. The Navy identified the following action-specific ARARs for excavation and off-site disposal.

Soil Sampling

The following RCRA requirements are ARARs for any waste generated from soil sampling activities to determine if any waste generated is hazardous waste in accordance with the RCRA requirements of Title 22 CCR 66261.10 and 66261.11. The following requirements are potential ARARs for any RCRA hazardous waste:

- Title 22 CCR 66262.34 (RCRA hazardous waste accumulation requirements)
- Title 22 CCR 66262.30 (RCRA packaging requirements)
- Title 22 CCR 66262.31 (RCRA labeling requirements)
- Title 22 CCR 66262.32 (RCRA marking requirements)
- Title 22 CCR 66262.33 (RCRA placarding requirements)
- Title 22 CCR 66262.20, 66262.21, 66252.22 and 66262.23 (RCRA manifest requirements)

The following Federal Hazardous Materials Transportation Law sections are potential ARARs for transporting of any hazardous waste:

- Federal Hazardous Materials Transportation Law, Title 49 USC 5101 through 5127, 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 (requirements for transporting hazardous wastes, including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements)

Table 5-7 summarizes the action-specific ARARs associated with Site 6 soil.

5.4.2.3 Long-Term Effectiveness and Permanence

This alternative would reduce potential exposures and associated health risks by identifying potential contamination present in the soil and instituting institutional controls. If constituents are found at concentrations greater than risk-based screening levels, then additional action may be warranted to protect human health and the environment. However, this alternative would not include using controls to manage potentially contaminated soil that remains at the site. Institutional controls will remain in effect as long as required to adequately protect human health and the environment. In summary, Alternative 2 is not considered a permanent alternative.

5.4.2.4 *Reduction of Toxicity, Mobility, or Volume through Treatment*

Because no active treatment or removal of potentially contaminated soil occurs under this alternative, is not effective in reducing the toxicity, mobility, or volume of potential contaminants through treatment.

5.4.2.5 *Short-Term Effectiveness*

Because Alternative 2 for soil involves no remedial action or construction, the alternative would not pose additional health risks to the community, workers, or the environment. The alternative would not meet RAOs for soil; however, it would identify potential contamination and provide institutional controls. If constituents are found at concentrations greater than risk-based screening levels, then additional action may be warranted to protect human health and the environment.

Alternative 2 for soil would be effective in the short term.

5.4.2.6 *Implementability*

In terms of feasibility, this alternative would likely require coordination with departments within the Navy and with the regulatory agencies to appropriately define sampling methodology and goals to ensure that soil associated with OWS-040A and OWS-040B has been adequately characterized. This alternative is considered to be relatively easy to implement because groundwater sampling technologies are well proven.

5.4.2.7 *Cost*

The total estimated capital cost of this alternative is approximately $253,000. Details of the cost estimate are presented in Appendix C.

5.4.3 Detailed Analysis of Alternative 3: One-Time Soil Sampling, Excavation, and Off-Site Disposal

Under this alternative soil would be sampled near OWS-040A and OWS-040B to determine the nature and extent of contamination remaining at the site. Following sampling any contaminated soil exceeding PRGs for COCs identified at the site would be excavated and disposed of off site.

5.4.3.1 *Overall Protection of Human Health and the Environment*

The principal objectives of this alternative are to eliminate direct contact with potentially contaminated soil adjacent to OWS-040A and OWS-040B and to prevent transport of potentially contaminated soil. Alternative 3 protects human health by removing soils containing

contaminants greater than remediation goals. This alternative would remediate the site to unrestricted reuse criteria and is considered to be highly effective in protecting human health.

5.4.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

This alternative would comply with chemical and location-specific ARARs that were identified in Sections 5.1.3.1 and 5.1.3.2. This section identifies action-specific ARARs for implementing Alternative 2 at the site. The following subsections present a summary of the action-specific ARARs that are included in Alternative 2 and how they will comply with ARARs.

Potential Action

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken. These requirements are triggered by the particular remedial activities selected. Action-specific ARARs indicate how each alternative must be conducted. The Navy identified the following action-specific ARARs for excavation and off-site disposal.

Soil Sampling and Excavation

The following RCRA requirements are ARARs for any waste generated from soil sampling activities to determine if any waste generated is hazardous waste in accordance with the RCRA requirements of Title 22 CCR 66261.10 and 66261.11. The following requirements are potential ARARs for any RCRA hazardous waste:

- Title 22 CCR 66262.34 (RCRA hazardous waste accumulation requirements)
- Title 22 CCR 66262.30 (RCRA packaging requirements)
- Title 22 CCR 66262.31 (RCRA labeling requirements)
- Title 22 CCR 66262.32 (RCRA marking requirements)
- Title 22 CCR 66262.33 (RCRA placarding requirements)
- Title 22 CCR 66262.20, 66262.21, 66252.22 and 66262.23 (RCRA manifest requirements)

The following Clean Air Act requirement is a potential ARAR for excavation:

- Regulation 6-302: Opacity Limitation (prohibiting emissions for a period aggregating more than 3 minutes in any hour an emission equal to or greater than 20 percent opacity).

The City of Alameda Ordinance No. 2824 sets forth restrictions for excavation in the Marsh Crust areas of Alameda Point. This ordinance is to be considered criteria for excavations that

affect the Marsh Crust. If any excavation will be conducted as a result of sampling activities, this ordinance would be a "to be considered" criteria.

Transportation of Hazardous Waste

The following Federal Hazardous Materials Transportation Law sections are potential ARARs for transporting of any hazardous waste:

- Federal Hazardous Materials Transportation Law, Title 49 USC 5101 through 5127, 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 (requirements for transporting hazardous wastes, including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements)

Table 5-7 summarizes the action-specific ARARs associated with Site 6 Soil.

Summary of Compliance with Applicable or Relevant and Appropriate Requirements

Excavated soil adjacent to OWS-040A and OWS-040B at Site 6 will be sampled to determine whether it is hazardous, and sampling, staging, transport, and disposal actions conducted on site will comply with ARARs. RCRA requirements will be used to identify hazardous waste (22 CCR 66261.24). Excavated soils containing hazardous waste will be handled in accordance with ARARs. Land disposal restrictions will be met by treating and disposing of contaminated waste at an off-site, permitted facility.

Bay Area Air Quality Management District Regulations 6-301 for visible emissions and 6-302 for opacity limits would be met by using water to control construction dust. Air monitoring would ascertain the effectiveness of the construction dust control measures in complying with these regulations. Because of the site's location, the Coastal Zone Management Act may be applicable. This law requires site development to be consistent with the San Francisco Bay Conservation and Development Commission (BCDC) Bay Plan. Alternative 3 does not significantly change the current site use, the nearby shoreline, or other natural resources associated with the site; thus Alternative 3 would comply with the BCDC Bay Plan and with all ARARs.

Excavation may affect the Marsh Crust encountered at Site 6. In that event, excavation would comply with the substantive provisions of the Marsh Crust Ordinance (City of Alameda 2000).

5.4.3.3 Long-Term Effectiveness and Permanence

Alternative 3 is expected to prevent human contact with potentially contaminated soil adjacent to OWS-040A and OWS-040B that exceeds the remediation goals. Confirmation sampling conducted after soil excavation would verify that potential contaminant concentrations in residual soils are less than the RAOs. In addition, confirmation sampling for the appropriate

chemicals conducted after soil excavation within a 15-by-15-foot area adjacent to OWS-040A and OWS-040B would verify that soils are less than PRGs for the chemicals determined to be an issue during the initial sampling effort. The excavated area would then be backfilled with clean, imported soil and graded. This alternative is highly effective at eliminating known human health risks to future residents.

5.4.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 3 would reduce the toxicity, mobility, or volume of potentially contaminated soil adjacent to OWS-040A and OWS-040B by excavating, disposing of contaminated materials at an off-site facility. In addition, if needed, the treated soil would be disposed of at a hazardous or solid waste disposal facility. If treatment at an off-site facility occurred, this treatment would further reduce the mobility and/or toxicity of chemicals in removed soils.

5.4.3.5 Short-Term Effectiveness

Alternative 3 would result in potential site risks to the community during excavation and transporting activities. Wetting soils during excavation would help to control blowing dust. Short-term risks to workers would be limited to potential direct contact with soil potentially contaminated with VOCs, SVOCs, pesticides, PCBs, metals and TPH adjacent to OWS-040A and OWS-040B, and risks inherent to construction and solids handling. Adherence to standard industry health and safety practices is expected to provide adequate protection to workers and the nearby community during excavation and removal of contaminated soil. No additional environmental impacts are expected during implementation. Field activities associated with this alternative, including pre-design sampling, excavation, confirmation sampling and analysis, stockpile sampling and analysis, profiling, and off-site transportation would take 2 weeks. This alternative would meet the RAOs for soil in the short term but would increase short-term risks to workers, the community, and the environment. Alternative 3 is considered to be highly effective in the short term.

5.4.3.6 Implementability

All of the alternatives are readily implementable. In terms of administrative feasibility, this alternative would likely require coordination with departments within the Navy and with the regulatory agencies to (1) identify any utilities that may be present, (2) obtain utility clearances, and (3) obtain any necessary permits. This alternative is considered to be moderately easy to implement.

5.4.3.7 Cost

The total estimated capital cost of this alternative is approximately $240,000. Details of the cost estimate are presented in Appendix C.

5.5 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR SOIL

This section presents a comparative analysis between Alternative 1 (no action), Alternative 2 (sampling and institutional controls) and Alternative 3 (excavation and disposal) to identify the relative advantages and disadvantages of each alternative. The comparative analysis is based on the same nine criteria that were applied individually to each of the alternatives in Section 5.4.

5.5.1 Threshold Criteria

This section evaluates alternatives in relation to the two threshold criteria: overall protection of human health and the environment and compliance with ARARs.

5.5.1.1 Overall Protection of Human Health and the Environment

The extent of contamination, if any, is unknown in soil adjacent to OWS-040A and OWS-040B. The no-action alternative (Alternative 1) would not eliminate or reduce risk or define the extent of contamination adjacent to OWS-040A and OWS-040B at Site 6. Soil sampling (Alternative 2) would reduce risks at Site 6 to acceptable levels by delineating potentially contaminated soil adjacent to OWS-040A and OWS-040B and by implementing institutional controls to prevent the domestic use of groundwater at Site 6. Excavation and disposal (Alternative 3) would reduce risks at Site 6 to acceptable levels such that there would be no restrictions on site use by removing potentially contaminated soil adjacent to OWS-040A and OWS-040B that exceeds RAOs.

5.5.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 would not trigger ARARs at Site 6. Alternatives 2 and 3 meet or have the potential to meet ARARs for soil and groundwater at Site 6 based on the respective reuse scenarios for each alternative.

5.5.2 Balancing Criteria

This section evaluates the alternatives in relation to the five balancing criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume; short-term effectiveness; implementability; and cost.

5.5.2.1 Long-Term Effectiveness and Permanence

Alternative 3 (soil sampling, excavation and disposal) has the highest degree of long-term effectiveness and permanence because potentially contaminated soil at Site 6 is removed from the sites such that there are no restrictions on site use. The no-action alternative and Alternative 2 would leave contaminated soil at the site.

5.5.2.2 *Reduction in Toxicity, Mobility, and Volume*

Alternative 1 does not reduce the toxicity, mobility, or volume of potentially contaminated through treatment or disposal. The institutional control for Alternative 2 prohibits excavation and therefore will reduce the mobility of contaminated soil at the site. Alternative 3 reduces the mobility of these contaminants by relocating and treating them at an off-site facility, thus preventing their exposure to human or ecological receptors.

5.5.2.3 *Short-Term Effectiveness*

The no-action alternative would have no short-term impacts on the environment. Alternative 2 would have minimal short-term impacts on the environment during sampling activities. Alternative 3 includes excavation, which has the potential to create negative, short-term air and water quality impacts; such impacts would be reduced through use of dust and erosion control methods. None of these alternatives would be expected to pose unacceptable short-term risks to site workers or the community.

5.5.2.4 *Implementability*

All of the alternatives are readily implementable.

5.5.2.5 *Cost*

The no-action alternative is based on an assumption of zero cost. Alternative 2 and Alternative 3, have costs of $253,000 and $240,000, respectively.

5.6 DETAILED ANALYSIS OF ALTERNATIVES FOR GROUNDWATER

The following sections present a detailed analysis of each groundwater alternative. The no-action alternative is evaluated in Section 5.6.1. Alternative 2 is evaluated in Section 5.6.2, Alternatives 3A and 3B are evaluated in Section 5.6.3, and Alternatives 4A and 4B are evaluated in Section 5.6.4.

5.6.1 Detailed Analysis of Alternative 1: No Action for Groundwater

Under this alternative, no efforts would be made to contain, remove, monitor, or treat the contaminated groundwater at Site 6. An evaluation of the no-action alternative provides a baseline against which other alternatives can be measured.

5.6.1.1 *Overall Protection of Human Health and the Environment*

Groundwater at Site 6 contains chlorinated compounds at concentrations that pose a risk to humans if groundwater were extracted and used for drinking water. With unrestricted reuse,

Alternative 1 is not protective of human health because it does not prevent exposure to domestic consumption of groundwater. Domestic use of groundwater, however, is not expected under the planned reuse for Site 6.

Groundwater concentrations of chlorinated compounds at Site 6 pose a risk to humans through indoor vapor intrusion. Alternative 1 is not protective of human health because it does not prevent inhalation of indoor vapors that may partition from the groundwater and migrate to buildings.

5.6.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 would not trigger ARARs for groundwater. Section 121(d)(2) of CERCLA indicates that ARARs apply only to on-site response actions. If there is no response action, then there is no need to identify ARARs.

5.6.1.3 Long-Term Effectiveness and Permanence

Alternative 1 does not provide a mechanism to prevent extraction and domestic use of groundwater, which could result in exposure of human receptors that ingest the groundwater.

Alternative 1 also does not provide a mechanism to prevent indoor vapor intrusion of chlorinated compounds partitioning from groundwater at Sites 6.

5.6.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative would not reduce the toxicity, mobility, or volume of contaminants at Site 6 because they would not be treated. However, this alternative would eventually meet the RAOs due to natural degradation processes.

5.6.1.5 Short-Term Effectiveness

Because this alternative does not involve any action, there will be no risks to the community or worker during implementation. The RAOs for soil and groundwater would not be achieved. Therefore, the no-action alternative is not considered effective in the short term.

5.6.1.6 Implementability

Implementability includes the technical and administrative feasibility and availability of required resources. No construction or administrative activities will be required to implement this alternative; therefore, the alternative is technically feasible. This alternative is easily implemented because no action will be conducted and additional resources are not required.

5.6.1.7 Cost

No capital or O&M costs are associated Alternative 1.

5.6.2 Detailed Analysis of Alternative 2: Plume Boundary Delineation, MNA, and LUCs

The principal components of Alternative 2 are (1) MNA, (2) LUCs preventing the extraction and use of groundwater at the site, (3) LUCs requiring vapor barrier/removal system for new buildings constructed over the plumes and (4) LUCs (vapor removal systems) in existing buildings above plumes if vapor monitoring indicates that TCE or vinyl chloride concentrations in indoor air exceed the remediation goals. LUCs for groundwater extraction are necessary to protect potential receptors until MNA confirms reduction in contaminant concentrations below remediation goals. Under this alternative, no active treatment is applied to the groundwater.

Additional details for the components of Alternative 2 for Site 6 are as follows:

- MNA of COCs for an assumed duration of 30 years.
- Implementation of groundwater restrictions to prohibit (1) installation of groundwater extraction wells in the shallow aquifer and (2) extraction and use of groundwater in the shallow aquifer for any purpose until EPA, DTSC, and the Water Board concur that there is no longer an unacceptable risk from exposure to groundwater.
- Entry of the DTSC into a land use covenant restricting future occupants from drinking or discharging groundwater from the shallow aquifer. The land use covenant would provide assurances for its future enforcement.
- Recording of deed restriction to restrict the public use of groundwater at Site 6.
- LUCs requiring installation of vapor barrier/removal systems in new buildings constructed above the groundwater plumes of vapor intrusion COCs.
- Periodic drive-by inspections for the duration of the LUCs.
- Preparation of a LUC remedial design (LUC RD) report to specify the roles and responsibilities for implementing and enforcing the LUCs. The draft LUC RD report would be provided to the Federal Facilities Agreement signatories.
- LUCs (vapor removal system) in existing buildings (Building 41) located above vapor intrusion COC plumes (necessary only if vapor monitoring indicates that TCE or vinyl chloride concentrations in indoor air exceed the remediation goal)

5.6.2.1 Overall Protection of Human Health and the Environment

Alternative 2 would protect human health and the environment by preventing exposures to contaminated groundwater and vapors partitioning from groundwater. No significant risk to ecological receptors was identified in the RI report (Tetra Tech 2004). Risk to human health would be prevented by (1) prohibiting the installation of extraction wells at Site 6, (2) prohibiting the extraction and use of groundwater from the shallow aquifer at the site for any purpose, and (3) requiring installation of a vapor barrier/removal system in new buildings constructed above the groundwater plumes and (4) engineering controls (vapor removal systems) in existing buildings above plumes if vapor monitoring indicates that TCE or vinyl chloride concentrations in indoor air exceed the remediation goals. These controls would prevent exposure of human receptors to contaminated groundwater and vapors partitioning from groundwater.

5.6.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 2 would eventually meet chemical-specific ARARs through MNA. This alternative would comply with the location-specific and action-specific ARARs.

5.6.2.3 Long-term Effectiveness and Permanence

MNA to evaluate the achievement of remediation goals is assumed to last 30 years for Alternative 2. Under Alternative 2, LUCs would limit exposure to groundwater and potential vapors at Site 6 until concentrations attenuate to below the remediation goals.

5.6.2.4 Reduction of Mobility, Toxicity, or Volume through Treatment

Alternative 2 would not reduce the mobility, toxicity, or volume of hazardous substances over time through treatment at Site 6 because groundwater would not be treated. However, this alternative would eventually meet the RAOs due to natural degradation processes.

5.6.2.5 Short-term Effectiveness

Alternative 2 would involve no remedial alternative construction activities; therefore, it would not pose new health risks to the community, current occupants, or workers. This alternative would be highly effective in the short term.

5.6.2.6 Implementability

Implementability includes technical and administrative feasibility and the availability of required resources. From an administrative perspective, Alternative 2 would require agency acceptance of deed restrictions, covenants, and resolution of several legal issues; however, this alternative would be easy to implement technically, because no active remediation is required. The implementation period for LUCs would be the time required to reach vapor intrusion remediation goals.

5.6.2.7 Cost

For Site 6, the estimated total present worth cost for Alternative 2 is $1.1 million. Calculations of these costs are provided in Appendix C.

5.6.3 Detailed Analysis of Alternatives 3A and 3B: Plume Boundary Delineation, Active Groundwater Treatment to Commercial/Industrial Reuse Criteria, MNA, and LUCs

Alternatives 3A and 3B consist of active treatment of Site 6 groundwater followed by MNA. Groundwater treatment by ISCO (Alternative 3A) or hydrogen release compounds (Alternative 3B) will be conducted until COC concentrations continue to meet remedial goals and decrease in concentration within 30 years (groundwater treatment target concentrations). LUCs that prevent domestic use of groundwater will be implemented until COC concentrations are reduced below remediation goals. LUCs to prevent vapor intrusion into buildings would be implemented until vapor intrusion COC concentrations are reduced to below the inhalation remediation goals. Vapor removal systems would be installed in existing Building 41 located above vapor intrusion COC plumes if vapor monitoring inside the building indicates that TCE or vinyl chloride concentrations in indoor air are elevated.

At Site 6, implementation of ISCO (Alternative 3A) would require primary and secondary treatment with three injection events for each treatment. Each treatment would take between 6 months and 1 year. Groundwater samples will be collected after each injection event and quarterly for 2 years after the final injection event to determine if concentration rebound occurs. A total of 21 injection points would be required for Site 6. ISCO (Alternative 3A) work would be performed in Level C personal protective equipment.

Implementation of hydrogen release compounds (Alternative 3B) at Site 6 would require primary and follow-up treatment. One injection event would be required during each round of treatment. The secondary treatment would be required at 50 percent of the primary treatment injection points. Each treatment event would take approximately 1.5 years to complete. Groundwater samples will be collected after each injection event and quarterly for 3 years after the final injection event. A total of 21 injection points will be required for Site 6. Hydrogen release compound work (Alternative 3B) would be performed in Level D personal protective equipment.

The groundwater treatment target concentrations for the chlorinated ethene COCs (PCE, TCE, 1,2-DCE, and vinyl chloride) would be reduced to approximately 2 to 12 µg/L. Groundwater contamination will be examined for 30 years, although inhalation remediation goals would likely be achieved within a shorter timeframe.

MNA and LUC components for Alternatives 3A and 3B for Site 6 are the same as those for Alternative 2, described in Section 5.6.2.

5.6.3.1 *Overall Protection of Human Health and the Environment*

The evaluation of the overall protection of human health of Alternatives 3A and 3B is the same as that for Alternative 2 with the additional protection of human health by reducing concentrations of chlorinated compounds in groundwater and then allowing groundwater concentrations to attenuate naturally to below domestic use remediation goals in 30 years.

5.6.3.2 *Compliance with Applicable or Relevant and Appropriate Requirements*

Alternatives 3A and 3B would comply with all chemical-, location- and action-specific ARARs identified for the alternatives. Specific ARARs associated with the active groundwater remediation technology selected for this alternative are provided below.

In Situ Chemical Oxidation and Hydrogen Releasing Compounds

This alternative will involve the use of ISCO (Alternative 3A) and hydrogen releasing compounds (Alternative 3B) to treat contaminated groundwater in high concentration areas. For ISCO (Alternative 3A) and hydrogen release compounds (Alternative 3B), the Safe Drinking Water Act, Title 40 CFR 144.12 (prohibiting injection activities that allow movement of contaminants into underground sources of drinking water) is an ARAR.

The Navy does not expect large quantities of hazardous waste to be generated as a result of the ISCO (Alternative 3A) and hydrogen release compounds (Alternative 3B) process. Soil cuttings and water generated during the course of installing and operating the ISCO (Alternative 3A) and hydrogen release compounds (Alternative 3B) process are, however, subject to RCRA requirements to determine whether such wastes would be classified as hazardous, Title 22 CCR 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1) and 66261.100 (RCRA hazardous waste classification criteria).

In addition, the following are ARARs would be evaluated in the event hazardous waste is generated:

- Title 22 CCR 66262.34 (RCRA hazardous waste accumulation requirements)
- Title 22 CCR 66262.30 (RCRA packaging requirements)
- Title 22 CCR 66262.31 (RCRA labeling requirements)
- Title 22 CCR 66262.32 (RCRA marking requirements)
- Title 22 CCR 66262.33 (RCRA placarding requirements)
- Title 22 CCR 66262.20, 66262.21, 66252.22 and 66262.23. (RCRA manifest requirements)
- Federal Hazardous Materials Transportation Law, Title 49 USC 5101 through 5127; 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 (requirements for transporting hazardous wastes)

The Navy will also determine whether any waste generated is a designated waste or nonhazardous waste pursuant to Title 22 CCR 20210 and 20220.

For any excavation or drilling of wells into the Marsh Crust area, the Marsh Crust Ordinance (City of Alameda 2000) is a TBC criterion.

5.6.3.3 Long-Term Effectiveness and Permanence

MNA to evaluate the achievement of remediation goals is assumed to last 30 years for Alternatives 3A and 3B. Under Alternatives 3A and 3B, LUCs would limit exposure to groundwater and potential vapors at Site 6 until concentrations attenuate to below the remediation goals.

5.6.3.4 Reduction of Mobility, Toxicity, or Volume through Treatment

ISCO (Alternative 3A) and hydrogen release compounds (Alternative 3B) will reduce the toxicity of contaminants and the volume of contaminants by promoting degradation of toxic chlorinated compounds to less toxic or nontoxic products. The remaining residual contamination in the source area and downgradient of the source area will be reduced by natural attenuation.

5.6.3.5 Short-term Effectiveness

ISCO (Alternative 3A) or hydrogen release compounds (Alternative 3B) would reduce the COC concentrations to the groundwater treatment target concentrations at Site 6 within 2 to 3 years and then to below domestic use remediation goals in an additional 30 years. ISCO (Alternative 3A) presents temporary hazards during treatment agent transport and application. These hazards would be mitigated by following proper chemical handling procedures and a health and safety plan. Hydrogen release compound (Alternative 3B) does not present any hazards.

An ISCO pilot test would evaluate the most effective oxidant and catalyst to reduce contaminant concentrations at the site. Some ISCO processes such as a modified Fenton's Reagent and stabilized peroxide can generate hydroxyl radicals under neutral conditions and do not require injection of acid. Other ISCO processes operating under low temperature and pressure require the addition of small quantities of acid (1 to 2 gallons in the injection areas). If the pH of the aquifer is lowered, metals will initially go into solution; however, concentrations generally return to background after treatment and would not be expected to affect the Oakland Inner Harbor.

5.6.3.6 Implementability

Implementability includes technical and administrative feasibility and the availability of required resources. This alternative is technically feasible. Several ISCO (Alternative 3A) or hydrogen release compound (Alternative 3B) injections, however, will likely be necessary to achieve the

domestic use remediation goals. Some discussions with regulators will be necessary to implement ISCO (Alternative 3A) or hydrogen release compounds (Alternative 3B).

5.6.3.7 Cost

For Site 6, the estimated total present worth cost for Alternative 3A, using ISCO, is $1.6 million and for Alternative 3B, hydrogen release compounds, $1.3 million. The basis for these cost estimates is presented in Appendix C.

5.6.4 Detailed Analysis of Alternatives 4A and 4B: Plume Boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, MNA, and LUCs

Alternatives 4A and 4B consist of active treatment of Site 6 using ISCO (Alternative 4A) or hydrogen release compounds (Alternative 4B) with MNA. LUCs will remain until the remediation goals are reached. ISCO (Alternative 4A) and hydrogen release compound (Alternative 4B) designs for this alternative are the same as for Alternatives 3A and 3B except that target concentrations for Alternatives 4A and 4B are lower. Because PCE, TCE, and 1,2-DCE can all degrade to vinyl chloride, the target concentrations for all of the chlorinated ethenes are based on the vinyl chloride remediation goal. MNA will be followed for 30 years to confirm that COCs continue to meet remedial goals and decrease in concentration.

ISCO treatment (Alternative 4A) would require nine injection events over a 3-year period. Hydrogen release compounds (Alternative 4B) would require three injection events over a 4.5-year period. Wells will be monitored quarterly for both technologies during active treatment.

LUC components for Alternatives 4A and 4B for Site 6 are the same as those for Alternative 2. LUCs will remain for the duration of active treatment until remediation goals are met.

5.6.4.1 Overall Protection of Human Health and the Environment

The evaluation of the overall protection of human health of Alternatives 4A and 4B is the same as that for Alternatives 3A and 3B with the additional protection of human health by reducing concentrations of chlorinated compounds in groundwater to remediation goals within 3 years for ISCO (Alternative 4A) and 4.5 years for hydrogen release compounds (Alternative 4B). No significant risk to ecological receptors was identified in the RI (Tetra Tech 2004).

5.6.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

Evaluation of this criterion for Alternatives 4A and 4B is the same as for Alternatives 3A and 3B. Alternatives 4A and 4B will comply with all chemical-specific, location-specific, and action-specific ARARs.

5.6.4.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternatives 4A and 4B is greater than that of Alternatives 3A and 3B due to the time to reach remediation goals. Domestic use remediation goals and vapor intrusion remediation goals would be reached following active treatment at Site 6. MNA to evaluate the achievement of remediation goals is assumed to last 30 years for Alternatives 3A and 3B. Under Alternatives 3A and 3B, LUCs would limit exposure to groundwater and potential vapors at Site 6 until concentrations attenuate to below the remediation goals.

5.6.4.4 Reduction of Mobility, Toxicity, or Volume through Treatment

Reduction of mobility, toxicity or volume for Alternatives 4A and 4B is greater than for Alternatives 3A and 3B.

5.6.4.5 Short-Term Effectiveness

Evaluation of this criterion for Alternatives 4A and 4B is the same as for Alternatives 3A and 3B, except that remediation goals would be reached within 3 to 4.5 years instead of 30 years.

5.6.4.6 Implementability

Implementability includes technical and administrative feasibility and the availability of required resources. This alternative is technically feasible. Several ISCO (Alternative 4A) or hydrogen release compound (Alternative 4B) injections, however, will likely be necessary to achieve the domestic use remediation goal. Some discussions with regulators will be necessary to implement ISCO (Alternative 4A) or hydrogen release compounds (Alternative 4B) as well as to negotiate the LUCs.

5.6.4.7 Cost

For Site 6, the estimated total present worth cost for Alternative 4A, using ISCO, is $3.6 million and for Alternative 4B, hydrogen release compounds, $2.1 million. The basis for these cost estimates is presented in Appendix C.

5.7 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR GROUNDWATER

This section presents a comparative analysis of the remedial alternatives proposed in this FS report. The comparative analysis of remedial alternatives evaluates the relative performance of Alternatives 1 through 4B for seven of the nine specific NCP evaluation criteria presented in Section 4.0. The comparative analysis of groundwater remedial alternatives is summarized in Table 5-8.

The purpose of this comparative analysis is to identify the relative advantages and disadvantages of each alternative and thereby provide a sound basis for remedy selection that is consistent with the NCP. The NCP states, "The national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste."

5.7.1 Threshold Criteria

This section evaluates alternatives in relation to the two threshold criteria: overall protection of human health and the environment and compliance with ARARs.

5.7.1.1 Overall Protection of Human Health and the Environment

No unacceptable ecological risks have been identified at Site 6. With unrestricted reuse, Alternative 1 is not protective of human health because it does not prevent exposure to domestic consumption of groundwater and it does not prevent inhalation of indoor vapors that may partition from the groundwater and migrate to buildings.

Alternatives 2 through 4B would protect human health by preventing exposures to contaminated groundwater and vapors partitioning from groundwater. Risk to human health would be prevented by (1) prohibiting the installation of extraction wells at Site 6, (2) prohibiting the extraction and use of groundwater from the shallow aquifer at the site for any purpose, and (3) requiring installation of vapor barrier/removal systems in new buildings constructed above the groundwater plumes. In addition, if vapor monitoring indicates the presence of vapors at toxic concentrations in existing buildings over the plume, a vapor removal system would be installed to prevent exposure of human receptors to contaminated groundwater and vapors partitioning from groundwater.

The long-term effectiveness and permanence of Alternatives 4A and 4B is greater than Alternatives 3A and 3B due to the time to reach remediation goals. Domestic use remediation goals and vapor intrusion remediation goals would be reached following active treatment at Site 6. Groundwater monitoring to evaluate the achievement of remediation goals is assumed to last 30 years for Alternatives 3A and 3B. Under Alternatives 3A and 3B, LUCs would limit exposure to groundwater and potential vapors at Site 6 until concentrations attenuate to below the remediation goals.

The evaluation of the overall protection of human health of Alternatives 4A and 4B is the same as that for Alternatives 3A and 3B with the additional protection of human health by reducing concentrations of chlorinated compounds in groundwater to remediation goals within 3 years for ISCO (Alternative 4A) and 4.5 years for hydrogen release compounds (Alternative 4B). No significant risk to ecological receptors was identified during the RI (Tetra Tech 2004).

5.7.1.2 *Compliance with Applicable or Relevant and Appropriate Requirements*

Alternative 1 would not trigger ARARs for groundwater. Alternatives 2 through 4B are expected to meet the chemical-specific, location-specific, and action-specific ARARs identified in this FS report.

5.7.2 Balancing Criteria

This section evaluates the alternatives in relation to the five balancing criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume; short-term effectiveness; implementability; and cost.

5.7.2.1 *Long-Term Effectiveness and Permanence*

Alternative 1 would not provide long-term effectiveness and permanence for unanticipated groundwater uses at Site 6. Although risks posed by unanticipated groundwater use may decrease over time through natural attenuation, Alternative 1 would not provide any controls to prevent exposure to groundwater or indoor vapor intrusion.

Alternative 2 provides an adequate level of long-term effectiveness and permanence under both anticipated and unanticipated future land-use scenarios by preventing domestic use of groundwater and preventing indoor vapor intrusion. LUCs transfer with the land and are binding upon future owners and occupants of the property. Procedures for implementing, monitoring, and enforcing the deed restrictions will be delineated in the LUC RD, which will be reviewed and approved by all Federal Facilities Agreement signatories and the transferee.

Alternatives 3A, 3B, 4A, and 4B provide higher levels of long-term effectiveness because contamination would be actively treated. Alternatives 4A and 4B would provide the most adequate and reliable controls.

5.7.2.2 *Reduction of Mobility, Toxicity, or Volume through Treatment*

Alternative 1 will not reduce the mobility, toxicity, and volume of contamination. Alternatives 2 through 4B would eventually reduce the mobility, toxicity, and volume of contamination through natural degradation processes; however, only Alternatives 3A, 3B, 4A, and 4B would reduce the mobility, toxicity, and volume of contamination through active treatment.

5.7.2.3 *Short-Term Effectiveness*

Alternatives 1 and 2 will not introduce a risk to the community or the environment because no active remedial treatment will be conducted. Because of the injection of oxidation reagents during implementation of ISCO, Alternatives 3A and 4A may pose certain risks to the community, remediation action workers, or the environment. These risks can be mitigated through best management practices such as proper personal protective equipment and the

installation of a fence or physical barriers at the treatment area. No short-term risks are expected with implementation of hydrogen release compounds (Alternatives 3B and 4B).

5.7.2.4 Implementability

Alternative 1 is easy to implement because it requires no action. Alternative 2, 3A, 3B, 4A, and 4B may involve some implementation issues because they require the regulatory agencies and the City to agree on the legal language for the deed restrictions and the contents of the LUC RD. Alternatives 3A, 3B, 4A, and 4B are technically feasible; however, they would require numerous injections under ISCO (Alternatives 3A or 4A) or hydrogen release compounds (Alternatives 3B or 4B) to reach domestic use remediation goals, and discussions with regulators will be necessary to agree on the details of installing and operating these alternatives. Although Alternatives 3A, 3B, 4A, and 4B would require establishment of LUCs and the implementation of engineering controls in existing buildings, their required duration would be shorter than that of Alternative 2. In terms of remediation, Alternatives 3A and 3B would require active treatment followed by 30 years of MNA, while Alternatives 4A and 4B would only require active treatment.

5.7.2.5 Cost

Estimated total capital costs for each alternative are summarized below and in Table 5-6. These cost estimates were prepared based on commercially available cost estimating tools and previous estimates (published and unpublished) for similar projects. Actual costs will depend on actual labor rates, productivity, the final project schedule, and other variable factors. The table below summarizes the costs for Alternatives 2, 3A, 3B, 4A, and 4B, with hydrogen release compounds (Alternatives 3B and 4B), and ISCO options for Alternatives 3A and 4A are.

	Total Cost of Alternatives (millions of dollars)				
Site	Alternative 2	Alternative 3A Using ISCO	Alternative 3B Using Hydrogen Release Compounds	Alternative 4A Using ISCO	Alternative 4B Using Hydrogen Release Compounds
Site 6	$1.1	$1.6	$1.3	$3.6	$2.1

5.7.3 Comparative Analysis Summary

Alternative 1, no action, provides the lowest degree of protectiveness and is not acceptable. Alternatives 2, 3A, 3B, 4A, and 4B would each protect human health and would each comply with ARARs.

Potential significant risks to human health could result from the unlikely domestic use of shallow groundwater at Site 6. This FS report has developed Alternatives 3A, 3B, 4A, and 4B, which provide active groundwater treatment to reduce concentrations of VOCs to domestic use

remediation goals within 3 to 30 years. Although these times are considerably shorter than the time for Alternative 2 to reach domestic use remediation goals, it is not necessary to achieve these goals to protect human health; it is only necessary to prevent the highly unlikely domestic use of the shallow groundwater. Alternatives 2 through 4B all provide for LUCs to prevent domestic use of groundwater until domestic use remediation goals are reached.

Potential site risks to human health are present also through potential indoor vapor intrusion of COCs that partition from groundwater and may migrate through soil into buildings. Alternatives 2 through 4B all provide protection against indoor vapor intrusion through deed restrictions, but Alternatives 3A through 4B provide better protection against indoor vapor intrusion through treatment that is more effective and permanent than Alternative 2 LUCs.

For Site 6, the estimated costs for actively treating groundwater to domestic use remediation goals using ISCO as part of Alternatives 3A or 4A ($1.7 million or $3.27 million, respectively) are 50 to 100 percent higher than the cost of Alternative 2 ($1.2 million). Furthermore, Alternative 3B (active treatment [high target concentrations] with hydrogen release compounds and allowing groundwater to attenuate for 30 years to the remediation goals) would be lower in cost than Alternative 4B (active treatment [low target concentrations] using hydrogen release compounds to achieve remediation goals), but the additional cost of Alternative 4B is small compared to its shorter remediation time. Alternative 4B using hydrogen release compounds would take 5 years compared to 30 years for Alternative 3B using hydrogen release compounds and MNA. Alternative 2 is expected to require approximately 30 years to attain commercial/industrial use remediation goals at Site 6.

ISCO options (Alternatives 3A and 4A) for Site 6 are approximately $300,000 to $1.4 million higher than the cost of the hydrogen release compounds options (Alternatives 3B and 4B). For Alternatives 2 through 4B, LUCs would have to be implemented for estimated times of 30 years for Alternative 2, 30 years for Alternatives 3A and 3B, and up to 5 years for Alternatives 4A and 4B, or until domestic use remediation goals are reached. Based on modeling, inhalation remediation goals could be achieved within a shorter timeframe than domestic use remediation goals. For Site 6, Alternative 4B using hydrogen release compounds offers a relatively rapid attainment of domestic use remediation goals at a cost that is only somewhat higher than that of Alternative 2.

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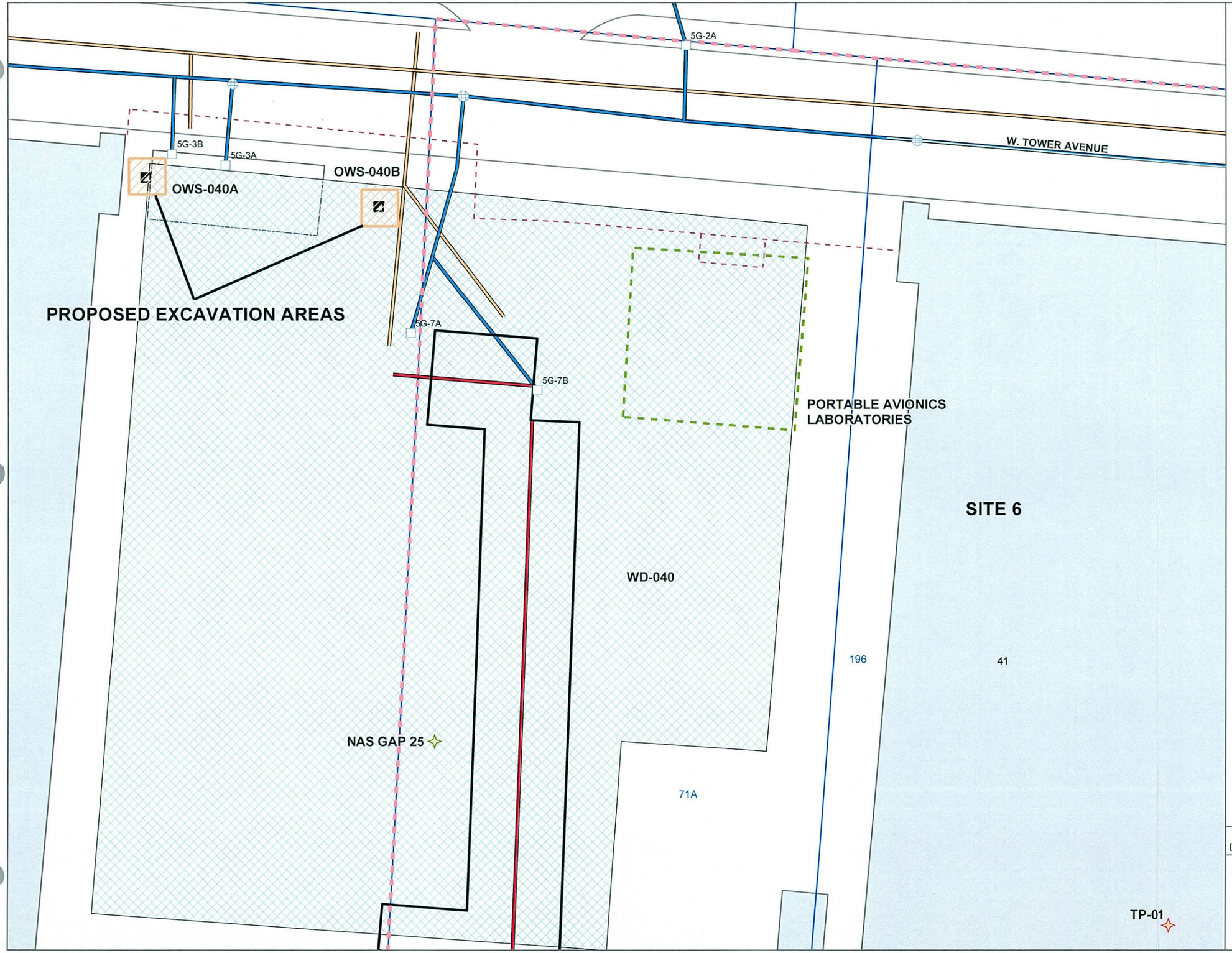
ALAMEDA POINT
SSIC NO. 5090.3.A.

FIGURES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005



OIL WATER SEPARATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
RCRA UNIT TIERED PERMIT FACILITY (TP)
FORMER SOLVENT DIP TANK
FENCE
FUEL LINE
SANITARY SEWER LINE
STORM SEWER LINE
CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
CORRECTIVE ACTION AREA (CAA)
WASHDOWN AREA (WD)
WASH PAD
PORTABLE AVIONICS LABORATORIES
PROPOSED EXCAVATION AREAS

BUILDING
Former
Present
LAND COVER

Notes:

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

Approximate Location based on the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

1 Approximate direction and velocity of groundwater movement

N

20 0 20 40 Feet

SulTech

Alameda Point
Department of the Navy, BRAC PMO West, San Diego, CA

FIGURE 5-1
PROPOSED EXCAVATION AREAS FOR SITE 6 SOIL AND OWS-040A AND OWS-040B
Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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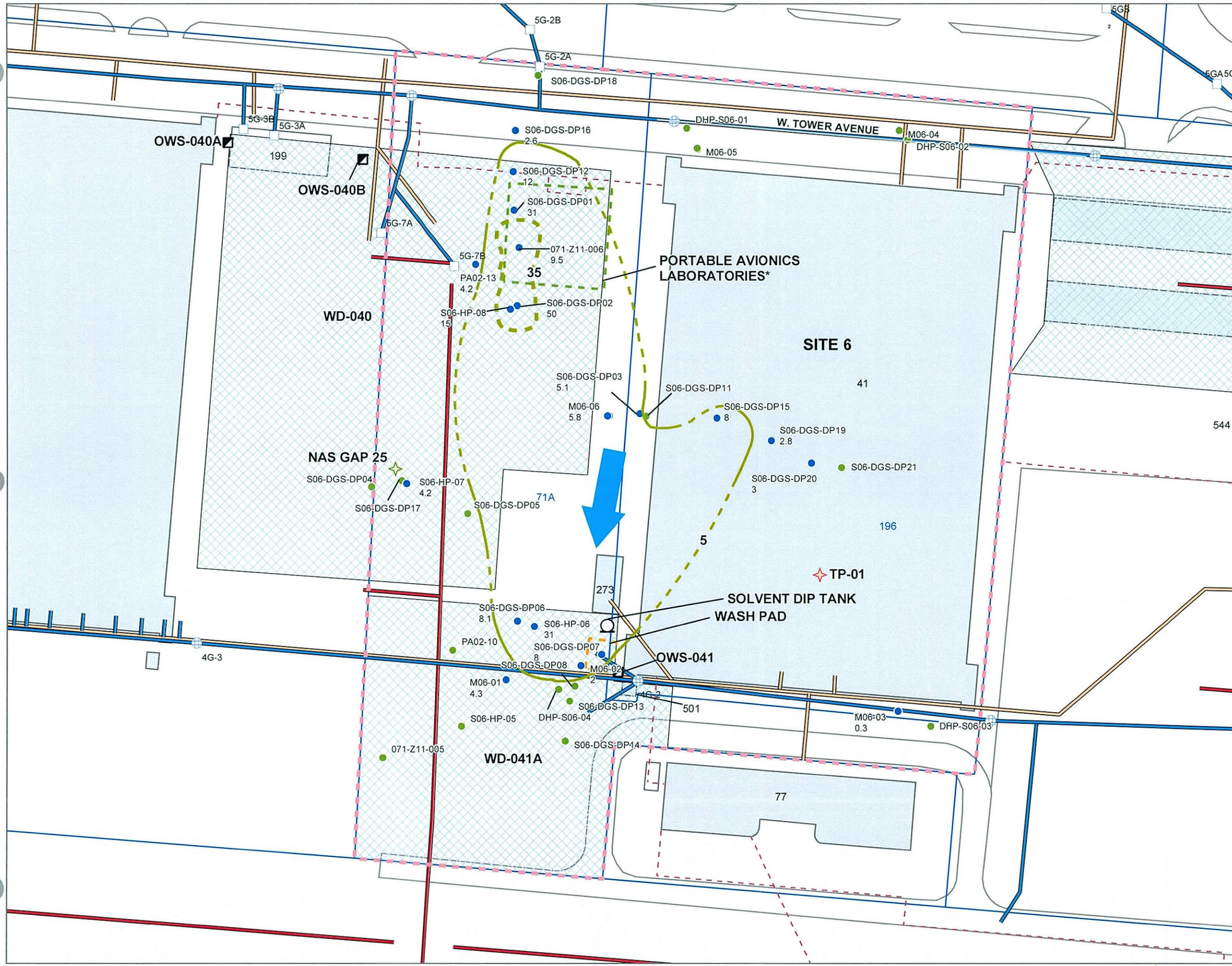

TRICHLOROETHENE (TCE) ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L.

MW06-06 4.2 — GROUNDWATER SAMPLING LOCATION WITH TCE CONCENTRATION IN µg/L.

M06-05 — GROUNDWATER SAMPLING LOCATION TCE NOT DETECTED

GROUNDWATER FLOW DIRECTION

OIL-WATER SEPARATOR (OWS)

CATCH BASIN

MANHOLE

GENERATOR ACCUMULATION POINT (GAP)

RCRA UNIT TIERED PERMIT FACILITY (TP)

FORMER SOLVENT DIP TANK

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL

WASHDOWN AREA (WD)

WASH PAD

PORTABLE AVIONICS LABORATORIES*

BUILDING

Former

Present

LAND COVER

Notes:
CERCLA Comprehensive Environmental Response, Compensation, and Liability
ug/L Microgram per liter
J Estimated
U Nondetected
Posted concentrations reflect the maximum concentration since November 1998.
* Approximate location based on the "Final Follow-On RI/FS, Phases 2B & 3" (PRC 1994)

Risk Level	Concentration (ppb)
1.00E-06	0.028
1.00E-05	0.28
1.00E-04	2.8
CA MCL	5.0

35 0 35 70 Feet

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FIGURE 5-2
TRICHLOROETHENE CONCENTRATIONS IN GROUNDWATER, SITE 6

Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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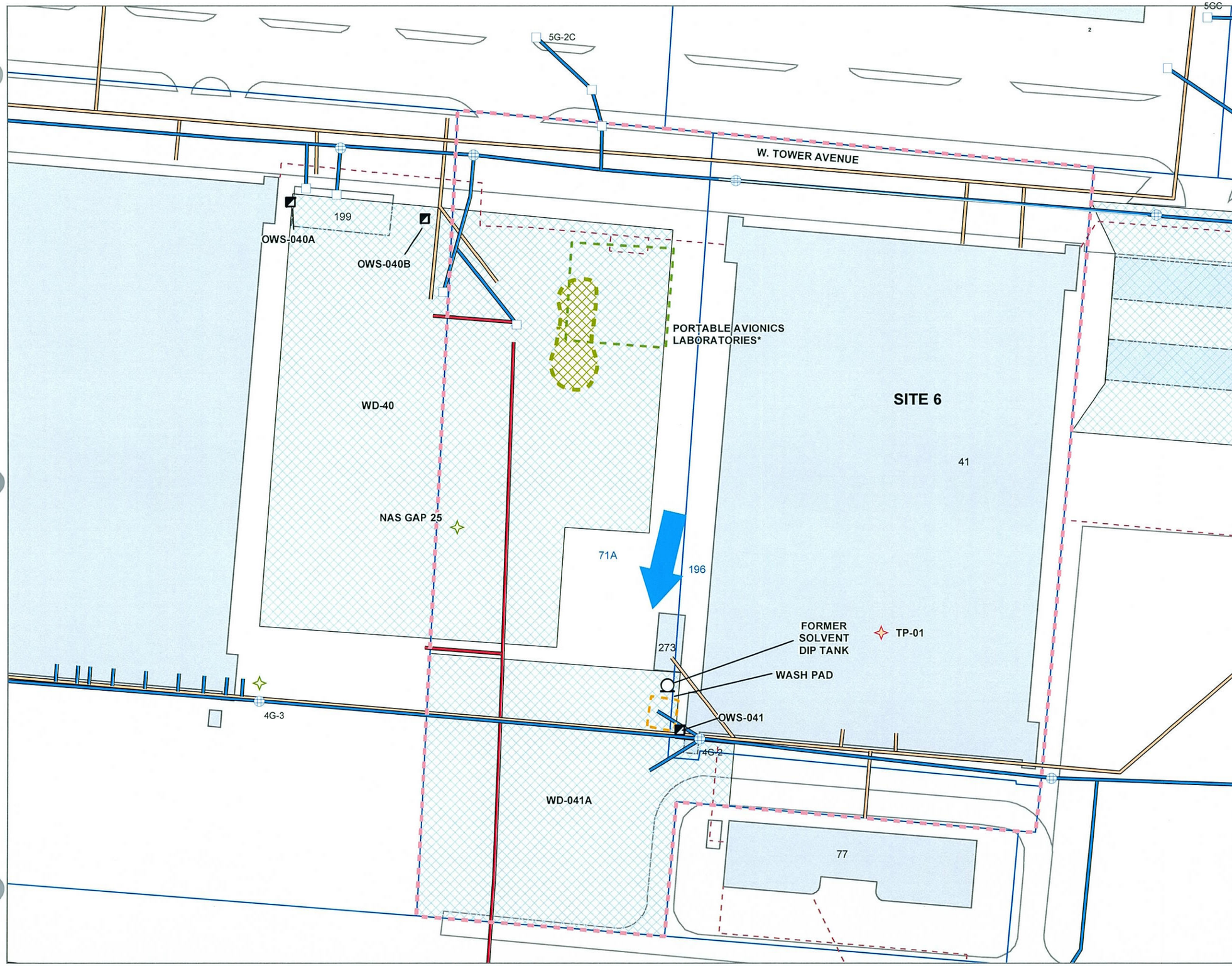

TRICHLOROETHENE ISOCONCENTRATION CONTOUR FOR 5 µg/L
GROUNDWATER FLOW DIRECTION
OIL WATER SEPARATOR (OWS)
CATCH BASIN
MANHOLE
GENERATOR ACCUMULATION POINT (GAP)
RCRA UNIT TIERED PERMIT FACILITY (TP)
FORMER SOLVENT DIP TANK
FENCE
FUEL LINE
SANITARY SEWER LINE
STORM SEWER LINE
REMEDIAL ACTION AREA
CERCLA SITE BOUNDARY
ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
WASHDOWN AREA (WD)
WASH PAD
PORTABLE AVIONICS LABORATORIES*

BUILDING
Former
Present
LAND COVER

Notes:
ug/L Microgram per liter
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
* Approximate Location based on the "Final Follow-On RI/FS, Phases 2B & 3" (PRC 1994)

35 0 35 70 Feet

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FIGURE 5-3
PROPOSED REMEDIAL ACTION AREA FOR GROUNDWATER BASED ON COMMERCIAL/INDUSTRIAL REUSE, SITE 6
Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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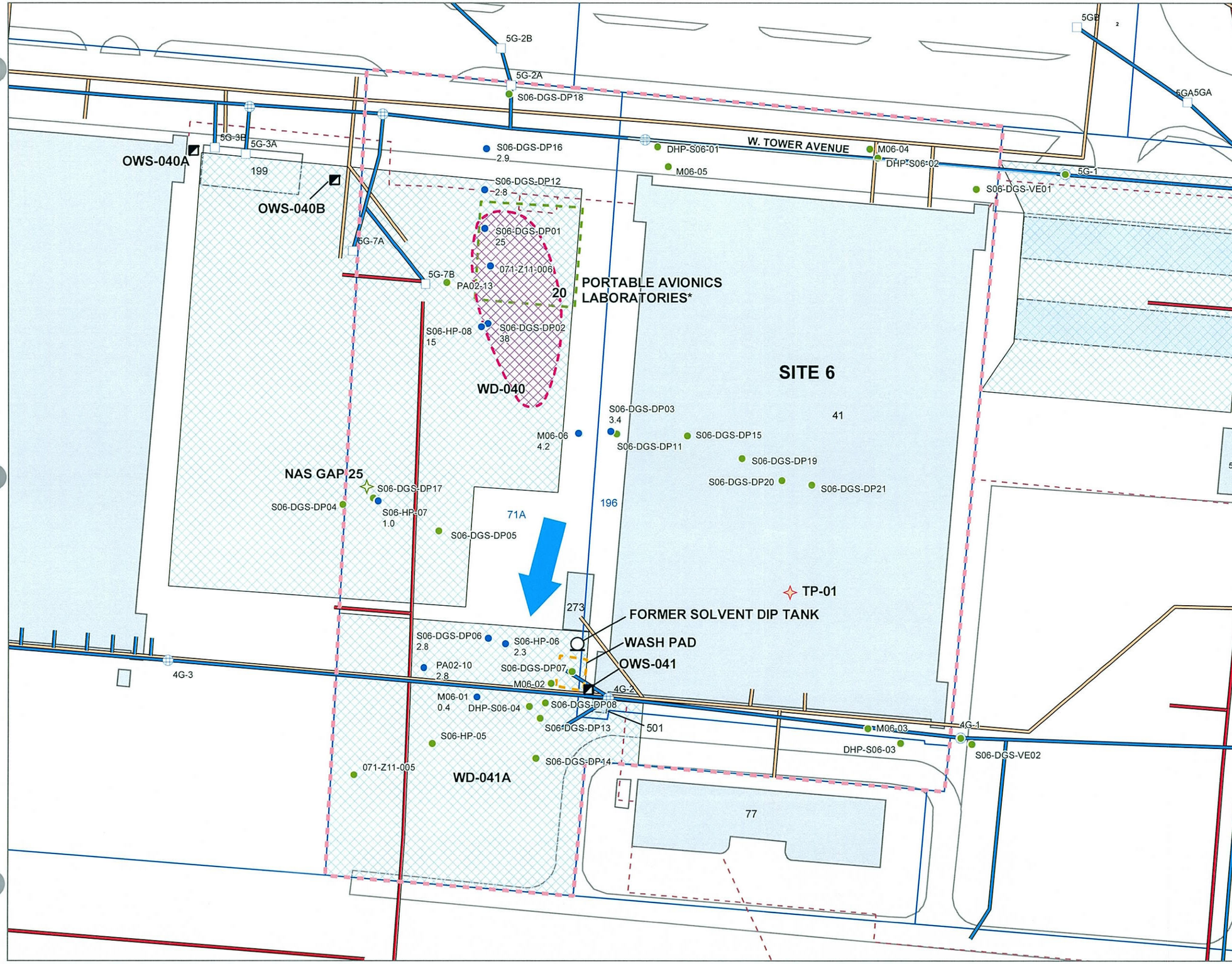

TETRACHLOROETHENE (PCE) ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L.

TETRACHLOROETHENE PLUME AREA ABOVE MCLs

MW06-06 4.2 — GROUNDWATER SAMPLING LOCATION WITH PCE CONCENTRATION IN µg/L.

M06-05 — GROUNDWATER SAMPLING LOCATION PCE NOT DETECTED

GROUNDWATER FLOW DIRECTION

OIL WATER SEPARATOR (OWS)

CATCH BASIN

MANHOLE

GENERATOR ACCUMULATION POINT (GAP)

RCRA UNIT TIERED PERMIT FACILITY (TP)

FORMER SOLVENT DIP TANK

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL

WASHDOWN AREA (WD)

WASH PAD

PORTABLE AVIONICS LABORATORIES*

BUILDING

Former

Present

LAND COVER

Notes:

Target groundwater concentration for inhalation risk is 20 µg/L.

µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
Posted concentrations reflect the maximum concentration since November 1998.
* Approximate Location designated in the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

35 0 35 70 Feet

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FIGURE 5-4
TETRACHLOROETHENE CONCENTRATIONS IN GROUNDWATER, SITE 6

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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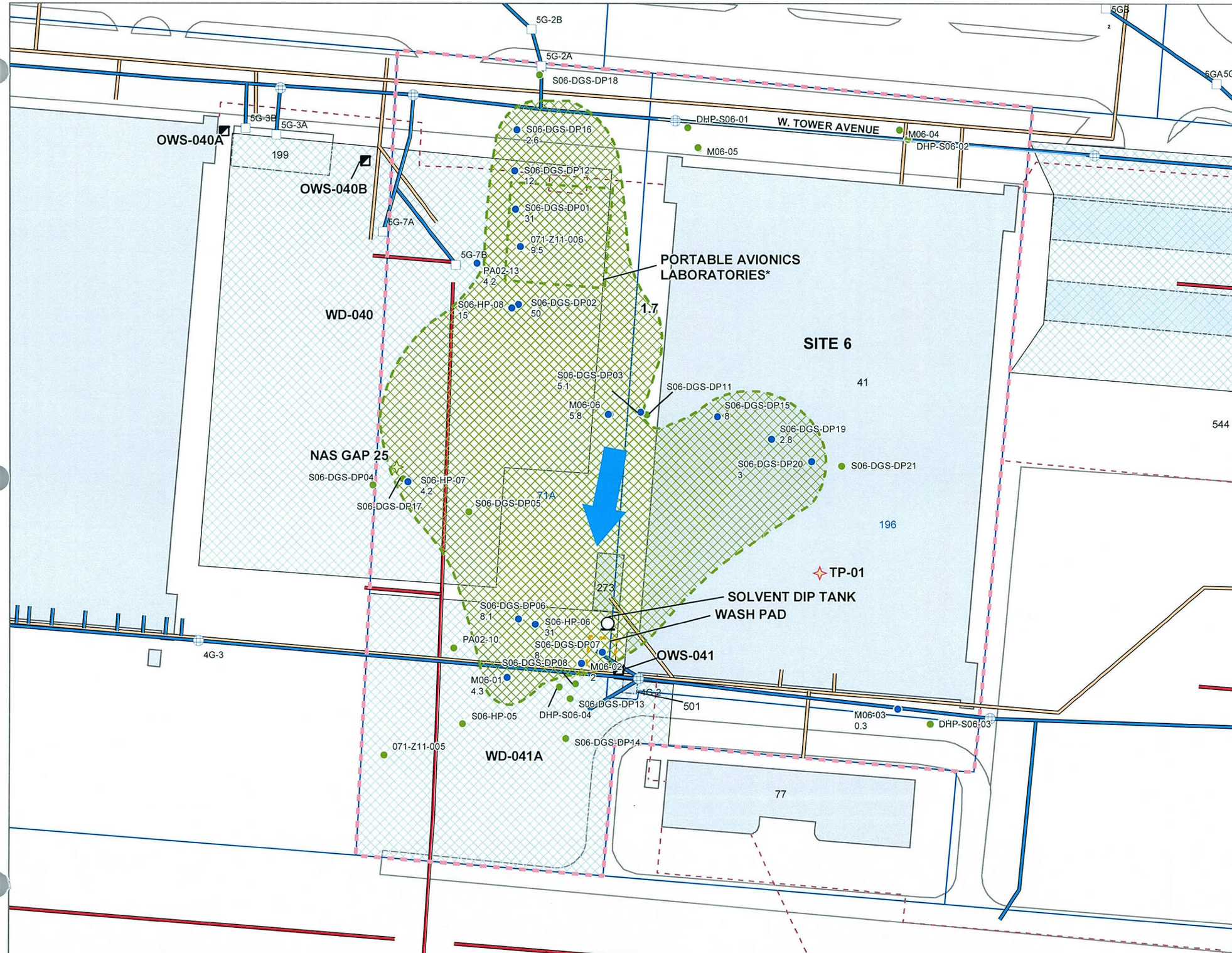

–5–	TRICHLOROETHENE (TCE) ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L.
	TRICHLOROETHENE PLUME AREA ABOVE MCLs
MW06-06 4.2	GROUNDWATER SAMPLING LOCATION WITH TCE CONCENTRATION IN µg/L.
M06-05	GROUNDWATER SAMPLING LOCATION TCE NOT DETECTED
	GROUNDWATER FLOW DIRECTION
	OIL WATER SEPARATOR (OWS)
	CATCH BASIN
	MANHOLE
	GENERATOR ACCUMULATION POINT (GAP)
	RCRA UNIT TIERED PERMIT FACILITY (TP)
	FORMER SOLVENT DIP TANK
	FENCE
	FUEL LINE
	SANITARY SEWER LINE
	STORM SEWER LINE
	CERCLA SITE BOUNDARY
	ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
	WASHDOWN AREA (WD)
	WASH PAD
	PORTABLE AVIONICS LABORATORIES*

BUILDING

- Former
- Present
- LAND COVER

Notes:

Target groundwater concentration for inhalation risk is 1.7 µg/L.

µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
Posted concentrations reflect the maximum concentration since November 1998.
* Approximate Location based on the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

35 0 35 70 Feet

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FIGURE 5-5
TRICHLOROETHENE CONCENTRATIONS IN GROUNDWATER, SITE 6

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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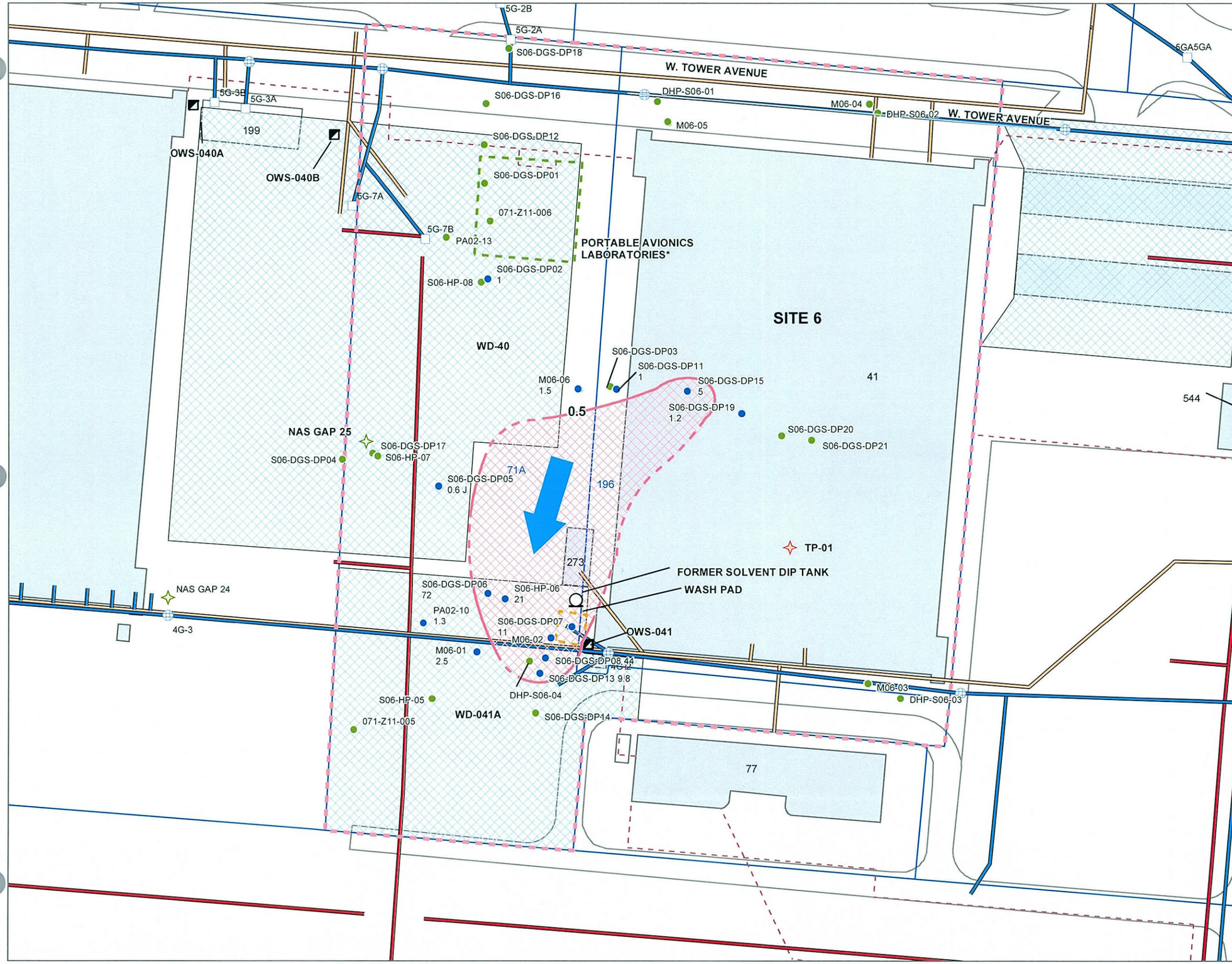

0.5 VINYL CHLORIDE ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L

VINYL CHLORIDE PLUME AREA ABOVE MCLs

MW06-06 4.2 GROUNDWATER SAMPLING LOCATION WITH VINYL CHLORIDE CONCENTRATION IN µg/L

M06-05 GROUNDWATER SAMPLING LOCATION VINYL CHLORIDE NOT DETECTED

GROUNDWATER FLOW DIRECTION

OIL WATER SEPARATOR (OWS)

CATCH BASIN

MANHOLE

GENERATOR ACCUMULATION POINT (GAP)

RCRA UNIT TIERED PERMIT FACILITY (TP)

FORMER SOLVENT DIP TANK

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL

WASHDOWN AREA (WD)

WASH PAD

PORTABLE AVIONICS LABORATORIES*

BUILDING

Former

Present

LAND COVER

Notes:

Target groundwater concentration for inhalation risk is 5.9 ug/L

µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
Posted concentrations reflect the maximum concentration since November 1998.
* Approximate Location based on the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

70 0 35 70 Feet

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FIGURE 5-6
VINYL CHLORIDE CONCENTRATIONS IN GROUNDWATER, SITE 6

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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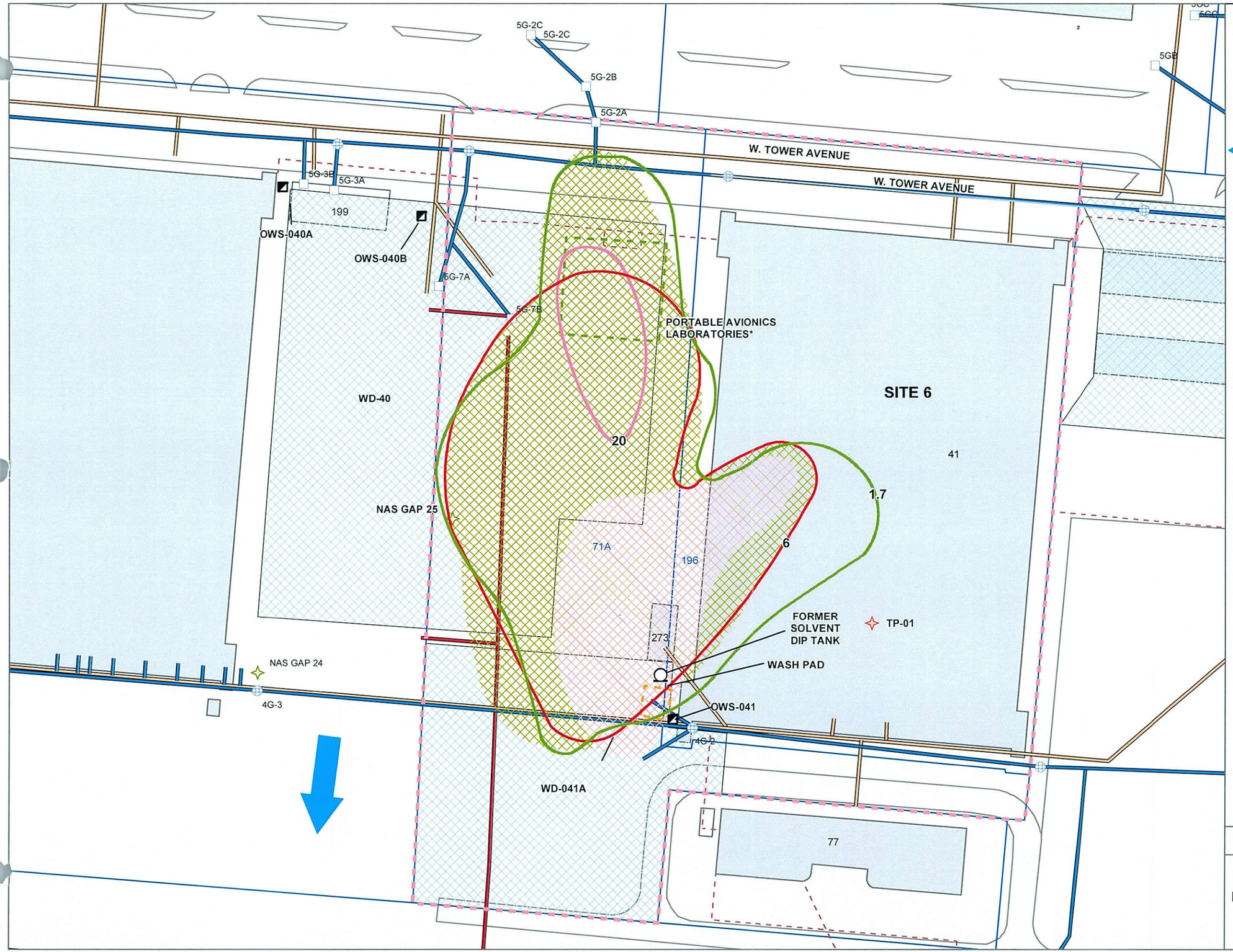

VINYL CHLORIDE PLUME (ALL DETECTIONS ABOVE 0.5 µg/L)

TRICHLOROETHENE ISO-CONCENTRATION CONTOUR FOR 1.7 µg/L

1,2-DICHLOROETHENE ISO-CONCENTRATION CONTOUR FOR 6 µg/L

TETRACHLOROETHENE ISO-CONCENTRATION CONTOUR FOR 20 µg/L

GROUNDWATER FLOW DIRECTION

OIL WATER SEPARATOR (OWS)

CATCH BASIN

MANHOLE

GENERATOR ACCUMULATION POINT (GAP)

RCRA UNIT TIERED PERMIT FACILITY (TP)

FORMER SOLVENT DIP TANK

FENCE

FUEL LINE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL

WASHDOWN AREA (WD)

WASH PAD

PORTABLE AVIONICS LABORATORIES*

PROPOSED REMEDIAL ACTION AREA

BUILDING

Former

Present

LAND COVER

Notes:

µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

* Approximate Location based on the Final Follow-On RI/FS Phases 2B & 3 (PRC 1994)

70 0 35 70 Feet

SulTech

Alameda Point
Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 5-7
PROPOSED REMEDIAL ACTION AREA FOR GROUNDWATER PLUMES BASED ON UNRESTRICTED REUSE AT SITE 6
Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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ALAMEDA POINT
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TABLES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005

TABLE 5-1: POTENTIAL RECEPTORS AND EXPOSURE ROUTES
Feasibility Study Report for OU-1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Potential Receptor	Exposure Route	Comment on the Pathway	Land Use Scenario
Soil			
Commercial/Industrial Worker	Inhalation of airborne dust particles	Results of the RI risk assessment indicate acceptable levels of risk for this pathway.	Commercial/Industrial
	Dermal contact with soil	Results of the RI risk assessment indicate acceptable levels of risk for this pathway; however, risk associated with potential contamination adjacent to the OWSs is unknown.	
Construction Worker	Inhalation of airborne dust particles	Results of the RI risk assessment indicate an acceptable level of risk for this pathway.	Commercial/Industrial/ Residential
	Dermal contact with soil	Results of the RI risk assessment indicate an acceptable level of risk for this pathway; however, risk associated with potential contamination adjacent to the OWSs is unknown.	
Recreational	Inhalation of airborne dust particles	Results of the RI risk assessment indicate an acceptable level of risk for this pathway.	Recreational Commercial/Industrial/ Residential
	Dermal contact with soil	Results of the RI risk assessment indicate an acceptable level of risk for this pathway; however, risk associated with potential contamination adjacent to the OWSs is unknown.	
Hypothetical Residential	Inhalation of airborne particles as dust	Results of the RI risk assessment indicate an acceptable level of risk for this pathway.	Residential
	Ingestion or dermal contact with soil	Results of the RI risk assessment indicate an acceptable level of risk for this pathway; however, risk associated with potential contamination adjacent to the OWSs is unknown.	

TABLE 5-1: POTENTIAL RECEPTORS AND EXPOSURE ROUTES (CONTINUED)
Feasibility Study Report for OU-1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Potential Receptor	Exposure Route	Comment on the Pathway	Land Use Scenario
Groundwater			
Commercial/Industrial Worker	Indoor air inhalation of VOCs from groundwater	Results of the RI risk assessment indicate an unacceptable level of risk for this pathway.	Commercial/Industrial
Construction Worker	Inhalation of VOCs in outdoor air from the subsurface and dermal contact with VOCs in groundwater	Inhalation of VOCs in outdoor air from the subsurface and dermal contact with groundwater were considered incomplete because dewatering would occur during construction activities. It is likely that construction workers would be exposed to vapors from VOCs in outdoor air; however, this should be mitigated through standard health and safety procedures to protect worker health.	Commercial/Industrial/ Residential
Recreational	Inhalation of VOCs in outdoor air from the subsurface	Results of the RI risk assessment indicate an acceptable level of risk for this pathway.	Recreational Commercial/Industrial/ Residential
Hypothetical Residential	Residential use of groundwater (dermal contact, ingestion, and inhalation of VOC while showering) Inhalation of VOCs in indoor air	Results of the RI risk assessment indicate an unacceptable level of risk for this pathway.	Residential
Ecological life (Aquatic receptors)	Ingestion or dermal contact with VOCs that have migrated in groundwater to surface water	The Site 6 plume does not extend to surface water surrounding Alameda Point and data do not indicate that migration of chemicals through storm drains would be a significant pathway; therefore, exposure pathways are possible but insignificant.	Not applicable

Notes:

OWS Oil-water separator
RI Remedial investigation
VOC Volatile organic compound

TABLE 5-2: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
		GROUNDWATER		
State Requirements				
Cal/EPA Department of Toxic Substances Control				
Describes the water basins in the San Francisco Bay Region, establishes beneficial uses of groundwater and surface water, establishes WQOs, including narrative and numerical standards, establishes implementation plans to meet WQOs and protect beneficial uses, and incorporates statewide water quality control plans and policies.		Comprehensive Water Quality Control Plan for the San Francisco Bay (Basin Plan) (Cal. Water Code § 13240)	Applicable	Substantive requirements pertaining to beneficial uses, WQOs, and certain statewide water quality control plans are potential state ARARs for the the alternatives addressing groundwater
Incorporated into all regional board basin plans. 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.		SWRCB Res. 88-63 (Sources of Drinking Water Policy)	Applicable	This resolution is potential ARAR for the alternatives addressing groundwater.

TABLE 5-2: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
		SOIL		
Federal				
Resource Conservation and Recovery Act (Title 42 USC Chapter 82, 6901 through 6991[i])[c]				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste.	Title 22 CCR 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether waste is hazardous.
Land Disposal Restrictions prohibit disposal of hazardous waste unless treatment standards are met.	Hazardous waste land disposal	Title 22 CCR 66268.1(f)	Applicable	This requirement is applicable if hazardous waste is to be disposed of on land.
Toxic Substances Control Act (15 USC, ch. 53, §§ 2601–2692)[c]				
Regulates storage and disposal of PCB remediation waste. There are three options: a) self-implementing on-site cleanup and disposal; b) performance-based disposal using existing approved disposal technologies; and c) risk-based disposal.	Soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm.	40 CFR § 761.61(a)(4), (b), and (c)	Relevant and Appropriate	This section is potentially relevant and appropriate for PCB contaminated soil. Section (a)(4) establishes a cleanup level for bulk PCB remediation waste in high-occupancy areas of less than or equal to 1 ppm. The cleanup level for bulk PCB remediation waste in low-occupancy areas is less than or equal to 25 ppm. Section (c) offers an alternative using risk-based levels and technologies.
State				
State and Regional Water Quality Control Board				
Definitions of designated waste, nonhazardous waste, and inert waste		Title 27 CCR 20210, 20220 and 20230	Applicable	Potential ARAR for classifying waste.

TABLE 5-2: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

a	Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables
b	Only the substantive provisions of the requirements cited in this table are potential ARARs
c	Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs
ARAR	Applicable or relevant and appropriate requirement
CCR	*California Code of Regulations*
gpd	Gallon per day
PCB	Polychlorinated biphenyl
ppm	Part per million
RCRA	Resource Conservation and Recovery Act
SWRCB	State Water Resources Control Board
TCLP	Toxicity characteristic leaching procedure
TDS	Total dissolved solids
TSCA	Toxic Substances Control Act
USC	*United States Code*
WQO	Water quality objective

TABLE 5-3: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Federal					
Endangered Species Act of 1973 (Title 16 USC §§ 1531–1543)[b]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	16 USC § 1536(a), (h)(1)(B)	Applicable	Applicable if endangered species are found at Site 6.
Coastal Zone Management Act (Title 16 USC §§ 1451–1464)[b]					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands under and adjacent to shore land.	16 USC § 1456(c) 15 CFR § 930	Relevant and Appropriate	Remedial alternatives will comply with the Coastal Zone Management Act and Bay Plan
State					
Endangered species habitat	No person shall import, export, take, possess, or sell any endangered or threatened species or part or product thereof.	Threatened or endangered species determination on or before 01 January 1985 or a candidate species with proper notification.	Cal. Fish & Game Code § 2080	Relevant and Appropriate	This section may be potentially relevant and appropriate if there are threatened or endangered species/habitats present at the site. If endangered species are present, the ecological assessment will evaluate potential effects of the contamination present and the planned response action.

TABLE 5-3: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

a	only the substantive provisions of the requirements cited in this table are potential ARARs
b	statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs
ARAR	Applicable or relevant and appropriate requirement
CFR	*Code of Federal Regulations*
USC	*United States Code*

TABLE 5-4: REMEDIAL ACTION OBJECTIVES FOR SITE 6 GROUNDWATER

Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Chemical of Concern	Potential Receptor	Exposure Route	Remediation Goal (µg/L)
1,2-Dichloroethene	Commercial/Industrial Worker	Inhalation of VOCs in indoor air	121,000
	Hypothetical Resident	Inhalation of VOCs in indoor air	8,800
Tetrachloroethene	Commercial/Industrial Worker	Inhalation of VOCs in indoor air	420
	Hypothetical Resident	Inhalation of VOCs in indoor air	20
Trichloroethene	Commercial/Industrial Worker	Inhalation of VOCs in indoor air	37
	Hypothetical Resident	Inhalation of VOCs in indoor air	1.7
Vinyl Chloride	Commercial/Industrial Worker	Inhalation of VOCs in indoor air	240
	Hypothetical Resident	Inhalation of VOCs in indoor air	5.9

Notes:

µg/L Microgram per liter
VOC Volatile organic compound

TABLE 5-5: PRELIMINARY SCREENING OF GROUNDWATER TREATMENT TECHNOLOGIES FOR SITE 6
Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

General Response Action	Technology Group	Treatment Technology	Description	Evaluation Result [a,b]
No Action	No Action	No Action	No remediation, control, or monitoring actions would be taken at the site. The site would be left as it is.	Retained for Site 6: required to be evaluated under NCP and CERCLA as amended as a baseline for comparison with other remedial alternatives.
Land Use Controls	Governmental Controls	Zoning Restrictions	A common land use restriction specifying allowed land uses for certain areas. Zoning can be used to prohibit activities that could disturb a certain aspect of a remedy or to control certain exposures not otherwise protected under a remedy.	Retained for Site 6: effective, readily implementable, and low cost.
		Groundwater Use Restrictions	Restrictions directed at limiting or prohibiting certain uses of groundwater; for example, the use of groundwater as a drinking water source and prohibitions on well drilling.	Retained for Site 6: effective, readily implementable, and low cost.
	Proprietary Controls	Easements	A property right conveyed by a landowner to another party, which gives the second party rights with regard to the landowner's land. For example: affirmative easement – access by a nonlandowner to a property to conduct inspection or monitoring and negative easement – prohibit well-drilling on the property by the landowner.	Retained for Site 6: necessary component of LUCs to allow property access for long-term monitoring, and readily implementable.
		Covenants	A covenant is an agreement between a landowner to another made in connection with a conveyance of property to use or refrain from using a property in a certain manner (for example, a covenant not to dig on a certain portion of the property).	Retained for Site 6: effective to ensure that the property would not be used in a manner that compromises the restrictions and is readily implementable.
	Enforcement and permit tools with IC components	Administrative Orders	An order directly restricting the use of property by a named party.	Eliminated for Site 6: zoning and groundwater use restrictions would be able to serve the objectives.

TABLE 5-5: PRELIMINARY SCREENING OF GROUNDWATER TREATMENT TECHNOLOGIES FOR SITE 6 (CONTINUED)
Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

General Response Action	Technology Group	Treatment Technology	Description	Evaluation Result [a,b]
Land Use Controls	Informational Tools	Deed Notice	Commonly refers to a non-enforceable, purely informational document filed in public land records that alerts anyone searching the records to important information about the property.	Retained for Site 6: compliments other LUC components and can be used to require the installation of vapor barrier systems prior to construction of new buildings.
	Engineering Controls	Vapor Barrier	Vapor barriers are a passive approach typically employed during construction. Vapor barrier construction consists of installation of the vapor barrier (6-mil polyethylene or equivalent) sealing plumbing penetrations, mixing of floor slab concrete with superplasticizers, reinforcing of slab at reentrant corners and proper slab curing and loading.	Eliminated for existing buildings because of technical impracticability of installation. Retained as a potential LUC requirement for future buildings.
		Vapor Removal Systems	This is an active approach, such as a depressurization fan to lower the pressure below the slab. This lower pressure creates a sink for vapors beneath the building where vapors are typically collected in perforated piping, and then extracted from below the building and diverted to ambient air	Retained as a potentially effective control for both existing and future buildings.
Active Remediation	Ex situ Treatment	Pump and Treat by Air Stripping	Air stripping is a full-scale technology in which volatile organic compounds are partitioned from groundwater by greatly increasing the surface area of the contaminated water exposed to air. Types of aeration methods include packed towers, diffused aeration, tray aeration, and spray aeration.	Eliminated for Site 6: Aquifer too thin and permeability too low for effective pumping.
	Ex situ Treatment	Pump and Treat by Chemical/UV Oxidation	Organic compounds are destroyed by addition of strong oxidizers and irradiation with UV light. Oxidation reactions are achieved by the synergistic action of UV light with ozone and/or hydrogen peroxide.	Eliminated for Site 6: Aquifer too thin and permeability too low for effective pumping.

TABLE 5-5: PRELIMINARY SCREENING OF GROUNDWATER TREATMENT TECHNOLOGIES FOR SITE 6 (CONTINUED)
Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

General Response Action	Technology Group	Treatment Technology	Description	Evaluation Result [a,b]
Active Remediation	Ex situ treatment	Pump and Treat by Carbon Adsorption	Groundwater is pumped through a series of canisters or columns containing activated carbon to which dissolved organic contaminants adsorb. Periodic replacement or regeneration of saturated carbon is required.	Eliminated for Site 6: Considered a presumptive remedy by EPA[c] but with limited effectiveness for halogenated VOCs, long-term timeframe and high cost.
		Pump and Treat by Aerobic Biological Reactors	Contaminants in extracted groundwater are put into contact with microorganisms in attached or suspended growth biological reactors. In suspended systems, such as activated sludge, contaminated groundwater is circulated in an aeration basin. In attached systems, such as rotating biological contractors and trickling filters, microorganisms are established on an inert support matrix.	Eliminated for Site 6: Considered a presumptive remedy by EPA[c] but with limited effectiveness for halogenated VOCs, long-term timeframe and high cost.
	In situ Treatment	Air Sparging	For air sparging, air is injected through a contaminated aquifer. Injected air traverses horizontally and vertically in channels through the soil column, creating an underground stripper that removes contaminants by volatilization.	Retained for Site 6: An effective technology for halogenated VOCs.
		Biosparging	Biosparging is similar to air sparging except that air is injected at a much lower flow rate and vapor collection is not needed. The application of this technology relies on adequate distribution of air through the subsurface.	Eliminated for Site 6: Limited effectiveness for treatment of TCE and PCE.
		In Situ Chemical Oxidation	Oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Retained for Site 6: effective for halogenated VOCs, short-term timeframe and medium cost. Modified Fenton's reagent can be used to operate process at neutral pH.

TABLE 5-5: PRELIMINARY SCREENING OF GROUNDWATER TREATMENT TECHNOLOGIES FOR SITE 6 (CONTINUED)
Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

General Response Action	Technology Group	Treatment Technology	Description	Evaluation Result [a,b]
Active Remediation	In Situ Treatment	In Situ Chemical Oxidation	Oxidation chemically converts hazardous contaminants to nonhazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Retained for Site 6: effective for halogenated VOCs, short-term timeframe and medium cost. Modified Fenton's reagent can be used to operate process at neutral pH.
		Thermal Treatment (Steam Flushing)	Steam is forced into an aquifer through injection wells to vaporize volatile and semivolatile contaminants. Vaporized components rise to the unsaturated zone, where they are removed by vacuum extraction and then treated.	Eliminated for Site 6: low effectiveness and high cost
		Passive Treatment Wall	A permeable reaction wall is installed across the flow path of a contaminant plume, allowing the water portion of the plume to passively move through the wall. These barriers allow the passage of water while prohibiting the movement of contaminants by employing such agents as zero-valent metals, chelators (ligands selected for their specificity for a given metal), sorbents, microbes, and others.	Eliminated for Site 6: long-term timeframe.
Active Remediation	In Situ Treatment	Enhanced In Situ Bioremediation using HRC/ORC	HRC is a proprietary polyacetate ester specially formulated for slow release of lactic acid upon hydration. ORC® is a patented formulation of magnesium peroxide that produces a slow and sustained release of molecular oxygen when in contact with soil moisture or groundwater. ORC and HRC are applied to the subsurface via push-point injection or within dedicated wells and are left in place to stimulate rapid contaminant degradation.	Retained for Site 6: HRC is effective for halogenated VOCs. Medium-term timeframe and medium cost eliminated for Site 6: ORC is effective for vinyl chloride and 1,2-DCE but would not reduce TCE and PCE concentrations.

TABLE 5-5: PRELIMINARY SCREENING OF GROUNDWATER TREATMENT TECHNOLOGIES FOR SITE 6 (CONTINUED)

Feasibility Study Report for OU-1 Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

General Response Action	Technology Group	Treatment Technology	Description	Evaluation Result [a,b]
Active Remediation	In Situ Treatment	Groundwater Contaminant Examination	Data collection with long-term monitoring to determine extent of residual contamination post active remediation.	Retained: Long-term timeframe but may be effective in locating residual contamination following LUCs and/or active remediation by other methods.

Notes:

a Cost::

Low Less than $3.00/1,000 gallons
Medium $3.00-$10.00/1,000 gallons
High More than $10/1,000 gallons

b Timeframe:

Short Term Less than 3 years of implementation
Medium Term 3 to 10 years of implementation
Long Term More than 10 years of implementation

c EPA. 1996. "Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites." Final Guidance. Directive 9283.1-12, EPA 540/R-96/023. Office of Solid Waste and Emergency Response. Washington, D.C. October.

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
DCE Dichloroethene
EC Engineering controls
EPA U.S. Environmental Protection Agency
HRC Hydrogen releasing compound
IC Institutional control
LUC Land-use control
NCP National Oil and Hazardous Substances Pollution Contingency Plan
ORC Oxygen releasing compounds
PCE Tetrachloroethene
TCE Trichloroethene
VOC Volatile organic compound
UV Ultraviolet

TABLE 5-6: SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER TREATMENT TECHNOLOGIES RETAINED FROM THE PRELIMINARY SCREENING FOR SITE 6

Feasibility Study Report for OU-1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Evaluation Criteria	Hydrogen Release Compound	In Situ Chemical Oxidation	Air Sparging
Effectiveness	Innovative technology with successful pilot test at Site 4. Treatability study should be conducted. Expected remediation time is 3 years.	Innovative technology with successful treatability study at Site 16. Expected remediation time is 3 years.	Well known with proven success. May be limited by low permeability. Expected remediation time is 2 years.
Implementability	Implementable at both sites. Treatment agents are not hazardous. Access to site not restricted because no surface structures required.	Implementable at both sites. Treatment agents are hazardous. Access to site restricted during injections because of hazardous treatment agents but not restricted other times because no surface structures required.	Likely to be implementable, but shallow water table could be a problem. Air sparging should be tested before full-scale implementation. Access to site restricted by above ground structures.
Cost[a]	Site 6: $1.7 million	Site 6: $1.9 million	$4.6 million

Notes:

a Cost estimates are for reducing COC concentrations to below domestic use remedial goals.

TABLE 5-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL SAMPLING AND EXCAVATION[1]					
Resource Conservation and Recovery Act (42 USC, Chapter 82, §§ 6901-6991[i]) *					
On-site waste generation	Person who generates waste shall determine if that waste is hazardous waste.	Generator of waste	Title 22 CCR Sections 66261.10 (a), 66262.11	Applicable	The requirements of 22 CCR, Division 4.5, Chapter 14 are applicable for determining whether material generated as a result of the soil sampling, excavation or in situ chemical oxidation (ISCO) process of hydrogen release compound (HRC) contains hazardous waste. These requirements may be relevant and appropriate to material that is similar or identical to RCRA hazardous waste or non-RCRA hazardous waste.
Hazardous waste accumulation	On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers or tanks, on drip pads or inside buildings, and is labeled and dated.	Accumulate hazardous waste	Title 22 CCR Section 66262.34	Applicable	These requirements are applicable if hazardous waste is generated and accumulated on site before transport.
Pre-transport requirements	Hazardous waste must be packaged in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR Section 66262.30	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Hazardous waste must be labeled in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR 22 Section 66262.31	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Provides requirements for marking hazardous waste prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR Section 66262.32	Applicable	These requirements are applicable if hazardous waste is to be transported.

TABLE 5-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL SAMPLING AND EXCAVATION[1] (Continued)					
Resource Conservation and Recovery Act (42 USC, Chapter 82, §§ 6901-6991[i]) * (Continued)					
Pre-transport requirements	A generator must ensure that the transport vehicle is correctly placarded prior to transport of hazardous waste.	Any operation where hazardous waste is generated	Title 22 CCR 66262.33	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Requires preparation of a manifest for transport of hazardous waste off site.	Any operation where hazardous waste is generated	Title 22 CCR 66262.20-66262.23	Applicable	These requirements are applicable if hazardous waste is to be transported.
Federal Hazardous Materials Transportation Law (49 USC §§ 5101-5127) *					
Transportation of hazardous material 49 USC Sections 5101-5127	Sets forth requirements for transporting hazardous waste including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements.	Interstate carriers transporting hazardous waste and substance by motor vehicle.	49 CFR Section 171.2(f), 171.2(g), 172.300, 172.301, 172.302, 172.303, 172.304, 172.312, 172.400, 172.504	Relevant and appropriate	Relevant and appropriate for transporting hazardous materials on site.
Clean Air Act (42 USC § 7401 et seq.) *					
Excavation	Sets forth opacity limitations.	Excavation	BAAQMD Regulation 6, Regulation 6-302	Applicable	These requirements are applicable for excavation activities.
Excavation	Provides requirements for maintaining, covering and stockpiling excavated soil.	Soil stockpile	BAAQMD Regulation 8, Rule 40	Relevant and appropriate	These requirements are applicable for excavation activities.

TABLE 5-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
INSTITUTIONAL CONTROLS (Land use controls)					
California Civil Code*					
Land use controls	Provides conditions under which land use restrictions will apply to successive owners of land.	Transfer property from the Navy to a nonfederal agency	Cal. Civ. Code Section 1471	Applicable	Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land ... where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety of the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health & Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed at the time of transfer.
Cal. Code Regulations Title 22*					
Land Use Controls	Sets forth recording requirements for land use covenants.	Recorded Land Use Control	Title 22 CCR 67391.1	Applicable	The substantive provisions of Section 67391.1 are potential ARARs.

TABLE 5-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
INSTITUTIONAL CONTROLS (Land use controls)					
California Health & Safety Code*					
Land Use Controls	Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Transfer property from the Navy to a nonfederal agency	Cal. Health & Safety Code Section 25202.5	Applicable	The substantive provisions of this section are the general narrative standards to restrict "present and future uses of all or part of the land on which the facility ...is located."
Land Use Controls	Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of Cal. Health & Safety Code Section 25232(b)(1)(A)–(E).	Transfer property from the Navy to a nonfederal agency.	Cal. Health & Safety Code Section 25222.1	Applicable	This section is a potential ARAR when the Navy is transferring property to a nonfederal entity. Cal. Health & Safety Code Section 25222.1 provides the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of the property. The substantive provision of Cal. Health & Safety Code Section 25222.1 is the general narrative standard: "restricting specified uses of the property."
Land Use Controls	Provides a process for obtaining a written variance from a land use restriction.	Transfer property from the Navy to a nonfederal entity.	Cal. Health & Safety Code Section 25233(c)	Applicable	This section is a potential ARAR for institutional controls where the Navy is transferring property to a nonfederal entity. Cal. Health & Safety Code Section 25233(c) sets forth substantive criteria for granting variances from the uses prohibited in Section 25232(b)(1)(A)-(E) based on specific environmental and health criteria.

TABLE 5-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
City of Alameda Ordinance No. 2824*					
Excavation	Regulates excavation activities in the Marsh Crust area of Alameda Point.	Excavation below threshold depths	City of Alameda Ordinance No. 2824	TBC	Ordinance No. 2824 is a TBC criterion for excavation activities in the Marsh Crust area at threshold depths.
Groundwater Treatment					
Safe Drinking Water Act (42 USC 300f et seq.) *					
	The UIC program prohibits injection activities that allow movement of contaminants into underground sources of drinking water that may result in violations of MCLs or adversely affect health.	An approved UIC program is required in states listed under SDWA Section 1422. Class I wells and Class IV wells are the relevant classifications for CERCLA sites. Class I wells are used to inject hazardous waste beneath the lowermost formation that contains a USDW within 0.25 mile of the well.	40 CFR Section 144.12, excluding the reporting requirements in Sections 144.12(b) and 144.12(c)(1)	Relevant and appropriate	These requirements are relevant and appropriate for ISCO and HRC.

TABLE 5-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
DISPOSAL OF PCB-CONTAMINATED SOIL					
Toxic Substances Control Act (15 USC §§ 2601–2692)*					
Disposal of PCBs	This act regulates the storage and disposal of PCB remediation waste. There are three options: (1) self-implementing on-site cleanup and disposal; (2) performance-based disposal using existing approved disposal technologies; and (3) risk-based disposal. This act is applicable to soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm.	PCB-contaminated soil	40 CFR Section 761.61(a)(4), (b), and (c)	Relevant and appropriate	This section is relevant and appropriate for the disposal of soil containing PCBs.

Notes:

1 The Clean Air Act ARARs apply only to the alternatives involving excavation.

* Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of specific citations are considered potential ARARs

ARAR	Applicable or relevant and appropriate requirement	PCB	Polychlorinated biphenyl
BAAQMD	Bay Area Air Quality Management District	ppm	Parts per million
CCR	*California Code of Regulations*	RCRA	Resource Conservation and Recovery Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	SDWA	Safe Drinking Water Act
CFR	*Code of Federal Regulations*	TBC	To be considered
DTSC	Department of Toxic Substances Control	TSCA	Toxic Substances Control Act
DOT	U.S. Department of Transportation	UIC	Underground injection control
HRC	Hydrogen Release Compound	USC	*United States Code*
ISCO	In situ chemical oxidation	USDW	U.S. Drinking Water
MCL	Maximum contaminant level		

TABLE 5-8: SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES FOR SITE 6
Feasibility Study Report for OU 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Alternative	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost Effectiveness*
	Parameters considered: • The expected long-term reduction in risk posed by the site • The level of effort needed to maintain the remedy and monitor the area for changes in site conditions • The compatibility of the remedy with planned future use of the site	Parameters considered: • The amount of hazardous materials destroyed or treated • The degree of expected reduction in toxicity, mobility, or volume • The degree to which the benefits of the remedial alternative are irreversible • The types and quantities of treatment residuals that remain following treatment	Parameters considered: • Protection of the community during the remedial alternative • Protection of workers during the remedial alternative • Environmental impacts of the remedial alternative • Time required to achieve RAOs	Parameters considered: • Technical and administrative feasibility • Availability of required resources	Parameters considered: • Capital costs • Operations and maintenance costs • Net present value
Alternative 1 – No Action	Low	Low	High	High	High
	Not effective and permanent because it does not address potential risks	Would not reduce toxicity, mobility, or volume of contamination through treatment.	No short-term risk because no active remediation activities are proposed	Readily implementable	No costs incurred
Alternative 2 – Monitoring and LUCs	Low	Low	High	High	Medium
	Prevents exposure until groundwater concentrations degrade to vapor intrusion remedial goals. Much longer time frame than Alternatives 1, 3, and 4	Would not reduce toxicity, mobility, or volume of contamination through treatment.	No short-term risk because no active remediation activities are proposed.	Readily implementable; groundwater sampling technology is proven; may have some difficulty reaching agreement on legal issues associated with the covenants and deed restrictions.	Low present value cost compared to Alternative 4. Site 6: $1.1 M
Alternative 3 – HRC or ISCO to Commercial/Industrial Reuse, Monitoring, and LUCs	Medium	Medium	Medium	Medium	Medium
	Prevents exposure until groundwater concentrations degrade to vapor intrusion remedial goals, and quickens degradation rate, this will occur faster than under Alternative 2.	Would reduce toxicity, mobility, or volume of contamination through treatment; however, less of the plume is treated than for Alternative 4.	If ISCO is implemented, moderate short-term risks exist during the injection or treatment agents. No short-term risks with HRC.	Technically feasible. Requires large number of injection points and multiple rounds of injection. HRC requires larger number of injection points, but fewer rounds of injection than ISCO. May have some difficulty reaching agreement on LUCs.	Low present value cost compared to Alternative 4. Site 6 ISCO: $1.6 M Site 6 HRC: $1.3 M
Alternative 4 – HRC or ISCO to Unrestricted Reuse Criteria, Monitoring, and LUCs	High	High	Medium	Medium	Low
	Prevents exposure until groundwater concentrations degrade to vapor intrusion remedial goals, and provides quickest degradation rate, this will occur faster than under Alternative 2.	Would reduce toxicity, mobility, or volume of contamination through treatment, more of the plume is treated than for Alternative 3.	If ISCO is implemented, moderate short-term risks exist during the injection or treatment agents. No short-term risks with HRC.	Technically feasible. Requires large number of injection points and multiple rounds of injection. HRC requires larger number of injection points, but fewer rounds of injection than ISCO. May have some difficulty reaching agreement on LUCs.	High present value cost compared to Alternatives 1, 2, and 3. Site 6 ISCO: $3.6 M Site 6 HRC: $2.1 M

Notes:

*	Based on net present value
HRC	Hydrogen release compounds
ISCO	In situ chemical oxidation
LUC	Land use control
MNA	Monitored natural attenuation
RAO	Remedial action objectives

6.0 SITE 7 FEASIBILITY STUDY EVALUATION

The following sections describe the development and analysis of alternatives for remediation of soil and groundwater at Site 7. No remedial alternatives were developed for groundwater at Site 7, because of the absence of CERCLA COPCs detected above background concentrations (see Section 3.3.3). In addition, the groundwater at Site 7 does not meet the TDS criterion (TDS less than 10,000 mg/L), set by the EPA to define drinking water aquifers; therefore, groundwater below Site 7 is not a suitable source drinking water (see Section 2.4.3).

Section 6.1 describes soil RAOs, and Section 6.2 discusses GRAs and remedial alternatives in detail. Sections 6.3 and 6.4 compare each alternative with the requirements of the NCP, and Section 6.5 compares one alternative with the other.

6.1 REMEDIAL ACTION OBJECTIVES FOR SITE 7

RAOs are medium-specific goals for protecting human health and the environment. Each RAO should specify (1) the contaminants of concern, (2) the exposure routes and receptors, and (3) acceptable contaminant concentrations for each exposure pathway. RAOs can be achieved either by reducing COCs or eliminating the exposure pathways. This FS evaluation considers alternatives for both approaches.

General response objectives are discussed below followed by the remaining criteria that were used to develop the RAOs including COCs in Section 6.1.1, potential receptors and exposure pathways in Section 6.1.2, ARARs in Section 6.1.3, and remediation goals in Section 6.1.4. The RAOs developed for Site 7 are presented in Section 6.1.5.

The general response objectives for soil are: (1) to prevent dermal contact and ingestion of the contaminated soil from the Site 7 soil debris area that contains arsenic, cadmium, and lead at concentrations that pose risk to human health; (2) to prevent human exposures to soil adjacent to OWS-459 that is found to exceed residential PRG concentrations for VOCs, SVOCs, metals, pesticides, PCBs, or TPH; and (3) to prevent any such soils from acting as a continuing source of contaminants to groundwater.

6.1.1 Chemicals of Concern

Based on the results of the RI, arsenic, cadmium, and lead are the only COCs in soil at Site 7 (soil debris area only). In addition, soil concentrations of VOCs, SVOCs, metals (such as aluminum and copper), pesticides, and PCBs adjacent to OWS-459 are unknown and are recommended for further evaluation in this FS. Elevated levels of metals and PAHs in groundwater at Site 7 will be monitored through the Basewide Groundwater Monitoring Program. The distributions of arsenic, cadmium, and lead in the soil debris area, and the location of OWS-459 are discussed below.

As discussed in the RI report, statistical population testing indicates that arsenic and cadmium concentrations in soil above ambient concentrations (15.6 and 3.1 mg/kg, respectively) are collocated with the debris layer at Site 7 (Tetra Tech 2004). There is no known specific usage of arsenic or cadmium at Site 7, and arsenic and cadmium are naturally occurring components of soil. Arsenic and cadmium concentrations in soil are shown on Figures 3-8 and 3-9, respectively.

Lead concentrations in soil above ambient concentrations are found at the Site 7 soil debris area within a layer of blue, crystalline material and debris between approximately 1.5 to 2.0 feet bgs and 2.5 to 3 feet bgs in the parking lot south of Building 459 as well as underneath the building itself. The extent of contaminated soil beneath Building 459 is unknown. Lead concentrations in soil are shown on Figure 3-10.

OWS-459 is located in the southwest corner of the debris area. The OWS is likely concrete with steel components. The exact size of the OWS is unknown but was estimated to be 6 feet by 8 feet by 5 feet in depth. OWS-459 received material from floor drains in the repair shop located in Building 459 and may have received wastewater runoff from the dip tank and steam-clean area (ERM-West, Inc. 1994). Wastewaters from automotive repair activities were channeled into OWS-459.

6.1.2 Potential Receptors and Exposure Pathways

The sources, affected media, and exposure components of the exposure pathways for Site 7 all involved soil and dust particles. Potential receptors and exposure routes for soil at Site 7 are provided in Table 6-1. Based on the unsuitability of the groundwater for drinking, the absence of a pathway to surface water, and the absence of CERCLA COPCs, potential receptors and exposure pathways were not identified for this media.

6.1.3 Applicable or Relevant and Appropriate Requirements

Section 121(d)(l) of CERCLA states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environment standards, requirements, criteria, or limitations that are determined to be ARARs.

The identification of ARARs is a site-specific determination and involves a two-part analysis: first, a determination of whether a given requirement is applicable; then, if it is not applicable, a determination of whether it is relevant and appropriate. A requirement is deemed applicable if the specific terms of the law or regulation directly address the chemical of concern, remedial action, or site location. If the jurisdictional prerequisites of the law or regulation are not met, a legal requirement may nonetheless be relevant and appropriate if the site's circumstances are sufficiently similar to circumstances in which the law otherwise applies and it is well-suited to the conditions of the site. An evaluation of the relevance and appropriateness of a requirement is site specific, and must be based on best professional judgment. A requirement may be relevant, but not appropriate, for the specific site. In Title 40 CFR 300.400(g)(2), the NCP lists factors to

consider in evaluating relevance and appropriateness. Only requirements determined to be both relevant and appropriate must be followed. Portions of a requirement may be relevant and appropriate even if a requirement in its entirety is not. A requirement must be substantive in order to constitute an ARAR for activities conducted on site. Procedural or administrative requirements such as permits and reporting are not ARARs.

In addition to ARARs, the preamble to the NCP provides agency advisories, criteria, or other "to-be-considered (TBC) guidance in helping to determine what is protective at a site or how to carry out certain actions or requirements" (Title 55 *Federal Register* 8666, 8745, March 9, 1990). The preamble to the NCP states, however, that provisions in the TBC category "should not be required as cleanup standards because they are, by definition, generally neither promulgated nor enforceable, so they do not have the same status under CERCLA as do ARARs."

As the lead federal agency, the Navy has primary responsibility for identifying federal ARARs for remediation at Sites 6, 7, 8, and 16. State agencies are responsible for identifying state ARARs; the lead state agency in California is the DTSC. In a letter submitted to DTSC dated March 8, 2004, the Navy requested the state to identify chemical-, location-, and action-specific ARARs for Sites 6, 7, 8, and 16 (Navy 2004). No response has been received to date. The Navy has reviewed and identified the state ARARs that apply to Sites 6, 7, 8, and 16 according to a letter received from DTSC on November 13, 1996 (DTSC 1996).

ARARs and TBCs are generally divided into three categories: chemical-specific, location-specific, and action-specific. The evaluation of ARARs for this FS is presented in Appendix B. The potential chemical- and location-specific ARARs having implications for this FS are summarized below. Action-specific ARARs and TBCs criteria are identified and discussed following development and screening of site-specific remedial alternatives.

6.1.3.1 Chemical

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 clean-up values. These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the environment that is protective of human health and the environment.

The only federal chemical-specific ARARs for soil are the RCRA hazardous waste and land disposal restrictions and the Toxic Substances Control Act PCB remediation waste requirements for PCB-contaminated soil.

The applicability of RCRA requirements depends on whether the soil contains listed or characteristic RCRA waste, whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement, and whether the a given remedial alternative at the site constitutes generation, treatment, storage or disposal as defined by RCRA. Excavation of soil containing RCRA hazardous waste constitutes generation of waste to which RCRA

requirements apply. The Navy will comply with RCRA requirements to the extent the excavated soil contains RCRA hazardous wastes.

The following RCRA requirements are potential ARARs because they define RCRA hazardous wastes:

- Title 22 CCR § 66261.21
- Title 22 CCR § 66261.22(a)(1)
- Title 22 CCR § 66261.23
- Title 22 CCR § 66261.24(a)(1)
- Title 22 CCR § 66261.100

RCRA land-disposal restrictions at Title 22 CCR § 66268.1(f) are potential ARARs for discharging waste to land.

The Navy also considered state requirements and determined that the requirements of CCR, Title 27, §§ 20210 and 20220 are potential ARARs. The Navy will determine whether any waste generated is a designated waste or nonhazardous waste pursuant to Title 27 CCR §§ 20210 and 20220.

Table 6-2 summarizes the chemical-specific ARARs associated with soil at Site 7.

There are no chemical-specific ARARs for groundwater, because COPCs, in groundwater attributed to CERCLA releases that exceed risk criteria have not been identified at Site 7.

6.1.3.2 Location

Location-specific ARARs are restrictions placed on the concentrations of hazardous substances or on the conduct of activities solely because of the specific qualities of some locations. Specific locations include flood plains, wetlands, historic places, and sensitive ecosystems or habitats. Based on the location of Site 7 and its proximity to the Oakland Inner Harbor, the Navy identified the following location-specific ARARs:

- The Endangered Species Act (Title 16 USC §§1531 through 1543) (requires that federal agencies not jeopardize the continued existence of a listed species or cause the destruction or adverse modification of critical habitat)
- The California Endangered Species Act (California Fish and Game Code § 2080)
- Coastal Zone Management Act (Title 16 USC § 1456[c]) (requires that activities near a coastal zone be conducted in a manner consistent with approved state management programs)

Table 6-3 summarizes the location-specific ARARs associated with Site 7.

6.1.4 Remediation Goals

Remediation goals for Site 7 are based on the general remedial action objective, chemicals of concern, and federal and state ARARs. The table below presents the remediation goals for the Site 7 soil debris area.

COC	Remediation Goal
Arsenic	9.1 mg/kg
Cadmium	1.7 mg/kg
Lead	230 mg/kg

The remediation goal for arsenic and cadmium is the 95 percentile of the background data set distribution (Tetra Tech 2004). The remediation goal for lead (230 mg/kg) is based on DTSC's LeadSpread model (DTSC 2003), which uses lead concentrations in soil and drinking water to predict a child blood lead level for comparison with acceptable levels. Details regarding the assumptions used to apply the LeadSpread model at Site 7 are discussed in the RI (Tetra Tech 2004).

The potential soil contamination located adjacent to OWS-459 will be investigated by conducting soil and groundwater sampling beneath and adjacent to the OWS for VOCs, SVOCs, metals, pesticides, PCBs, and TPH. Residential PRGs will be used as the remediation goals for all of these chemicals.

6.1.5 Remedial Action Objectives

The following RAO were developed for soil at Site 7 based on the identified COCs, potential receptors and exposure pathways, ARARs, and remediation goals.

- For the residential receptor, prevent dermal contact and ingestion of soils that exceed the following concentrations: 9.1 mg/kg of arsenic, 1.7 mg/kg of cadmium, and 230 mg/kg of lead.
- For all receptors, prevent any exposures to soil contamination located adjacent to OWS-459 that exceeds the residential PRGs.

6.2 General Response Actions and Remedial Alternatives

GRAs are broad-based, medium-specific categories of actions that can be identified to satisfy RAOs of an FS. Three GRAs were identified for the contaminated soils at Site 7: (1) no action, (2) one-time sampling at OWS-459 and excavation with off-site disposal, and (3) treatment, such

as soil washing or thermal treatment. GRAs for groundwater have not been identified based on the absence of COCs identified at the site.

The three GRAs for soil were assembled into two practicable remedial alternatives, which included: (1) no action and (2) one-time soil sampling, excavation, and off-site disposal. The third GRA, treatment, was considered impracticable at Site 7 with the presence of a debris area posing unacceptable risk to human health, and the remediation surface area and volume (about 40 cubic yards) at OW-459 being extremely small and impracticable for any active remedy. The following subsections describe Alternatives 1 and 2 for soil.

6.2.1 Alternative 1: No Action

A no-action response provides the baseline assessment for comparison with other remedial alternatives with a greater level of response. A no-action alternative may be considered appropriate if an alternative response action would cause a greater environmental or health danger than the no-action alternative itself. The NCP requires evaluation of the no-action response as part of the FS process.

6.2.2 Alternative 2: One-Time Soil Sampling, Excavation, and Off-Site Disposal

Alternative 2 would involve sampling to determine the extent of soil contaminated adjacent to OWS-459 and excavating contaminated soil in the soil debris area and near OWS-459 and disposing of it at an appropriate off-site facility. Excavation activities would involve conventional heavy construction equipment, including backhoes, cranes, bulldozers, loaders, scrapers, and haulers. This alternative is applicable to all conditions at Site 7; however, it may become cost-prohibitive at other sites that are contaminated to great depths or that have complex hydrologic environments (Wagner and others 1986).

Disposal refers to the impoundment of excavated materials at a facility that is approved to accept them. Soils classified as hazardous waste under state and federal laws would be transported to a permitted California Class I hazardous waste landfill for treatment (if necessary) and disposal. Soils classified as nonhazardous would be transported to a California Class II or III landfill, depending on the landfill's permit limitation.

Based on data obtained during the RI and HHRA, volumes of arsenic-, cadmium-, and lead-contaminated soils and soil that exceed the RAOs are estimated at 1,820 yd^3 of soil (2,700 tons) at Site 7. This volume includes the excavation area for OWS-459 because the OWS is located within the excavation footprint for the arsenic-, cadmium-, and lead-contaminated soils, however the depth of the excavation near OWS-459 was assumed to be 1 foot deeper than the surrounding excavation.

The excavation limits for Site 7 soil in the soil debris area are based on the remediation goals established for the COCs at Site 7. The area of excavation is shown on Figure 6-1. Arsenic,

cadmium, and lead concentrations are elevated in the blue metallic debris layer encountered at depth ranging from 2 to 3 feet bgs. The layer is approximately 8 to 12 inches thick and requires remediation. The extent of contamination beneath Building 459 is unknown. If contamination is detected in soil samples collected beneath Building 459 before excavation activities, this alternative may need to be reevaluated and the volume of contamination adjusted.

6.3 DETAILED ANALYSIS OF ALTERNATIVE 1: NO ACTION

Under the no-action alternative, no remedial actions would be conducted to reduce the mobility, volume, or toxicity of the soil, and the extent of soil contamination adjacent to OWS-459 would not be determined. The no-action alternative is evaluated against NCP criteria in the following sections.

6.3.1 Overall Protection of Human Health and the Environment

The no-action alternative provides little or no decrease in the risk associated with arsenic-, cadmium-, and lead-contaminated soil or in determining the extent of contamination adjacent to OWS-459. Because the no-action alternative does not prevent contact resulting from intrusive activities, it is not protective of human health.

6.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

If potentially contaminated soil is left undisturbed, this would not trigger ARARs. Section 121(d)(2) of CERCLA indicates that ARARs apply only to on-site response actions. If there is no response action, then no ARARs were identified.

6.3.3 Long-term Effectiveness and Permanence

The no-action alternative would not reduce potential exposures and associated health risks. The no-action alternative does not include using controls to manage potentially contaminated soil that remains at the site. In summary, the no-action alternative is not considered an effective or permanent alternative.

6.3.4 Reduction of Toxicity, Mobility, or Volume

Because no active treatment or removal of potentially contaminated soil would occur under this alternative, the no-action alternative is not effective in reducing the toxicity, mobility, or volume of contaminants.

6.3.5 Short-Term Effectiveness

The no-action alternative for soil does not involve remedial action or construction; therefore, the alternative would not pose additional health risks to the community, workers, or the environment. The no-action alternative, however, would not meet RAOs for soil. The no-action alternative for soil would not be effective in the short term.

6.3.6 Implementability

With respect to technical feasibility, this alternative does not require construction, continuous monitoring, O&M activities, or replacement of equipment, and is, therefore, easy to implement. In terms of administrative feasibility, implementing this alternative would not require coordination with other agencies. The availability of services and materials is not applicable to this alternative. No technical or administrative difficulties are associated with implementing the no-action alternative.

6.3.7 Cost

No capital or O&M costs are associated with this alternative.

6.4 DETAILED ANALYSIS OF ALTERNATIVE 2: ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL

As stated previously, Alternative 2 would involve sampling to determine the extent of soil contaminated adjacent to OWS-459 and excavating and off-site disposal of contaminated soil removed from the soil debris area at Site 7. Further delineation of the extent of soil debris underneath Building 459 at Site 7, where contamination is suspected, will also be conducted. If the extent of contaminated soil beneath Building 459 is significant, this remedial alternative would be reevaluated. If not, contaminated soil will be excavated using standard excavation equipment at Site 7. Soils would be excavated to 4 feet bgs and disposed of at an appropriate off-site facility (except soils within a 15-by-15-foot area around OWS-459 would be excavated to 5 feet bgs). Confirmation soil sampling would then be conducted to verify that residual soils are below the remediation goals. In addition, confirmation soil samples would also be collected adjacent to OWS-459 to verify any residual soils are below residential PRGs for contaminates identified during the initial sampling activities.

Excavated materials would be stockpiled and covered with plastic or canvas sheeting and labeled. A representative composite sample would be collected at a frequency of once every 500 yd^3 of excavated material and analyzed for arsenic, cadmium, and lead using the waste extraction test protocol. If needed, the excavated soils adjacent to OWS-459 would be stockpiled separately and sampled appropriately. Cells that exceed the soluble threshold limit criteria or waste extraction test procedures would be profiled and transported to an appropriate landfill for treatment (if necessary) and disposal. Cells that do not exceed the soluble threshold limit concentration or waste extraction test for arsenic, cadmium, and lead would be transported to an

appropriate landfill for disposal only. An estimated 1,820 cubic yards of soil would be excavated (including OWS-459). The actual volume of soils excavated and disposed of off site would depend on the results of the pre-remedial design and confirmation sampling and analysis.

After excavating contaminated soil and performing soil sampling to confirm that concentrations in residual soils meet the remediation goals, the excavated area would be filled using clean, imported soil. This soil would be compacted and graded.

The following sections present the results of evaluating Alternative 2 against NCP criteria.

6.4.1 Overall Protection of Human Health and the Environment

The principal objectives of this alternative are to eliminate direct contact with contaminated soil and to prevent transport of contaminated soil by surface water run-off and wind erosion. Alternative 2 protects human health by removing soils containing arsenic, cadmium, and lead concentrations greater than the RAOs and addressing potentially contaminated soil adjacent to OWS-459; therefore, this alternative is considered to be highly effective in protecting human health.

6.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

This alternative would comply with the chemical and location specific ARARs for Site 7 soil that were identified in Section 6.1.3. Action-specific ARARs depend on the types of actions that are included in each remedial alternative. Section 6.4.2.1 identifies the types of action-specific ARARs that may apply to Alternative 2, and Section 6.4.2.2 summarizes the potential of Alternative 2 to comply with those action-specific ARARs.

6.4.2.1 Potential Action

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken. These requirements are triggered by the particular remedial activities selected. Action-specific ARARs indicate how each alternative must be conducted. The Navy identified the following action-specific ARARs for excavation and off-site disposal.

Soil Sampling and Excavation

The following RCRA requirements are ARARs for soil sampling activities to determine if any waste generated is hazardous waste in accordance with the RCRA requirements of Title 22 CCR §§ 66261.10 and 66261.11. The following requirements are potential ARARs for any RCRA hazardous waste:

- Title 22 CCR 66262.34 (RCRA hazardous waste accumulation requirements)
- Title 22 CCR 66262.30 (RCRA packaging requirements)
- Title 22 CCR 66262.31 (RCRA labeling requirements)
- Title 22 CCR 66262.32 (RCRA marking requirements)
- Title 22 CCR 66262.33 (RCRA placarding requirements)
- Title 22 CCR 66262.20, 66262.21, 66252.22 and 66262.23 (RCRA manifest requirements)

The following Clean Air Act requirements are potential ARARs for excavation:

- Regulation 6-302: Opacity Limitation (prohibiting emissions for a period aggregating more than 3 minutes in any hour an emission equal to or greater than 20 percent opacity); and

- Regulation 8, Rule 40: Aeration of Contaminated Soil and Removal of Underground Storage Tanks (setting forth standards for maintaining, covering, and stockpiling soil).

The City of Alameda Ordinance No. 2824 sets forth restrictions for excavation in the Marsh Crust areas of Alameda Point. This ordinance is to be considered criteria for excavation that impacts the Marsh Crust. If any excavation will be conducted as a result of sampling activities, this ordinance would be a "to be considered" criteria.

The following Federal Hazardous Materials Transportation Law sections are potential ARARs for transporting of any hazardous waste:

- Federal Hazardous Materials Transportation Law, Title 49 USC 5101 through 5127, 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 (requirements for transporting hazardous wastes, including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements)

Table 6-4 summarizes the action-specific ARARs associated with Site 7.

6.4.2.2 Summary of Compliance with Applicable or Relevant and Appropriate Requirements

Excavated contaminated soil would be sampled to determine whether it is hazardous, and sampling, staging, transport, and disposal actions conducted on site would comply with ARARs. RCRA requirements would be used to identify hazardous waste (Title 22 CCR 66261.24). Excavated soils containing hazardous waste would be handled in accordance with ARARs. Land

disposal restrictions would be met by treating and disposing of contaminated waste at an off-site, permitted facility.

Bay Area Air Quality Management District Regulations 6-301 for visible emissions and 6-302 for opacity limits would be met by using water to control construction dust. Air monitoring would ascertain the effectiveness of the construction dust control measures in complying with these regulations.

One location-specific ARAR, the Coastal Zone Management Act, was identified as having potential applicability to Alternative 2. This law requires site development to be consistent with the BCDC Bay Plan. However, Alternative 2 does not significantly change the current site use, the nearby shoreline, or other natural resources associated with the site; therefore, Alternative 2 would comply with the BCDC Bay Plan.

Excavation may impact the Marsh Crust encountered at Site 7. In that event, excavation would comply with the substantive provisions of the Marsh Crust Ordinance (City of Alameda 2000).

6.4.3 Long-term Effectiveness and Permanence

Alternative 2 is expected to prevent human contact with potentially contaminated soil that exceeds the remediation goals. Confirmation sampling conducted after soil excavation would verify that arsenic, cadmium, and lead concentrations in residual soils are less than the RAOs. In addition, confirmation sampling, conducted after soil excavation within a 15-by-15-foot area around OWS-459, would verify that soil chemical concentrations are less than residential PRGs. The excavated area would then be backfilled with clean, imported soil and graded. This alternative is highly effective at eliminating known human health risks to future residents.

6.4.4 Reduction of Toxicity, Mobility, or Volume

Disposal of contaminated materials at a hazardous or solid waste disposal facility would meet the RAO by removing the volume of the contaminated materials at Site 7. In addition, if needed, the soil that is disposed of at a hazardous or solid waste disposal facility would be treated to reduce the mobility and/or toxicity of any arsenic, cadmium, or lead concentrations in soil from the soil debris area and any necessary chemicals in soil adjacent to OWS-459 that may otherwise become mobile in groundwater.

6.4.5 Short-term Effectiveness

Alternative 2 would result in potential site risks to the community during excavation and transporting activities. Wetting soils during excavation would help to control blowing dust. Short-term risks to workers would be limited to potential direct contact with arsenic-, cadmium-, and lead-contaminated soil in the soil debris area, soil potentially contaminated with VOCs, SVOCs, pesticides, PCBs, metals and TPH, and risks inherent to construction and solids handling. Adherence to standard industry health and safety practices is expected to provide

adequate protection to workers and the nearby community during excavation and removal of contaminated soil. No additional environmental impacts are expected during implementation. Field activities associated with this alternative, including pre-design sampling, excavation, confirmation sampling and analysis, stockpile sampling and analysis, profiling, and off-site transportation would take 3 to 6 months. This alternative would meet the RAOs for soil in the short term but would increase short-term risks to workers, the community, and the environment. Alternative 2 is considered to be highly effective in the short term.

6.4.6 Implementability

This alternative is implementable. Although removing contaminated soil from beneath Building 459 would involve additional personnel, equipment resources, and construction activities, adequate personnel and equipment exist to successfully implement this alternative.

In terms of administrative feasibility, this alternative would likely require coordination with departments within the Navy and with the regulatory agencies to (1) identify any utilities that may be present, (2) obtain utility clearances, and (3) obtain any necessary permits. This alternative is considered to be moderately easy to implement.

6.4.7 Cost

The total estimated capital cost of this alternative is approximately $1.4 million. Details of the cost estimate are presented in Appendix C. Note that the costs do not include additional soil removal beneath Building 459 or the possible demolition of the building to remove contaminated soil that might exist.

6.5 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR SOIL

This section presents the comparative analysis between Alternative 1 (no action) and Alternative 2 (excavation and disposal) to identify the relative advantages and disadvantages of each alternative. The comparative analysis is based on the same nine criteria that were applied individually to each of the alternatives in Sections 6.3 and 6.4.

6.5.1 Threshold Criteria

This section evaluates alternatives in relation to the two threshold criteria: overall protection of human health and the environment and compliance with ARARs.

6.5.1.1 Overall Protection of Human Health and the Environment

The results of the HHRA indicate that contaminated soil presents unacceptable risks to human health at Site 7. In addition, the extent of contamination, if any, is unknown in soil adjacent to OWS-459. The no-action alternative (Alternative 1) would not eliminate or reduce risk.

Excavation and disposal (Alternatives 2) would reduce risks at Site 7 to acceptable levels by removing contaminated soil that exceeds RAOs.

6.5.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 would not trigger ARARs for Site 7. Alternative 2 meets or has the potential to meet ARARs for soil and groundwater at Site 7 based on the respective reuse scenarios for the alternative.

6.5.2 Balancing Criteria

This section evaluates the alternatives in relation to the five balancing criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume; short-term effectiveness; implementability; and cost.

6.5.2.1 Long-Term Effectiveness and Permanence

Excavation and disposal (Alternative 2) would result in the highest degree of long-term effectiveness and permanence because potentially contaminated soil would be removed from the sites. The no-action alternative will leave contaminated soil at the site.

6.5.2.2 Reduction in Toxicity, Mobility, and Volume

Neither alternative would reduce the toxicity, or volume of contaminated soil through treatment. However, Alternative 2 reduces the mobility of these contaminants by relocating them at an off-site facility, thus preventing their exposure to human or ecological receptors.

6.5.2.3 Short-term Effectiveness

The no-action alternative would have no short-term impacts on the environment. Alternative 2 includes excavation, which has the potential to create negative, short-term air and water quality impacts; however, such impacts would be reduced through use of dust and erosion control methods. Neither of the alternatives would be expected to pose unacceptable short-term risks to site workers or the community.

6.5.2.4 Implementability

Both of the alternatives are readily implementable.

6.5.2.5 Cost

The no-action alternative would have zero costs. Alternative 2, excavation and disposal, would cost $1.4 million.

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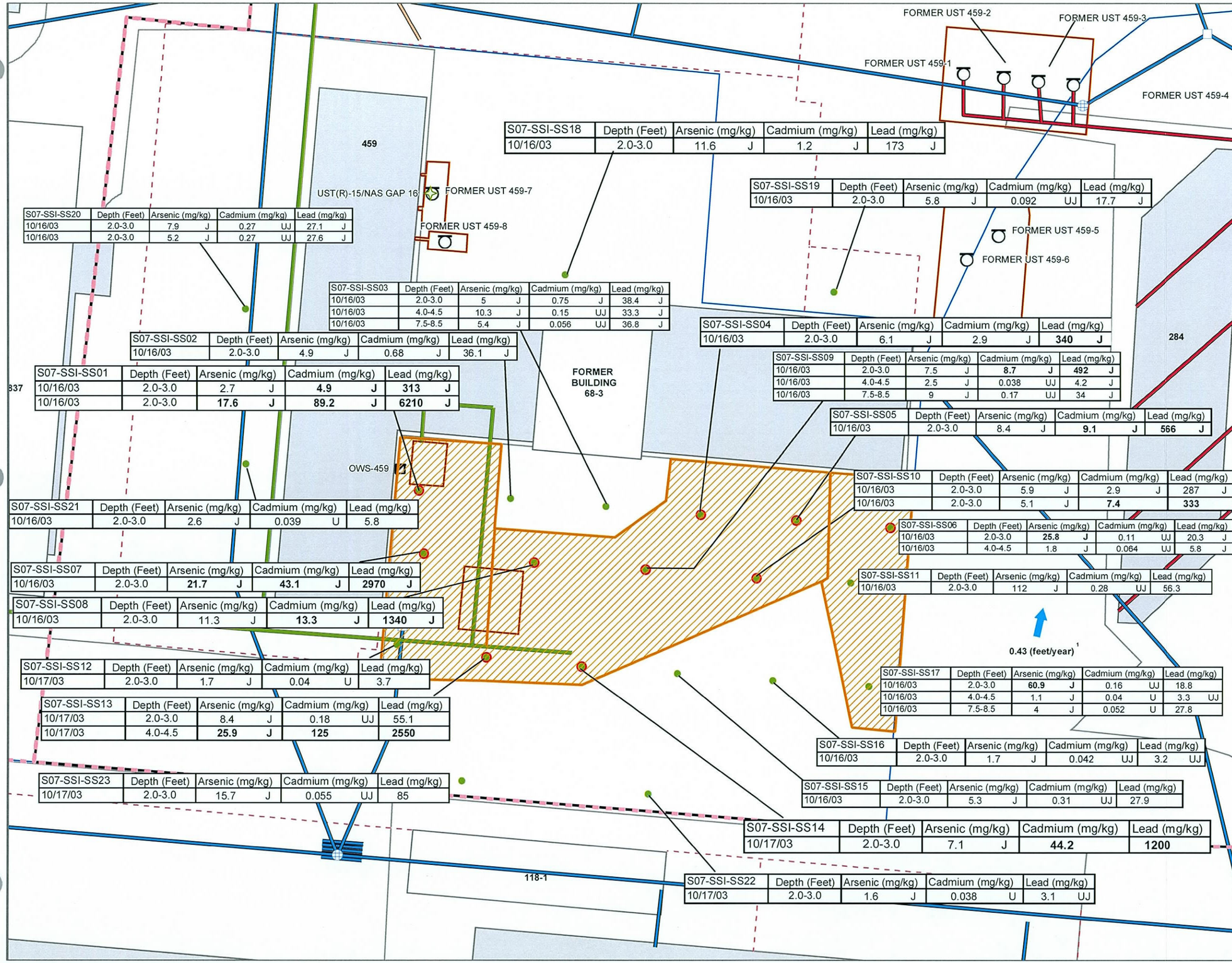
FIGURES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005



S07-SSI-SS18	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	11.6 J	1.2 J	173 J

S07-SSI-SS19	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	5.8 J	0.092 UJ	17.7 J

S07-SSI-SS20	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	7.9 J	0.27 UJ	27.1 J
10/16/03	2.0-3.0	5.2 J	0.27 UJ	27.6 J

S07-SSI-SS03	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	5 J	0.75 J	38.4 J
10/16/03	4.0-4.5	10.3 J	0.15 UJ	33.3 J
10/16/03	7.5-8.5	5.4 J	0.056 UJ	36.8 J

S07-SSI-SS04	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	6.1 J	2.9 J	**340 J**

S07-SSI-SS02	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	4.9 J	0.68 J	36.1 J

S07-SSI-SS09	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	7.5 J	**8.7 J**	**492 J**
10/16/03	4.0-4.5	2.5 J	0.038 UJ	4.2 J
10/16/03	7.5-8.5	9 J	0.17 UJ	34 J

S07-SSI-SS01	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	2.7 J	**4.9 J**	**313 J**
10/16/03	2.0-3.0	**17.6 J**	**89.2 J**	**6210 J**

S07-SSI-SS05	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	8.4 J	**9.1 J**	**566 J**

S07-SSI-SS10	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	5.9 J	2.9 J	287 J
10/16/03	2.0-3.0	5.1 J	**7.4**	**333**

S07-SSI-SS21	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	2.6 J	0.039 U	5.8

S07-SSI-SS06	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	**25.8 J**	0.11 UJ	20.3 J
10/16/03	4.0-4.5	1.8 J	0.064 UJ	5.8 J

S07-SSI-SS07	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	**21.7 J**	**43.1 J**	**2970 J**

S07-SSI-SS11	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	112 J	0.28 UJ	56.3

S07-SSI-SS08	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	11.3 J	**13.3 J**	**1340 J**

S07-SSI-SS12	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/17/03	2.0-3.0	1.7 J	0.04 U	3.7

S07-SSI-SS17	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	**60.9 J**	0.16 UJ	18.8
10/16/03	4.0-4.5	1.1 J	0.04 U	3.3 UJ
10/16/03	7.5-8.5	4 J	0.052 U	27.8

S07-SSI-SS13	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/17/03	2.0-3.0	8.4 J	0.18 UJ	55.1
10/17/03	4.0-4.5	**25.9 J**	**125**	**2550**

S07-SSI-SS16	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	1.7 J	0.042 UJ	3.2 UJ

S07-SSI-SS23	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/17/03	2.0-3.0	15.7 J	0.055 UJ	85

S07-SSI-SS15	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/16/03	2.0-3.0	5.3 J	0.31 UJ	27.9

S07-SSI-SS14	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/17/03	2.0-3.0	7.1 J	**44.2**	**1200**

S07-SSI-SS22	Depth (Feet)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
10/17/03	2.0-3.0	1.6 J	0.038 U	3.1 UJ

SOIL SAMPLING LOCATIONS 2003

EXCEEDS REMEDIAL GOAL[2]

UNDERGROUND STORAGE TANK (UST)

- Removed
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- OIL WATER SEPARATOR (OWS)
- FENCE
- FUEL LINE
- SANITARY SEWER LINE
- STORM SEWER LINE
- INDUSTRIAL STORM SEWER LINE
- CERCLA SITE BOUNDARY
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- CORRECTIVE ACTION AREA (CAA)

BUILDING

- Former
- Present
- PROPOSED EXCAVATION
- EXCAVATION
- LAND COVER

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

1 Approximate direction and velocity of groundwater movement

2 Remedial goal for lead is 299 mg/kg

Remedial goal for arsenic is 9.1 mg/kg

Remedial goal for cadmium is 1.7 mg/kg

Bold denotes concentration that exceeds remedial goal

15 0 15 30 Feet

SulTech

Alameda Point

Department of the Navy,BRAC PMO West, San Diego, California

FIGURE 6-1
PROPOSED EXCAVATION AREA
SITE 7 SOIL

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8 and 16

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TABLES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005

TABLE 6-1: POTENTIAL RECEPTORS AND EXPOSURE ROUTES FOR SOIL IN THE SITE 7 SOIL DEBRIS AREA
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Potential Receptor	Exposure Route	Comment on the Pathway	Land Use Scenario
Commercial/Industrial Worker	Inhalation of arsenic, cadmium, and lead in airborne dust particles	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway	Commercial/Industrial
Construction Worker	Inhalation of arsenic, cadmium, and lead in airborne dust particles	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway	Commercial/Industrial/ Residential
	Dermal contact with arsenic, cadmium, and lead in soil	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway	
Hypothetical Resident	Inhalation of arsenic, cadmium, and lead in airborne dust particles	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway	Residential
	Dermal contact with arsenic, cadmium, and lead in soil	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway	
	Ingestion of arsenic, cadmium, and lead in soil or homegrown produce	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway	
Ecological life	Ingestion of or dermal contact with arsenic, cadmium, and lead in soil	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway, however there is limited ecological habitat at Site 7	Not applicable

TABLE 6-2: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
		SOIL		
Federal				
Resource Conservation and Recovery Act (Title 42 USC Chapter 82, 6901 through 6991[i]) [c]				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste.	Title 22 CCR 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether waste is hazardous.
Land Disposal Restrictions prohibit disposal of hazardous waste unless treatment standards are met.	Hazardous waste land disposal	Title 22 CCR 66268.1(f)	Applicable	This requirement is applicable if hazardous waste is to be disposed of on land.
Toxic Substances Control Act (15 USC, ch. 53, §§ 2601–2692)[c]				
Regulates storage and disposal of PCB remediation waste. There are three options: a) self-implementing on-site cleanup and disposal; b) performance-based disposal using existing approved disposal technologies; and c) risk-based disposal.	Soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm.	40 CFR § 761.61(a)(4), (b), and (c)	Relevant and Appropriate	This section is potentially relevant and appropriate for PCB contaminated soil. Section (a)(4) establishes a cleanup level for bulk PCB remediation waste in high-occupancy areas of less than or equal to 1 ppm. The cleanup level for bulk PCB remediation waste in low-occupancy areas is less than or equal to 25 ppm. Section (c) offers an alternative using risk-based levels and technologies.

TABLE 6-2: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
State				
State and Regional Water Quality Control Board				
Definitions of designated waste, nonhazardous waste, and inert waste		Title 27 CCR 20210, 20220 and 20230	Applicable	Potential ARAR for classifying waste.

Notes:

a many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables
b only the substantive provisions of the requirements cited in this table are potential ARARs
c statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs
ARAR Applicable or relevant and appropriate requirement
CCR *California Code of Regulations*
PCB Polychlorinated biphenyl
ppm Part per million
RCRA Resource Conservation and Recovery Act
TCLP Toxicity characteristic leaching procedure
TSCA Toxic Substances Control Act
USC *United States Code*

TABLE 6-3: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Federal					
Endangered Species Act of 1973 (Title 16 USC §§ 1531–1543) [b]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	16 USC § 1536(a), (h)(1)(B)	Applicable	Applicable if endangered species are found at Site 7.
Coastal Zone Management Act (Title 16 USC §§ 1451–1464) [b]					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands under and adjacent to shore land.	16 USC § 1456(c) 15 CFR § 930	Relevant and Appropriate	Remedial alternatives will comply with the Coastal Zone Management Act and Bay Plan
State					
Endangered species habitat	No person shall import, export, take, possess, or sell any endangered or threatened species or part or product thereof.	Threatened or endangered species determination on or before 01 January 1985 or a candidate species with proper notification.	Cal. Fish & Game Code § 2080	Relevant and Appropriate	This section may be potentially relevant and appropriate if there are threatened or endangered species/habitats present at the site. If endangered species are present, the ecological assessment will evaluate potential effects of the contamination present and the planned response action.

TABLE 6-3: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

a	Only the substantive provisions of the requirements cited in this table are potential ARARs
b	Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs
ARAR	Applicable or relevant and appropriate requirement
CFR	*Code of Federal Regulations*
USC	*United States Code*

TABLE 6-4: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
			SOIL SAMPLING AND EXCAVATION		
Resource Conservation and Recovery Act (42 USC, Chapter 82, §§ 6901-6991[i]) *					
On-site waste generation	Person who generates waste shall determine if that waste is hazardous waste.	Generator of waste	Title 22 CCR §§ 66261.10(a), 66262.11	Applicable	The requirements of 22 CCR, Division 4.5, Chapter 14 are applicable for determining whether material generated as a result of the soil sampling, excavation or in situ chemical oxidation (ISCO) process of hydrogen release compound (HRC) contains hazardous waste. These requirements may be relevant and appropriate to material that is similar or identical to RCRA hazardous waste or non-RCRA hazardous waste.
Hazardous waste accumulation	On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers or tanks, on drip pads or inside buildings, and is labeled and dated.	Accumulate hazardous waste	Title 22 CCR § 66262.34	Applicable	These requirements are applicable if hazardous waste is generated and accumulated on site before transport.
Pre-transport requirements	Hazardous waste must be packaged in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR § 66262.30	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Hazardous waste must be labeled in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR 22 § 66262.31	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Provides requirements for marking hazardous waste prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR § 66262.32	Applicable	These requirements are applicable if hazardous waste is to be transported.

TABLE 6-4: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL SAMPLING AND EXCAVATION (Continued)					
Resource Conservation and Recovery Act (42 USC, Chapter 82, §§ 6901-6991[i]) * (Continued)					
Pre-transport requirements	A generator must ensure that the transport vehicle is correctly placarded prior to transport of hazardous waste.	Any operation where hazardous waste is generated	Title 22 CCR 66262.33	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Requires preparation of a manifest for transport of hazardous waste off site.	Any operation where hazardous waste is generated	Title 22 CCR 66262.20-66262.23	Applicable	These requirements are applicable if hazardous waste is to be transported.
Federal Hazardous Materials Transportation Law (49 USC §§ 5101-5127) *					
Transportation of hazardous material 49 USC §§ 5101-5127	Sets forth requirements for transporting hazardous waste including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements.	Interstate carriers transporting hazardous waste and substance by motor vehicle.	49 CFR § 171.2(f), 171.2(g), 172.300, 172.301, 172.302, 172.303, 172.304, 172.312, 172.400, 172.504	Relevant and appropriate	Relevant and appropriate for transporting hazardous materials on site.
Clean Air Act (42 USC § 7401 et seq.) *					
Excavation	Sets forth opacity limitations.	Excavation	BAAQMD Regulation 6, Regulation 6-302	Applicable	These requirements are applicable for excavation activities.
Excavation	Provides requirements for maintaining, covering and stock-piling excavated soil.	Soil stockpile	BAAQMD Regulation 8, Rule 40	Relevant and appropriate	These requirements are applicable for excavation activities.
City of Alameda Ordinance No. 2824*					
Excavation	Regulates excavation activities in the Marsh Crust area of Alameda Point.	Excavation below threshold depths	City of Alameda Ordinance No. 2824	TBC	Ordinance No. 2824 is a TBC criteria for excavation activities in the Marsh Crust area at threshold depths.

TABLE 6-4: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
DISPOSAL OF PCB-CONTAMINATED SOIL					
Toxic Substances Control Act (15 USC §§ 2601–2692)*					
Disposal of PCBs	This act regulates the storage and disposal of PCB remediation waste. There are three options: (1) self-implementing on-site cleanup and disposal; (2) performance-based disposal using existing approved disposal technologies; and (3) risk-based disposal. This act is applicable to soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm.	PCB-contaminated soil	40 CFR § 761.61(a)(4), (b), and (c)	Relevant and appropriate	This section is relevant and appropriate for the disposal of soil containing PCBs.

Notes:

1 The Clean Air Act ARARs apply only to the alternatives involving excavation.

* statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of specific citations are considered potential ARARs

ARAR Applicable or relevant and appropriate requirement
BAAQMD Bay Area Air Quality Management District
CCR *California Code of Regulations*
CFR *Code of Federal Regulations*
DOT U.S. Department of Transportation
HRC Hydrogen Release Compound
ISCO In situ chemical oxidation
PCB Polychlorinated biphenyl
ppm Parts per million
SDWA Safe Drinking Water Act
TBC To be considered
TSCA Toxic Substances Control Act
USC *United States Code*

7.0 SITE 8 FEASIBILITY STUDY EVALUATION

The following sections describe the development and analysis of alternatives for remediation of soil at Site 8. No remedial alternatives were developed for groundwater at Site 8, because of the absence of CERCLA COPCs detected above background concentrations (see Section 3.4.3). In addition, groundwater below Site 8 is not considered a drinking water source based on potential for saltwater intrusions and subsequent groundwater degradation if pumping were to occur under federal criteria (see Section 2.4.3). However, groundwater beneath Site 8 will be protected in accordance with California's groundwater protection requirements.

Section 7.1 describes soil RAOs. Section 7.2 discusses GRAs and remedial alternatives in detail. Sections 7.3, 7.4, and 7.5 compare each alternative with the requirements of the NCP, and Section 7.6 compares the alternatives to each other.

7.1 REMEDIAL ACTION OBJECTIVES FOR SITE 8

RAOs are medium-specific goals for protecting human health and the environment. Each RAO should specify (1) the contaminants of concern, (2) the exposure routes and receptors, and (3) acceptable contaminant concentrations for each exposure pathway. RAOs can be achieved by either reducing COCs or eliminating the exposure pathways. This FS evaluation considers alternatives for both approaches.

General response objectives are discussed below followed by the remaining criteria that were used to develop the RAOs including COCs in Section 7.1.1, potential receptors and exposure pathways in Section 7.1.2, ARARs in Section 7.1.3, and remediation goals in Section 7.1.4. The RAOs developed for Site 8 are presented in Section 7.1.5.

The general response objectives for soil are: (1) to prevent dermal contact and ingestion of Aroclor-1254-, Aroclor-1260-, dieldrin-, and lead-contaminated soil that poses risk to human health and (2) to prevent human exposure to soil adjacent to OWS-114 that is found to contain VOCs, SVOCs, metals, pesticides, PCBs, or TPH at concentrations that exceed their respective PRG concentrations.

The development of RAOs, including a discussion of the COCs, exposure pathways, and remediation goals, is presented in the following sections.

7.1.1 Chemicals of Concern

Based on the results of the RI, Aroclor-1254, Aroclor-1260, dieldrin, and lead are the only COCs in soil requiring remedial action at Site 8. In addition, soil concentrations of VOCs, SVOCs, metals, pesticides, PCB, and TPH adjacent to OWS-114 are unknown and are recommended for further evaluation in this FS report. The distributions of Aroclor-1260, dieldrin, and lead are discussed below.

The highest concentrations of Aroclor-1254, Aroclor-1260 and dieldrin concentrations in soil are located in the northeastern corner of the site in surface soil. In addition, Aroclor-1260 has been detected along the storm sewer line south of Building 114 at concentrations slightly above residential PRGs. Aroclor-1254 and Aroclor-1260 in Site 8 soil likely are related to the use of oils containing PCBs to control weeds and minimize dust and a leaky sanitary sewer line. Dieldrin is likely associated with storage of pesticides at the site. Aroclor-1260 and dieldrin concentrations in soil are shown on Figures 3-12 and 3-13, respectively.

Lead concentrations in soil above ambient concentrations are found within surficial soil at the northeast corner of Site 8, with a maximum concentration of 774 mg/kg. The vertical extent of elevated lead concentrations in soil is 1 foot bgs. Lead concentrations in soil are shown on Figure 3-14.

7.1.2 Potential Receptors and Exposure Pathways

The sources, affected media, and exposure components of the exposure pathways for Site 8 all involved soil and dust particles. Potential receptors and exposure routes for soil at Site 8 are provided in Table 7-1. Based on the non-beneficial use of groundwater, the absence of a pathway to surface water, and the fact that no CERCLA COCs were identified in groundwater, potential receptors and exposure pathways were not identified for this media.

7.1.3 Applicable or Relevant and Appropriate Requirements

Section 121(d)(l) of CERCLA states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environment standards, requirements, criteria, or limitations that are determined to be ARARs.

The identification of ARARs is a site-specific determination and involves a two-part analysis: first, a determination of whether a given requirement is applicable; then, if it is not applicable, a determination of whether it is relevant and appropriate. A requirement is deemed applicable if the specific terms of the law or regulation directly address the chemical of concern, remedial action, or site location. If the jurisdictional prerequisites of the law or regulation are not met, a legal requirement may nonetheless be relevant and appropriate if the site's circumstances are sufficiently similar to circumstances in which the law otherwise applies and it is well-suited to the conditions of the site. An evaluation of the relevance and appropriateness of a requirement is site specific, and must be based on best professional judgment. A requirement may be relevant, but not appropriate, for the specific site. In Title 40 CFR 300.400(g)(2), the NCP lists factors to consider in evaluating relevance and appropriateness. Only requirements determined to be both relevant and appropriate must be followed. Portions of a requirement may be relevant and appropriate even if a requirement in its entirety is not. A requirement must be substantive in order to constitute an ARAR for activities conducted on site. Procedural or administrative requirements such as permits and reporting are not ARARs.

In addition to ARARs, the preamble to the NCP provides agency advisories, criteria, or other "to-be-considered (TBC) guidance in helping to determine what is protective at a site or how to carry out certain actions or requirements" (Title 55 *Federal Register* 8666, 8745, March 9, 1990). The preamble to the NCP states, however, that provisions in the TBC category "should not be required as cleanup standards because they are, by definition, generally neither promulgated nor enforceable, so they do not have the same status under CERCLA as do ARARs."

As the lead federal agency, the Navy has primary responsibility for identifying federal ARARs for remediation at Site 8. State agencies are responsible for identifying state ARARs; the lead state agency in California is the DTSC. In a letter submitted to DTSC dated March 8, 2004, the Navy requested the state to identify chemical-, location-, and action-specific ARARs for Sites 6, 7, 8, and 16 (Navy 2004). No response has been received to date. The Navy has reviewed and identified the state ARARs that apply to Site 8 according to a letter received from DTSC on November 13, 1996 (DTSC 1996).

ARARs and TBCs are generally divided into three categories: chemical-specific, location-specific, and action-specific. The evaluation of ARARs for this FS is presented in Appendix B. The potential chemical- and location-specific ARARs having implications for this FS are summarized below. Action-specific ARARs are identified and discussed following development and screening of site-specific remedial alternatives.

ARARs for Site 8 soil are nearly identical to ARARs for Site 6 soil, which are presented in Section 5.1.3.

7.1.3.1 Chemical

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 clean-up values. These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the environment that is protective of human health and the environment.

Chemical-specific ARARs for Site 8 soil are identical to those presented in Section 6.1.3.1 for Site 7. Table 7-2 summarizes the chemical-specific ARARs associated with soil at Site 8.

7.1.3.2 Location

Location-specific ARARs for Site 8 soil are identical to those presented in Section 6.1.3.2 for Site 7 soil. Table 7-3 summarizes the location-specific ARARs associated with Site 8.

7.1.4 Remediation Goals

Remediation goals for Site 8 are based on the general RAOs, chemicals of concern, and federal and state ARARs. Two sets of soil remediation goals were developed for Site 8 to allow the

consideration of two different future reuse scenarios for the site. The table below presents the soil concentrations of Aroclor-1254, Aroclor-1260, dieldrin, and lead under the commercial industrial reuse scenario at Site 8.

COC	Remediation Goal
Aroclor-1254	0.74 mg/kg
Aroclor-1260	0.74 mg/kg
Dieldrin	0.11 mg/kg
Lead	3,572 mg/kg

The table below presents the remediation goals for total PCBs or the individual contaminants of Aroclor-1254, Aroclor-1260, dieldrin, and lead in soil under the unrestricted residential reuse scenario at Site 8.

COC	Remediation Goal
Total PCBs	1 mg/kg
Aroclor-1254	0.22 mg/kg
Aroclor-1260	0.22 mg/kg
Dieldrin	0.03 mg/kg
Lead	230 mg/kg

The remediation goals for Aroclor-1254, Aroclor-1260, and dieldrin are based on PRGs (EPA 2002). The remediation goal for lead (230 mg/kg) is based on DTSC's LeadSpread model (DTSC 2003), which uses lead concentrations in soil and drinking water to predict a child blood lead level for comparison with acceptable levels. Details regarding the LeadSpread model and assumption inputs are discussed in the RI report (Tetra Tech 2004).

The potential soil contamination located adjacent to OWS-114 will be investigated by conducting soil sampling for VOCs, SVOCs, metals, pesticides, PCBs, and TPH. Residential PRGs will be used as the remediation goals for all of these chemicals.

7.1.5 Remedial Action Objectives

The following RAOs were developed for soil at Site 8 based on the identified COCs, potential receptors and exposure pathways, ARARs, and remediation goals.

- For the potential residential receptor, prevent dermal contact and ingestion of soils that exceed the following concentrations: 0.22 mg/kg of Aroclor-1254 or Aroclor-1260 or 1 mg/kg total PCBs, 0.03 mg/kg of dieldrin, and 230 mg/kg of lead

- For the commercial/industrial receptor, prevent dermal contact and ingestion of soils that exceed the following concentrations: 0.74 mg/kg of Aroclor-1254 or Aroclor-1260, 0.11 mg/kg of dieldrin, and 3,572 mg/kg of lead

- For human receptors, prevent any exposures to soil contamination located adjacent to OWS-114 that exceeds the residential PRGs

The RAOs are summarized in Table 7-4.

7.2 GENERAL RESPONSE ACTIONS AND REMEDIAL ALTERNATIVES

GRAs are broad-based, medium-specific categories of actions that can be identified to satisfy RAOs. Four GRAs were identified for the contaminated soils at Site 8: (1) no action, (2) one-time soil sampling at the OWS-114 area, (3) implementation of institutional controls, and (4) excavation with off-site disposal. GRAs for groundwater were not identified based on the absence of COCs.

The four GRAs for soil were assembled into three remedial alternatives for Site 8: (1) no action, (2) one-time soil sampling at the OWS-114 area and institutional controls, and (3) one-time soil sampling at the OWS-114 area, excavation, and off-site disposal. The following subsections describe each of these alternatives.

7.2.1 Alternative 1: No Action

A no-action response provides the baseline assessment for comparison with action-oriented remedial alternatives. A no-action alternative may be considered appropriate if an alternative response action would cause a greater environmental or health danger than no-action. The NCP requires evaluation of the no-action response as part of the FS process.

7.2.2 Alternative 2: One-Time Soil Sampling and Institutional Controls

Alternative 2 would involve a one-time sampling event to determine the nature and extent of contamination adjacent to OWS-114. The sampling event would entail collecting one groundwater sample and soil samples at four locations based on historical site activities, at depths of 2.5 and 5 feet bgs. Because all concentrations of Aroclor-1254, Aroclor-1260, dieldrin, and lead are below the commercial/industrial remediation goals, no excavation activities are necessary. Depending on results of samples collected adjacent to OWS-114, ICs would be applied to prevent contact through inhalation and ingestion of contaminated soil and to prevent contact with Aroclor-1254, Aroclor-1260, dieldrin, and lead contamination at the site by prohibiting excavation without regulatory approval. If constituents are found at concentrations greater than risk-based screening levels, then additional action may be warranted to protect human health and the environment. Institutional controls would be in place indefinitely; however, for the purpose of cost comparison, institutional controls are assumed to last 100 years.

7.2.3 Alternative 3: One-Time Soil Sampling, Excavation, and Off-Site Disposal

Alternative 3 involves sampling to determine the extent of soil contaminated adjacent to OWS-114 and in the northeastern corner of Site 8, excavating contaminated soil, and disposing of it at an appropriate off-site facility (see Figure 7-1). Excavation activities are accomplished with conventional heavy construction equipment, including backhoes, cranes, bulldozers, loaders, scrapers, and haulers. This alternative is applicable to all conditions at Site 8, although it may become cost-prohibitive at sites with contamination at great depths or that have complex hydrologic environments (Wagner and others 1986).

Disposal refers to the impoundment of excavated materials at a facility that is approved to accept them. Soils classified as hazardous waste under state and federal laws would be transported to a permitted California Class I hazardous waste landfill for treatment (if necessary) and disposal. Soils classified as nonhazardous would be transported to a California Class II or III landfill, depending on the lead concentrations in the soil.

The excavation limits for Site 8 soil adjacent to OWS-114 and in the northeastern portion of Site 8 are based on potentially contaminated soil exceeding residential PRGs. The areas of excavation are shown on Figure 7-1 and are estimated to be 42 yd^3 of soil adjacent to OWS-114 (including disposal of the OWS) and 128 yd^3 from the northeastern portion of Site 8.

7.3 DETAILED ANALYSIS OF ALTERNATIVE 1: NO ACTION

Under the no-action alternative, no remedial actions would be conducted to reduce the mobility, volume, or toxicity of the contaminated soil at the site and the extent of soil contamination adjacent to OWS-114 would not be determined. The no-action alternative is evaluated against NCP criteria in the following sections.

7.3.1 Overall Protection of Human Health and the Environment

The no-action alternative provides little or no decrease in the risk associated with contaminated soil and it does not determine the extent of contamination at the site. Because the no-action alternative does not prevent contact resulting from intrusive activities, it is not protective of human health.

7.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

If potentially contaminated soil is left undisturbed, this would not trigger ARARs. Section 121(d)(2) of CERCLA indicates that ARARs apply only to on-site response actions. If there is no response action, then no ARARs were identified.

7.3.3 Long-Term Effectiveness and Permanence

The no-action alternative would not reduce potential exposures and associated health risks. The no-action alternative does not include using controls to manage potentially contaminated soils adjacent to OWS-114 contaminated soils at Site 8. In summary, the no-action alternative is not considered an effective or permanent alternative.

7.3.4 Reduction of Toxicity, Mobility, or Volume

No active treatment or removal of potentially contaminated soil would occur under this alternative. Therefore, the no-action alternative is not effective in reducing the toxicity, mobility, or volume of contaminated soils at Site 8.

7.3.5 Short-Term Effectiveness

The no-action alternative for soil does not involve remedial action or construction; therefore, the alternative would not pose additional health risks to the community, workers, or the environment. The no-action alternative, however, would not meet RAOs for soil. The no-action alternative for soil would not be effective in the short term.

7.3.6 Implementability

With respect to technical feasibility, this alternative does not require construction, continuous MNA, O&M activities, or replacement of equipment, and is, therefore, easy to implement. In terms of administrative feasibility, implementing this alternative would not require coordination with other agencies. The availability of services and materials is not applicable to this alternative. No technical or administrative difficulties are associated with implementing the no-action alternative.

7.3.7 Cost

No capital or O&M costs are associated with this alternative.

7.4 DETAILED ANALYSIS OF ALTERNATIVE 2: ONE-TIME SOIL SAMPLING AND INSTITUTIONAL CONTROLS

As stated previously, Alternative 2 consists of sampling to determine the extent of contaminated soil and implementation of institutional controls at the site (see Section 7.2.2).

7.4.1 Overall Protection of Human Health and the Environment

The principal objectives of this alternative are to characterize the extent of contamination present at soils adjacent to OWS-114 and to eliminate direct contact with potentially contaminated soil adjacent to OWS-114 and contaminated soil through the use of institutional controls to prevent domestic use of groundwater from the property for a period of 100 years at Site 8. Alternative 2 protects human health by addressing soil adjacent to OWS-114 and contaminated soil at Site 8; therefore, this alternative is considered highly effective in protecting human health.

7.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

This alternative would comply with chemical-and location-specific ARARs for Site 8 that are identified in Section 7.1.3. This section identifies action-specific ARARs for implementing Alternative 2 at the site. Section 7.4.2.1 identifies the types of action-specific ARARs that may apply to Alternative 2, and Section 7.4.2.2 summarizes the potential of Alternative 2 to comply with those action-specific ARARs.

7.4.2.1 Potential Action

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken. These requirements are triggered by the particular remedial activities selected. Action-specific ARARs indicate how each alternative must be conducted. The Navy identified the following action-specific ARARs for excavation and off-site disposal.

Soil Sampling

ARARs for soil sampling at Site 8 under Alternative 2 are identical to those presented for Site 6 soil under Alternative 2 in Section 5.4.2.2.

Transportation of Hazardous Waste

Potential ARARs for transporting hazardous waste from Site 8 are identical to those presented for Site 6 in Section 5.4.2.2.

Land Use Controls

There are no federal ARARs for institutional controls. The following state requirements have been identified as potential ARARs for institutional controls:

- Title 22 CCR § 67391.1 (Requirements for Land Use Covenants)
- *California Health and Safety Code* § 25202.5 (sets forth the general narrative standard to restrict "present and future uses of all or part of the land on which the facility is located")
- *California Health and Safety Code* § 25222.1 (sets forth the general narrative standard: "restricting specified uses of the property.")
- *California Health and Safety Code* § 25233(c) (sets forth substantive criteria for granting variances from the uses prohibited in § 25232(b)(1)(A)-(E) based on specific environmental and health criteria.)
- *California Civil Code* § 1471 (sets forth the following narrative standard: "to do or refrain from doing some act on his or her own land ... where...(c) Each such act relates to the use of land and each such act is reasonably necessary to protect future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in § 25260 of the Health and Safety Code.")

Table 7-5 summarizes the action-specific ARARs associated with Site 8.

7.4.2.2 Summary of Compliance with Applicable or Relevant and Appropriate Requirements

RCRA requirements will be used to identify hazardous waste (22 CCR § 66261.24) during sampling activities associated with OWS-114. Investigation-derived waste produced during sampling activities containing hazardous waste will be handled in accordance with ARARs. Land disposal restrictions will be met by treating and disposing of contaminated waste at an off-site, permitted facility. Institutional control criteria would be met by complying with the CCR and *California Health and Safety Code* listed above.

7.4.3 Long-Term Effectiveness and Permanence

Alternative 2 is expected to prevent human contact with potentially contaminated soil adjacent to OWS-114 and to prevent contact with Aroclor-1254, Aroclor-1260, dieldrin, and lead-contaminated soil that exceeds the remediation goals for unrestricted residential reuse. Land-use controls would be implemented for a period of 100 years preventing ingestion, inhalation, and dermal contact by residential receptors.

7.4.4 Reduction of Toxicity, Mobility, or Volume

No active treatment or removal of potentially contaminated soil would occur under this alternative. Therefore, the alternative is not effective in reducing the toxicity, mobility, or volume of lead-contaminated soil.

7.4.5 Short-Term Effectiveness

Alternative 2 would result in short-term risk to workers during sampling activities near OWS-114, but would be limited to potential direct contact with potentially contaminated soil adjacent to OWS-114, as well as risks inherent to solids handling. Adherence to standard industry health and safety practices is expected to provide adequate protection to workers and the nearby community during sampling activities. No additional environmental impacts are expected during implementation. Field activities associated with this alternative would take less than 1 week. This alternative would meet the RAOs for soil in the short term by identifying potentially contaminated soil and implementing institutional controls to prevent contact but would slightly increase short-term risks to workers, the community, and the environment. Alternative 2 is considered highly effective in the short term.

7.4.6 Implementability

This alternative is implementable. Adequate personnel exist to implement this alternative.

In terms of administrative feasibility, this alternative would likely require coordination with departments within the Navy and with the regulatory agencies to (1) identify the sampling scheme for the OWS-114 area, (2) dispose of any investigation-derived hazardous waste, and (3) obtain any necessary permits. This alternative is considered easy to implement.

7.4.7 Cost

The total estimated capital cost of this alternative is approximately $237,000. Details of the cost estimate are presented in Appendix C.

7.5 DETAILED ANALYSIS OF ALTERNATIVE 3: ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL

As stated previously, Alternative 3 consists of sampling to determine the extent of soil contaminated adjacent to OWS-114 and excavating and off-site disposal of soil adjacent to OWS-114 and in the northeast corner at Site 8. Contaminated soil will be excavated using standard excavation equipment at Site 8. Soils adjacent to OWS-114 (in an area 15 feet by 15 feet) and soils in the excavation area located in the northeastern portion of the site would be excavated to 5 feet bgs and disposed of at an appropriate off site facility. Confirmation soil sampling would then be conducted to verify that VOC, SVOCs, metals, pesticides, PCB, and TPH in residual soils from the OWS excavation, and Aroclor-1254, Aroclor-1260, dieldrin, and lead in the excavation area in the northeastern portion of the site are below the remediation goals for residential receptors.

Excavated materials from each excavation area would be stockpiled separately, covered with plastic or canvas sheeting, and labeled. One composite sample will be collected from the each stockpile and analyzed for the appropriate analytes using the waste extraction test protocol.

Cells that exceed the soluble threshold limit criteria or waste extraction test procedures will be profiled and transported to an appropriate landfill for treatment (if necessary) and disposal. Cells that do not exceed the soluble threshold limit concentration or waste extraction test will be transported to an appropriate landfill for disposal only. An estimated 128 cubic yards of contaminated soil from the northeast corner of the site, and an estimated 42 cubic yards of contaminated soil from OWS-114 would be sent to a Class I landfill for disposal. The actual volume of soils excavated and disposed of off site will depend on the results of the pre-remedial design and confirmation sampling and analysis.

After excavating the contaminated soil and soil adjacent to OWS-114 as well as performing soil sampling to confirm that concentrations in residual soils meet the remediation goals, the excavated area will be filled using clean, imported soil. This soil would be compacted and graded.

The following sections present the results of evaluating Alternative 3 against NCP criteria.

7.5.1 Overall Protection of Human Health and the Environment

The principal objectives of this alternative are to eliminate direct contact with soil adjacent to OWS-114 and contaminated soil and to prevent transport of potentially contaminated soil adjacent to OWS-114 and contaminated soil by surface water run-off and wind erosion. Alternative 3 protects human health by removing soils containing contaminants (including lead) greater than remediation goals. This alternative would remediate the site to unrestricted reuse criteria and is considered highly effective in protecting human health.

7.5.2 Compliance with Applicable or Relevant and Appropriate Requirements

This alternative would comply with the chemical and location specific ARARs for Site 8 that were identified in Section 7.1.3. This section identifies action-specific ARARs for implementing Alternative 3 at the site. Section 7.5.2.1 identifies the types of action-specific ARARs that may apply to Alternative 3, and Section 7.5.2.1 summarizes the potential of Alternative 3 to comply with those action-specific ARARs.

7.5.2.1 Potential Action

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken. These requirements are triggered by the particular remedial activities selected. Action-specific ARARs indicate how each alternative must be conducted. The Navy identified the following action-specific ARARs for excavation and off-site disposal.

Soil Sampling and Excavation

ARARs for soil sampling and excavation at Site 8 under Alternative 3 are identical to those presented for Site 6 soil under Alternative 3 in Section 5.4.3.2.

Transportation of Hazardous Waste

Potential ARARs for transporting hazardous waste from Site 8 are identical to those presented for Site 6 in Section 5.4.3.2.

Table 7-5 summarizes the action-specific ARARs associated with Site 8.

7.5.2.2 Summary of Compliance with Applicable or Relevant and Appropriate Requirements

Excavated soil adjacent to OWS-114 and contaminated soil at Site 8 will be sampled to determine whether it is hazardous, and sampling, staging, transport, and disposal actions conducted on site will comply with ARARs. RCRA requirements will be used to identify hazardous waste (22 CCR § 66261.24). Excavated soils containing hazardous waste will be handled in accordance with ARARs. Land disposal restrictions will be met by treating and disposing of contaminated waste at an off-site, permitted facility.

Bay Area Air Quality Management District Regulations 6-301 for visible emissions and 6-302 for opacity limits would be met by using water to control construction dust. Air monitoring would ascertain the effectiveness of the construction dust control measures in complying with these regulations. Because of the site's location, the Coastal Zone Management Act may be applicable. This law requires site development to be consistent with the BCDC Bay Plan. Alternative 3 does not significantly change the current site use, the nearby shoreline, or other natural resources associated with the site; thus, Alternative 3 would comply with the BCDC Bay Plan and with all ARARs.

Excavation may affect the Marsh Crust encountered at Site 8. In that event, excavation would comply with the substantive provisions of the Marsh Crust Ordinance (City of Alameda 2000).

7.5.3 Long-Term Effectiveness and Permanence

Alternative 3 is expected to prevent human contact with contaminated soil that exceeds the remediation goals for Site 8. Confirmation sampling conducted after soil excavation would verify that contaminant concentrations in the residual soils are below the RAOs for residential receptors. The excavated areas would be backfilled with clean, imported soil and graded. This alternative is highly effective at eliminating known human health risks to future residents.

7.5.4 Reduction of Toxicity, Mobility, or Volume

Alternative 3 would not reduce the toxicity, mobility, or volume of contaminated soil at Site 8 by excavating and disposing of contaminated materials through treatment unless treatment is conducted at the off-site disposal facility. In addition, if needed, the soil that is disposed of at a hazardous or solid waste disposal facility would be treated to reduce the mobility and/or toxicity of any chemical concentrations in soil that may otherwise become mobile in groundwater.

7.5.5 Short-Term Effectiveness

Alternative 3 would result in potential site risks to the community during excavation and transporting activities. Wetting soils during excavation would help to control blowing dust. Short-term risks to workers would be limited to potential direct contact with contaminated soil at Site 8, and risks inherent to construction and solids handling. Adherence to standard industry health and safety practices is expected to provide adequate protection to workers and the nearby community during excavation and removal of contaminated soil. No additional environmental impacts are expected during implementation. Field activities associated with this alternative, including pre-design sampling, excavation, confirmation sampling and analysis, stockpile sampling and analysis, profiling, and off-site transportation would take 2 months. This alternative would meet the RAOs for soil in the short term but would increase short-term risks to workers, the community, and the environment. Alternative 3 is considered highly effective in the short term.

7.5.6 Implementability

This alternative is implementable. Although removing contaminated soil at Site 8 would involve additional personnel, equipment resources, and construction activities, adequate personnel and equipment exist to implement this alternative.

In terms of administrative feasibility, this alternative would likely require coordination with departments within the Navy and with the regulatory agencies to (1) identify any utilities that may be present, (2) obtain utility clearances, and (3) obtain any necessary permits. This alternative is considered moderately easy to implement.

7.5.7 Cost

The total estimated capital cost of this alternative is approximately $158,000. Details of the cost estimate are presented in Appendix C.

7.6 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR SOIL

This section presents a comparative analysis between Alternative 1 (no action), Alternative 2 (one-time soil sampling and institutional controls) and Alternative 3 (excavation and off-site

disposal) to identify the relative advantages and disadvantages of each alternative. The comparative analysis is based on the same criteria that were applied individually to each of the alternatives in Sections 7.3, 7.4, and 7.5.

7.6.1 Threshold Criteria

This section evaluates alternatives in relation to the two threshold criteria: overall protection of human health and the environment and compliance with ARARs.

7.6.1.1 Overall Protection of Human Health and the Environment

The results of the HHRA indicate that contaminated soil in the northeastern corner of Site 8 presents unacceptable risks to human health. In addition, the extent of contamination, if any, is unknown in soil adjacent to OWS-114. The no-action alternative (Alternative 1) would not reduce risk or define the extent of contamination adjacent to OWS-114 at Site 8. Soil sampling Alternative 2 would reduce risks at Site 8 to acceptable levels by delineating potentially contaminated soil adjacent to OWS-114 and by implementing ICs to eliminate contact with contaminated soil by preventing domestic use of groundwater from Site 8. Alternative 3 would reduce risks at Site 8 to acceptable levels such that there would be no restrictions on site use by removing contaminated soils that exceed residential RAOs.

7.6.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 would not trigger ARARs for Site 8. Alternatives 2 and 3 meet or have the potential to meet ARARs for soil and groundwater at Site 8 based on the respective reuse scenarios for each alternative.

7.6.2 Balancing Criteria

This section evaluates the alternatives in relation to the five balancing criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume; short-term effectiveness; implementability; and cost.

7.6.2.1 Long-Term Effectiveness and Permanence

Alternative 3 (soil sampling, excavation, and disposal) has the highest degree of long-term effectiveness and permanence because contaminated soil at Site 8 is removed from the sites such that there are no restrictions on site use. The no-action alternative and Alternative 2 would leave contaminated soil at the site.

7.6.2.2 *Reduction in Toxicity, Mobility, and Volume*

Alternative 1 and 2 do not reduce the toxicity, mobility, or volume of contaminated soil through treatment or disposal. Alternative 3 reduces the mobility of these contaminants by relocating them at an off-site facility thus preventing their exposure to human or ecological receptors.

7.6.2.3 *Short-Term Effectiveness*

None of these alternatives would be expected to pose unacceptable short-term risks to site workers or the community. The no-action alternative would have no short-term impacts on the environment. Alternative 2 would have minimal short-term impacts on the environment during sampling activities. Alternative 3 includes excavation, which has the potential to create negative, short-term air and water quality impacts; however, such impacts would be reduced through use of dust and erosion control methods.

7.6.2.4 *Implementability*

All of the alternatives are readily implementable.

7.6.2.5 *Cost*

The no-action alternative is based on the assumption of zero cost. Alternative 2 and Alternative 3, have costs of $237,000 and $158,000, respectively.

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FIGURES

FINAL
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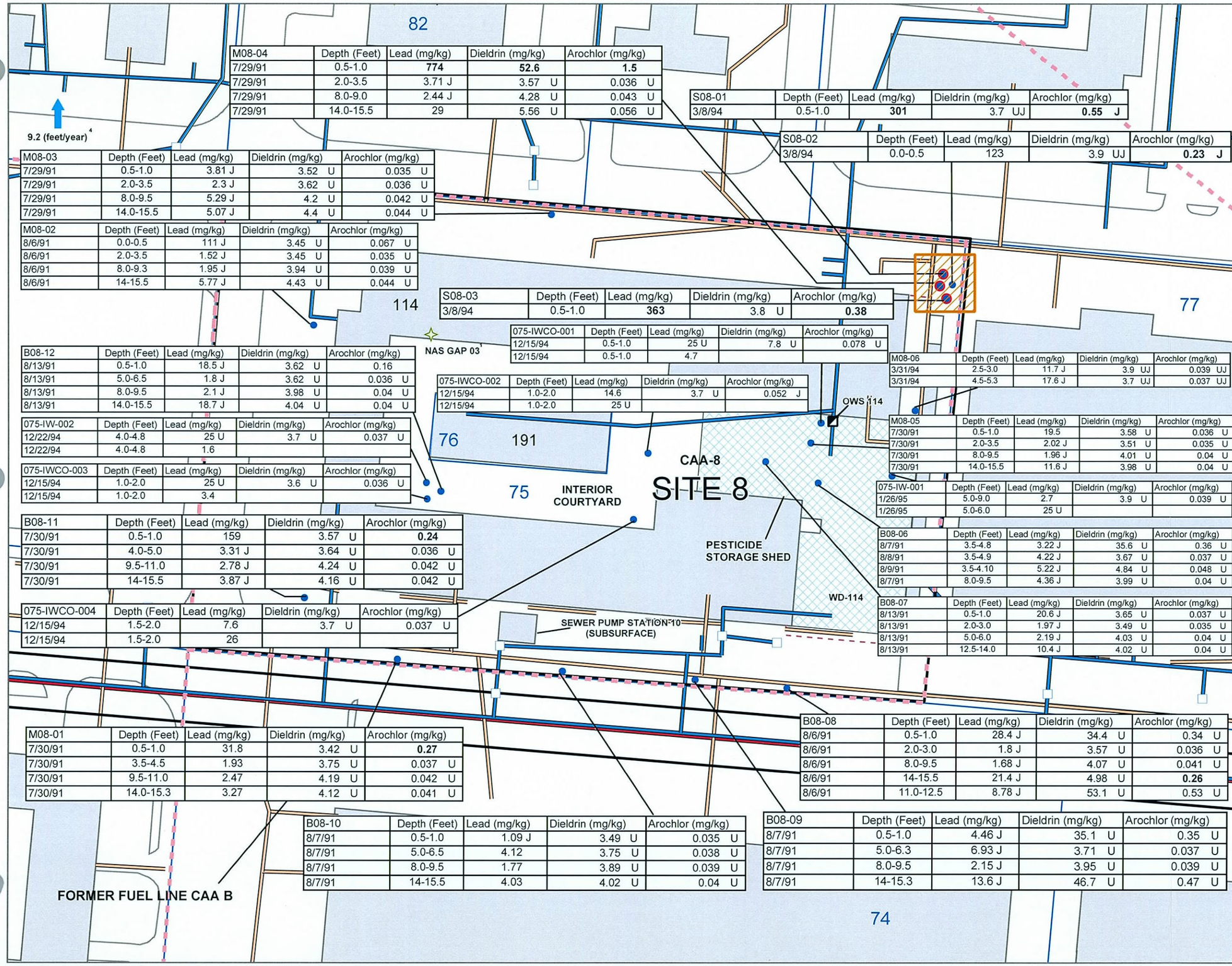
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005



M08-04	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
7/29/91	0.5-1.0	**774**	**52.6**	**1.5**
7/29/91	2.0-3.5	3.71 J	3.57 U	0.036 U
7/29/91	8.0-9.0	2.44 J	4.28 U	0.043 U
7/29/91	14.0-15.5	29	5.56 U	0.056 U

S08-01	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
3/8/94	0.5-1.0	**301**	3.7 UJ	**0.55 J**

S08-02	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
3/8/94	0.0-0.5	123	3.9 UJ	**0.23 J**

M08-03	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
7/29/91	0.5-1.0	3.81 J	3.52 U	0.035 U
7/29/91	2.0-3.5	2.3 J	3.62 U	0.036 U
7/29/91	8.0-9.5	5.29 J	4.2 U	0.042 U
7/29/91	14.0-15.5	5.07 J	4.4 U	0.044 U

M08-02	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
8/6/91	0.0-0.5	111 J	3.45 U	0.067 U
8/6/91	2.0-3.5	1.52 J	3.45 U	0.035 U
8/6/91	8.0-9.3	1.95 J	3.94 U	0.039 U
8/6/91	14-15.5	5.77 J	4.43 U	0.044 U

S08-03	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
3/8/94	0.5-1.0	**363**	3.8 U	**0.38**

075-IWCO-001	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
12/15/94	0.5-1.0	25 U	7.8 U	0.078 U
12/15/94	0.5-1.0	4.7		

B08-12	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
8/13/91	0.5-1.0	18.5 J	3.62 U	0.16
8/13/91	5.0-6.5	1.8 J	3.62 U	0.036 U
8/13/91	8.0-9.5	2.1 J	3.98 U	0.04 U
8/13/91	14.0-15.5	18.7 J	4.04 U	0.04 U

075-IWCO-002	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
12/15/94	1.0-2.0	14.6	3.7 U	0.052 J
12/15/94	1.0-2.0	25 U		

M08-06	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
3/31/94	2.5-3.0	11.7 J	3.9 UJ	0.039 UJ
3/31/94	4.5-5.3	17.6 J	3.7 UJ	0.037 UJ

075-IW-002	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
12/22/94	4.0-4.8	25 U	3.7 U	0.037 U
12/22/94	4.0-4.8	1.6		

M08-05	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
7/30/91	0.5-1.0	19.5	3.58 U	0.036 U
7/30/91	2.0-3.5	2.02 J	3.51 U	0.035 U
7/30/91	8.0-9.5	1.96 J	4.01 U	0.04 U
7/30/91	14.0-15.5	11.6 J	3.98 U	0.04 U

075-IWCO-003	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
12/15/94	1.0-2.0	25 U	3.6 U	0.036 U
12/15/94	1.0-2.0	3.4		

075-IW-001	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
1/26/95	5.0-9.0	2.7	3.9 U	0.039 U
1/26/95	5.0-6.0	25 U		

B08-11	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
7/30/91	0.5-1.0	159	3.57 U	**0.24**
7/30/91	4.0-5.0	3.31 J	3.64 U	0.036 U
7/30/91	9.5-11.0	2.78 J	4.24 U	0.042 U
7/30/91	14-15.5	3.87 J	4.16 U	0.042 U

B08-06	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
8/7/91	3.5-4.8	3.22 J	35.6 U	0.36 U
8/8/91	3.5-4.9	4.22 J	3.67 U	0.037 U
8/9/91	3.5-4.10	5.22 J	4.84 U	0.048 U
8/7/91	8.0-9.5	4.36 J	3.99 U	0.04 U

075-IWCO-004	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
12/15/94	1.5-2.0	7.6	3.7 U	0.037 U
12/15/94	1.5-2.0	26		

B08-07	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
8/13/91	0.5-1.0	20.6 J	3.65 U	0.037 U
8/13/91	2.0-3.0	1.97 J	3.49 U	0.035 U
8/13/91	5.0-6.0	2.19 J	4.03 U	0.04 U
8/13/91	12.5-14.0	10.4 J	4.02 U	0.04 U

M08-01	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
7/30/91	0.5-1.0	31.8	3.42 U	**0.27**
7/30/91	3.5-4.5	1.93	3.75 U	0.037 U
7/30/91	9.5-11.0	2.47	4.19 U	0.042 U
7/30/91	14.0-15.3	3.27	4.12 U	0.041 U

B08-08	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
8/6/91	0.5-1.0	28.4 J	34.4 U	0.34 U
8/6/91	2.0-3.0	1.8 J	3.57 U	0.036 U
8/6/91	8.0-9.5	1.68 J	4.07 U	0.041 U
8/6/91	14-15.5	21.4 J	4.98 U	**0.26**
8/6/91	11.0-12.5	8.78 J	53.1 U	0.53 U

B08-10	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
8/7/91	0.5-1.0	1.09 J	3.49 U	0.035 U
8/7/91	5.0-6.5	4.12	3.75 U	0.038 U
8/7/91	8.0-9.5	1.77	3.89 U	0.039 U
8/7/91	14-15.5	4.03	4.02 U	0.04 U

B08-09	Depth (Feet)	Lead (mg/kg)	Dieldrin (mg/kg)	Arochlor (mg/kg)
8/7/91	0.5-1.0	4.46 J	35.1 U	0.35 U
8/7/91	5.0-6.3	6.93 J	3.71 U	0.037 U
8/7/91	8.0-9.5	2.15 J	3.95 U	0.039 U
8/7/91	14-15.3	13.6 J	46.7 U	0.47 U

- LEAD DETECTED
- EXCEEDS REMEDIAL GOAL[3]
- CATCH BASIN
- MANHOLE
- GENERATOR ACCUMULATION POINT (GAP)
- OIL-WATER SEPERATOR (OWS)
- FENCE
- FUEL LINE
- SANITARY SEWER LINE
- STORM SEWER LINE
- WASHDOWN AREA (WD)
- CERCLA SITE BOUNDARY
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- CORRECTIVE ACTION AREA (CAA)
- PROPOSED EXCAVATION

BUILDING
- Former
- Present
- LAND COVER

Notes:

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
J	Estimated
mg/kg	Milligram per kilogram
U	Nondetected

1 Location designated in the Resource Conservation and Recovery Act Facility Assessment (DTSC 1992); exact location unkown

2 Remedial goal for lead is 299 mg/kg

3 Bold denotes concentration that exceeds remedial goal.

4 Approximate direction and velocity of groundwater movement

35 0 35 70 Feet

SulTech

Alameda Point
Department of the Navy, BRAC PMO West, San Diego, CA

FIGURE 7-1
PROPOSED EXCAVATION AREAS
SITE 8 SOIL

Feasibility Study Report
Operable Unit 1, Sites 6, 7, 8, and 16

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TABLES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005

TABLE 7-1: POTENTIAL RECEPTORS AND EXPOSURE ROUTES FOR SOIL IN THE NORTHEAST CORNER OF SITE 8
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Potential Receptor	Exposure Route	Comment on the Pathway	Land Use Scenario
Commercial/Industrial Worker	Inhalation of Aroclor-1254, Aroclor-1260, dieldrin, and lead airborne particles as dust	Results of the remedial investigation risk assessment indicate an acceptable level of risk for this pathway	Commercial/Industrial
Construction Worker	Inhalation of Aroclor-1254, Aroclor-1260, dieldrin, and lead airborne particles as dust	Results of the remedial investigation risk assessment indicate an acceptable level of risk for this pathway	Commercial/Industrial/ Residential
	Dermal contact with Aroclor-1254, Aroclor-1260, dieldrin, and lead in soil	Results of the remedial investigation risk assessment indicate an acceptable level of risk for this pathway	
Hypothetical Resident	Inhalation of Aroclor-1254, Aroclor-1260, dieldrin, and lead airborne particles as dust	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway	Residential
	Dermal contact with Aroclor-1254, Aroclor-1260, dieldrin, and lead in soil	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway	
	Ingestion of Aroclor-1254, Aroclor-1260, dieldrin, and lead in soil or homegrown produce	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway	
Ecological life	Ingestion of or dermal contact with Aroclor-1254, Aroclor-1260, dieldrin, and lead in soil	Results of the remedial investigation risk assessment indicate an unacceptable level of risk for this pathway; however, there is limited ecological habitat at Site 8	Not applicable

TABLE 7-2: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
		SOIL		
Federal				
Resource Conservation and Recovery Act (Title 42 USC Chapter 82, 6901 through 6991[i])[c]				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste.	Title 22 CCR 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether waste is hazardous.
Land Disposal Restrictions prohibit disposal of hazardous waste unless treatment standards are met.	Hazardous waste land disposal	Title 22 CCR 66268.1(f)	Applicable	This requirement is applicable if hazardous waste is to be disposed of on land.
Toxic Substances Control Act (15 USC, ch. 53, §§ 2601–2692)[c]				
Regulates storage and disposal of PCB remediation waste. There are three options: a) self-implementing on-site cleanup and disposal; b) performance-based disposal using existing approved disposal technologies; and c) risk-based disposal.	Soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm.	40 CFR § 761.61(a)(4), (b), and (c)	Relevant and Appropriate	This section is potentially relevant and appropriate for PCB contaminated soil. Section (a)(4) establishes a cleanup level for bulk PCB remediation waste in high-occupancy areas of less than or equal to 1 ppm. The cleanup level for bulk PCB remediation waste in low-occupancy areas is less than or equal to 25 ppm. Section (c) offers an alternative using risk-based levels and technologies.

TABLE 7-2: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
		SOIL		
State				
State and Regional Water Quality Control Board				
Definitions of designated waste, nonhazardous waste, and inert waste		Title 27 CCR 20210, 20220 and 20230	Applicable	Potential ARAR for classifying waste.

Notes:

a Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables

b Only the substantive provisions of the requirements cited in this table are potential ARARs

c Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs

ARAR Applicable or relevant and appropriate requirement
CCR *California Code of Regulations*
MCL Maximum contaminant level
RCRA Resource Conservation and Recovery Act
TCLP Toxicity characteristic leaching procedure
TSCA Toxic Substances Control Act
USC *United States Code*

TABLE 7-3: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Federal					
Endangered Species Act of 1973 (Title 16 USC §§ 1531–1543)[b]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	16 USC § 1536(a), (h)(1)(B)	Applicable	Applicable if endangered species are found at Site 8.
Coastal Zone Management Act (Title 16 USC §§ 1451–1464)[b]					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands under and adjacent to shore land.	16 USC § 1456(c) 15 CFR § 930	Relevant and Appropriate	Remedial alternatives will comply with the Coastal Zone Management Act and Bay Plan
State					
Endangered species habitat	No person shall import, export, take, possess, or sell any endangered or threatened species or part or product thereof.	Threatened or endangered species determination on or before 01 January 1985 or a candidate species with proper notification.	Cal. Fish & Game Code § 2080	Relevant and Appropriate	This section may be potentially relevant and appropriate if there are threatened or endangered species/habitats present at the site. If endangered species are present, the ecological assessment will evaluate potential effects of the contamination present and the planned response action.

TABLE 7-3: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

a	Only the substantive provisions of the requirements cited in this table are potential ARARs
b	Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs
ARAR	Applicable or relevant and appropriate requirement
CFR	*Code of Federal Regulations*
USC	*United States Code*

TABLE 7-4: REMEDIAL ACTION OBJECTIVES FOR SOIL IN THE NORTHEAST CORNER OF SITE 8
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Chemical of Concern	Potential Receptor	Exposure Route	Remediation Goal (mg/kg)
Total PCBs	Commercial/Industrial Worker	Inhalation of airborne particles as dust	1
	Hypothetical Resident	Dermal contact, ingestion, and inhalation as dust	1
Aroclor-1254	Commercial/Industrial Worker	Inhalation of airborne particles as dust	0.74
	Hypothetical Resident	Dermal contact, ingestion, and inhalation as dust	0.22
Aroclor-1260	Commercial/Industrial Worker	Inhalation of airborne particles as dust	0.74
	Hypothetical Resident	Dermal contact, ingestion, and inhalation as dust	0.22
Dieldrin	Commercial/Industrial Worker	Inhalation of airborne particles as dust	0.11
	Hypothetical Resident	Dermal contact, ingestion, and inhalation as dust	0.03
Lead	Commercial/Industrial Worker	Inhalation of airborne particles as dust	3,572
	Hypothetical Resident	Dermal contact, ingestion, and inhalation as dust	230

Notes:

mg/kg Milligram per kilogram
PCB Polychlorinated biphenyl

TABLE 7-5: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
		SOIL SAMPLING AND EXCAVATION			
Resource Conservation and Recovery Act (42 USC, Chapter 82, §§ 6901-6991[i]) *					
On-site waste generation	Person who generates wste shall determine if that waste is hazardous waste.	Generator of waste	Title 22 CCR §§ 66261.10(a), 66262.11	Applicable	The requirements of 22 CCR, Division 4.5, Chapter 14 are applicable for determining whether material generated as a result of the soil sampling, excavation or in situ chemical oxidation (ISCO) process of hydrogen release compound (HRC) contains hazardous waste. These requirements may be relevant and appropriate to material that is similar or identical to RCRA hazardous waste or non-RCRA hazardous waste.
Hazardous waste accumulation	On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers or tanks, on drip pads or inside buildings, and is labeled and dated.	Accumulate hazardous waste	Title 22 CCR § 66262.34	Applicable	These requirements are applicable if hazardous waste is generated and accumulated on site before transport.
Pre-transport requirements	Hazardous waste must be packaged in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR § 66262.30	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Hazardous waste must be labeled in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR 22 § 66262.31	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Provides requirements for marking hazardous waste prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR § 66262.32	Applicable	These requirements are applicable if hazardous waste is to be transported.

TABLE 7-5: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL SAMPLING AND EXCAVATION (Continued)					
Resource Conservation and Recovery Act (42 USC, Chapter 82, §§ 6901-6991[i]) * (Continued)					
Pre-transport requirements	A generator must ensure that the transport vehicle is correctly placarded prior to transport of hazardous waste.	Any operation where hazardous waste is generated	Title 22 CCR 66262.33	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Requires preparation of a manifest for transport of hazardous waste off site.	Any operation where hazardous waste is generated	Title 22 CCR 66262.20-66262.23	Applicable	These requirements are applicable if hazardous waste is to be transported.
Federal Hazardous Materials Transportation Law (49 USC §§ 5101-5127) *					
Transportation of hazardous material 49 USC §§ 5101-5127	Sets forth requirements for transporting hazardous waste including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements.	Interstate carriers transporting hazardous waste and substance by motor vehicle.	49 CFR § 171.2(f), 171.2(g), 172.300, 172.301, 172.302, 172.303, 172.304, 172.312, 172.400, 172.504	Relevant and appropriate	Relevant and appropriate for transporting hazardous materials on site.
Clean Air Act (42 USC § 7401 et seq.) *					
Excavation	Sets forth opacity limitations.	Excavation	BAAQMD Regulation 6, Regulation 6-302	Applicable	These requirements are applicable for excavation activities.
Clean Air Act (42 USC § 7401 et seq.) *					
Excavation	Provides requirements for maintaining, covering and stock-piling excavated soil.	Soil stockpile	BAAQMD Regulation 8, Rule 40	Relevant and appropriate	These requirements are applicable for excavation activities.

TABLE 7-5: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
			LAND USE CONTROLS		
California Civil Code*					
Land use controls	Provides conditions under which land use restrictions will apply to successive owners of land.	Transfer property from the Navy to a nonfederal agency	Cal. Civ. Code § 1471	Applicable	Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land ... where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety of the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health & Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed at the time of transfer.
California Civil Code*					
Cal. Code Regulations Title 22*					
Land Use Controls	Sets forth recording requirements for land use covenants.	Recorded Land Use Control	Title 22 CCR 67391.1	Applicable	The substantive provisions of § 67391.1 are potential ARARs.

TABLE 7-5: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
		LAND USE CONTROLS (Continued)			
California Civil Code*					
California Health & Safety Code*					
Land Use Controls	Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Transfer property from the Navy to a nonfederal agency	Cal. Health & Safety Code § 25202.5	Applicable	The substantive provisions of this section are the general narrative standards to restrict "present and future uses of all or part of the land on which the facility ...is located."
Land Use Controls	Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of Cal. Health & Safety Code § 25232(b)(1)(A)-(E).	Transfer property from the Navy to a nonfederal agency.	Cal. Health & Safety Code § 25222.1	Applicable	This section is a potential ARAR when the Navy is transferring property to a nonfederal entity. Cal. Health & Safety Code § 25222.1 provides the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of the property. The substantive provision of Cal. Health & Safety Code § 25222.1 is the general narrative standard: "restricting specified uses of the property."

TABLE 7-5: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
		LAND USE CONTROLS (Continued)			
California Civil Code*					
California Health & Safety Code*					
Land Use Controls	Provides a process for obtaining a written variance from a land use restriction.	Transfer property from the Navy to a nonfederal entity.	Cal. Health & Safety Code § 25233(c)	Applicable	This section is a potential ARAR for institutional controls where the Navy is transferring property to a nonfederal entity. Cal. Health & Safety Code § 25233(c) sets forth substantive criteria for granting variances from the uses prohibited in § 25232(b)(1)(A)-(E) based on specific environmental and health criteria.
City of Alameda Ordinance No. 2824*					
Excavation	Regulates excavation activities in the Marsh Crust area of Alameda Point.	Excavation below threshold depths	City of Alameda Ordinance No. 2824	TBC	Ordinance No. 2824 is a TBC criteria for excavation activities in the Marsh Crust area at threshold depths.

TABLE 7-5: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
		DISPOSAL OF PCB-CONTAMINATED SOIL			
Toxic Substances Control Act (15 USC §§ 2601–2692)*					
Disposal of PCBs	This act regulates the storage and disposal of PCB remediation waste. There are three options: (1) self-implementing on-site cleanup and disposal; (2) performance-based disposal using existing approved disposal technologies; and (3) risk-based disposal. This act is applicable to soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm.	PCB-contaminated soil	40 CFR § 761.61(a)(4), (b), and (c)	Relevant and appropriate	This section is relevant and appropriate for the disposal of soil containing PCBs.

Notes:

* Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of specific citations are considered potential ARARs

1 The Clean Air Act ARARs apply only to the alternatives involving excavation.

ARAR	Applicable or relevant and appropriate requirement	PCB	Polychlorinated biphenyl
BAAQMD	Bay Area Air Quality Management District	ppm	Parts per million
CCR	*California Code of Regulations*	RCRA	Resource Conservation and Recovery Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	SDWA	Safe Drinking Water Act
CFR	*Code of Federal Regulations*	TBC	To be considered
DTSC	Department of Toxic Substances Control	UIC	Underground injection control
DOT	U.S. Department of Transportation	USC	*United States Code*
HRC	Hydrogen Release Compound	USDW	U.S. Drinking Water
ISCO	In situ chemical oxidation	TSCA	Toxic Substances Control Act

8.0 SITE 16 FEASIBILITY STUDY EVALUATION

The following sections describe the development and analysis of alternatives for remediation of soil and groundwater at Site 16. Section 8.1 describes soil and groundwater RAOs. Section 8.2 discusses GRAs and screening of technologies. Section 8.3 describes the remedial alternatives for soil and groundwater in detail. Section 8.4 compares each of the soil alternatives with the requirements of the NCP. Section 8.5 compares all of the soil alternatives with each other. Section 8.6 compares each of the groundwater alternatives with the requirements of the NCP. Section 8.7 compares all of the groundwater alternatives with each other.

8.1 REMEDIAL ACTION OBJECTIVES FOR SOIL AND GROUNDWATER AT SITE 16

RAOs are medium-specific goals for protecting human health and the environment. Each RAO specifies (1) the contaminants of concern, (2) the exposure routes and receptors, and (3) acceptable contaminant concentrations for each exposure pathway. RAOs can be achieved either by reducing COCs or eliminating the exposure pathways. This FS evaluation considers alternatives for both approaches.

General response objectives are discussed below followed by the remaining criteria that were used to develop the RAOs for soil and groundwater including COCs in Section 8.1.1, potential receptors and exposure pathways in Section 8.1.2, ARARs in Section 8.1.3, and remedial goals in Section 8.1.4. The RAOs developed for Site 16 are presented in Section 8.1.5.

The general response objectives for Site 16 soil and groundwater are presented below for each medium.

Soil

The RI for OU-1 concluded that soil at Site 16 does not pose a significant risk to human health or to the environment; however, the RI did not include a sufficient characterization of the soil adjacent to OWS-608A and OWS-608B. Furthermore, the regulatory agencies have requested that the Navy evaluate potential site risks associated with soil contaminated with PCBs exceeding the interim cleanup levels that were not adequately characterized during the RI. Therefore, the general response objectives for soil at Site 16 are (1) to determine whether soil adjacent to OWS-608A and OWS-608B contains VOCs, SVOCs, metals, pesticides, PCBs, or TPH at concentrations that exceed their respective residential PRG concentrations; (2) to prevent soil near OWS-608A and OWS 608B from acting as a continuing source of contaminants to groundwater; (3) to determine whether PCB-contaminated soil that was not adequately characterized during the RI had concentrations that exceeded the interim cleanup levels; and (4) to prevent human exposures to any such soils.

Groundwater

The RI for OU-1 concluded that groundwater at Site 16 poses a significant risk to human health from exposure to VOCs. Therefore, the general response objectives for groundwater include preventing human exposure from VOCs in the groundwater plume that poses risk to human health. In addition, the general response objectives include additional sampling of groundwater to fully delineate the plumes of VOCs that were identified during the RI.

The development of these RAOs, including a discussion of the COCs, exposure pathways and receptors, and remediation goals, is presented in the following sections.

8.1.1 Chemicals of Concern

COCs for soil and groundwater at Site 16 are provided below.

8.1.1.1 Soil

Based on the RI at Site 16 (see Section 3.5.3), a total of three COPCs, arsenic, lead and PCBs, were identified, of which arsenic and lead are not evaluated further in this FS. The RI found that arsenic and lead concentrations at the site are related to the shipping storage container area in the southeast corner of Alameda Point and the former location of UST 608-1. In addition, soil contaminated with PCBs and lead was excavated from three areas of Site 16 during a soil removal action in 1997. Concentrations of arsenic, PCBs and lead are within the risk management range at Site 16. However, little information is known about potential contamination adjacent to OWS-608A and OWS-608B, and PCB-contaminated soil that was not adequately characterized during the RI may have concentrations that exceed the interim cleanup levels. Therefore, the soil adjacent to OWS-608A and OWS-608B will require additional sampling for VOCs, SVOCs, pesticides, PCBs, metals, and TPH to determine the extent of any contamination, and soil with PCB contamination exceeding interim cleanup levels will require additional sampling.

8.1.1.2 Groundwater

Based on results of the RI, a total of 10 COPCs were identified in groundwater at Site 16, five of which (arsenic, cadmium, manganese, chlordane, and heptachlor) are not evaluated further in this FS report. The RI found that arsenic, cadmium, and manganese are similar to background and are attributable to ambient conditions at the site. Chlordane and heptachlor concentrations in groundwater were evaluated using old data and subsequently were not detected in more recent samples.

The remaining five COPCs that were identified during the RI (PCE, TCE, 1,3-DCB, 1,4-DCB, and vinyl chloride) are associated with the solvents used at the shipping storage container area and their degradation products. These five COCs are evaluated further in this FS report.

8.1.2 Potential Receptors and Exposure Pathways

The sources, affected media, and exposure point components of the exposure pathways for Site 16 all involve the soil and dust particles for soil exposures, and groundwater or vapors from groundwater for groundwater exposures. Potential receptors and exposure routes for soil and groundwater at Site 16 are provided in the Table 8-1.

8.1.3 Applicable or Relevant and Appropriate Requirements for Soil and Groundwater

ARARs and TBCs are generally divided into three categories: chemical-specific, location-specific, and action-specific. The evaluation of ARARs for this FS is presented in Appendix B. The potential chemical- and location-specific ARARs having implications for this FS are summarized below. Action-specific ARARs are identified and discussed following development and screening of site-specific remedial alternatives.

A description of the process for identifying and selecting ARARs is presented in Section 5.1.3.

8.1.3.1 Chemical

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 that may be found in or discharged to the ambient environment that is protective of human health and the environment.

Soil

Chemical-specific ARARs for Site 16 soil are identical to those presented in Section 5.1.3.1 for Site 6.

Groundwater

Site 16 groundwater is considered a potential drinking water source. The Navy evaluated federal and state MCLs for the COCs at Site 16. Federal MCLs are found at Title 40 § CFR 141.61(a) and (c). In their 1996 ARARs response, DTSC identified the California MCLs as ARARs. The Navy has selected the state MCL for 1,4-DCB, where there is no federal MCL, and the state MCL for vinyl chloride, where the state MCL is more stringent than the federal MCL. For TCE and PCE, the state and federal MCLs are the same. Primary and secondary state MCLs are set forth in Title 22 CCR, as follows:

- 64431 (Maximum Contaminant Levels – Inorganic Chemicals)
- 64444 (Maximum Contaminant Levels – Organic Chemicals)
- 64449(a) (Secondary Maximum Contaminant Levels)

Air

There are no chemical-specific ARARs for the vapor intrusion pathway. The Navy has derived the following risk-based remediation goals for vapor: 0.017 micrograms per cubic meter ($\mu g/m^3$) for PCE, 0.33 $\mu g/m^3$ for TCE, and 0.33 $\mu g/m^3$ for vinyl chloride.

Table 8-2 summarizes the chemical-specific ARARs associated with Site 16.

8.1.3.2 Location

Location-specific ARARs for Site 16 soil are identical to those presented in Section 5.1.3.2 for Site 6 soil.

Table 8-3 summarizes the location-specific ARARs associated with Site 16.

8.1.4 Remediation Goals

The remediation goals for soil and groundwater at Site 16 are based on the general RAOs, chemicals of concern, and federal and state ARARs.

8.1.4.1 Soil

Currently, there are no remediation goals for Site 16 soil because the COCs identified during the RI do not pose significant risk to human health or the environment. The remediation goals for any COCs that are identified during sampling adjacent to OWS-608A and OWS-608B, and PCB sampling will be based on residential PRGs.

8.1.4.2 Groundwater

Two sets of groundwater remediation goals were developed for Site 16 groundwater to allow the consideration of two different site reuse scenarios. One set of remediation goals requires cleanup to allow commercial/industrial reuse of the site, and the other set requires cleanup to allow unrestricted reuse of the site. The table below presents the concentrations of COCs that are associated with each set of remediation goals for the Site 16 groundwater.

COC	Remedial Goals for Commercial/Industrial Reuse		Remedial Goals for Unrestricted Reuse	
	Inhalation Criteria		Inhalation Criteria	Drinking Water Criteria
	Inhalation of Indoor Air ($\mu g/m^3$)	Corresponding Concentration in Groundwater ($\mu g/L$)	Inhalation of Indoor Air ($\mu g/m^3$)	MCL ($\mu g/L$)
PCE	0.69	420	0.33	5
TCE	0.036	35	0.017	5
1,3-DCB	4.6	18,000	3.3	5.5
1,4-DCB	0.6	3,000	0.28	5
Vinyl Chloride	0.89	240	0.22	0.5

8.1.5 Remedial Action Objectives

This section summarizes the RAOs developed for soil and groundwater at Site 16 based on the identified COCs, potential receptors and exposure pathways, ARARs, and remediation goals.

8.1.5.1 Soil

- Prevent human exposures to soils adjacent to OWS-608A and OWS-608B that are found to contain VOCs, SVOCs, metals, pesticides, or PCBs (in contaminated soil in the storage area) that exceed their respective residential PRG concentrations.

8.1.5.2 Groundwater

- For the potential residential receptor, prevent dermal contact, ingestion, and inhalation of VOCs in groundwater above MCLs.
- For the commercial/industrial receptor, prevent inhalation of indoor air containing VOCs from the groundwater plumes that exceed the following concentrations: 420 µg/L of PCE, 37 µg/L of TCE, 18,000 µg/L of 1,3-DCB, 3,000 µg/L of 1,4-DCB, and 240 µg/L of vinyl chloride.

The groundwater RAOs for each COC are summarized in Table 8-4.

8.2 General Response Actions and Preliminary Screening of Technologies

The table below presents the GRA that were identified to meet RAOs for soil and groundwater at Site 16.

Soil GRAs for Site 16	Groundwater GRAs for Site 16
No Action	No Action
One-Time Soil Sampling adjacent to OWS-608A and OWS-608B	Plume Boundary Delineation
Institutional Controls	LUCs
Excavation and Off-Site Disposal	Active Groundwater Remediation

The following sections present the results of a preliminary screening evaluation that was conducted on these GRAs and on the technologies that were identified under the GRA for active groundwater remediation at Site 16. However, it should be noted that one-time soil sampling and plume boundary delineation were not included in the screening process, because the Navy and regulatory agencies previously agreed that these activities are necessary at Site 16. Section 8.2.1 presents the screening criteria. Section 8.2.2 describes and screens each GRA, technology, and process option. Section 8.2.3 summarizes the retained GRAs, remedial technologies and process options.

Information about the various treatment technologies discussed in this section were obtained from the following sources:

- EPA guidance on presumptive remedies for contaminated groundwater (EPA 1996)
- FRTR screening matrix on remediation technologies (FRTR 2002)
- NFESC environmental restoration website (NFESC 2002)
- Office of Solid Waste and Emergency Response publication on LUCs (EPA 2000)
- Treatability studies conducted previously at Alameda Point
- RACER™ (Earth Tech 2003)

8.2.1 Screening Criteria

Various treatment technologies were evaluated during the initial screening for their ability to address groundwater contamination at Site 16. All treatment technologies identified by EPA as presumptive remedies for groundwater contaminated by VOCs (EPA 1996) were considered in the preliminary screening of treatment technologies for groundwater at Site 16. Other treatment technologies were also considered. The screening evaluations focused on each technology's effectiveness in removing contamination, implementability, and cost at Site 16.

8.2.1.1 Effectiveness

The evaluation of effectiveness focused on (1) the ability of the technology to address contaminants of interest, (2) the ability of the technology to meet the remediation goals within

a reasonable timeframe, and (3) the reliability of the technology. The ability of a technology to achieve the remediation goals within a reasonable timeframe is an important factor in the evaluation of effectiveness because the Navy has set a 5-year timeframe to transfer the sites for redevelopment. In terms of remediation timeframe, a technology is classified as short-term (achieving the remediation goals after less than 3 years of implementation), medium-term (achieving the remediation goals after 3 to 10 years of implementation), or long-term (requiring more than 10 years of implementation to achieve the remediation goals) (FRTR 2002).

8.2.1.2 Implementability

The evaluation of implementability encompasses both the technical and the administrative feasibility of implementing a treatment technology. 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 capabilities to design, construct, and maintain the system. Administrative feasibility includes the ease of completing permitting processes and obtaining approvals from authorities.

8.2.1.3 Cost

The evaluation of cost addresses direct and indirect capital costs and annual O&M costs. When the information is available, the cost range is presented quantitatively. Otherwise, qualitative descriptions of low, moderate, and high are used. The terms low, moderate, and high cost describe a unit cost for treatment that is less than $3 per 1,000 gallons, $3 to $10 per 1,000 gallons, and more than $10 per 1,000 gallons, respectively (FRTR 2002). The cost ranges are based on a review of the literature, vendor quotations, and data prepared for other studies.

8.2.2 Screening of GRAs and Technologies for Soil and Groundwater

The GRAs and technologies are described and evaluated with respect to the three preliminary screening criteria described in this section. A summary of the preliminary screening process for groundwater treatment technologies is presented in Table 8-5.

Technologies and GRAs were retained based on their demonstration of acceptable levels of effectiveness in treating halogenated VOCs, implementability, and cost. The no-action and LUCs GRAs are discussed first followed by a discussion of groundwater treatment technologies. The following sections identify and present screening rationale for each of the options that were considered for Site 16.

8.2.2.1 No Action

Under the no action GRA, no remedial action would be conducted on site and there would be no LUCs, containment, removal, treatment, or other mitigating actions. This GRA would not be effective in reducing potential site risks to human health that may result from soil and

groundwater exposures under unrestricted land use. Because no action is taken, no cost is associated with this option. The NCP requires evaluation of the no-action response in every FS (Title 40 CFR 300.430[e][6]). The no-action alternative provides a baseline for comparison to the other remedial response actions.

8.2.2.2 Land Use Controls

The evaluation of LUCs for Site 16 is identical to the evaluation of LUCs for Site 6 that is described in Section 5.2.2.2.

8.2.2.3 Excavation and Off-Site Disposal

Excavation and off-site disposal would be effective in the treatment of soil at Site 16 because the source area would be removed. This GRA would be effective in reducing potential site risks to human health that may result from soil exposures under unrestricted land use. Excavation and off-site disposal is effective in the treatment of soil contamination at Site 16.

8.2.2.4 Active Remediation

This section presents the technologies that were considered during the preliminary screening process as primary options for the active cleanup of the contaminated groundwater at Site 16 Alameda Point. The primary technologies discussed below include pump and treat with advanced oxidation processes, pump and treat with air stripping, air sparging, biosparging, ISCO, thermal flushing, passive treatment wall, enhanced in situ bioremediation, and MNA.

Air Sparging

Air sparging is an in situ treatment technology that is implemented by injecting pressurized air into a contaminated aquifer so that air streams traverse horizontally and vertically through the soil column, stimulating volatilization of VOCs, which become entrained in the injected air. The injected air and entrained contaminants are removed from the subsurface by a vapor extraction system. This technology is designed to operate at high flow rates to strip the VOCs from groundwater. In addition to removing contaminants, the injected air enhances aerobic biodegradation of the contaminants by increasing dissolved oxygen concentrations in the subsurface. Air sparging is effective in the treatment of halogenated compounds and is retained for Site 16.

Biosparging

Biosparging is similar to air sparging except that air is injected at a much lower flow rate, and vapor collection is not needed. The application of this technology relies on adequate distribution of air through the subsurface. Biosparging is not retained for application at Site 16 because it has limited effectiveness for the treatment of TCE and PCE, two of the major groundwater contaminants at the site.

In Situ Chemical Oxidation

ISCO involves injecting chemical oxidants into the vadose zone and/or groundwater to oxidize contaminants to carbon dioxide, water, and chloride ions. ISCO would effectively degrade the halogenated compounds of concern at the site. The chemical oxidants most commonly employed to date include peroxide, ozone, permanganate, Fenton's reagent (hydrogen peroxide with iron catalyst), modified Fenton's reagent (chelated organometallic catalyst), and stabilized peroxide. The main difference between Fenton's reagent and modified Fenton's reagent is that that with the modified Fenton's reagent, hydroxyl radical can be generated under neutral subsurface conditions, and the catalyst resists precipitation and soil adsorption for more efficient hydroxyl radical distribution.

ISCO is effective for the treatment of halogenated VOCs in groundwater, and treatability studies conducted at Site 16 were successful. Pilot-scale tests for ISCO have recently been conducted at Site 16 in the southern and northern portions using modified Fenton's reagent-based oxidation chemistry. Based on information provided at the RAB meeting by the remedial action contractor on February 10, 2004, the injections achieved a radius of influence of 15 to 30 feet and a 90 percent reduction in chlorinated compound concentrations in groundwater. Based on the results of the pilot-scale test, the remedial action contractor recommended full-scale application of ISCO at Site 16. Based on its effectiveness and the relatively short time frame to implement this technology (less than 3 years); ISCO is retained for further evaluation for Site 16.

Thermal Treatment (Steam Flushing)

Steam flushing is implemented by forcing steam into an aquifer through injection wells to vaporize VOCs and SVOCs. Vaporized components rise to the unsaturated (vadose) zone, where they are removed by vacuum extraction and then treated. Hot water or steam flushing/stripping is a pilot-scale technology. In situ biological treatment may be applied after steam flushing and is continued until groundwater contaminant concentrations achieve the remediation goals. SVOCs and fuels are the target contaminant groups for steam flushing. VOCs also can be treated by this technology, but there are more cost-effective processes for sites contaminated with VOCs. Furthermore, steam flushing is not recommended for treatment of low permeability soils. Treatment costs typically range from $2,000 to $6,000 per 1,000 gallons of groundwater treated based on a 70 percent on-line efficiency (FRTR 2002). Because more cost-effective methods are available for VOC removal, thermal treatment using steam flushing was eliminated from further consideration for Site 16.

Passive Treatment Wall

Implementation of this technology involves installing a permeable reaction wall across the flow path of a contaminant plume, allowing the water portion of the plume to move passively through the wall. These barriers allow the passage of water while prohibiting the movement of contaminants by employing such agents as zero-valent metals, chelators (ligands selected for their specificity for a given metal), sorbents, microbes, and others. The contaminants will either be degraded or retained in a concentrated form by the barrier material.

A common treatment barrier configuration is the funnel-and-gate system. The funnel-and-gate system for in situ treatment of contaminated plumes consists of low hydraulic conductivity (for example, 10^{-6} centimeters per second) cutoff walls (the funnel) with a gate that contains reactive porous media. The reactive media removes contaminants by physical, chemical, or biological processes as the groundwater passes through the gate. The types of cutoff walls most likely to be used are slurry walls or sheet piles.

The time required to achieve remediation goals using passive treatment walls typically range from 3 to 30 years. An average implementation cost ranges from $300 to $1,500 per square foot of reactive barrier installed (assuming a barrier thickness of 2 to 4 feet) (FRTR 2002).

A funnel-and-gate system using in situ reactive iron remediated halogenated VOCs such as those found at Site 16 during tests that were conducted at CERCLA Site 1 (Tetra Tech 1998a). However, a passive treatment wall would treat only water moving through the wall, but not the source area, resulting in a prolonged implementation time. Therefore, this technology is eliminated from further consideration at the site.

Enhanced In Situ Bioremediation

Hydrogen-release compounds and oxygen-releasing compounds were both considered as options for enhancing in-situ bioremediation at Site 16.

Hydrogen Release Compounds. Hydrogen release compound is a proprietary polyacetate ester formulated for slow release of lactic acid upon hydration. The hydrogen release compound is applied to the subsurface via push-point injection or within dedicated wells. The hydrogen release compound is then left in place where it passively stimulates rapid contaminant degradation. Hydrogen release compound is injected directly into the aquifer matrix in a grid pattern over the aerial extent and across the vertical zone of the contaminant plume. Because of the time-released characteristic of hydrogen release compounds, one round of hydrogen release compounds injection will provide the dissolved hydrogen continually for 6 to 12 months, at which time reapplication may be needed. Enhanced in situ bioremediation using hydrogen release compounds is effective for halogenated VOCs and is retained for Site 16.

Oxygen Releasing Compounds. Oxygen Release Compound® is a patented formulation of magnesium peroxide that produces a slow and sustained release of molecular oxygen when in contact with soil moisture or groundwater. The introduction of additional oxygen provides an aerobic environment for naturally occurring microorganisms that aerobically degrade pollutants into less-toxic by-products, ultimately to carbon dioxide and water. Oxygen release compounds may be used directly in the contaminant plume area to treat the contaminants dissolved in groundwater or contaminants sorbed to soil below the water table. Since aerobic bioremediation is at least 10 to 100 times faster than anaerobic bioremediation, the oxygen release compounds application stimulates much faster contaminant reduction rates when compared to unamended natural attenuation, which is generally oxygen deficient. Similar to hydrogen release compounds application, oxygen release compounds are injected directly into the aquifer matrix in a grid pattern over the aerial extent and across the vertical zone of the contaminant plume. Enhanced in

situ bioremediation using oxygen release compounds is effective for treating vinyl chloride but would not reduce TCE and PCE concentrations. Therefore, it was not retained.

Pump and Treat with Advanced Oxidation Processes

Advanced oxidation processes destroy contaminants by chemical reaction with hydroxyl radicals. Hydroxyl radicals are formed through the various combinations of ozone and hydrogen peroxide, both with and without ultraviolet light. The advanced oxidation process systems currently receiving attention include O_3/high pH, H_2O_2+O_3, O_3/ultraviolet light, H_2O_2/O_3/ultraviolet light. These variations can be used with or without a cavitation chamber. During the oxidation process, chemical bonds are broken and new compounds are formed. The technology has the potential to oxidize various organic compounds to carbon dioxide, water, and salts. Pump and treat with advanced oxidation processes is effective in the treatment of halogenated compounds and is retained for Site 16.

Pump and Treat with Air Stripping

Air stripping is a process for removing VOCs from water. The process has been applied widely and successfully to groundwater remediation for a number of contaminants, including TCE, benzene, toluene, xylene, and methylene chloride. Common air stripping configurations, for extracted groundwater, impacted by VOCs include packed tower air strippers and low profile tray towers. Pump and treat with air stripping is effective in the treatment of halogenated compounds and is retained for Site 16.

Monitored Natural Attenuation

This response action involves natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials that are allowed to reduce contaminant concentrations to acceptable levels. Consideration of this option usually requires modeling and evaluation of contaminant degradation rates and pathways and predicting contaminant concentrations at downgradient receptor points. The primary objective of site modeling is to demonstrate that natural processes of contaminant degradation will reduce contaminant concentrations to levels below regulatory standards or risk-based levels before potential exposure pathways are completed. Long-term monitoring must be conducted throughout the process to confirm that degradation is proceeding at rates consistent with meeting remediation goals.

A number of factors may limit the applicability and effectiveness of MNA: (1) extensive amounts of data must be collected and analyzed to determine plume behavior, (2) MNA should be used only where there are no impacts on potential receptors, and (3) subsurface conditions may not allow for MNA of the contaminant. MNA is not sufficiently effective as a single remediation approach to achieve the RAO (it may take 30 years, or more, to reach remediation goals). If LUCs are implemented, however, and/or other remedial actions are undertaken to reduce contamination in the source area, MNA is likely to be an effective tool to confirm the decrease in residual contamination; therefore, it was retained for further consideration in this FS.

8.2.3 Summary of Retained GRAs and Remedial Technologies for Groundwater

All of the GRAs that were considered for soil (no action, selected institutional controls, and excavation with off-site disposal) and groundwater (no action, selected LUCs and active groundwater treatment, and MNA) were accepted for use in developing remedial alternatives at Site 16. However, further screening was required to evaluate specific technologies that were retained for active groundwater treatment and the MNA at Site 16. The active groundwater treatment technologies that required further evaluation include:

- ISCO
- Enhanced in-situ bioremediation using hydrogen release compounds
- Pump and treat with advanced oxidation processes
- Pump and treat with air stripping

Although MNA is not sufficiently effective as a single remediation approach to achieve the RAOs (it may take 30 years, or more, to reach remediation goals), MNA is likely to be an effective tool to confirm the decrease in residual contamination if other remedial actions are undertaken to reduce contamination in the source area. MNA is not considered to be a stand-alone remedy for Site 16.

The active treatment alternatives from the preliminary screening were screened a second time against the criterion discussed below.

8.2.4 Evaluation of Groundwater Treatment Technologies Retained from the Preliminary Screening

As discussed in Section 8.2.3, the table below lists the technologies retained from the preliminary screening.

Active Technology Retained from Preliminary Screening				
Site	ISCO	Hydrogen Release Compounds	Pump and Treat with Advanced Oxidation Processes	Pump and Treat with Air Stripping
Site 16	X	X	X	X

These four active treatment options were evaluated and compared using the criteria in effectiveness, implementability, and cost. A summary of this comparison is presented in Table 8-6. Costs were calculated for each of the retained technologies assuming treatment to domestic use remediation goals.

Based on the evaluation presented in the following sections, the preferred technologies for Site 16 are hydrogen release compounds and ISCO. The following sections present the evaluation of each of the technologies.

8.2.4.1 Enhanced Bioremediation Using Hydrogen Releasing Compounds

This section discusses the effectiveness, implementability, and cost of remediating Site 16 groundwater by hydrogen release compounds.

Effectiveness

Enhanced bioremediation using hydrogen release compounds was successfully tested at a pilot test conducted at Site 4 (Battelle Memorial Institute 2000) to treat chlorinated hydrocarbons. Hydrogen release compound is expected to reduce COC concentrations to below domestic use remediation goals within 3 years. A treatability study should be conducted before full-scale operation.

Implementability

Hydrogen release compound is implementable at Site 16. Implementation would require application of the treatment agent through push points across the plume. Follow-up treatment would likely be required. The remediation timeframe is approximately 3 years. Access restriction during treatment is not required because hydrogen release compounds do not require any aboveground structures. Hydrogen release compound treatment agents are not hazardous, are relatively easy to apply, and do not require special personal protection.

Cost

The estimated cost of treating groundwater at Site 16 using hydrogen release compounds until domestic use remediation goals are reached is $7.6 million. Calculations of these costs are provided in Appendix C.

8.2.4.2 In Situ Chemical Oxidation

This section discusses the effectiveness, implementability, and cost of remediating groundwater at Site 16 using ISCO.

Effectiveness

ISCO using a Modified Fenton's reagent has been demonstrated in several treatability studies at Alameda Point sites, including Site 16. Treatability study results for Site 16 showed 89 to 95 percent reductions in COC concentrations after 4 weeks, following application of treatment agent. Based on the Site 16 results and vendor information, ISCO is expected to reduce COC

concentrations to below domestic use remediation goals within 2 years. While pilot-scale tests have been conducted at Site 16, a treatability study should be conducted prior to application at Site 16.

Implementability

ISCO is implementable at Site 16. Implementation would require application of the treatment agent through push points. For the primary treatment, three injection events would be required and the treatment time for those first three events would be 6 months to 1 year. Follow-up treatment will require three additional injection events and will take approximately 6 months to a year to complete. Access restriction is required during injection because of the hazardous nature of the oxidants. Workers completing injections will require that Level C personal protection.

Cost

The estimated cost of treating groundwater using ISCO until domestic use remediation goals are reached is $12.0 million for Site 16. Calculations of these costs are provided in Appendix C.

8.2.4.3 Pump and Treat using Advanced Oxidation Processes

This section discusses the effectiveness, implementability, and cost of remediating Site 16 groundwater by pump and treat with advanced oxidation processes.

Effectiveness

Pump and treat by advanced oxidation processes is expected to be effective for reducing Site 16 COC concentrations. It is proven successful in many applications under conditions similar to those at Site 16. Effectiveness may be limited by the low permeability of the aquifer zone to be treated. This technology is expected to reduce COC concentrations to below domestic use remediation goals within 15 years. A treatability study should be conducted prior to full-scale application.

Implementability

Pump and treat with advanced oxidation processes is implementable at Site 16. Access to the site would have to be restricted during the treatment period.

Cost

The estimated cost of treating groundwater at Site 16 using pump and treat with advanced oxidation processes until domestic use remediation goals are reached is $23.1 million. Calculations of these costs are provided in Appendix C.

8.2.4.4 Pump and Treat using Air Stripping

This section discusses the effectiveness, implementability, and cost of remediating Site 16 groundwater by pump and treat with air stripping.

Effectiveness

Pump and treat by air stripping is expected to be effective for reducing Site 16 COC concentrations. It is a technology with proven success in many applications under conditions similar to those at Site 16. Effectiveness may be limited by the low permeability of the aquifer zone to be treated. This technology is expected to reduce COC concentrations to below domestic use remediation goals within 15 years. A treatability study should be conducted prior to full-scale application.

Implementability

Pump and treat by air stripping is implementable at Site 16. Access to the site would have to be restricted during the treatment period.

Cost

The estimated cost of treating groundwater at Site 16 using hydrogen release compounds until domestic use remediation goals are reached is $18 million. Calculations of these costs are provided in Appendix C.

8.2.5 Comparative Analysis of Groundwater Treatment Technologies Retained from the Preliminary Screening

This section compares the five treatment technologies retained from the preliminary screening for each of the three technology evaluation criteria. A summary of the comparative analysis is presented in Table 8-6.

8.2.5.1 Effectiveness

The two pump and treat options and ISCO are all likely to be highly effective, but ISCO would take significantly less time to achieve remediation goals. The pump and treat options are expected to require at least 15 years to achieve domestic use remediation goals, while ISCO and Hydrogen release compounds are expected to require up to 3 years. The effectiveness of the pump and treat options could be limited by low permeability. Hydrogen release compounds may also be highly effective with a similar remediation time to ISCO, but a treatability study should be conducted to confirm its effectiveness. The effectiveness of air sparging may be limited by low permeability soil at Site 16.

8.2.5.2 Implementability

ISCO and hydrogen release compounds are both implementable, and neither option would restrict access to the site because no surface structures are required. ISCO treatment agents, however, are hazardous, while hydrogen release compounds treatment agents are not. The pump and treat options are likely to be implementable, but pumping tests should be conducted to evaluate the sustainability of pumping. Air sparging is likely to be implementable at Site 16, but the shallow water table could be a problem if water levels rise excessively. Air sparging at Site 16 should be tested before full-scale implementation. The pump and treat options and air sparging would restrict access to the site because of aboveground structures.

8.2.5.3 Cost

Hydrogen release compounds would have the lowest cost of all the treatment options and is approximately 1.5 to 2 times lower than the ISCO and air sparging. The pump and treat options would be the most expensive option.

8.2.6 Overall Evaluation

Based on the comparison of groundwater treatment technologies, ISCO and hydrogen release compounds are the most preferable active treatment technologies. These technologies were carried forward and are included in a number of remedial alternatives for groundwater.

8.3 REMEDIAL ALTERNATIVES

The retained GRAs and groundwater treatment technologies were assembled into a number of specific remedial alternatives that would satisfy RAOs for soil and groundwater at Site 16. Section 8.3.1 identifies remedial alternatives for soil at Site 16 and identifies the volume of contaminated soil. Section 8.3.2 identifies remedial alternatives for groundwater at Site 16, and Section 8.3.3 identifies the volumes of groundwater that were considered for each general response action.

8.3.1 Remedial Alternatives for Soil

The following remedial alternatives were identified to address contaminated soils at Site 16: (1) no action, (2) one-time soil sampling with possible institutional controls, and (3) one-time soil sampling with possible excavation, and off-site disposal.

8.3.1.1 Alternative 1: No Action for Soil

A no-action response provides the baseline assessment for comparison with other remedial alternatives. A no-action alternative may be considered appropriate if an alternative response

action would cause a greater environmental or health danger than the no-action alternative. The NCP requires evaluation of the no-action response as part of the FS process.

8.3.1.2 Alternative 2: One-Time Soil Sampling and Institutional Controls

Alternative 2 involves a one-time sampling event to delineate the nature and extent of soil contamination adjacent to OWS-608A and OWS-608B as well as the former PCB excavation area. The sampling event will entail collecting soil samples at eight locations based on historical site activities, at depths of 2.5 and 5 feet bgs. If COCs are present in soil above their PRGs, institutional controls would be applied to prevent contact through inhalation and ingestion of contaminated soil by prohibiting excavation without regulatory approval. Institutional controls would be in place indefinitely; however, for the purpose of cost comparison, ICs are assumed to last 100 years.

8.3.1.3 Alternative 3: One-Time Soil Sampling, Excavation, and Off-Site Disposal

Alternative 3 involves a one-time sampling event to delineate the nature and extent of soil contamination adjacent to OWS-608A and OWS-608B. The sampling event will entail collecting soil samples at eight locations based on historical site activities, at depths of 2.5 and 5 feet bgs. If COCs are present in soil above their PRG, the contaminated soil would be excavated and disposed at an appropriate off-site facility.

Excavation is accomplished with conventional heavy construction equipment, including backhoes, cranes, bulldozers, loaders, scrapers, and haulers. This alternative is applicable to almost all site conditions, although it may become cost-prohibitive at great depths or in complex hydrologic environments (Wagner and others 1986).

Disposal refers to the impoundment of excavated materials at a facility that is approved to accept them. Soils classified as hazardous waste under state and federal laws would be transported to an appropriate facility for treatment, if necessary, and disposal. Soils classified as nonhazardous would be transported to an appropriate facility for disposal.

Based on data obtained during the RI and HHRA, the anticipated volume of soil to be removed at the area associated with OWS-608A and OWS-608B (see Figure 8-1) is approximately 41.7 cubic yards. This volume is based on a preliminary excavation boundary of 15-feet by 15-feet and a depth of 5 feet bgs. This volume may change depending on excavation boundaries being revised based on additional sampling in this area and/or contamination encountered during field activities. Excavation limits will be based on PRGs for COCs to be identified at this area. Excavation limits have not yet been established on the former PCB excavation area based on absence of sampling data to delineate the extent of contamination at the site.

8.3.2 Remedial Alternatives for Groundwater

The following remedial alternatives were identified for contaminated groundwater at Site 16: (1) no action, (2) plume boundary delineation, MNA and LUCs; (3) plume boundary delineation, active remediation of the plumes to commercial/industrial reuse criteria, and LUC; and (4) plume boundary delineation and active remediation to unrestricted reuse criteria. Groundwater modeling presented in Attachment C1 of Appendix C was used for cost estimating purposes in this FS report.

8.3.2.1 Alternative 1: No Action for Groundwater

A no-action response provides the baseline assessment for comparison with other remedial alternatives with a greater level of response. A no-action alternative may be considered appropriate if an alternative response action would cause a greater environmental or health danger than the no-action alternative itself. The NCP requires evaluation of the no-action response as part of the FS process.

8.3.2.2 Alternative 2 – Plume Boundary Delineation, MNA, and LUCs

Under Alternative 2 for groundwater, sampling would be required to further delineate the VOC plume boundaries. In addition, the VOC plumes at Site 16 would be monitored for the COCs identified in Section 8.1.1 for a period of 30 years to measure decreases in concentrations that approach remediation goals under a commercial/industrial reuse scenario, specified in Section 8.1.4, for the vapor intrusion pathway. LUCs would be required to prevent the use of groundwater for drinking water and to prevent the installation of drinking water wells without regulatory approval. LUCs require installation of a vapor barrier/removal technology in new buildings until remediation goals have been reached over plume areas. LUCs also require vapor removal systems in existing buildings above plumes where vapor monitoring indicates that COCs identified in groundwater exceed indoor air remediation goals.

8.3.2.3 Alternatives 3A and 3B – Sampling, Active Groundwater Treatment to Commercial/industrial Reuse Criteria, MNA, and LUCs

Alternatives 3A and 3B would require sampling to further delineate the VOC plume boundaries. In addition, this alternative would require active groundwater treatment of vinyl chloride and 1,4-DCB because they are the COCs present at Site 16 at concentrations exceeding the commercial/industrial remedial goals. Active groundwater treatment would involve either ISCO (Alternative 3A) or hydrogen release compounds (Alternative 3B). Active groundwater treatment would be followed by MNA for a period of 30 years to determine whether COCs continue to meet remedial goals and decrease in concentration. LUCs would be required to prevent the use of groundwater for drinking water and to prevent the installation of drinking water wells without regulatory approval. LUCs require installation of a vapor barrier/removal technology in new buildings until remediation goals have been reached over plume areas. LUCs also require vapor removal systems in existing buildings above plumes where vapor monitoring indicates that COCs identified in groundwater exceed indoor air remediation goals.

8.3.2.4 *Alternatives 4A and 4B – Plume Boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, MNA, and LUCs*

Alternatives 4A and 4B would require sampling to further delineate the VOC plume boundaries. In addition, this alternative would require active groundwater treatment of VOC concentrations greater than MCLs to meet remediation goals for unrestricted reuse. Active groundwater treatment would involve either ISCO (Alternative 4A) or hydrogen release compounds (Alternative 4B) MNA to meet the criteria that allow unrestricted reuse of Site 16. LUCs would be required to prevent the use of groundwater for drinking water and to prevent the installation of drinking water wells without regulatory approval. LUCs require installation of a vapor barrier/removal technology in new buildings until remediation goals have been reached over plume areas. LUCs also require vapor removal systems in existing buildings above plumes where vapor monitoring indicates that COCs identified in groundwater exceed indoor air remediation goals.

8.3.3 Volumes of Contaminated Groundwater

The volume of contaminated groundwater requiring treatment under Alternatives 3A and 3B is lower than the volume that would be treated under Alternatives 4A and 4B. Figures 8-2 and 8-4 through 8-10 are groundwater plume maps for all of the individual Site 16 COCs. Figure 8-3 shows a plan view of the treatment area based on commercial/industrial reuse. The groundwater concentration contour on each of the figures corresponds to the chemical's unrestricted reuse remediation goal (MCLs for all of the Site 16 COCs). Figure 8-11 shows a plan view of the treatment area based on unrestricted reuse.

The volumes of contaminated groundwater based on commercial/industrial and unrestricted reuse were calculated using the following formula:

$$V_{gw} = 7.48\, A\, T\, n$$

where

- V_{gw} is the volume (gallons) of contaminated groundwater
- A is the area (feet^2) of the contamination based on domestic remediation goal
- T is the thickness (feet) of the contaminated area
- n is the aquifer porosity

The estimated areas of contamination that were used in the formula are as follows:

Plume	Area (square feet)
Commercial/Industrial Reuse Plume	6,500
Unrestricted Reuse Plume	362,700

An aquifer thickness of 20 feet was estimated for both reuses at Site 16. Assuming an aquifer porosity of 0.3, the estimated volumes of contaminated groundwater for the plumes are presented in the table below.

Plume	Volume of Contaminated Groundwater	
	cubic feet	gallons
Commercial/Industrial Reuse Plume	39,000	291,720
Unrestricted Reuse Plume	2,176,200	16,277,980

8.4 DETAILED ANALYSIS OF ALTERNATIVES FOR SOIL

The following sections present a detailed analysis of each soil alternative. The no-action alternative is evaluated in Section 8.4.1. Alternative 2 is evaluated in Section 8.4.2 and Alternative 3 is evaluated in Section 8.4.3.

8.4.1 Detailed Analysis of Alternative 1: No Action for Soil

Under this alternative, no efforts would be made to treat the contaminated soil at Site 16. An evaluation of the no-action alternative provides a baseline against which other alternatives can be measured.

8.4.1.1 Overall Protection of Human Health and the Environment

The no-action alternative provides little or no decrease in the risk associated with potentially contaminated soil in proximity to OWS-608A, OWS-608B, and the former PCB excavation area. Because the no-action alternative does not prevent contact resulting from intrusive activities, it is not protective of human health.

8.4.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

If potentially contaminated soil were left undisturbed, this would not trigger ARARs. Section 121(d)(2) of CERCLA indicates that ARARs apply only to on-site response actions. If there is no response action, then no ARARs were identified.

8.4.1.3 Long-Term Effectiveness and Permanence

The no-action alternative would not reduce potential exposures and associated health risks. The no-action alternative does not include using controls to manage potentially contaminated soil that remains at the site. In summary, the no-action alternative is not considered an effective or permanent alternative.

8.4.1.4 *Reduction of Toxicity, Mobility, or Volume through Treatment*

Because no active treatment or removal of potentially contaminated soil occurs under this alternative, the no-action alternative is not effective in reducing the toxicity, mobility, or volume of potential contaminants.

8.4.1.5 *Short-Term Effectiveness*

Because the no-action alternative for soil involves no remedial action or construction, the alternative would not pose additional health risks to the community, workers, or the environment.

8.4.1.6 *Implementability*

With respect to technical feasibility, this alternative does not require construction, continuous monitoring, O&M activities, or replacement of equipment, and is, therefore, easy to implement. In terms of administrative feasibility, implementing this alternative would not require coordination with other agencies. The availability of services and materials is not applicable to this alternative. No technical or administrative difficulties are associated with implementing the no-action alternative.

8.4.1.7 *Cost*

No capital or O&M costs are associated with this alternative.

8.4.2 Detailed Analysis of Alternative 2: One-Time Soil Sampling and Institutional Controls

Under this alternative soil would be sampled adjacent to OWS-608A, OWS-608B, and the former PCB excavation area to determine the nature and extent of contamination remaining at the site. Institutional controls would be implemented based on results of the additional sampling.

8.4.2.1 *Overall Protection of Human Health and the Environment*

Alternative 2 protects human health by identifying the nature and extent of contamination present in soil at OWS-608A, OWS-608B, and the former PCB excavation area and prevents further contact by instituting ICs at potential exposure areas where contaminants are found at concentrations below risk-based concentrations. If constituents are found at concentrations greater than risk-based screening levels, then additional action may be warranted to protect human health and the environment. This alternative would be effective in reducing human exposure to potential COCs present in soil at Site 16.

8.4.2.2 *Compliance with Applicable or Relevant and Appropriate Requirements*

Chemical and location-specific ARARs were identified in Sections 8.1.3.1 and 8.1.3.2.

Chemical-specific ARARs may be added based on additional one-time soil sampling conducted at OWS-608A, OWS-608B, and the former PCB excavation area to determine the nature of soil contamination.

The following subsections present a summary of the action-specific ARARs that are included in Alternative 2 and how they will comply with ARARs.

Potential Action

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken. These requirements are triggered by the particular remedial activities selected. Action-specific ARARs indicate how each alternative must be conducted. The Navy identified the following action-specific ARARs for excavation and off-site disposal.

Soil Sampling. The following RCRA requirements are ARARs for soil sampling activities to determine if any waste generated is hazardous waste in accordance with the RCRA requirements of Title 22 CCR 66261.10 and 66261.11. The following requirements are potential excavation, transportation, and off-site disposal ARARs for any RCRA hazardous waste:

- Title 22 CCR 66262.34 (RCRA hazardous waste accumulation requirements)
- Title 22 CCR 66262.30 (RCRA packaging requirements)
- Title 22 CCR 66262.31 (RCRA labeling requirements)
- Title 22 CCR 66262.32 (RCRA marking requirements)
- Title 22 CCR 66262.33 (RCRA placarding requirements)
- Title 22 CCR 66262.20, 66262.21, 66252.22 and 66262.23 (RCRA manifest requirements)

The following Federal Hazardous Materials Transportation Law sections are potential ARARs for transporting of any hazardous waste:

- Federal Hazardous Materials Transportation Law, Title 49 USC 5101 through 5127, 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 (requirements for transporting hazardous wastes, including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements)

Table 8-7 summarizes the action-specific ARARs associated with Site 16 soil.

8.4.2.3 *Long-Term Effectiveness and Permanence*

Alternative 2 would reduce potential exposures and associated health risks by identifying potential contamination present in the soil and instituting institutional controls to prevent any exposure; however, it would not include using controls to manage potentially contaminated soil that remains at the site. In summary, this alternative is considered a permanent alternative.

8.4.2.4 *Reduction of Toxicity, Mobility, or Volume through Treatment*

Because no active treatment or removal of potentially contaminated soil occurs under this alternative, this alternative is not effective in reducing the toxicity, mobility, or volume of potential contaminants through treatment.

8.4.2.5 *Short-Term Effectiveness*

Because Alternative 2 for soil involves no remedial action or construction, the alternative would not pose additional health risks to the community, workers, or the environment. The alternative would not meet RAOs for soil; however, it would identify potential contamination and provide institutional controls to prevent further exposure. Alternative 2 for soil would be effective in the short term.

8.4.2.6 *Implementability*

In terms of feasibility, this alternative would likely require coordination with departments within the Navy and with the regulatory agencies to appropriately define sampling methodology and goals to ensure that soil associated with OWS-608A, OWS-608B, and the former PCB excavation area has been adequately characterized. This alternative is considered to be moderately easy to implement.

8.4.2.7 *Cost*

The total estimated capital cost of this alternative is approximately $268,000. Details of the cost estimate are presented in Appendix C.

8.4.3 Detailed Analysis of Alternative 3: One-Time Soil Sampling, Excavation, and Off-Site Disposal

Under this alternative soil would be sampled near OWS-608A, OWS-608B, and the former excavation area to determine the nature and extent of contamination remaining at the site. Following sampling any contaminated soil exceeding PRG levels for COCs identified at the site would be excavated and disposed of off site.

8.4.3.1 Overall Protection of Human Health and the Environment

Alternative 3 protects human health by identifying the nature and extent of contamination present in soil at OWS-608A, OWS-608B, and the former PCB excavation area and prevents further contact by removing contaminated soil and disposing of it off site. This alternative is considered to be effective in reducing human exposure to potential COCs present in soil at Site 16 and is therefore, protective of human health.

8.4.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

Chemical and location-specific ARARs were identified in Sections 8.1.3.1 and 8.1.3.2. Chemical-specific ARARs may be added based on additional one-time soil sampling conducted at OWS-608A and OWS-608B to determine the nature of soil contamination. The following subsections present a summary of the action-specific ARARs that are included in Alternative 2 and how they will comply with ARARs.

Potential Action

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken. These requirements are triggered by the particular remedial activities selected. Action-specific ARARs indicate how each alternative must be conducted. The Navy identified the following action-specific ARARs for excavation and off-site disposal.

Soil Sampling and Excavation. The following RCRA requirements are ARARs for soil sampling activities to determine if any waste generated is hazardous waste in accordance with the RCRA requirements of Title 22 CCR 66261.10 and 66261.11. The following requirements are potential ARARs for any RCRA hazardous waste:

- Title 22 CCR 66262.34 (RCRA hazardous waste accumulation requirements)
- Title 22 CCR 66262.30 (RCRA packaging requirements)
- Title 22 CCR 66262.31 (RCRA labeling requirements)
- Title 22 CCR 66262.32 (RCRA marking requirements)
- Title 22 CCR 66262.33 (RCRA placarding requirements)
- Title 22 CCR 66262.20, 66262.21, 66252.22 and 66262.23 (RCRA manifest requirements)

The following Clean Air Act requirements are potential ARARs for excavation:

- Regulation 6-302: Opacity Limitation (prohibiting emissions for a period aggregating more than 3 minutes in any hour an emission equal to or greater than 20 percent opacity); and

- Regulation 8, Rule 40: Aeration of Contaminated Soil and Removal of Underground Storage Tanks (setting forth standards for maintaining, covering, and stockpiling soil).

The City of Alameda Ordinance No. 2824 sets forth restrictions for excavation in the Marsh Crust areas of Alameda Point. This ordinance is to be considered criteria for excavations that affect the Marsh Crust. If any excavation will be conducted as a result of sampling activities, this ordinance would be a TBC criteria.

Transportation of Hazardous Waste. The following Federal Hazardous Materials Transportation Law sections are potential ARARs for transporting of any hazardous waste:

- Federal Hazardous Materials Transportation Law, Title 49 USC §§ 5101 through 5127, 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 (requirements for transporting hazardous wastes, including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements)

Table 8-7 summarizes the action-specific ARARs associated with Site 16 soil.

Summary of Compliance with Applicable or Relevant and Appropriate Requirements

Excavated soil adjacent to OWS-608A and OWS-608B at Site 16 will be sampled to determine whether it is hazardous, and sampling, staging, transport, and disposal actions conducted on site will comply with ARARs. RCRA requirements will be used to identify hazardous waste (22 CCR 66261.24). Excavated soils containing hazardous waste will be handled in accordance with ARARs. Land disposal restrictions will be met by treating and disposing of contaminated waste at an off-site, permitted facility.

Bay Area Air Quality Management District Regulations 6-301 for visible emissions and 6-302 for opacity limits would be met by using water to control construction dust. Air monitoring would ascertain the effectiveness of the construction dust control measures in complying with these regulations. Because of the site's location, the Coastal Zone Management Act may be applicable. This law requires site development to be consistent with the BCDC Bay Plan. Alternative 3 does not significantly change the current site use, the nearby shoreline, or other natural resources associated with the site; thus Alternative 3 would comply with the BCDC Bay Plan and with all ARARs.

Excavation may affect the Marsh Crust encountered at Site 16. In that event, excavation would comply with the substantive provisions of the Marsh Crust Ordinance (City of Alameda 2000).

8.4.3.3 Long-Term Effectiveness and Permanence

Alternative 3 is expected to prevent human contact with potentially contaminated soil adjacent to OWS-608A and OWS-608B that exceeds the remediation goals. Confirmation sampling conducted after soil excavation would verify that potential contaminant concentrations in residual soils are less than the RAOs. In addition, confirmation sampling for the appropriate chemicals conducted after soil excavation within a 15-by-15-foot area adjacent to OWS-608A and OWS-608B would verify that soils are less than PRGs for the chemicals determined to be an issue during the initial sampling effort. The excavated area would then be backfilled with clean, imported soil and graded. This alternative is highly effective at eliminating known human health risks to future residents.

8.4.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 3 would not reduce the toxicity, mobility, or volume of potentially contaminated soil adjacent to OWS-608A and OWS-608B by excavating and disposing of contaminated materials at an off-site facility unless the soil is treated at the disposal facility. In addition, if needed, the soil that is disposed of at a hazardous or solid waste disposal facility would be treated to reduce the mobility and/or toxicity of any necessary chemicals in soil adjacent to the OWSs that may otherwise become mobile in groundwater.

8.4.3.5 Short-Term Effectiveness

Alternative 3 would result in potential site risks to the community during excavation and transporting activities. Wetting soils during excavation would help to control blowing dust. Short-term risks to workers would be limited to potential direct contact with soil potentially contaminated with VOCs, SVOCs, pesticides, PCBs, metals and TPH adjacent to OWS-608A and OWS-608B, and risks inherent to construction and solids handling. Adherence to standard industry health and safety practices is expected to provide adequate protection to workers and the nearby community during excavation and removal of contaminated soil. No additional environmental impacts are expected during implementation. Field activities associated with this alternative, including pre-design sampling, excavation, confirmation sampling and analysis, stockpile sampling and analysis, profiling, and off-site transportation would take 2 weeks. This alternative would meet the RAOs for soil in the short term but would increase short-term risks to workers, the community, and the environment. Alternative 3 is considered to be highly effective in the short term.

8.4.3.6 Implementability

All of the alternatives are readily implementable. In terms of administrative feasibility, this alternative would likely require coordination with departments within the Navy and with the regulatory agencies to (1) identify any utilities that may be present, (2) obtain utility clearances, and (3) obtain any necessary permits. This alternative is considered to be moderately easy to implement.

8.4.3.7 Cost

The total estimated capital cost of this alternative is approximately $1.3 million. Details of the cost estimate are presented in Appendix C.

8.5 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR SOIL

This section presents a comparative analysis between Alternative 1 (no action), Alternative 2 (sampling and institutional controls) and Alternative 3 (excavation and off-site disposal) to identify the relative advantages and disadvantages of each alternative. The comparative analysis is based on the same nine criteria that were applied individually to each of the alternatives in Section 8.4.

8.5.1 Threshold Criteria

This section evaluates alternatives in relation to the two threshold criteria: overall protection of human health and the environment and compliance with ARARs.

8.5.1.1 Overall Protection of Human Health and the Environment

The extent of contamination, if any, is unknown in soil adjacent to OWS-608A and OWS-608B. The no-action alternative (Alternative 1) would not eliminate or reduce risk or define the extent of contamination adjacent to OWS-608A and OWS-608B at Site 16. Soil sampling (Alternative 2) would reduce risks at Site 16 to acceptable levels by delineating potentially contaminated soil adjacent to OWS-608A and OWS-608B and by implementing ICs to eliminate contact with contaminated soil by preventing domestic use of groundwater from Site 16. Excavation and disposal (Alternative 3) would reduce risks at Site 16 to acceptable levels such that there would be no restrictions on site use by removing potentially contaminated soil adjacent to OWS-608A and OWS-608B that exceeds RAOs.

8.5.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 would not trigger ARARs at Site 16. Alternatives 2 and 3 meet or have the potential to meet ARARs for soil and groundwater at Site 16 based on the respective reuse scenarios for each alternative.

8.5.2 Balancing Criteria

This section evaluates the alternatives in relation to the five balancing criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume; short-term effectiveness; implementability; and cost.

8.5.2.1 *Long-Term Effectiveness and Permanence*

Soil sampling, excavation, and disposal (Alternative 3) have the highest degree of long-term effectiveness and permanence because potentially contaminated soil at Site 16 is removed from the sites such that there are no restrictions on site use. The no-action alternative and Alternative 2 would leave contaminated soil at the site.

8.5.2.2 *Reduction in Toxicity, Mobility, and Volume*

Alternative 1 does not reduce the toxicity, mobility, or volume of potentially contaminated through treatment or disposal. Alternative 2 does not reduce the mobility or volume of contaminated soil at the site but does reduce the toxicity of contaminated soil, although not through treatment, by implementing an institutional control preventing domestic use of groundwater at Site 16. Alternative 3 reduces the mobility of these contaminants by relocating them at an off-site facility thus preventing their exposure to human or ecological receptors.

8.5.2.3 *Short-Term Effectiveness*

The no-action alternative would have no short-term impacts on the environment. Alternative 2 would have minimal short-term impacts on the environment during sampling activities. Alternative 3 includes excavation, which has the potential to create negative, short-term air and water quality impacts; such impacts would be reduced through use of dust and erosion control methods. None of these alternatives would be expected to pose unacceptable short-term risks to site workers or the community.

8.5.2.4 *Implementability*

All of the alternatives are readily implementable.

8.5.2.5 *Cost*

The no-action alternative is based on an assumption of zero cost. Alternative 2 and Alternative 3, have costs of $268,000 and $1.3 million, respectively.

8.6 DETAILED ANALYSIS OF GROUNDWATER ALTERNATIVES

The following sections present a detailed analysis of each groundwater alternative. The No Action alternative is evaluated in Section 8.6.1. Alternative 2 is evaluated in Section 8.6.2, Alternatives 3A and 3B are evaluated in Section 8.6.3, Alternatives 4A and 4B are evaluated in Section 8.6.4.

8.6.1 Detailed Analysis of Alternative 1: No Action

Under this alternative, no efforts would be made to contain, remove, monitor, or treat the contaminated groundwater at Site 16. An evaluation of the no-action alternative provides a baseline against which other alternatives can be measured.

8.6.1.1 Overall Protection of Human Health and the Environment

Groundwater at Site 16 contains chlorinated compounds at concentrations that pose a risk to humans if groundwater were extracted and used for drinking water. With unrestricted reuse, Alternative 1 is not protective of human health because it does not prevent exposure to domestic consumption of groundwater. Domestic use of groundwater, however, is not expected under the planned reuse for Site 16.

Groundwater concentrations of chlorinated compounds at Site 16 pose a risk to humans through indoor vapor intrusion. Alternative 1 is not protective of human health because it does not prevent inhalation of indoor vapors that may partition from the groundwater and migrate to buildings.

8.6.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 would not trigger ARARs for groundwater. Section 121(d)(2) of CERCLA indicates that ARARs apply only to on-site response actions. If there is no response action, then no ARARs were identified.

8.6.1.3 Long-Term Effectiveness and Permanence

Alternative 1 does not provide a mechanism to prevent extraction and domestic use of groundwater, which could result in exposure of human receptors that ingest the groundwater.

Alternative 1 also does not provide a mechanism to prevent indoor vapor intrusion of chlorinated compounds partitioning from groundwater at Site 16.

8.6.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative would not reduce the toxicity, mobility, or volume of contaminants at Site 16 because they would not be treated. However, this alternative would eventually meet the RAOs due to natural degradation processes.

8.6.1.5 *Short-Term Effectiveness*

Because this alternative does not involve any action, there will be no risks to the community or worker during implementation. The RAOs for soil and groundwater would not be achieved. Therefore, the no-action alternative is not considered effective in the short term.

8.6.1.6 *Implementability*

Implementability includes the technical and administrative feasibility and availability of required resources. No construction or administrative activities will be required to implement this alternative; therefore, the alternative is technically feasible. This alternative is easily implemented because no action will be conducted and additional resources are not required.

8.6.1.7 *Cost*

No capital or O&M costs are associated Alternative 1.

8.6.2 Detailed Analysis of Alternative 2: Plume Boundary Delineation, MNA, and LUCs

The principal components of Alternative 2 are (1) sampling to further define the VOC plume boundary, (2) MNA, (3) LUCs preventing the extraction and use of groundwater at the site, (4) LUCs requiring vapor barrier/removal systems for new buildings constructed over the plumes and (5) engineering controls and LUCs (vapor removal systems) in existing buildings above plumes if vapor monitoring indicates that TCE or vinyl chloride concentrations in indoor air exceed the remediation goals. LUCs for groundwater extraction are necessary to protect potential receptors until MNA confirms reduction in contaminant concentrations below remediation goals. Under this alternative, no active treatment is applied to the groundwater.

Additional details for the components of Alternative 2 for Site 16 are as follows:

- Modeling to demonstrate that concentrations of groundwater COCs will reach remediation goals in 37 years (presented in Attachment C1 of Appendix C).
- Long-term monitoring of concentrations of groundwater COCs for an assumed duration of 30 years.
- Implementation of groundwater restrictions to prohibit (1) installation of groundwater extraction wells in the shallow aquifer and (2) extraction and use of groundwater in the shallow aquifer for any purpose until the Navy, EPA, DTSC, and the Water Board concur that there is no longer an unacceptable risk from exposure to groundwater.

- Entry of the DTSC into a land use covenant restricting future occupants from drinking or discharging groundwater from the shallow aquifer. The land use covenant would provide assurances for its future enforcement.

- Recording of deed notice to notify the public regarding the existence of the contamination.

- Deed restrictions requiring installation of vapor barrier/removal systems in new buildings constructed above the groundwater plumes of vapor intrusion COCs.

- Periodic drive-by inspections for the duration of the LUCs.

- Preparation of a LUC RD to specify the roles and responsibilities for implementing, MNA, and enforcing the LUCs. The draft LUC RD would be provided to the Federal Facilities Agreement signatories.

- LUCs (vapor removal system) in existing buildings located above vapor intrusion COC plumes (necessary only if vapor monitoring indicates that TCE or vinyl chloride concentrations in indoor air exceed the remediation goal)

8.6.2.1 Overall Protection of Human Health and the Environment

Alternative 2 would protect human health and the environment by preventing exposures to contaminated groundwater and vapors partitioning from groundwater. No significant risk to ecological receptors was identified in the RI (Tetra Tech 2004). Risk to human health would be prevented by (1) prohibiting the installation of extraction wells at Site 16, (2) prohibiting the extraction and use of groundwater from the shallow aquifer at the site for any purpose, and (3) requiring installation of vapor barrier/removal systems in new buildings constructed above the groundwater plumes and (4) vapor removal systems in existing buildings above plumes if vapor monitoring indicates that TCE or vinyl chloride concentrations in indoor air exceed the remediation goals. These controls would prevent exposure of human receptors to contaminated groundwater and vapors partitioning from groundwater.

8.6.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 2 would eventually meet chemical-specific ARARs through MNA. Based on recent monitoring data, the more oxidizing groundwater state shows a favorable vinyl chloride degradation trend. MNA would comply with the location-specific and action-specific ARARs.

8.6.2.3 Long-Term Effectiveness and Permanence

MNA to evaluate the achievement of remediation goals is assumed to last 30 years for Alternative 2. Under Alternative 2, LUCs would limit exposure to groundwater and potential vapors at Site 16 until concentrations attenuate to below the remediation goals.

8.6.2.4 Reduction of Mobility, Toxicity, or Volume through Treatment

Alternative 2 would not reduce the mobility, toxicity, or volume of hazardous substances over time through treatment at Site 16 because groundwater would not be treated. However, this alternative would eventually meet the RAOs due to natural degradation processes.

8.6.2.5 Short-Term Effectiveness

Alternative 2 would involve no remedial alternative construction activities; therefore, it would not pose new health risks to the community, current occupants, or workers. This alternative would be highly effective in the short term.

8.6.2.6 Implementability

Implementability includes technical and administrative feasibility and the availability of required resources. From an administrative perspective, Alternative 2 would require agency acceptance of deed restrictions, covenants, and resolution of several legal issues; however, this alternative would be easy to implement technically, because no active remediation is required. The implementation period for LUCs would be the time required to reach vapor intrusion remediation goals. Alternative 2 is readily implementable because groundwater sampling technologies are well proven.

8.6.2.7 Cost

The detailed cost analysis for Alternative 2 includes an estimation of both capital and O&M costs. The capital costs primarily involve preparation of the LUC RD, deed restrictions, and work plans for post-remediation monitoring. The O&M costs involve periodic drive-by inspections, 5-year engineering reviews, and post-remediation monitoring every 5 years until the concentrations attenuate to below the domestic remediation goals. A 25 percent markup factor is included to account for Navy oversight. The total cost for LUCs, however, does not include the cost for enforcing the LUC components; litigation costs are not likely but could be potentially significant.

For Site 16, the estimated total present worth cost for Alternative 2 is $ 1.8 million. Calculations of these costs are provided in Appendix C.

8.6.3 Detailed Analysis of Alternatives 3A and 3B: Plume Boundary Delineation, Active Groundwater Treatment to Industrial/Commercial Use Criteria, MNA, and LUCs

Alternatives 3A and 3B consist of defining the plume boundary and active treatment of Site 16 groundwater followed by MNA. Groundwater treatment by ISCO (Alternative 3A) or hydrogen release compounds (Alternative 3B) will be conducted until COC concentrations are reduced to levels below domestic use remediation goals within 30 years (groundwater treatment target

concentrations). Institutional controls that prevent domestic use of groundwater will be implemented until COC concentrations are reduced below MCLs. Engineering controls to prevent vapor intrusion into buildings would be implemented until vapor intrusion COC concentrations are reduced to below the inhalation remediation goals.

At Site 16, implementation of ISCO (Alternative 3A) would require primary and secondary treatment with follow-up injection events for each treatment. Each treatment would take between 6 months and 1 year. Groundwater samples will be collected after each injection event and quarterly for 2 years after the final injection event to determine if concentration rebound occurs. A total of 70 injection points would be required for Site 16. ISCO (Alternative 3A) work would be performed in Level C personal protective equipment.

Implementation of hydrogen release compounds (Alternative 3B) at Site 16 would require primary and follow-up treatment. One injection event would be required during each stage. The secondary treatment would only be required at 50 percent of the primary treatment injection points. Each treatment event would take approximately 1.5 years to complete. Groundwater samples will be collected after each injection event and quarterly for 3 years after the final injection event. A total of 70 injection points will be required for Site 16. Hydrogen release compound work (Alternative 3B) would be performed in Level D PPE.

The groundwater treatment target concentrations for the chlorinated ethene COCs (PCE, TCE, 1,3-DCB, 1,4-DCB, and vinyl chloride) would be reduced restricted commercial/industrial reuse. Based on modeling, it would take 30 years after active treatment for the chlorinated ethene concentration to reach the domestic use remediation goals for vinyl chloride of 0.5 µg/L. Inhalation remediation goals would be achieved within a shorter timeframe.

MNA and LUC components for Alternatives 3A and 3B for Site 16 are the same as those for Alternative 2, described in Section 8.6.2.

8.6.3.1 Overall Protection of Human Health and the Environment

The evaluation of the overall protection of human health of Alternatives 3A and 3B is the same as that for Alternative 2 with the additional protection of human health by reducing concentrations of chlorinated compounds in groundwater and then allowing groundwater concentrations to attenuate naturally to below domestic use remediation goals in 30 years.

8.6.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 3A and 3B would comply with all chemical-, location- and action-specific ARARs identified for this alternative. Specific action-specific ARARs associated with the active groundwater remediation technology selected for this alternative are provided below.

This alternative will involve the use of ISCO (Alternative 3A) and hydrogen releasing compounds (Alternative 3B) to treat contaminated groundwater in high concentration areas. For ISCO (Alternative 3A) and hydrogen release compounds (Alternative 3B), the Safe Drinking Water Act, Title 40 CFR 144.12 (prohibiting injection activities that allow movement of contaminants into underground sources of drinking water) is an ARAR.

The Navy does not expect large quantities of hazardous waste to be generated as a result of the ISCO (Alternative 3A) and hydrogen release compounds (Alternative 3B) process. Soil cuttings and water generated during the course of installing and operating the ISCO (Alternative 3A) and hydrogen release compounds (Alternative 3B) process are, however, subject to RCRA requirements to determine whether such wastes would be classified as hazardous, Title 22 CCR 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1) and 66261.100 (RCRA hazardous waste classification criteria).

In addition, the following are ARARs would be evaluated if hazardous waste is generated:

- Title 22 CCR 66262.34 (RCRA hazardous waste accumulation requirements)
- Title 22 CCR 66262.30 (RCRA packaging requirements)
- Title 22 CCR 66262.31 (RCRA labeling requirements)
- Title 22 CCR 66262.32 (RCRA marking requirements)
- Title 22 CCR 66262.33 (RCRA placarding requirements)
- Title 22 CCR 66262.20, 66262.21, 66252.22 and 66262.23. (RCRA manifest requirements)
- Federal Hazardous Materials Transportation Law, Title 49 USC 5101 through 5127; 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 (requirements for transporting hazardous wastes)

The Navy will also determine whether any generated waste is classified as either designated waste or nonhazardous waste pursuant to Title 22 CCR 20210 and 20220.

8.6.3.3 Long-Term Effectiveness and Permanence

MNA to evaluate the achievement of remediation goals is assumed to last 30 years for Alternatives 3A and 3B. Under Alternatives 3A and 3B, LUCs would limit exposure to groundwater and potential vapors at Site 16 until concentrations attenuate to below the remediation goals.

8.6.3.4 Reduction of Mobility, Toxicity, or Volume through Treatment

ISCO (Alternative 3A) and hydrogen release compounds (Alternative 3B) will reduce the toxicity of contaminants and the volume of contaminants by promoting degradation of toxic chlorinated compounds to less toxic or nontoxic products. The remaining residual contamination in the source area and downgradient of the source area will be reduced by natural attenuation.

8.6.3.5 Short-Term Effectiveness

ISCO (Alternative 3A) or hydrogen release compounds (Alternative 3B) would reduce the COC concentrations to the groundwater treatment target concentrations at Site 16 within 2 to 3 years and then to below domestic use remediation goals in an additional 30 years. ISCO (Alternative 3A) presents temporary hazards during treatment agent transport and application. These hazards would be mitigated by following proper chemical handling procedures and a health and safety plan. Hydrogen release compound (Alternative 3B) does not present any hazards.

An ISCO pilot test would evaluate the most effective oxidant and catalyst to reduce contaminant concentrations at the site. Some ISCO processes such as a modified Fenton's Reagent and stabilized peroxide can generate hydroxyl radicals under neutral conditions and do not require injection of acid. Other ISCO processes operating under low temperature and pressure require the addition of small quantities of acid (1 to 2 gallons in the injection areas). If the pH of the aquifer is lowered, metals will initially go into solution; however, concentrations generally return to background after treatment and would not be expected to affect the Oakland Inner Harbor.

8.6.3.6 Implementability

Implementability includes technical and administrative feasibility and the availability of required resources. This alternative is technically feasible, although treatability studies will be required to expand the existing pilot tests to full scale. Several ISCO (Alternative 3A) or hydrogen release compound (Alternative 3B) injections, however, will likely be necessary to achieve the domestic use remediation goals. Some discussions with regulators will be necessary to implement ISCO (Alternative 3A) or hydrogen release compounds (Alternative 3B).

8.6.3.7 Cost

For Site 16, the estimated total present worth cost for Alternative 3A, using ISCO, is $2.5 million and for Alternative 3B, hydrogen release compounds, $2.3 million. The basis for these cost estimates is presented in Appendix C.

8.6.4 Detailed Analysis of Alternatives 4A and 4B: Plume Boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, and LUCs

Alternatives 4A and 4B consist of defining the Site 16 VOC plume boundary and active treatment of the plume using ISCO (Alternative 4A) or hydrogen release compounds (Alternative 4B) until COC concentrations are reduced below groundwater domestic use remediation goals and inhalation remediation goals. LUCs will remain until the unrestricted residential reuse remediation goals are reached. ISCO (Alternative 4A) and hydrogen release compound (Alternative 4B) designs for this alternative are the same as for Alternatives 3A and 3B except that target concentrations for Alternatives 4A and 4B are lower. Because PCE and TCE can all degrade to vinyl chloride, the target concentrations for all of the chlorinated ethenes are based on the vinyl chloride domestic use remediation goal of 0.5 µg/L.

ISCO (Alternative 4A) treatment would require three rounds (nine injections) over a 3-year period. Hydrogen release compounds (Alternative 4B) will require three injection events over a 4.5 year period. Wells will be monitored quarterly for both technologies during active treatment.

Institutional control and engineering control components for Alternatives 4A and 4B for Site 16 are the same as those for Alternative 2. LUCs will remain for the duration of active treatment.

8.6.4.1 Overall Protection of Human Health and the Environment

The evaluation of the overall protection of human health of Alternatives 4A and 4B is the same as that for Alternatives 3A and 3B with the additional protection of human health by reducing concentrations of chlorinated compounds in groundwater to remediation goals within 3 years for ISCO (Alternative 4A) and 4.5 years for hydrogen release compounds (Alternative 4B). No significant risk to ecological receptors was identified in the RI (Tetra Tech 2004).

8.6.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

Evaluation of this criterion for Alternatives 4A and 4B is the same as for Alternatives 3A and 3B. Alternatives 4A and 4B will comply with all chemical-specific, location-specific, and action-specific ARARs.

8.6.4.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternatives 4A and 4B is the same as that of Alternatives 3A and 3B except for the times to reach remediation goals. Domestic use remediation goals and vapor intrusion remediation goals would be reached following active treatment at Site 16. MNA to evaluate the achievement of remediation goals is assumed to last 30 years for Alternatives 3A and 3B. Under Alternative 3A and 3B, LUCs would limit exposure to groundwater and potential vapors at Site 16 until concentrations attenuate to below the remediation goals.

8.6.4.4 *Reduction of Mobility, Toxicity, or Volume through Treatment*

Evaluation of this criterion for Alternatives 4A and 4B is the same as for Alternatives 3A and 3B.

8.6.4.5 *Short-Term Effectiveness*

Evaluation of this criterion for Alternatives 4A and 4B is similar to that for Alternatives 3A and 3B., except that remediation goals would be reached within 3 to 4.5 years instead of 30 years, respectively. The reduced time period for Alternatives 4A and 4B would reduce the chances of damage to installed wells and equipment.

8.6.4.6 *Implementability*

Implementability includes technical and administrative feasibility and the availability of required resources. This alternative is technically feasible, although treatability studies will be required to expand the existing pilot tests to full scale. Several ISCO (Alternative 4A) or hydrogen release compound (Alternative 4B) injections, however, will likely be necessary to achieve the domestic use remediation goal. Some discussions with regulators will be necessary to implement ISCO (Alternative 4A) or hydrogen release compounds (Alternative 4B) as well as to negotiate the LUCs.

8.6.4.7 *Cost*

For Site 16, the estimated total present worth cost for Alternative 4A, using ISCO, is $12.6 million and for Alternative 4B, hydrogen release compounds, is $9.1 million. The basis for these cost estimates is presented in Appendix C.

8.7 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR GROUNDWATER

This section presents a comparative analysis of the remedial actions proposed in this FS. The comparative analysis of remedial actions evaluates the relative performance of Alternatives 1 through 4 with respect to seven of the nine specific NCP evaluation criteria presented in Section 4.0. The comparative analysis of groundwater remedial actions is summarized in Table 8-8.

The purpose of this comparative analysis is to identify the relative advantages and disadvantages of each alternative and thereby provide a sound basis for remedy selection that is consistent with the NCP. The NCP states, "The national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste."

8.7.1 Overall Protection of Human Health and the Environment

No unacceptable ecological risks have been identified at Site 16. With unrestricted reuse, Alternative 1 is not protective of human health because it does not prevent exposure to domestic consumption of groundwater and it does not prevent inhalation of indoor vapors that may partition from the groundwater and migrate to buildings.

Alternatives 2 through 4B would protect human health by preventing exposures to contaminated groundwater and vapors partitioning from groundwater. Risk to human health would be prevented by (1) prohibiting the installation of extraction wells at Site 16, (2) prohibiting the extraction and use of groundwater from the shallow aquifer at the site for any purpose, and (3) requiring installation of vapor barrier/removal systems in new buildings constructed above the groundwater plumes. In addition, if vapor monitoring indicates the presence of vapors at toxic concentrations in existing buildings over the plume, a vapor removal system would be installed to prevent exposure of human receptors to contaminated groundwater and vapors partitioning from groundwater. Any LUC on the property will include a prohibition of groundwater use on detached residential homes. However, the LUC may allow some types of connected residential structures (such as apartments, lofts, and condominiums), provided that acceptable inhalation risks are demonstrated. Groundwater ingestion is not expected to occur in connected residential structures, because the residents would not be allowed to install wells.

8.7.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 1 would not meet the ARARs for soils at Site 16. Alternatives 2 through 4B are expected to meet the chemical-specific, location-specific, and action-specific ARARs identified in this FS report.

8.7.3 Long-Term Effectiveness and Permanence

Alternative 1 would not provide long-term effectiveness and permanence for unanticipated groundwater uses at Site 16. Although risks posed by unanticipated groundwater use may decrease over time through natural attenuation, Alternative 1 would not provide any controls to prevent exposure to groundwater or indoor vapor intrusion.

Alternative 2 provides an adequate level of long-term effectiveness and permanence under both anticipated and unanticipated future land-use scenarios by preventing domestic use of groundwater and preventing indoor vapor intrusion. Deed restrictions transfer with the land and are binding upon future owners and occupants of the property. Procedures for implementing, monitoring, and enforcing the deed restrictions will be delineated in the LUC RD, which will be reviewed and approved by all Federal Facilities Agreement signatories and the transferee. Alternative 2 would require a prohibition on domestic use of groundwater at the property.

Alternatives 3A and 4A provide higher levels of long-term effectiveness because contamination would be actively treated. Alternatives 3B and 4B would provide the quickest degradation rate for contamination.

8.7.4 Reduction of Mobility, Toxicity, or Volume through Treatment

All of the Alternatives would eventually reduce the mobility, toxicity, and volume of contamination through natural degradation processes; however, only Alternatives 3A, 3B, 4A, and 4B would reduce the mobility, toxicity, and volume of contamination actively through treatment.

8.7.5 Short-Term Effectiveness

Alternatives 1 and 2 will not introduce a risk to the community or the environment because no active remedial treatment will be conducted. Because of the injection of oxidation reagents during implementation of ISCO, Alternatives 3A and 4A may pose certain risks to the community, remediation action workers, or the environment. These risks can be mitigated through best management practices such as proper personal protective equipment and the installation of a fence or physical barriers at the treatment area. No short-term risks are expected with implementation of hydrogen release compounds (Alternatives 3B and 4B), Alternative 4B would achieve the greatest short-term effectiveness since it would induce the quickest contamination degradation rate while minimizing impacts on the workers and environment.

8.7.6 Implementability

Alternative 1 is easy to implement because it requires no action. Alternatives 2, 3A, 3B, 4A, and 4B may involve some implementation issues because they require the regulatory agencies and the City to agree on the legal language for the deed restrictions and the contents of the LUC RD. Alternatives 3A, 3B, 4A, and 4B are technically feasible; however, they would require numerous injections under ISCO (Alternatives 3A or 4A) or hydrogen release compounds (Alternatives 3B or 4B) to reach domestic use remediation goals, and discussions with regulators will be necessary to agree on the details of installing and operating these alternatives. Although Alternatives 3A, 3B, 4A, and 4B would require establishment of different levels of LUCs, their required duration would be shorter than that of Alternative 2. In terms of remediation, Alternatives 3A and 3B would require active treatment followed by 30 years of MNA, while Alternatives 4A and 4B would only require active treatment. LUCs for Alternatives 4A and 4B will be shorter since they will only remain for the duration of active treatment.

8.7.7 Cost

Estimated total capital costs for each alternative are summarized below and in Table 8-8. These cost estimates were prepared based on commercially available cost estimating tools and previous estimates (published and unpublished) for similar projects. Actual costs will depend on actual labor rates, productivity, the final project schedule, and other variable factors. The table below summarizes the costs for Alternatives 2, 3A and 4A (ISCO), and 3B and 4B (hydrogen release compounds).

Site	Total Cost of Alternatives (in millions of dollars)				
	Alternative 2	Alternative 3A Using ISCO	Alternative 3B Using Hydrogen Release Compounds	Alternative 4A Using ISCO	Alternative 4B Using Hydrogen Release Compounds
Site 16	$1.8	$2.5	$2.3	$12.6	$9.1

8.7.8 Comparative Analysis Summary

For Site 16, the cost for actively treating groundwater to domestic use remediation goals using ISCO as part of Alternatives 3A or 4A ($2.5 million or $12.6 million, respectively) is somewhat higher than the cost of Alternative 2 ($1.8 million). The cost savings of Alternative 3B (active treatment [high target concentrations] with hydrogen release compounds and allowing groundwater to attenuate for 30 years to the remediation goals) compared to Alternative 4B (active treatment [low target concentrations] using hydrogen release compounds to achieve remediation goals) is small and is considered unimportant compared to the shorter remediation time for Alternative 4B using hydrogen release compounds (4.5 years). Alternative 2 would require 37 years to attain domestic use remediation goals at Site 16. Groundwater modeling presented in Attachment C1 of Appendix C was developed to evaluate the timeframe for MNA remediation for the purpose of cost estimating in this FS report. The model concludes that it will take 37 years for Alternative 2 to reach remediation goals for Site 16.

Costs for ISCO options (Alternatives 3A and 4A) for Site 16 are similar to those for Alternative 3B, but are approximately $3.5 million higher than the cost of the hydrogen release compounds options under Alternative 4B.

For Alternatives 2, 3A, 3B, 4A, and 4B, LUCs would have to be implemented for an estimated time of 30 years, until domestic use remediation goals are reached. For Site 16, Alternative 4B using hydrogen release compounds offers a relatively rapid attainment of domestic use remediation goals at a cost that is only somewhat higher than that of Alternative 2.

Alternative 1, no action, provides the lowest degree of protectiveness and is not acceptable. Alternatives 2, 3A, 3B, 4A, and 4B would each protect human health and would each comply with ARARs.

Potential significant risks to human health could result from the unlikely domestic use of shallow groundwater at Site 16. This FS has developed Alternatives 3A, 3B, 4A, and 4B, which provide active groundwater treatment to reduce concentrations of VOCs to domestic use remediation goals within 3-5 years, followed by 30 years of MNA for rebound concentrations. Although these times are considerably shorter than the time for Alternative 2 to reach domestic use remediation goals, it is not necessary to achieve these goals to protect human health; it is only necessary to prevent domestic use of the shallow groundwater. Alternatives 2 through 4B all provide for LUCs to prevent domestic use of groundwater until domestic use remediation goals or the MCLs are reached.

Potential site risks to human health are present also through potential indoor vapor intrusion of COCs that partition from groundwater and may migrate through soil into buildings. Alternatives 2 through 4B all provide protection against indoor vapor intrusion through deed restrictions.

The comparative analysis summary is presented in Table 8-8.

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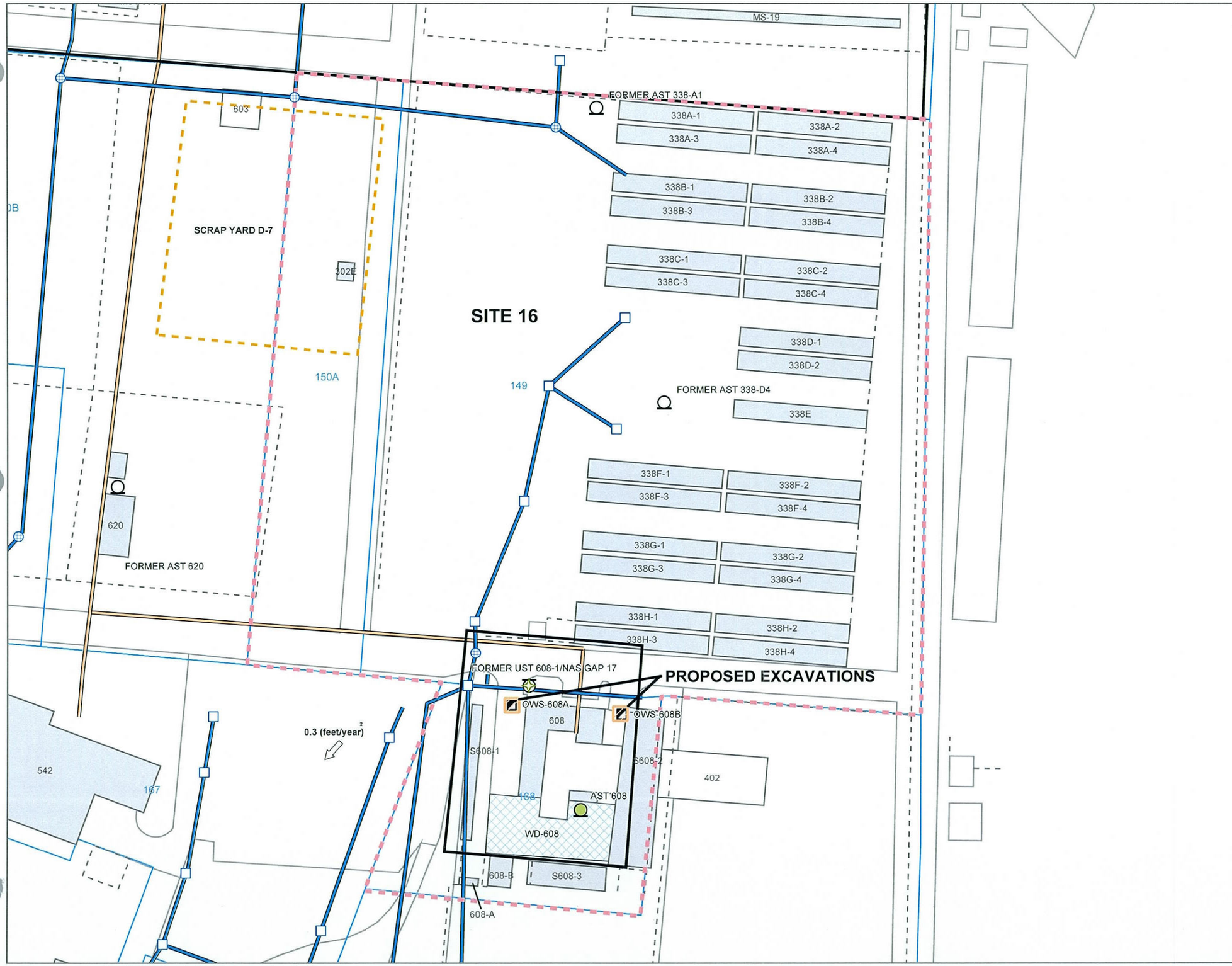
SSIC NO. 5090.3.A.

FIGURES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005



ABOVEGROUND STORAGE TANK (AST)
- Present
- Removed

UNDERGROUND STORAGE TANK (UST)
- Present
- Removed
- GENERATOR ACCUMULATION POINT (GAP)
- CATCH BASIN
- MANHOLE
- OIL-WATER SEPARATOR
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CORRECTIVE ACTION AREA (CAA)
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[1]
- ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL
- LAND COVER
- WASHDOWN AREA (WD)
- PROPOSED EXCAVATION AREAS

BUILDING
- Present
- Removed

Notes:
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
CERCLA Community Environmental Response Facilitation Act

1 Depicted in EBS CERFA (ERM-West 1994)
2 Approximate direction and velocity of groundwater flow

50 0 50 100 Feet

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FIGURE 8-1
PROPOSED EXCAVATION AREA FOR SITE 16 SOIL AND OWS-608A AND 608-B

Feasibility Study Report
Operable Unit 1, Site 6, 7, 8, and 16

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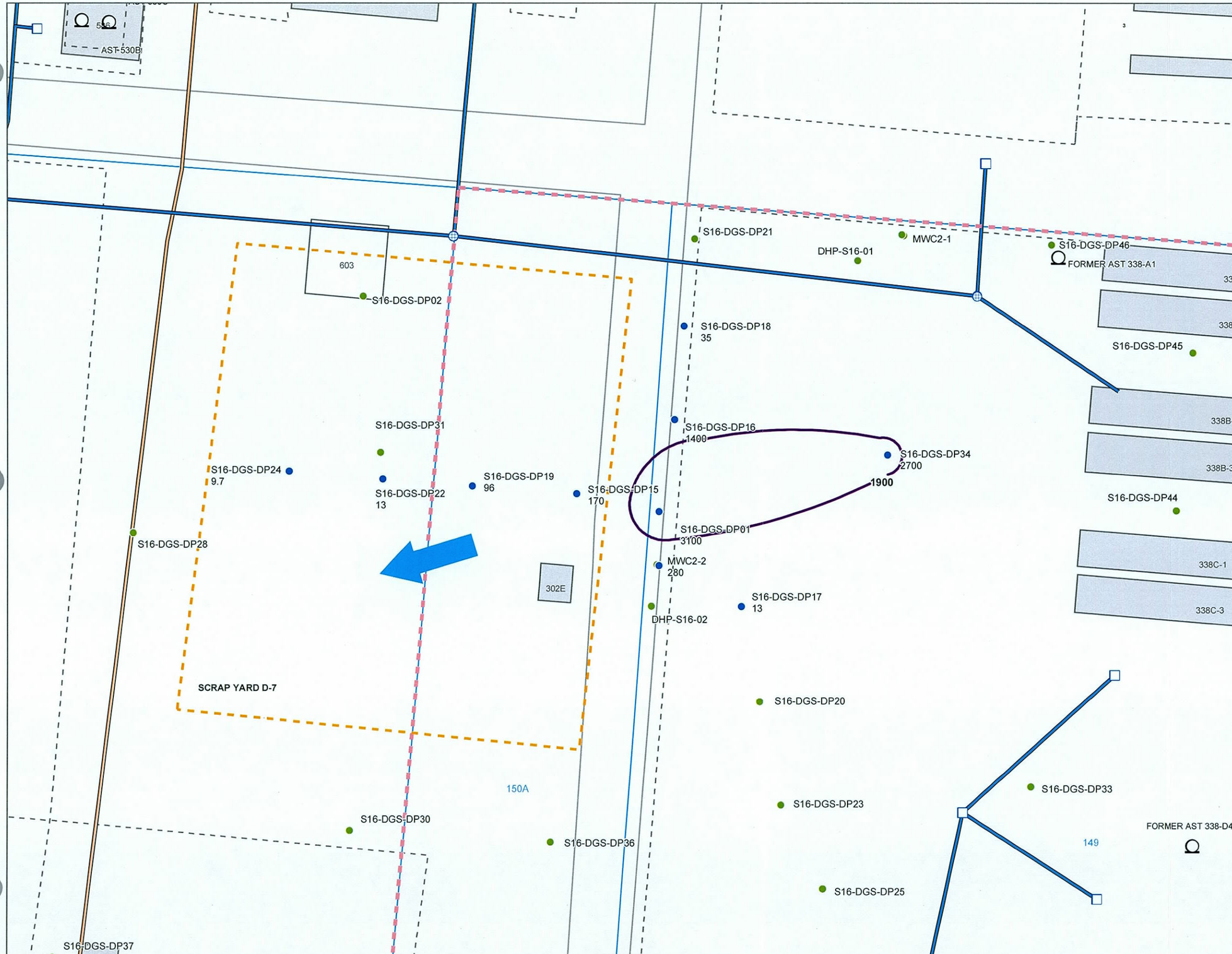

—5— 1,4-DICHLOROBENZENE (1,4-DCB) ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L.

MW06-06 4.2 GROUNDWATER SAMPLING LOCATION WITH 1,4-DCB CONCENTRATION IN µg/L.

M06-05 GROUNDWATER SAMPLING LOCATION 1,4-DCB NOT DETECTED

GROUNDWATER FLOW DIRECTION

ABOVEGROUND STORAGE TANK (AST)

- Removed
- CATCH BASIN
- MANHOLE
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[1]
- LAND COVER

BUILDING

- Present
- Removed

Notes:

Posted concentrations reflect the maximum concentration since July 2001.

µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
J = Estimated

1 Depicted in EBS CERFA (ERM West 1994)

Risk Level	Concentration (ppb)
1.00E-06	0.5
1.00E-05	5
1.00E-04	50
CA MCL	5.0

N

25 0 25 50 Feet

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FIGURE 8-2
1,4-DICHLOROBENZENE CONCENTRATIONS IN GROUNDWATER, SITE 16

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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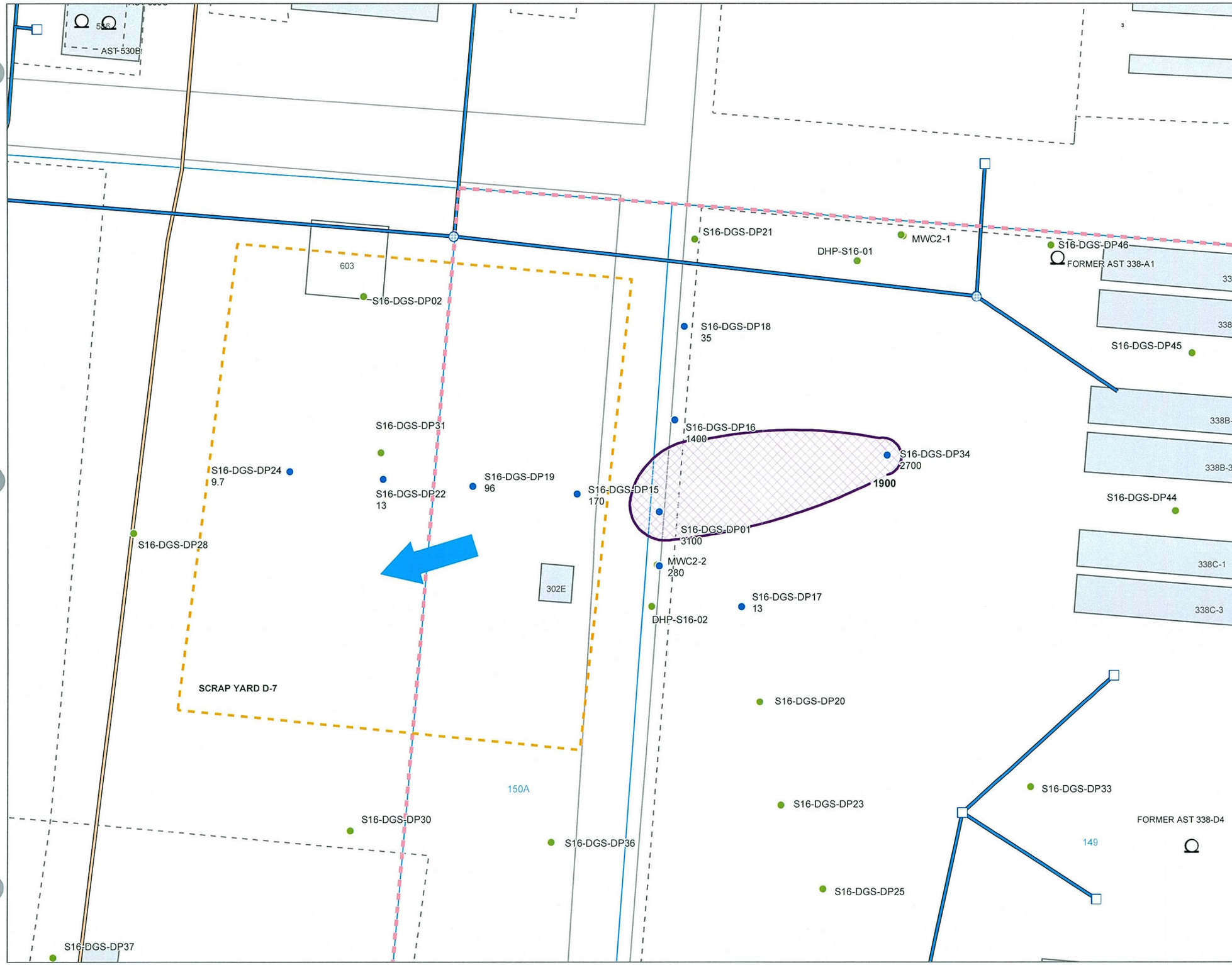

—5— 1,4-DICHLOROBENZENE (1,4-DCB) ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L.

1,4-DICHLOROBENZENE PLUME AREA ABOVE MCLs

MW06-06 4.2 GROUNDWATER SAMPLING LOCATION WITH 1,4-DCB CONCENTRATION IN µg/L.

M06-05 GROUNDWATER SAMPLING LOCATION 1,4-DCB NOT DETECTED

GROUNDWATER FLOW DIRECTION

ABOVEGROUND STORAGE TANK (AST)

- Removed
- CATCH BASIN
- MANHOLE
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[1]
- LAND COVER

BUILDING

- Present
- Removed

Notes:

Posted concentrations reflect the maximum concentration since July 2001.

µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
J = Estimated

1 Depicted in EBS CERFA (ERM West 1994)

Risk Level	Concentration (ppb)
1.00E-06	0.5
1.00E-05	5
1.00E-04	50
CA MCL	5.0

N

25 0 25 50 Feet

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FIGURE 8-3
PROPOSED REMEDIAL ACTION AREA FOR GROUNDWATER BASED ON COMMERCIAL\ INDUSTRIAL REUSE

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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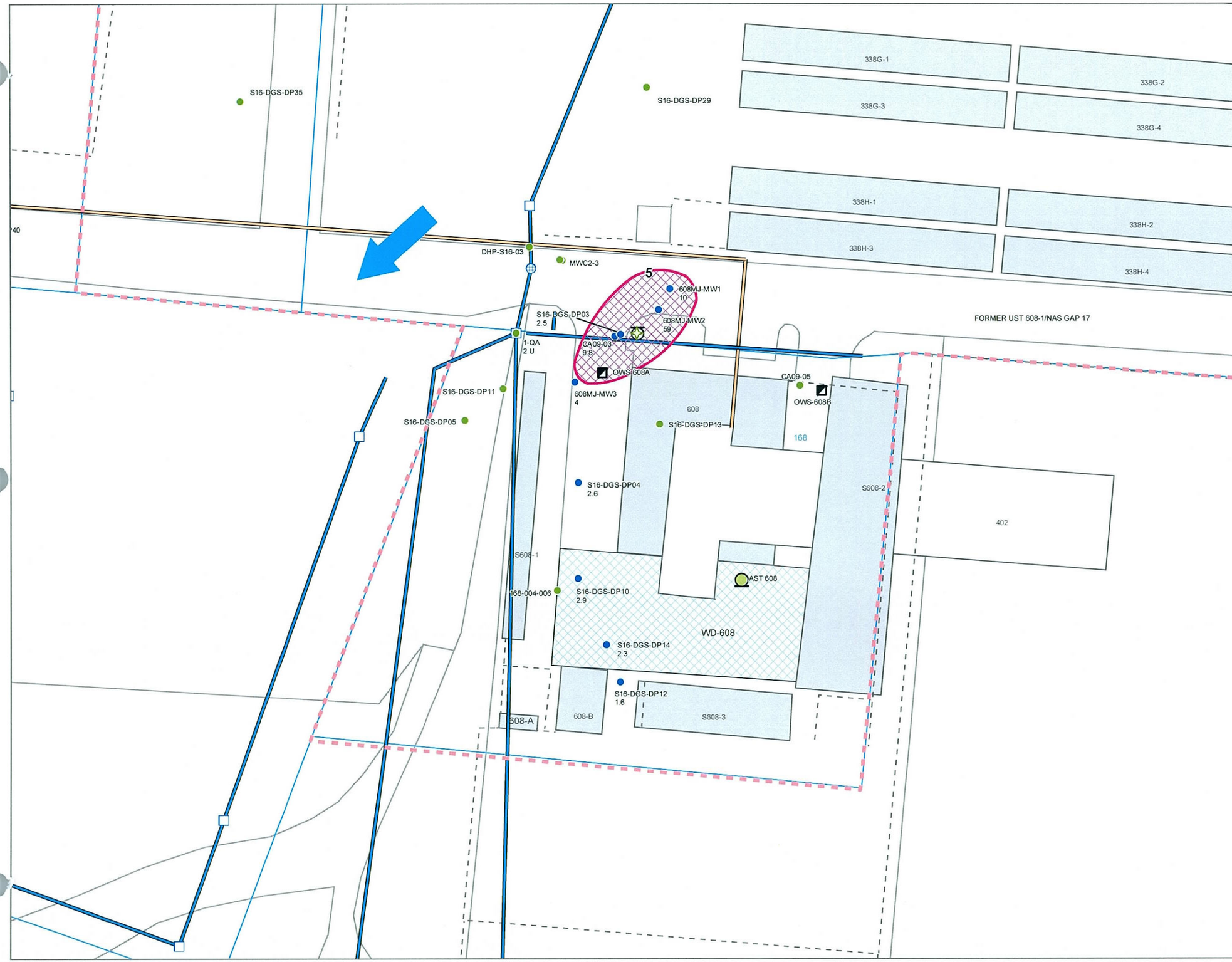

TETRACHLOROETHENE (PCE) ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L.

TETRACHLOROETHENE PLUME AREA ABOVE MCLs

MW06-06 4.2 GROUNDWATER SAMPLING LOCATION WITH PCE CONCENTRATION IN µg/L.

M06-05 GROUNDWATER SAMPLING LOCATION PCE NOT DETECTED

GROUNDWATER FLOW DIRECTION

ABOVEGROUND STORAGE TANK (AST)

Present

UNDERGROUND STORAGE TANK (UST)

Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

OIL WATER SEPARATOR (OWS)

FENCE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

LAND COVER

WASHDOWN AREA (WD)

BUILDING

Present

Removed

Notes:

Posted concentrations reflect the maximum concentration since July 2001.

µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

Risk Level	Concentration (ppb)
1.00E-06	0.66
1.00E-05	6.6
1.00E-04	66
CA MCL	5.0

25 0 25 50 Feet

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FIGURE 8-4
TETRACHLOROETHENE CONCENTRATIONS IN GROUNDWATER, SITE 16

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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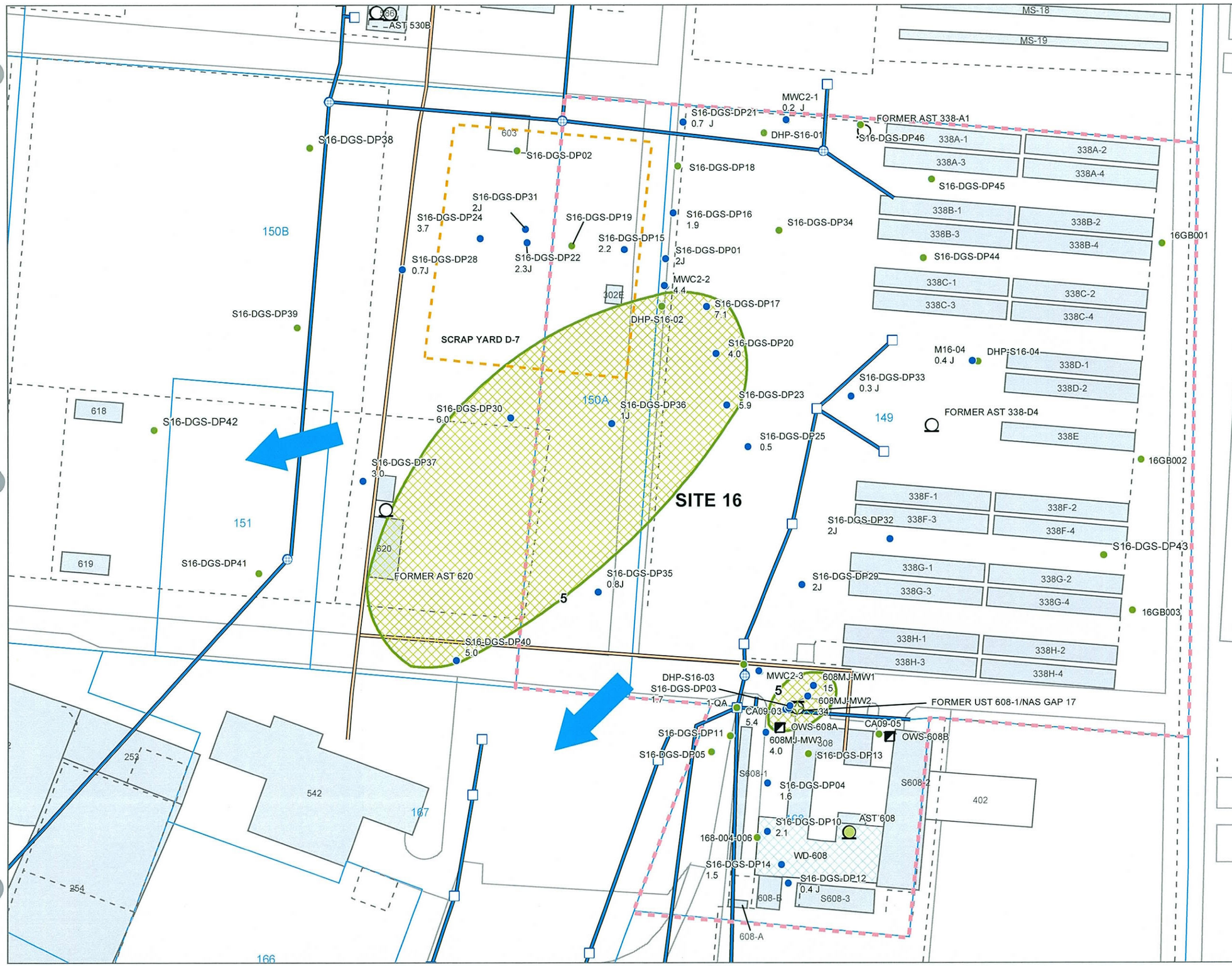

TRICHLOROETHENE (TCE) ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L

TRICHLOROETHENE PLUME AREA ABOVE MCLs

MW06-06 4.2 GROUNDWATER SAMPLING LOCATION WITH TCE CONCENTRATION IN µg/L

M06-05 GROUNDWATER SAMPLING LOCATION TCE NOT DETECTED

GROUNDWATER FLOW DIRECTION

ABOVEGROUND STORAGE TANK (AST)

- Present
- Removed

UNDERGROUND STORAGE TANK (UST)

- Present
- Removed

GENERATOR ACCUMULATION POINT (GAP)

OIL WATER SEPARATOR (OWS)

FENCE

CERCLA SITE BOUNDARY

SCRAP YARD D-7 APPROXIMATE LOCATION[1]

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL

LAND COVER

WASHDOWN AREA (WD)

BUILDING

- Present
- Removed

Notes:

µg/L = Micrograms per liter
Posted concentrations reflect the maximum concentration since July 2001.
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
J = Estimated

1 Depicted in EBS CERFA (ERM West 1994)

Risk Level	Concentration (ppb)
1.00E-06	0.028
1.00E-05	0.28
1.00E-04	2.8
CA MCL	5.0

50 0 50 100 Feet

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FIGURE 8-5
TRICHLOROETHENE CONCENTRATIONS IN GROUNDWATER, SITE 16

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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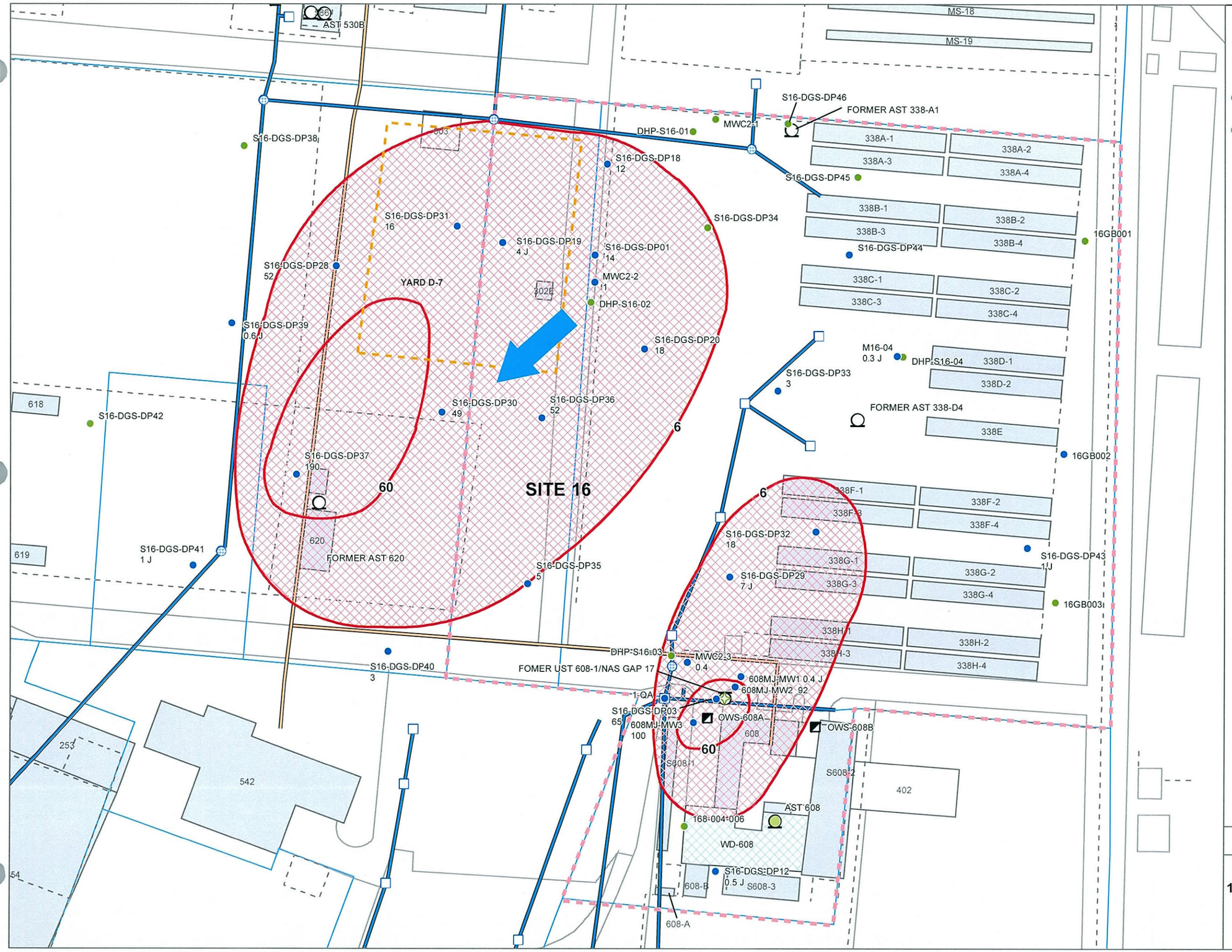

1,2-DICHLOROETHENE ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L

1,2-DICHLOROETHENE PLUME AREA ABOVE MCLs

MW06-06 4.2 GROUNDWATER SAMPLING LOCATION WITH PCE CONCENTRATION IN µg/L

M06-05 GROUNDWATER SAMPLING LOCATION PCE NOT DETECTED

GROUNDWATER FLOW DIRECTION

ABOVEGROUND STORAGE TANK (AST)

Present

Removed

UNDERGROUND STORAGE TANK (UST)

Present

Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

OIL WATER SEPARATOR

FENCE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

SCRAP YARD D-7 APPROXIMATE LOCATION

ENVIRONMENTAL BASELINE SURVEY (EBS) PARCEL

LAND COVER

WASHDOWN AREA (WD)

BUILDING

Present

Removed

Notes:

Posted concentrations reflect the maximum concentration since July 2001.

µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
J = Estimated

CA MCL is 6.0 µg/L.

50 0 50 100 Feet

N

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FIGURE 8-6
1,2-DICHLOROETHENE CONCENTRATIONS IN GROUNDWATER, SITE 16

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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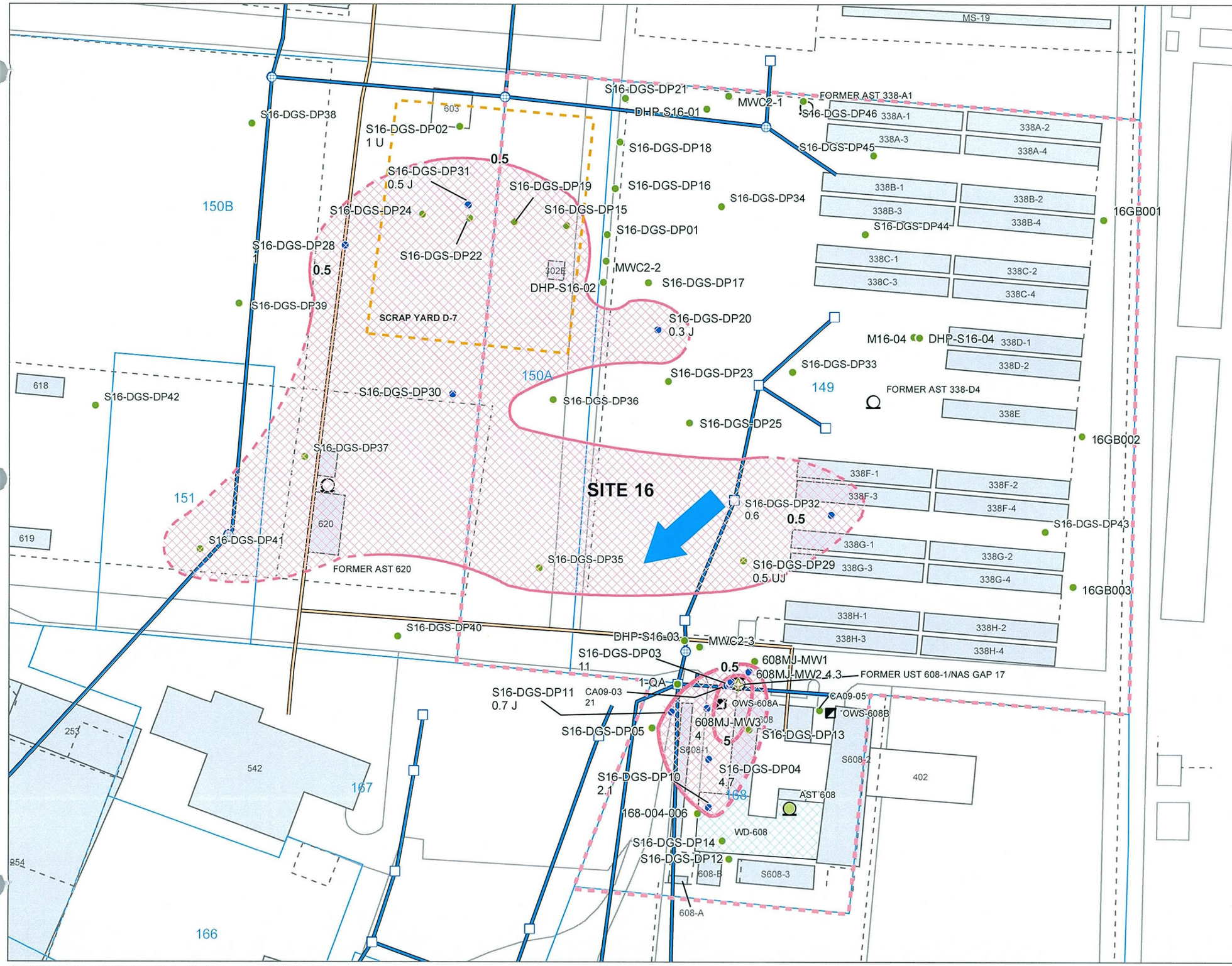

0.5 VINYL CHLORIDE ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L.

VINYL CHLORIDE PLUME AREA ABOVE MCLs

MW06-06 4.2 GROUNDWATER SAMPLING LOCATION WITH VINYL CHLORIDE CONCENTRATION IN µg/L.

M06-05 GROUNDWATER SAMPLING LOCATION VINYL CHLORIDE NOT DETECTED

GROUNDWATER FLOW DIRECTION

ABOVEGROUND STORAGE TANK (AST)

- Present
- Removed

UNDERGROUND STORAGE TANK (UST)

- Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

OIL WATER SEPARATOR (OWS)

FENCE

SANITARY SEWER LINE

STORM SEWER LINE

CORRECTIVE ACTION AREA (CAA)

CERCLA SITE BOUNDARY

SCRAP YARD D-7 APPROXIMATE LOCATION[1]

LAND COVER

WASHDOWN AREA (WD)

BUILDING

- Present
- Removed

Notes:
Posted concentrations reflect the maximum concentration since July 2001.
µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
J = Estimated
1 Depicted in EBS CERFA (REM West 1994)

Risk Level	Concentration (ppb)
1.00E-06	0.02
1.00E-05	0.2
1.00E-04	2
CA MCL	0.5

50 0 50 100 Feet

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FIGURE 8-7
VINYL CHLORIDE CONCENTRATIONS IN GROUNDWATER, SITE 16

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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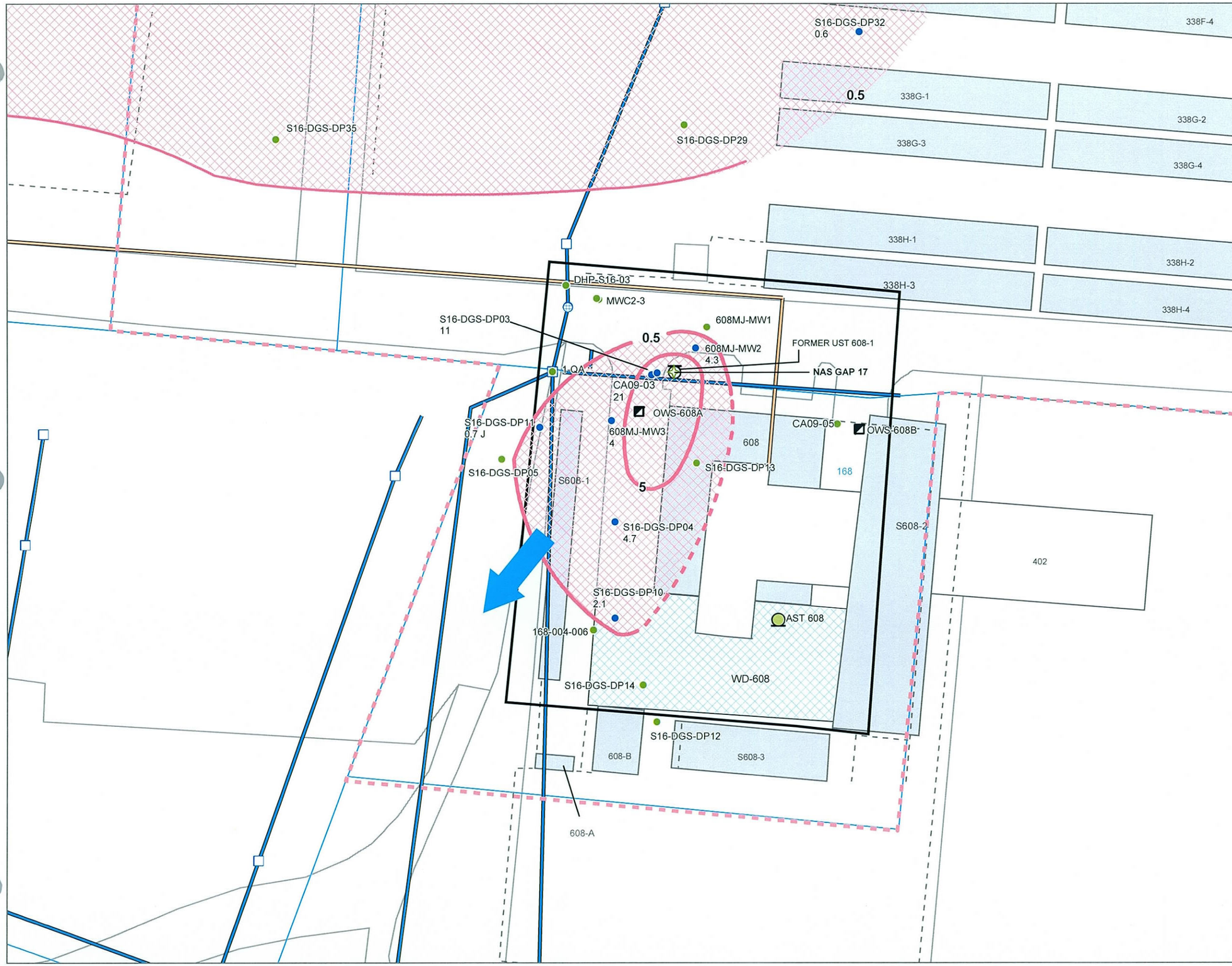

0.5 VINYL CHLORIDE ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L

VINYL CHLORIDE PLUME AREA ABOVE MCLs

MW06-06 4.2 GROUNDWATER SAMPLING LOCATION WITH VINYL CHLORIDE CONCENTRATION IN µg/L

M06-05 GROUNDWATER SAMPLING LOCATION VINYL CHLORIDE NOT DETECTED

GROUNDWATER FLOW DIRECTION

ABOVEGROUND STORAGE TANK (AST)

- Present
- Removed

UNDERGROUND STORAGE TANK (UST)

- Removed

GENERATOR ACCUMULATION POINT (GAP)

CATCH BASIN

MANHOLE

OIL WATER SEPARATOR

FENCE

SANITARY SEWER LINE

STORM SEWER LINE

CERCLA SITE BOUNDARY

LAND COVER

WASHDOWN AREA (WD)

BUILDING

- Present
- Removed

Notes:

Posted concentrations reflect the maximum concentration since July 2001.
µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
J = Estimated

Risk Level	Concentration (ppb)
1.00E-06	0.02
1.00E-05	0.2
1.00E-04	2
CA MCL	0.5

25 0 25 50 Feet

N

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FIGURE 8-8
VINYL CHLORIDE CONCENTRATIONS IN GROUNDWATER, SITE 16

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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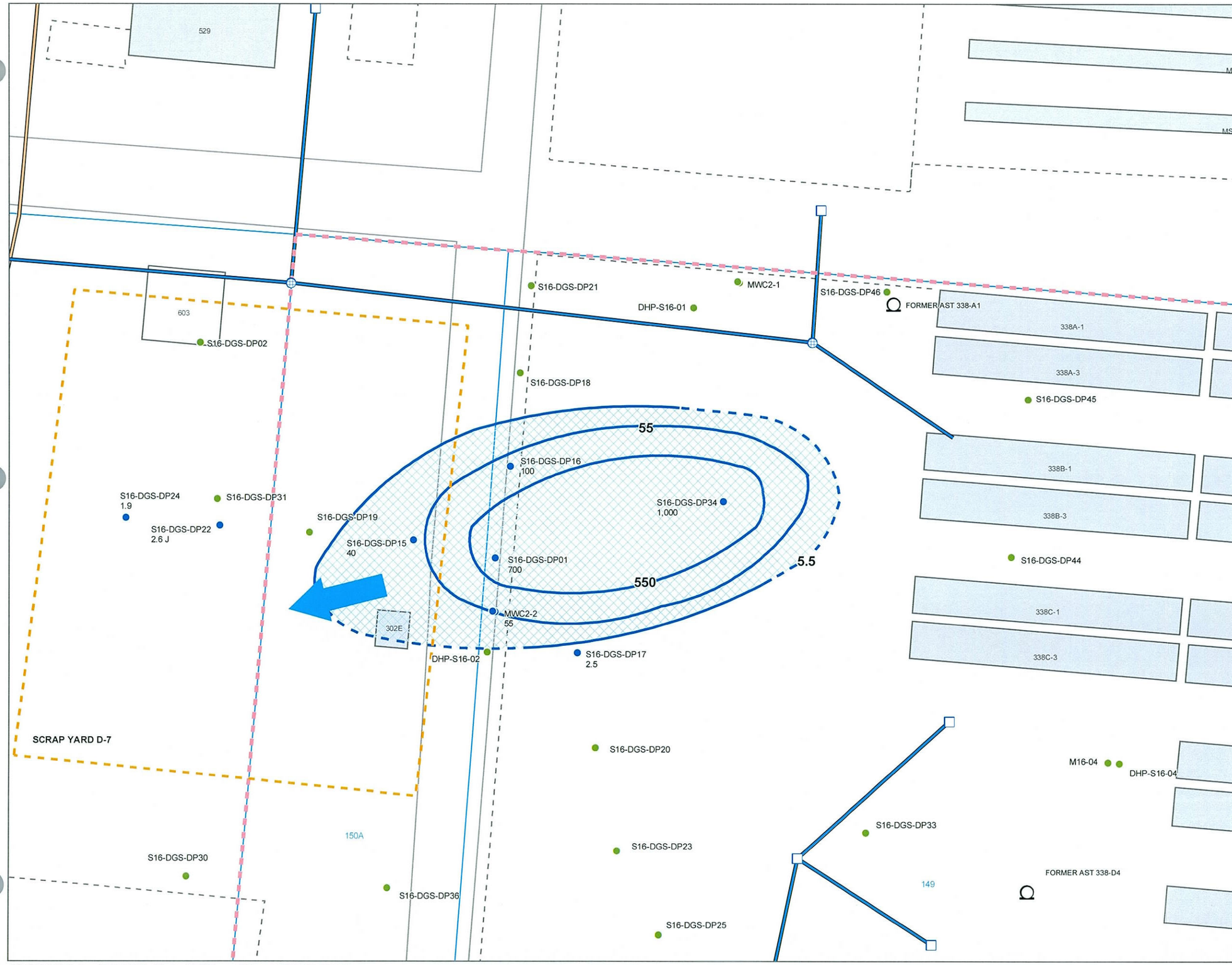

5:5 1,3-DICHLOROBENZENE (1,3-DCB) ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L

1,3-DICHLOROBENZENE PLUME AREA ABOVE MCLs

MW06-06 4.2 GROUNDWATER SAMPLING LOCATION WITH 1,3-DCB CONCENTRATION IN µg/L

M06-05 GROUNDWATER SAMPLING LOCATION 1,3-DCB NOT DETECTED

GROUNDWATER FLOW DIRECTION

ABOVEGROUND STORAGE TANK (AST)

- Removed
- CATCH BASIN
- MANHOLE
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[1]
- LAND COVER

BUILDING

- Present
- Removed

Notes:

Posted concentrations reflect the maximum concentration since July 2001.

µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
J = Estimated

1 Depicted in EBS CERFA (REM West 1994)

HQ	Concentration (ppb)
1	5.5
10	55
100	550
CA MCL	NA

25 0 25 50 Feet

N

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FIGURE 8-9
1,3-DICHLOROBENZENE CONCENTRATIONS IN GROUNDWATER, SITE 16

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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—5— 1,4-DICHLOROBENZENE (1,4-DCB) ISO-CONCENTRATION CONTOURS WITH CONCENTRATION IN µg/L.

1,4-DICHLOROBENZENE PLUME AREA ABOVE MCLs

MW06-06 4.2 GROUNDWATER SAMPLING LOCATION WITH 1,4-DCB CONCENTRATION IN µg/L.

M06-05 GROUNDWATER SAMPLING LOCATION 1,4-DCB NOT DETECTED

GROUNDWATER FLOW DIRECTION

ABOVEGROUND STORAGE TANK (AST)

- Removed
- CATCH BASIN
- MANHOLE
- FENCE
- SANITARY SEWER LINE
- STORM SEWER LINE
- CERCLA SITE BOUNDARY
- SCRAP YARD D-7 APPROXIMATE LOCATION[1]
- LAND COVER

BUILDING

- Present
- Removed

Notes:

Posted concentrations reflect the maximum concentration since July 2001.

µg/L = Micrograms per liter
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
J = Estimated

1 Depicted in EBS CERFA (ERM West 1994)

Risk Level	Concentration (ppb)
1.00E-06	0.5
1.00E-05	5
1.00E-04	50
CA MCL	5.0

N

25 0 25 50 Feet

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FIGURE 8-10
1,4-DICHLOROBENZENE CONCENTRATIONS IN GROUNDWATER, SITE 16

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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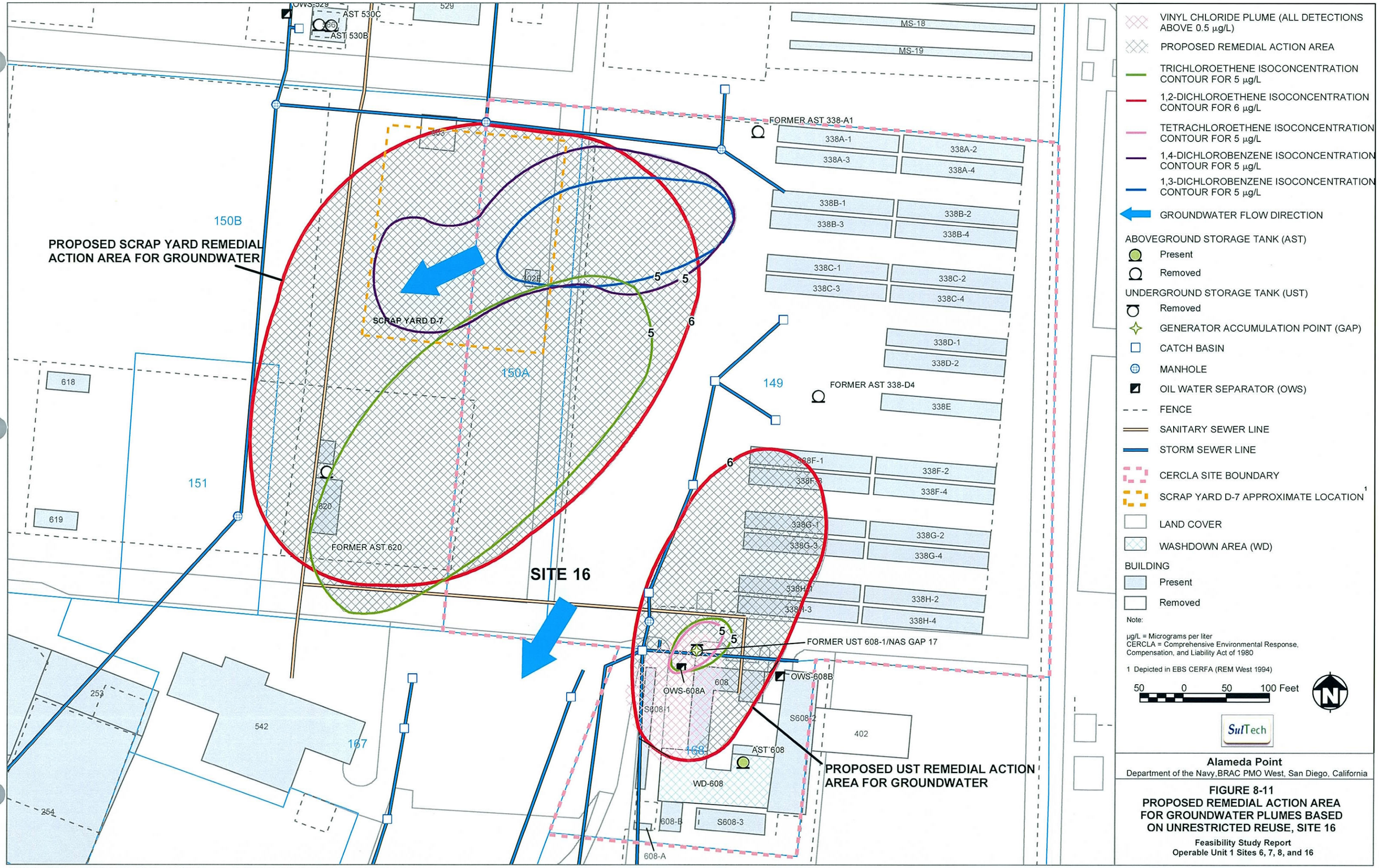

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FIGURE 8-11
PROPOSED REMEDIAL ACTION AREA FOR GROUNDWATER PLUMES BASED ON UNRESTRICTED REUSE, SITE 16

Feasibility Study Report
Operable Unit 1 Sites 6, 7, 8, and 16

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ALAMEDA POINT
SSIC NO. 5090.3.A.

TABLES

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

DATED 18 JULY 2005

TABLE 8-1: POTENTIAL RECEPTORS AND EXPOSURE ROUTES

Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Potential Receptor	Exposure Route	Comment on the Pathway	Land Use Scenario
Soil			
Commercial/Industrial Worker	Inhalation of airborne dust particles	Results of the RI risk assessment indicate acceptable levels of risk for this pathway.	Commercial/Industrial
	Dermal contact with soil	Results of the RI risk assessment indicate acceptable levels of risk for this pathway; however, risk associated with potential contamination adjacent to the OWSs is unknown.	
Construction Worker	Inhalation of airborne dust particles	Results of the RI risk assessment indicate an acceptable level of risk for this pathway.	Commercial/Industrial/ Residential
	Dermal contact with soil	Results of the RI risk assessment indicate an acceptable level of risk for this pathway; however, risk associated with potential contamination adjacent to the OWSs is unknown.	
Recreational	Inhalation of airborne dust particles	Results of the RI risk assessment indicate an acceptable level of risk for this pathway.	Recreational Commercial/Industrial/ Residential
	Dermal contact with soil	Results of the RI risk assessment indicate an acceptable level of risk for this pathway; however, risk associated with potential contamination adjacent to the OWSs is unknown.	
Hypothetical Residential	Inhalation of airborne particles as dust	Results of the RI risk assessment indicate an acceptable level of risk for this pathway.	Residential
	Ingestion or dermal contact with soil	Results of the RI risk assessment indicate an acceptable level of risk for this pathway; however, risk associated with potential contamination adjacent to the OWSs is unknown.	
Ecological life	Ingestion of or dermal contact with soil	Results of the RI risk assessment indicate an unacceptable level of risk for this pathway; however, there is limited ecological habitat at Site 16.	Not applicable

TABLE 8-1: POTENTIAL RECEPTORS AND EXPOSURE ROUTES (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Potential Receptor	Exposure Route	Comment on the Pathway	Land Use Scenario
Groundwater			
Commercial/Industrial Worker	Indoor air inhalation of VOCs from groundwater	Results of the RI risk assessment indicate an unacceptable level of risk for this pathway.	Commercial/Industrial
Construction Worker	Inhalation of VOCs in outdoor air from the subsurface and dermal contact with VOCs in groundwater	Inhalation of VOCs in outdoor air from the subsurface and dermal contact with groundwater pathway was considered incomplete because dewatering would occur during construction activities. It is likely that construction workers would be exposed to vapors from VOCs in outdoor air; however, this should be mitigated through standard health and safety procedures to protect worker health.	Commercial/Industrial/ Residential
Recreational	Inhalation of VOCs in outdoor air from the subsurface	Results of the RI risk assessment indicate an acceptable level of risk for this pathway.	Recreational Commercial/Industrial/ Residential
Hypothetical Residential	Residential use of groundwater (dermal contact, ingestion, and inhalation of VOC while showering)	Results of the RI risk assessment indicate an acceptable level of risk for this pathway.	Residential
	Inhalation of VOCs in indoor air	Results of the RI risk assessment indicate an unacceptable level of risk for this pathway.	
Ecological life (Aquatic receptors)	Ingestion or dermal contact with VOCs that have migrated in groundwater to surface water	The Site 16 plume does not extend to surface water surrounding Alameda Point and data do not indicate that migration of chemicals through storm drains would be a significant pathway; therefore, exposure pathways are possible but insignificant.	Not applicable

Notes:

OWS Oil-water separator
RI Remedial investigation
VOC Volatile organic compound

TABLE 8-2: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
		GROUNDWATER		
Federal Requirements				
Safe Drinking Water Act (42 USC, Chapter 6A, §§ 300[f]–300[j]-26)[c]				
National primary drinking water standards are health-based standards for public water systems (MCLs).	Public water system	40 CFR §§ 141.11–141.13, excluding § 141.11(d)(3), 141.15, 141.16, 141.61(a) and (c), and 141.62(b)	Relevant and appropriate	These are tap water standards that are potentially relevant and appropriate requirements for groundwater for PCE and TCE.
State Requirements				
Cal/EPA Department of Toxic Substances Control				
State MCL list	Groundwater that is a source of drinking water	Title 22 CCR 64444	Relevant and appropriate	Like federal MCLs, these are tap water standards and may be relevant and appropriate.
Describes the water basins in the San Francisco Bay Region, establishes beneficial uses of groundwater and surface water, establishes WQOs, including narrative and numerical standards, establishes implementation plans to meet WQOs and protect beneficial uses, and incorporates statewide water quality control plans and policies.		Comprehensive Water Quality Control Plan for the San Francisco Bay (Basin Plan) (*California Water Code* § 13240)	Applicable	Substantive requirements pertaining to beneficial uses, WQOs, and certain statewide water quality control plans are potential state ARARs for the alternatives addressing groundwater
Incorporated into all regional board basin plans. 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.		SWRCB Res. 88-63 (Sources of Drinking Water Policy)	Applicable	This resolution is potential ARAR for the alternatives addressing groundwater.

TABLE 8-2: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
		SOIL		
Federal				
Resource Conservation and Recovery Act (Title 42 USC Chapter 82, 6901 through 6991[i])[c]				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste	Title 22 CCR 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether waste is hazardous.
Land Disposal Restrictions prohibit disposal of hazardous waste unless treatment standards are met.	Hazardous waste land disposal	Title 22 CCR 66268.1(f)	Applicable	This requirement is applicable if hazardous waste is to be disposed of on land.
Toxic Substances Control Act (15 USC, Chapter 53, §§ 2601–2692)[c]				
Regulates storage and disposal of PCB remediation waste. There are three options: a) self-implementing on-site cleanup and disposal; b) performance-based disposal using existing approved disposal technologies; and c) risk-based disposal.	Soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm	Title 40 CFR § 761.61(a)(4), (b), and (c)	Relevant and Appropriate	This section is potentially relevant and appropriate for PCB contaminated soil. Section (a)(4) establishes a cleanup level for bulk PCB remediation waste in high-occupancy areas of less than or equal to 1 ppm. The cleanup level for bulk PCB remediation waste in low-occupancy areas is less than or equal to 25 ppm. Section (c) offers an alternative using risk-based levels and technologies.
State				
State and Regional Water Quality Control Board				
Definitions of designated waste, nonhazardous waste, and inert waste		Title 27 CCR 20210, 20220, and 20230	Applicable	Potential ARAR for classifying waste.

TABLE 8-2: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

a	Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables
b	Only the substantive provisions of the requirements cited in this table are potential ARARs
c	statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs
ARAR	Applicable or relevant and appropriate requirement
CCR	*California Code of Regulations*
gpd	Gallons per day
MCL	Maximum contaminant level
PCB	Polychlorinated biphenyl
ppm	Part per million
RCRA	Resource Conservation and Recovery Act
TCLP	Toxicity characteristic leaching procedure
TDS	Total dissolved solids
TSCA	Toxic Substances Control Act
USC	*United States Code*
WQO	Water quality objective

TABLE 8-3: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Federal					
Endangered Species Act of 1973 (Title 16 USC §§ 1531–1543)[b]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	Title 16 USC § 1536(a), (h)(1)(B)	Applicable	Applicable if endangered species are found at Site16.
Coastal Zone Management Act (Title 16 USC §§ 1451–1464)[b]					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands under and adjacent to shore land.	Title 16 USC § 1456(c) Title 15 CFR § 930	Relevant and Appropriate	Remedial alternatives will comply with the Coastal Zone Management Act and Bay Plan
State					
Endangered species habitat	No person shall import, export, take, possess, or sell any endangered or threatened species or part or product thereof.	Threatened or endangered species determination on or before January 1, 1985 or a candidate species with proper notification.	*California Fish and Game Code* § 2080	Relevant and Appropriate	This section may be potentially relevant and appropriate if there are threatened or endangered species/habitats present at the site. If endangered species are present, the ecological assessment will evaluate potential effects of the contamination present and the planned response action.

TABLE 8-3: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

a Only the substantive provisions of the requirements cited in this table are potential ARARs

b Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs

ARAR Applicable or relevant and appropriate requirement

CFR *Code of Federal Regulations*

USC *United States Code*

TABLE 8-4: REMEDIAL ACTION OBJECTIVES FOR SITE 16 GROUNDWATER

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Chemical of Concern	Potential Receptor	Exposure Route	Remediation Goal (µg/L)
Tetrachloroethene	Commercial/Industrial Worker	Inhalation of VOCs in indoor air	420
	Hypothetical resident	Dermal contact, ingestion, and inhalation of VOC (while showering)	5
		Inhalation of VOCs in indoor air	20
Trichloroethene	Commercial/Industrial Worker	Inhalation of VOCs in indoor air	37
	Hypothetical resident	Dermal contact, ingestion, and inhalation of VOC (while showering)	5
		Inhalation of VOCs in indoor air	1.7
1,3-Dichlorobenzene	Commercial/Industrial Worker	Inhalation of VOCs in indoor air	18,000
	Hypothetical resident	Dermal contact, ingestion, and inhalation of VOC (while showering)	5.5
		Inhalation of VOCs in indoor air	1,300
1,4-Dichlorobenzene	Commercial/Industrial Worker	Inhalation of VOCs in indoor air	1,900
	Hypothetical resident	Dermal contact, ingestion, and inhalation of VOC (while showering)	5
		Inhalation of VOCs in indoor air	86
Vinyl Chloride	Commercial/Industrial Worker	Inhalation of VOCs in indoor air	240
	Hypothetical resident	Dermal contact, ingestion, and inhalation of VOC (while showering)	0.5
		Inhalation of VOCs in indoor air	5.9

Note:

VOC Volatile organic compound

TABLE 8-5: PRELIMINARY SCREENING OF GROUNDWATER TREATMENT TECHNOLOGIES FOR SITE 16

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

General Response Action	Technology Group	Treatment Technology	Description	Evaluation Result [a,b]
No Action	No Action	No Action	No remediation, control, or monitoring actions would be taken at the site. The site would be left as it is.	Retained for Site 16: required to be evaluated under NCP and CERCLA as amended as a baseline for comparison with other remedial alternatives.
Land Use Controls	Governmental Controls	Zoning Restrictions	A common land use restriction specifying allowed land uses for certain areas. Zoning can be used to prohibit activities that could disturb a certain aspect of a remedy or to control certain exposures not otherwise protected under a remedy.	Retained for Site 16: effective, readily implementable, and low cost.
		Groundwater Use Restrictions	Restrictions directed at limiting or prohibiting certain uses of groundwater; for example, the use of groundwater as a drinking water source and prohibitions on well drilling.	Retained for Site 16: effective, readily implementable, and low cost.
	Proprietary Controls	Easements	A property right conveyed by a landowner to another party, which gives the second party rights with regard to the landowner's land. For example: affirmative easement – access by a nonlandowner to a property to conduct inspection or monitoring and negative easement – prohibit well-drilling on the property by the landowner.	Retained for Site 16: necessary component of LUCs to allow property access for long-term monitoring, and readily implementable.
		Deed Restrictions	Prohibits certain types of construction and development based on designated land use; sub-slab depressurization systems, limits on soil disturbance	Retained for Site 16: limited access for building
		Covenants	A covenant is an agreement between a landowner to another made in connection with a conveyance of property to use or refrain from using a property in a certain manner (for example, a covenant not to dig on a certain portion of the property).	Retained for Site 16: effective to ensure that the property would not be used in a manner that compromises the restrictions and is readily implementable.
	Enforcement and permit tools with LUC components	Administrative Orders	An order directly restricting the use of property by a named party.	Eliminated for Site 16: zoning and groundwater use restrictions would be able to serve the objectives.

TABLE 8-5: PRELIMINARY SCREENING OF GROUNDWATER TREATMENT TECHNOLOGIES FOR SITE 16 (CONTINUED)
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

General Response Action	Technology Group	Treatment Technology	Description	Evaluation Result [a,b]
Land Use Controls	Informational Tools	Deed Notice	Commonly refers to a non-enforceable, purely informational document filed in public land records that alerts anyone searching the records to important information about the property.	Retained for Site 16: compliments other LUC components and can be used to require the installation of vapor barrier systems prior to construction of new buildings.
Engineering Controls	Containment Systems	Vapor Barrier	Vapor barriers are a passive approach typically employed during construction. Vapor barrier construction consists of installation of the vapor barrier (6-mil polyethylene or equivalent) sealing plumbing penetrations, mixing of floor slab concrete with superplasticizers, reinforcing of slab at reentrant corners and proper slab curing and loading.	Eliminated for existing buildings because of technical impracticability of installation. Retained as a potential LUC requirement for future buildings.
		Vapor Removal Systems	This is an active approach, such as a depressurization fan, to lower the pressure below the slab. This lower pressure creates a sink for vapors beneath the building where vapors are typically collected in perforated piping, and then extracted from below the building and diverted to ambient air.	Retained as a potentially effective control for both existing and future buildings.
	In Situ Treatment	Air Sparging	For air sparging, air is injected through a contaminated aquifer. Injected air traverses horizontally and vertically in channels through the soil column, creating an underground stripper that removes contaminants by volatilization.	Retained for Site 16: An effective technology for halogenated VOCs.
		Biosparging	Biosparging is similar to air sparging except that air is injected at a much lower flow rate and vapor collection is not needed. The application of this technology relies on adequate distribution of air through the subsurface.	Eliminated for Site 16: Limited effectiveness for treatment of TCE and PCE.

TABLE 8-5: PRELIMINARY SCREENING OF GROUNDWATER TREATMENT TECHNOLOGIES FOR SITE 16 (CONTINUED)
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

General Response Action	Technology Group	Treatment Technology	Description	Evaluation Result [a,b]
Engineering Controls	In Situ Treatment	In Situ Chemical Oxidation	Oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Retained for Site 16: effective for halogenated VOCs, short-term timeframe and medium cost. Modified Fenton's reagent can be used to operate process at neutral pH.
		Thermal Treatment (Steam Flushing)	Steam is forced into an aquifer through injection wells to vaporize volatile and semivolatile contaminants. Vaporized components rise to the unsaturated zone, where they are removed by vacuum extraction and then treated.	Eliminated for Site 16: low effectiveness and high cost
		Passive Treatment Wall	A permeable reaction wall is installed across the flow path of a contaminant plume, allowing the water portion of the plume to passively move through the wall. These barriers allow the passage of water while prohibiting the movement of contaminants by employing such agents as zero-valent metals, chelators (ligands selected for their specificity for a given metal), sorbents, microbes, and others.	Eliminated for Site 16: long-term timeframe.
		Enhanced In Situ Bioremediation using HRC/ORC	HRC is a proprietary polyacetate ester specially formulated for slow release of lactic acid upon hydration. ORC® is a patented formulation of magnesium peroxide that produces a slow and sustained release of molecular oxygen when in contact with soil moisture or groundwater. ORC and HRC are applied to the subsurface via push-point injection or within dedicated wells and are left in place to stimulate rapid contaminant degradation.	Retained for Site 16: HRC is effective for halogenated VOCs. Medium-term timeframe and medium cost. Eliminated for Site 16: ORC is effective for vinyl chloride but would not reduce TCE and PCE concentrations.

TABLE 8-5: PRELIMINARY SCREENING OF GROUNDWATER TREATMENT TECHNOLOGIES FOR SITE 16 (CONTINUED)

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

General Response Action	Technology Group	Treatment Technology	Description	Evaluation Result [a,b]
Engineering Controls	In Situ Treatment	Pump and Treat by Chemical/UV Oxidation	Organic compounds are destroyed by addition of strong oxidizers and irradiation with UV light. Oxidation reactions are achieved by the synergistic action of UV light with ozone and/or hydrogen peroxide.	Retained for Site 16: An effective technology for halogenated VOCs.
		Pump and Treat by Air Stripping	Air stripping is a full-scale technology in which VOCs are partitioned from groundwater by greatly increasing the surface area of the contaminated water exposed to air. Types of aeration methods include packed towers, diffused aeration, tray aeration, and spray aeration.	Retained for Site 16: An effective technology for halogenated VOCs.
		Monitoring	Uses natural attenuation processes such as biodegradation, volatilization, and physical/chemical processes to remediate contamination, in conjunction with data collection, long-term monitoring, and modeling	Retained: Long-term timeframe but may be effective in treating residual contamination following LUCs and/or active remediation by other methods.

Notes:

a Cost::

Low	Less than $3.00/1,000 gallons
Medium	$3.00-$10.00/1,000 gallons
High	More than $10/1,000 gallons

b Timeframe:

Short Term	Less than 3 years of implementation
Medium Term	3 to 10 years of implementation
Long Term	More than 10 years of implementation

c EPA. 1996. "Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites." Final Guidance. Directive 9283.1-12, EPA 540/R-96/023. Office of Solid Waste and Emergency Response. Washington, D.C. October.

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	LUC	Land use control
DCE	Dichloroethene	NCP	National Oil and Hazardous Substances Pollution Contingency Plan
EC	Engineering controls	ORC	Oxygen releasing compound
EPA	U.S. Environmental Protection Agency	VOC	Volatile organic compound
HRC	Hydrogen releasing compound	UV	Ultraviolet

TABLE 8-6: SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER TREATMENT TECHNOLOGIES RETAINED FROM THE PRELIMINARY SCREENING FOR SITE 16

Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Evaluation Criteria	Hydrogen Release Compound	In Situ Chemical Oxidation	Pump and Treat with Air Stripping	Pump and Treat with Advanced Oxidation Processes
Effectiveness	Innovative technology with successful pilot test at Site 4. Treatability study should be conducted. Expected remediation time is 3 years.	Innovative technology with successful treatability study at Site 16. Expected remediation time is 3 years.	Aquifer too thin and permeability too low for effective pumping.	Aquifer too thin and permeability too low for effective pumping.
Implementability	Implementable at both sites. Treatment agents are not hazardous. Access to site not restricted because no surface structures required.	Implementable at both sites. Treatment agents are hazardous. Access to site restricted during injections because of hazardous treatment agents but not restricted other times because no surface structures required.	Aquifer too thin and permeability too low for effective pumping.	Aquifer too thin and permeability too low for effective pumping.
Cost[a]	Site 16: $7.6 million	Site 16: $12.0 million	Site 16: $18.1 million	Site 16: $23.1 million

Notes:

a Cost estimates are for reducing concentrations of chemicals of concern to below remediation goals for domestic use of groundwater.

TABLE 8-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
			SOIL SAMPLING AND EXCAVATION		
Resource Conservation and Recovery Act (Title 42 USC, Chapter 82, §§ 6901-6991[i]) *					
On-site waste generation	Person who generates waste shall determine if that waste is hazardous waste.	Generator of waste	Title 22 CCR Sections 66261.10 (a), 66262.11	Applicable	The requirements of 22 CCR, Division 4.5, Chapter 14 are applicable for determining whether material generated as a result of the soil sampling, excavation or in situ chemical oxidation (ISCO) process of hydrogen release compound (HRC) contains hazardous waste. These requirements may be relevant and appropriate to material that is similar or identical to RCRA hazardous waste or non-RCRA hazardous waste.
Hazardous waste accumulation	On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers or tanks, on drip pads or inside buildings, and is labeled and dated.	Accumulate hazardous waste	Title 22 CCR Section 66262.34	Applicable	These requirements are applicable if hazardous waste is generated and accumulated on site before transport.
Pre-transport requirements	Hazardous waste must be packaged in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR Section 66262.30	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Hazardous waste must be labeled in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR 22 Section 66262.31	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Provides requirements for marking hazardous waste prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR Section 66262.32	Applicable	These requirements are applicable if hazardous waste is to be transported.

TABLE 8-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL SAMPLING AND EXCAVATION (Continued)					
Resource Conservation and Recovery Act (Title 42 USC, Chapter 82, §§ 6901-6991[i]) * (Continued)					
Pre-transport requirements	A generator must ensure that the transport vehicle is correctly placarded prior to transport of hazardous waste.	Any operation where hazardous waste is generated	Title 22 CCR 66262.33	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Requires preparation of a manifest for transport of hazardous waste off site.	Any operation where hazardous waste is generated	Title 22 CCR 66262.20-66262.23	Applicable	These requirements are applicable if hazardous waste is to be transported.
Federal Hazardous Materials Transportation Law (Title 49 USC §§ 5101-5127) *					
Transportation of hazardous material 49 USC Sections 5101-5127	Sets forth requirements for transporting hazardous waste including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements.	Interstate carriers transporting hazardous waste and substance by motor vehicle.	Title 49 CFR Section 171.2(f), 171.2(g), 172.300, 172.301, 172.302, 172.303, 172.304, 172.312, 172.400, 172.504	Relevant and appropriate	Relevant and appropriate for transporting hazardous materials on site.
Clean Air Act (Title 42 USC § 7401 et seq.) *					
Excavation	Sets forth opacity limitations.	Excavation	BAAQMD Regulation 6, Regulation 6-302	Applicable	These requirements are applicable for excavation activities.
Excavation	Provides requirements for maintaining, covering and stockpiling excavated soil.	Soil stockpile	BAAQMD Regulation 8, Rule 40	Relevant and appropriate	These requirements are applicable for excavation activities.

TABLE 8-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
INSTITUTIONAL CONTROLS (Land Use Controls)					
California Civil Code*					
Land use controls	Provides conditions under which land use restrictions will apply to successive owners of land.	Transfer property from the Navy to a nonfederal agency	*California Civil Code* Section 1471	Applicable	Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land ... where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety of the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health & Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed at the time of transfer.
California Code Regulations* Title 22					
Land Use Controls	Sets forth recording requirements for land use covenants.	Recorded Land Use Control	Title 22 CCR 67391.1	Applicable	The substantive provisions of Section 67391.1 are potential ARARs.
Land Use Controls	Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Transfer property from the Navy to a nonfederal agency	*California Health and Safety Code* Section 25202.5	Applicable	The substantive provisions of this section are the general narrative standards to restrict "present and future uses of all or part of the land on which the facility ...is located."

TABLE 8-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
INSTITUTIONAL CONTROLS (Land Use Controls) (Continued)					
California Health and Safety Code*					
Land Use Controls	Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of *California Health and Safety Code* Section 25232(b)(1)(A)–(E).	Transfer property from the Navy to a nonfederal agency.	*California Health and Safety Code* Section 25222.1	Applicable	This section is a potential ARAR when the Navy is transferring property to a nonfederal entity. *California Health and Safety Code* Section 25222.1 provides the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of the property. The substantive provision of *California Health and Safety Code* Section 25222.1 is the general narrative standard: "restricting specified uses of the property."
Land Use Controls	Provides a process for obtaining a written variance from a land use restriction.	Transfer property from the Navy to a nonfederal entity.	*California Health and Safety Code* Section 25233(c)	Applicable	This section is a potential ARAR for institutional controls where the Navy is transferring property to a nonfederal entity. *California Health and Safety Code* Section 25233(c) sets forth substantive criteria for granting variances from the uses prohibited in Section 25232(b)(1)(A)-(E) based on specific environmental and health criteria.

TABLE 8-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
INSTITUTIONAL CONTROLS (Land Use Controls) (Continued)					
City of Alameda Ordinance No. 2824*					
Excavation	Regulates excavation activities in the Marsh Crust area of Alameda Point.	Excavation below threshold depths	City of Alameda Ordinance No. 2824	TBC	Ordinance No. 2824 is a TBC criterion for excavation activities in the Marsh Crust area at threshold depths.
Groundwater Treatment					
Safe Drinking Water Act (Title 42 USC 300f et seq.) *					
	The UIC program prohibits injection activities that allow movement of contaminants into underground sources of drinking water that may result in violations of MCLs or adversely affect health.	An approved UIC program is required in states listed under SDWA Section 1422. Class I wells and Class IV wells are the relevant classifications for CERCLA sites. Class I wells are used to inject hazardous waste beneath the lowermost formation that contains a USDW within 0.25 mile of the well.	Title 40 CFR Section 144.12, excluding the reporting requirements in Sections 144.12(b) and 144.12(c)(1)	Relevant and appropriate	These requirements are relevant and appropriate for ISCO and HRC.

TABLE 8-7: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
DISPOSAL OF PCB-CONTAMINATED SOIL					
Toxic Substances Control Act (Title 15 USC §§ 2601–2692)*					
Disposal of PCBs	This act regulates the storage and disposal of PCB remediation waste. There are three options: (1) self-implementing on-site cleanup and disposal; (2) performance-based disposal using existing approved disposal technologies; and (3) risk-based disposal. This act is applicable to soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm.	PCB-contaminated soil	Title 40 CFR Section 761.61(a)(4), (b), and (c)	Relevant and appropriate	This section is relevant and appropriate for the disposal of soil containing PCBs.

Notes:

1 The Clean Air Act ARARs apply only to the alternatives involving excavation

* Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of specific citations are considered potential ARARs

ARAR	Applicable or relevant and appropriate requirement	PCB	Polychlorinated biphenyl
BAAQMD	Bay Area Air Quality Management District	ppm	Part per million
CCR	*California Code of Regulations*	RCRA	Resource Conservation and Recovery Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	SDWA	Safe Drinking Water Act
CFR	*Code of Federal Regulations*	TBC	To be considered
DTSC	Department of Toxic Substances Control	TSCA	Toxic Substances Control Act
DOT	U.S. Department of Transportation	UIC	Underground injection control
HRC	Hydrogen Release Compound	USC	*United States Code*
ISCO	In situ chemical oxidation	USDW	U.S. Drinking Water

TABLE 8-8: SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES FOR SITE 16
Feasibility Study Report for OU-1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Alternative	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost Effectiveness*
	Parameters considered: • The expected long-term reduction in risk posed by the site • The level of effort needed to maintain the remedy and monitor the area for changes in site conditions • The compatibility of the remedy with planned future use of the site	Parameters considered: • The amount of hazardous materials destroyed or treated • The degree of expected reduction in toxicity, mobility, or volume • The degree to which the benefits of the remedial alternative are irreversible • The types and quantities of treatment residuals that remain following treatment	Parameters considered: • Protection of the community during the remedial alternative • Protection of workers during the remedial alternative • Environmental impacts of the remedial alternative • Time required to achieve RAOs	Parameters considered: • Technical and administrative feasibility • Availability of required resources	Parameters considered: • Capital costs • Operations and maintenance costs • Net present value
Alternative 1 -No Action	Low	Low	High	High	High
	Not effective and permanent because it does not address potential risks	Would not reduce toxicity, mobility, or volume of contamination through treatment.	No short-term risk because no active remediation activities are proposed	Readily implementable	No costs incurred.
Alternative 2 -Monitoring and LUCs	Low	Low	High	High	Medium
	Prevents exposure until groundwater concentrations degrade to vapor intrusion remedial goals. Much longer time frame than Alternatives 1, 3, and 4	Would not reduce toxicity, mobility, or volume of contamination through treatment.	No short-term risk because no active remediation activities are proposed.	Readily implementable;groundwater sampling technology is proven;may have some difficulty reaching agreement on legal issues associated with the covenants and deed restrictions.	Low present value cost compared to Alternative 4. Site 16: $1.8 M
Alternative 3 -HRC or ISCO to Commercial/Industrial Reuse, Monitoring, and LUCs	Medium	Medium	Medium	Medium	Medium
	Prevents exposure until groundwater concentrations degrade to vapor intrusion remedial goals, and quickens degradation rate, this will occur faster than under Alternative 2.	Would reduce toxicity, mobility, or volume of contamination through treatment;however, less of the plume is treated than for Alternative 4.	If ISCO is implemented, moderate short-term risks exist during the injection or treatment agents No short-term risks with HRC.	Technically feasible. Requires large number of injection points and multiple rounds of injection. HRC requires larger number of injection points, but fewer rounds of injection than ISCO. May have some difficulty reaching agreement on LUCs.	Low present value cost compared to Alternative 4. Site 16 ISCO: $2.5 M Site 16 HRC: $2.3 M
Alternative 4 -HRC or ISCO to Unrestricted Reuse Criteria, Monitoring, and LUCs	High	High	Medium	Medium	Low
	Prevents exposure until groundwater concentrations degrade to vapor intrusion remedial goals, and provides quickest degradation rate, this will occur faster than under Alternative 2.	Would reduce toxicity, mobility, or volume of contamination through treatment, more of the plume is treated than for Alternative 3.	If ISCO is implemented, moderate short-term risks exist during the injection or treatment agents. No short-term risks with HRC.	Technically feasible. Requires large number of injection points and multiple rounds of injection. HRC requires larger number of injection points, but fewer rounds of injection than ISCO. May have some difficulty reaching agreement on LUCs.	High present value cost compared to Alternatives 1, 2, and 3. Site 16 ISCO: $12.6 M Site 16 HRC: $9.1 M

Notes:

* Based on net present value

HRC Hydrogen release compounds
ISCO In situ chemical oxidation
LUC Land use control
MNA Monitored natural attenuation
RAO Remedial action objective

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APPENDIX A
DEVELOPMENT OF REMEDIAL ACTION GOALS FOR INHALATION RISK

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ACRONYMS AND ABBREVIATIONS

$\mu g/m^3$	Microgram per cubic meter
$\mu g/L$	Microgram per liter
COPC	Chemical of potential concern
EPA	U.S. Environmental Protection Agency
ft^2	Square feet
HEAST	Health Effects Assessment Summary Tables
HHRA	Human health risk assessment
HQ	Hazard quotient
IRIS	Integrated Risk Information System
MCL	Maximum contaminant level
mg/kg-day	Milligram per kilogram per day
NCEA	National Center for Environmental Assessment
PCE	Tetrachloroethene
RI	Remedial investigation
SF_i	Inhalation slope factor
TCE	Trichloroethene
Tetra Tech	Tetra Tech EM Inc.
VC	Vinyl chloride
VOC	Volatile organic compound

A1.0 INTRODUCTION

The results of the remedial investigation (RI) identified a number of volatile organic compounds (VOC) as chemicals of potential concern (COPC) in groundwater at Sites 6 and 16 (Tetra Tech EM Inc. [Tetra Tech] 2004). Groundwater COPCs at Site 6 included trichloroethene (TCE), tetrachloroethene (PCE), and vinyl chloride, and groundwater COPCs at Site 16 included TCE, PCE, vinyl chloride, 1,3-dichlorobenzene, and 1,4-dichlorobenzene. VOCs in groundwater pose a potential health risk to future receptors at Sites 6 and 16 because of their potential to vaporize and migrate to indoor air. The purpose of this appendix is to develop health risk-based remediation goals for VOCs that are considered COPCs at Sites 6 and 16.

Remediation goals were based on a cancer risk level of 1E-06 or a noncancer hazard quotient (HQ) of 1.0. Remediation goals were developed for all of the COPCs identified above. In addition, remediation goals were developed for cis-1,2-dichloroethene, because it is a potential degradation product of some of the COPCs at Sites 6 and 16, and it is a chemical precursor of vinyl chloride. Remediation goals were developed for future adult/child residential and commercial/industrial receptors based on the assumption that buildings would be constructed on the sites in the future. All remediation goals presented in this appendix are intended to aid risk management decisions and address remedial action objectives in the feasibility study.

Risk levels below a cancer risk of 1E-06 or a noncancer HQ of 1.0 generally are acceptable and do not require risk decisions on the need to implement remedial action. For cancer risk from inhalation of indoor air, a site is within the "risk management range" if the sum of the total cancer risk from all chemicals is between 1E-04 and 1E-06. The risk within the risk management range is addressed by risk management decisions. Cancer risks greater than the risk management range (that is, greater than 1E-04) generally require remedial action.

The following sections discuss the development of inhalation criteria that are protective of exposure to indoor air, chemical-specific uncertainty associated with inhalation risk criteria, and practical considerations associated with application of the remedial goals.

A2.0 DEVELOPMENT OF INHALATION CRITERIA

The remediation goals for groundwater (such as, target groundwater concentrations) were developed using the following steps.

- Develop target air concentrations that are protective of an adult/child residential exposure scenario at a cancer risk level of 1E-06 or a noncancer HQ of 1.0 (see Table A-1 in Section A2.1)

- Convert the target air concentration to an appropriate target groundwater concentration by incorporating the site- and contaminant-specific parameters in Attachment B of the baseline human health risk assessment (HHRA) (Appendix G to the RI report [Tetra Tech 2004]) into the U.S. Environmental Protection Agency's (EPA) 2003 vapor intrusion model.

These calculations resulted in target groundwater concentrations (see Table A-2 in Section A2.2). Practical considerations regarding application of these remediation goals are discussed in Section A3.0.

A2.1 APPROACH FOR DEVELOPING TARGET AIR CONCENTRATIONS

Table A-1 presents air concentrations that were calculated for adult/child residential and commercial/industrial exposure at a cancer risk level of 1E-06 or a noncancer HQ of 1.0. Target air concentrations were calculated using the EPA Region IX methodology for calculating preliminary remediation goals (PRG) (EPA 2004b); exposure parameters and toxicity criteria used to develop air concentrations were identical to those used in the baseline HHRA (Tetra Tech 2004). For chemicals with both cancer and noncancer target air concentrations, the lower of the two concentrations was used as the basis for the remediation goal.

TABLE A-1: CONCENTRATIONS OF CHEMICALS IN AIR CONFORMING TO A CANCER RISK LEVEL OF 1E-06 OR A NONCANCER HQ OF 1.0
Feasibility Study for OU-1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Chemical of Potential Concern	Target Air Concentration ($\mu g/m^3$)[a]			
	Adult/Child Resident		Commercial/Industrial Worker	
	Cancer Risk Level of 1E-06	Noncancer Hazard Quotient of 1.0	Cancer Risk Level of 1E-06	Noncancer Hazard Quotient of 1.0
Trichloroethene[b]	0.017	37	0.036	51
Tetrachloroethene	0.33	620	0.69	870
1,2-Dichloroethene	Not applicable	37	Not applicable	51
1,3-Dichlorobenzene	Not applicable	3.3	Not applicable	4.6
1,4-Dicholorbenzene	0.28	840	0.60	1,200
Vinyl Chloride[c]	0.22	110	0.89	150

Notes:

a Target air concentrations were calculated using toxicity factors and exposure parameters identical to those used in the human health risk assessment (Appendix G to the RI report [Tetra Tech 2004]). The values shown are calculated using EPA Region IX methodology for calculating PRGs (EPA 2002b).

b Proposed new toxicity criteria for trichloroethene are uncertain. The previous values listed in EPA's Integrated Risk Information System were withdrawn in July 1989, and the reassessment began in 1994. Because the National Center for Environmental Assessment value is not final and has not passed peer review, the EPA directive suggests defaulting to the values used here (EPA 2001). See text for details.

c The toxicity criterion for vinyl chloride for the child/adult was based on a continuous lifetime exposure from birth through adulthood and was used for the residential exposure scenario. The toxicity criterion for adult exposure was used for the commercial/industrial worker.

$\mu g/m^3$ Microgram per cubic meter

A2.2 APPROACH FOR DEVELOPING TARGET GROUNDWATER CONCENTRATIONS

The target air concentrations presented in Table A-1 were converted to appropriate target groundwater concentrations by incorporating the site- and contaminant-specific parameters in Attachment B to the HHRA (Appendix G to the RI report [Tetra Tech 2004]) into the EPA's 2003 vapor intrusion model. Groundwater concentrations were developed for the following exposure scenarios.

- For the adult/child resident, groundwater concentrations were calculated for a hypothetical one-story residence, approximately 1,000 square feet [ft^2]), with a building height of 8 feet.
- For the commercial/industrial worker, groundwater concentrations were calculated for both a small and large hypothetical industrial building. The small industrial building was assumed to be a two-story building of approximately 1,000 ft^2, with a building height of 16 feet. The large industrial building was assumed to be a one-story building of approximately 40,000 ft^2, with a building height of 10 feet.

Table A-2 presents the target groundwater concentrations.

TABLE A-2: CALCULATION OF TARGET GROUNDWATER CONCENTRATIONS AS REMEDIATION GOALS

Feasibility Study for OU-1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Chemical of Potential Concern	Residential		Small Commercial/ Industrial Building		Large Commercial/ Industrial Building	
	Target Air Concentration ($\mu g/m^3$)[a]	Target Groundwater Concentration ($\mu g/L$)[b]	Target Air Concentration ($\mu g/m^3$)[a]	Target Groundwater Concentration ($\mu g/L$)[b]	Target Air Concentration ($\mu g/m^3$)[a]	Target Groundwater Concentration ($\mu g/L$)[b]
1,2-Dichloroethene	37	8,800	51	121,000	51	290,000
1,3-Dichlorobenzene	3.3	1,300	4.6	18,000	4.6	42,000
1,4-Dichlorobenzene	0.28	140	0.60	3,000	0.60	7,100
Trichloroethene	0.017	1.7	0.036	35	0.036	84
Tetrachloroethene	0.33	20	0.69	420	0.69	970
Vinyl chloride[c]	0.22	5.9	0.89	240	0.89	630

Notes:

a From Table A-1.

b The target groundwater concentration was calculated by incorporating the site- and contaminant-specific parameters in Attachment B to the human health risk assessment (Appendix G to the RI report [Tetra Tech 2004]) into the EPA's 2003 vapor intrusion model. Target groundwater concentrations are rounded to two significant digits.

µg/L Microgram per liter

A3.0 CHEMICAL-SPECIFIC UNCERTAINTY ASSOCIATED WITH INHALATION RISK CRITERIA

On December 5, 2003, EPA changed the hierarchy for its preferred federal toxicity criteria and specified the conditions under which sites could use provisional values (EPA 2003). In October 2004, EPA Region IX updated the PRGs, incorporating the hierarchy in the selection of toxicity values. Since the HHRA in the RI was based on toxicity values as presented in the previous version (2002) of the PRG table, it is important to present the new facts on the federal direction for use of toxicity criteria in risk assessments as well as in setting remediation goals. The following sections present chemical-specific details relevant to the setting of remediation goals for OU-1.

A3.1 TETRACHLOROETHENE

In the 2004 Region IX PRG table, the toxicity criteria for PCE were revised based on the December 2003 EPA guidance. Specifically, the previous Health Effects Assessment Summary Tables (HEAST)-based inhalation slope factor (SF_i) of 0.001 per milligram per kilogram day (mg/kg-day) was revised to the "other EPA source"-based inhalation slope factor of 0.021 (0.02065) per mg/kg-day. This means PCE is considered a more potent carcinogen (based on the EPA 2003 guidance) than previously calculated in October 2002 by EPA Region IX. This means the current unit risk for a federal risk assessment or remediation goal should be based on a unit risk of 5.9E-06 per $\mu g/m^3$. Since the HHRA was completed after the EPA toxicity value guidance was issued, the HHRA incorporated the revised SF_i for PCE.

Note that these toxicity values have not met with consensus in the formal EPA peer review process. Although the EPA's Science Advisory Board recommended a cancer weight-of-evidence classification of C-B2, the EPA has not adopted a current position on the PCE cancer classification, and the oral slope factor and unit risk factor have been withdrawn from integrated risk information system (IRIS) (EPA 2004a) and HEAST. Thus, the provisional "other" National Center for Environmental Assessment (NCEA) source is cited here.

A3.2 TRICHLOROETHENE

The draft provisional SF_i of 0.4 per mg/kg-day from NCEA is the highest end of the NCEA draft inhalation slope factor range (equivalent to a unit risk of 0.0001 per $\mu g/m^3$) proposed to an external review panel in 2001. At present, because the NCEA 2001 review is not yet ready for public use (EPA 2001), neither (1) alternate unit risks from the draft unit risk range presented in the draft toxicological review nor the (2) previous (withdrawn) IRIS inhalation slope factor are recommended (EPA 2003).

However, this draft value of 0.4 per mg/kg-day is highly controversial, and it is expected that the unit risk for TCE will be finalized and officially posted to the EPA IRIS file, resulting in a different toxicity criterion being used by summer 2005. The external review draft discussed several cancer slope factors, with most between 0.02 and 0.4 per mg/kg-day (a higher slope factor indicates more

risk) (EPA 2001). The pre-1994 (withdrawn from IRIS) of 0.011 per mg/kg-day reflects the official IRIS toxicity values that were in use until 1994, when the TCE toxicity reassessment began (EPA 2004a). EPA attributes the proposed increase in the slope factor principally to the following two factors.

1. The pharmacokinetic models predict that humans would experience higher internal doses of breakdown products than would mice

2. The generation of breakdown products would be more efficient at the lower doses expected from environmental exposure than from doses used in the bioassays (EPA 2001)

At this time, however, until the reassessment is complete and the IRIS file is revised in 2005, the upper end of the draft NCEA value is retained as the most conservative "placeholder" toxicity value.

A4.0 PRACTICAL CONSIDERATIONS

At Site 16, the remediation goals developed for inhalation criteria should be considered in conjunction with the maximum contaminant levels (MCL) developed by the California Department of Health Services (2002). MCLs are protective of drinking water and dermal contact with groundwater but are not protective of the vapor intrusion pathway to indoor air. However, if the risk-based concentration for groundwater falls below the MCL for a chemical, then the MCL is recommended as the target groundwater concentration (EPA 2002a). Because remedial goals are considered protective for that chemical, a cumulative risk check should be implemented to ensure that the risk managers' ultimate goals (whether 1E-06 or 1E-05 considering all pathways and all media) are met.

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APPENDIX B
EVALUATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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B-4 Water Board's Concurrence for Drinking Water Exemption for Groundwater West of Saratoga Street

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B-1 Chemical-Specific Applicable or Relevant and Appropriate Requirements

B-2 Location-Specific Applicable or Relevant and Appropriate Requirements

B-3 Action-Specific Applicable or Relevant and Appropriate Requirements

ACRONYMS AND ABBREVIATIONS

§	Section
μg/100 cm^2	Microgram per 100 square centimeter
μg/L	Microgram per liter
ARAR	Applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
DCB	Dichlorobenzene
DCE	Dichloroethene
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
Fed. Reg.	*Federal Register*
FS	Feasibility study
FWBZ	First water-bearing zone
HRC	Hydrogen Release Compound
ISCO	In situ chemical oxidation
LDR	Land disposal restriction
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goal
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
MUN	Municipal and domestic water designation
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OU-1	Operable Unit 1
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
ppm	Part per million
PRG	Preliminary remediation goal
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation

ACRONYMS AND ABBREVIATIONS (Continued)

STLC	Soluble threshold limit concentration
SVOC	Semivolatile organic compound
SWRCB	State Water Resources Control Board
TBC	To be considered
TCE	Trichloroethene
TCLP	Toxicity characteristic leaching procedure
TDS	Total dissolved solids
Tetra Tech	Tetra Tech EM Inc.
TPH	Total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TTLC	total threshold limit concentrations
USC	*United States Code*
VOC	Volatile organic compound
Water Board	San Francisco Bay Regional Water Quality Control Board
WET	Waste extraction test
WQO	Water quality objective

B1.0 EVALUATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This appendix identifies and evaluates potential federal and state of California applicable or relevant and appropriate requirements (ARAR) and sets forth the U.S. Department of the Navy determinations for each response action alternative retained for detailed analysis in the feasibility study (FS) report for Operable Unit 1 (OU-1) at Alameda Point, Alameda, California.

This evaluation includes an initial determination of whether the potential ARARs actually qualify as ARARs and a comparison for stringency between the federal and state regulations to identify the controlling ARARs. The identification of ARARs is an iterative process. The final determination of ARARs will be made by the Navy in the record of decision, after public review, as part of the response action selection process.

B1.1 SUMMARY OF COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT AND NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN REQUIREMENTS

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Title 42 *United States Code* (USC) Section [§] 9621(d), as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, it is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed remedial action and are well suited to the conditions of the site (U.S. Environmental Protection Agency [EPA] 1988a). A requirement must be determined to be both relevant <u>and</u> appropriate to be considered an ARAR.

The criteria for determining relevance and appropriateness are listed in Title 40 *Code of Federal Regulations* (CFR) § 300.400(g)(2) and include the following:

- The purpose of the requirement and the purpose of the CERCLA action
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site
- The substances regulated by the requirement and the substances found at the CERCLA site
- The action or activities regulated by the requirement and the response action contemplated at the CERCLA site
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- The type of place regulated and the type of place affected by the release or CERCLA action
- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action
- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site

According to CERCLA ARARs guidance, a requirement may be "applicable" or "relevant and appropriate," but not both (EPA 1988a). ARARs must be identified on a site-specific basis and involve two determinations. First, a determination is made about whether a given requirement is applicable. Second, a determination is made about whether a nonapplicable requirement is nevertheless both relevant and appropriate. It is important to explain that some regulations may be applicable or not applicable but still be relevant and appropriate. When the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (EPA 1988a).

Tables B-1, B-2, and B-3 included in this appendix present each ARAR with a determination of ARAR status (that is, applicable, relevant and appropriate, or to be considered [TBC]). For the determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements addressed problems or situations sufficiently similar to the circumstances of the release or remedial action contemplated, and whether the requirement was well suited to the site.

To qualify as a state ARAR under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a state requirement must be:

- A state law or regulation
- An environmental or facility siting law
- Promulgated (of general applicability and legally enforceable)

- Substantive (not procedural or administrative)
- More stringent than the federal requirement
- Identified in a timely manner
- Consistently applied

To constitute an ARAR, a requirement must be substantive; only the substantive provisions of requirements identified as ARARs in the OU-1 FS are considered to be ARARs. Permits are considered to be procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations determined to be procedural or nonenvironmental, including permit requirements, are not considered to be ARARs. CERCLA § 121(e)(1), Title 42 USC § 9621(e)(1), states that "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term "on-site" is defined for purposes of this ARARs discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (Title 40 CFR § 300.5).

Nonpromulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. Such requirements may, however, be useful, and are TBC (Title 40 CFR § 300.400[g][3]). TBC requirements complement ARARs but do not override them. They are useful for guiding decisions regarding cleanup levels or methodologies when regulatory standards are not available.

Pursuant to EPA guidance (EPA 1988a), ARARs are generally divided intro three categories: chemical-specific, location-specific, and action-specific requirements. This classification was developed to aid in the identification of ARARs; some ARARs do not fall precisely into one group or another. ARARs are identified on a site basis for remedial actions where CERCLA authority is the basis for cleanup.

As the lead federal agency, the Navy has primary responsibility for identifying federal ARARs at Alameda Point. Potential federal ARARs that have been identified for OU-1 are discussed in this appendix.

Identification of potential state ARARs was initiated through Navy requests that the Department of Toxic Substances Control (DTSC) identify potential state ARARs, an action described in more detail in Section B1.2.3. Potential State ARARs that have been identified for OU-1 are discussed below.

B1.2 METHODOLOGY DESCRIPTION

This section describes the process of identifying and evaluating potential federal and state ARARs.

B1.2.1 General

As the lead federal agency, the Navy has primary responsibility for identification of potential ARARs for OU-1. In preparing this ARARs analysis, the Navy undertook the following measures, consistent with CERCLA and the NCP.

- Identified federal ARARs for each response action alternative addressed in the FS, taking into account site-specific information for OU-1
- Reviewed potential state ARARs identified by the state to determine whether they satisfy CERCLA and NCP criteria that must be met in order to constitute state ARARs
- Evaluated and compared federal ARARs and their state counterparts to determine whether state ARARs are more stringent than the federal ARARs or are in addition to the federally required actions
- Reached a conclusion as to which federal and state ARARs are the most stringent and/or "controlling" ARARs for each alternative

As outlined in Section 3.0 of this FS report, the following remedial action objectives (RAO) were identified for the different media at each OU-1 site.

Site 6

Soil. Prevent human exposures to soil adjacent to oil-water separator (OWS)-040A and OWS-040B that are found to contain volatile organic compounds (VOC), semivolatile organic compounds (SVOC), metals, pesticides, or polychlorinated biphenyls (PCB) at concentrations that exceed their respective residential preliminary remediation goal (PRG) concentrations.

Groundwater. For the residential receptor, prevent inhalation of VOCs due to concentrations in groundwater exceeding the following criteria: 1,2-dichloroethene (-DCE) at 8,800 micrograms per liter (µg/L), tetrachloroethene (PCE) at 20 µg/L, trichloroethene (TCE) at 1.7 µg/L, and vinyl chloride at 5.9 µg/L.

For the commercial/industrial receptor, prevent inhalation of indoor air containing VOCs due to concentrations in the groundwater plumes exceeding the following criteria: 1,2-DCE at 121,000 µg/L, PCE at 420 µg/L, TCE at 37 µg/L, and vinyl chloride at 240 µg/L.

Site 7

Soil. For the residential receptor, prevent dermal contact, ingestion, and inhalation of soils that exceed the following chemical concentrations: arsenic at 9.1 milligrams per kilogram (mg/kg), cadmium at 1.7 mg/kg, and lead at 230 mg/kg.

For all receptors, prevent any exposures to soil contamination located adjacent to OWS-459 that exceeds the residential PRGs.

Site 8

Soil. For the residential receptor, prevent dermal contact and ingestion of soils with chemical concentrations exceeding the following criteria: 0.22 mg/kg of Aroclor-1254 or Aroclor-1260 or 1 mg/kg of total PCBs, 0.03 mg/kg of dieldrin, and 230 mg/kg of lead.

For the commercial/industrial receptor, prevent dermal contact and ingestion of soils with chemical concentrations exceeding the following criteria: 0.74 mg/kg of Aroclor-1254 or Aroclor-1260, 0.11 mg/kg of dieldrin, and 3,572 mg/kg of lead.

For human receptors, prevent any exposures to soil contamination located adjacent to OWS-114 that exceeds residential PRGs.

Site 16

Soil. Prevent human exposures to soils adjacent to OWS-608A and OWS-608B that are found to contain VOCs, SVOCs, metals, pesticides, any PCBs (in contaminated soil in the storage area), or total petroleum hydrocarbons (TPH) at concentrations exceeding their respective residential PRGs.

Groundwater. For the residential receptor, prevent dermal contact, ingestion, and inhalation of VOCs in groundwater at concentrations exceeding California MCLs.

For the commercial/industrial receptor, prevent inhalation of indoor air containing VOCs from the groundwater plumes at concentrations exceeding the following criteria: 420 µg/L of PCE, 37 µg/L of TCE, 18,000 µg/L of 1,3-dichlorobenzene (-DCB), 3,000 µg/L of 1,4-DCB, and 240 µg/L of vinyl chloride.

Remedial alternatives retained for detailed analysis in this FS are designed to accomplish these RAOs for Sites 6, 7, 8, and 16.

The OU-1 remedial alternatives considered for detailed analysis, and for which an ARAR analysis is presented in this appendix, are presented below by site and medium.

Site 6 Soil

- Alternative 1 – No Action for Soil
- Alternative 2 – One-Time Soil Sampling and Institutional Controls
- Alternative 3 – One-Time Soil Sampling, Excavation, and Off-Site Disposal

Site 6 Groundwater

- Alternative 1: No Action for Groundwater
- Alternative 2: Plume Boundary Delineation, Groundwater Contaminant Examination, and Institutional Controls
- Alternative 3: Plume Boundary Delineation, Active Groundwater Treatment to Commercial/Industrial Reuse Criteria, Groundwater Contaminant Examination, and Institutional Controls
- Alternative 4: Plume Boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, Groundwater Contaminant Examination, and Institutional Controls

Site 7 Soil

- Alternative 1: No Action for Soil
- Alternative 2: One-Time Soil Sampling, Excavation, and Off-Site Disposal

Site 8 Soil

- Alternative 1: No Action for Soil
- Alternative 2: One-Time Soil Sampling and Institutional Controls
- Alternative 3: One-Time Soil Sampling, Excavation, and Off-Site Disposal

Site 16 Soil

- Alternative 1: No Action for Soil
- Alternative 2: One-Time Soil Sampling and Institutional Controls
- Alternative 3: One-Time Soil Sampling, Excavation, and Off-Site Disposal

Site 16 Groundwater

- Alternative 1: No Action for Groundwater
- Alternative 2: Plume Boundary Delineation, Groundwater Contaminant Examination, and Institutional Controls

- Alternative 3: Plume Boundary Delineation, Active Groundwater Treatment to Commercial/Industrial Reuse Criteria, Groundwater Contaminant Examination, and Institutional Controls

- Alternative 4: Plume Boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, Groundwater Contaminant Examination, and Institutional Controls

B1.2.2 Identifying and Evaluating Federal ARARs

The Navy is responsible for identifying federal ARARs as the lead federal agency under CERCLA and the NCP. The final determination of federal ARARs will be made when the Navy issues the record of decision. The federal government implements a number of federal environmental statutes that are the source of potential federal ARARs, either in the form of the statutes or regulations promulgated thereunder. Examples include the Resource Conservation and Recovery Act (RCRA), the Clean Water Act, the Safe Drinking Water Act, the Toxic Substances Control Act (TSCA), and their implementing regulations, to name a few. See NCP preamble at 55 *Federal Register* (Fed. Reg.) §§ 8764–8765 (1990) for a more complete listing.

The proposed response actions and alternatives were reviewed against all potential federal ARARs, including but not limited to those set forth at 55 Fed. Reg. §§ 8764–8765 (1990), in order to determine if they were applicable or relevant and appropriate utilizing the CERCLA and NCP criteria and procedures for ARARs identification by lead federal agencies.

B1.2.3 Identifying and Evaluating State ARARs

The process of identifying and evaluating potential state ARARs by the state and the Navy is described in this subsection.

B1.2.3.1 Solicitation of State ARARs Under NCP

EPA guidance recommends that the lead federal agency consult with the state when identifying state ARARs for remedial actions (EPA 1988b). In essence, the CERCLA and NCP requirements at Title 40 CFR § 300.515 for remedial actions provide that the lead federal agency request that the state identify chemical- and location-specific state ARARs upon completion of site characterization. The requirements also provide that the lead federal agency request identification of all categories of state ARARs (chemical-, location-, and action-specific) upon completion of identification of remedial alternatives for detailed analysis. The state must respond within 30 days of receipt of the lead federal agency requests. The remainder of this subsection documents the Navy's efforts to date to identify and evaluate state ARARs.

The Navy followed the procedures set forth in Title 40 CFR § 300.515 and Section 7.6 of the Federal Facilities Agreement for remedial actions in seeking state assistance in identifying state ARARs.

B1.2.3.2 Chronology of Efforts To Identify State ARARs

The following chronology summarizes the Navy efforts to obtain state assistance in identifying state ARARs for the response action at OU-1. Key correspondence between the Navy and the state agencies relating to this effort has been included in the Administrative Record for this FS.

In a letter dated September 12, 1996, the Navy requested ARARs for RI/FS efforts at Naval Air Station Alameda. The state of California's response, dated November 13, 1996, is included after this appendix as Attachment B1.

In a letter to DTSC, dated March 8, 2004, the Navy requested chemical-, location- and action-specific ARARs for OU-1, Alameda Point (see Attachment B2). The letter requested that DTSC coordinate responses from all California state agencies. Responses from DTSC had not been received at the time of this report.

B1.3 OTHER GENERAL ISSUES

This section discusses the general issues identified during the evaluation of ARARs for OU-1.

B1.3.1 General Approach to Requirements of the Federal Resource Conservation and Recovery Act

The RCRA is a federal statute passed in 1976 to meet four goals: the protection of human health and the environment, the reduction of waste, the conservation of energy and natural resources, and, wherever feasible, the reduction or elimination of the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments of 1984 significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions, and technical requirements. RCRA, as amended, contains several provisions that are potential ARARs for CERCLA sites.

Substantive RCRA requirements are applicable to response actions on CERCLA sites if the waste is a RCRA hazardous waste, and either:

- The waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement; or
- The activity at the CERCLA site constitutes treatment, storage, or disposal, as defined by RCRA (EPA 1988a).

The preamble to the NCP indicates that state regulations that are components of a federally authorized or delegated state program are generally considered federal requirements and potential federal ARARs for the purposes of ARARs analysis (55 Fed. Reg. §§ 8666 and 8742 [EPA 1990]). The state of California received approval for its base RCRA hazardous waste

management program on July 23, 1992 (57 Fed. Reg. § 32726 [EPA 1992]). The state of California "Environmental Health Standards for the Management of Hazardous Waste," set forth in Title 22 *California Code of Regulations* (CCR), Division 4.5, were approved by EPA as a component of the federally authorized state of California RCRA program. On September 26, 2001, California received final authorization of its revised State Hazardous Waste Management Program by the EPA (63 Fed. Reg. § 49118 [EPA 2001]).

Therefore, Title 22 CCR, Division 4.5, is a source of potential federal ARARs for CERCLA response actions. The exception is when a state regulation is "broader in scope" than the corresponding federal RCRA regulations. In that case, such regulations are not considered part of the federally authorized program or potential federal ARARs. Instead, they are purely state law requirements and potential state ARARs.

The EPA July 23, 1992 notice approving the state of California RCRA program (57 Fed. Reg. § 32726 [EPA 1992]) specifically indicated that the state regulations addressed certain non-RCRA, state-regulated hazardous wastes that fell outside the scope of federal RCRA requirements. Title 22 CCR, Division 4.5, requirements would be potential state ARARs for such non-RCRA, state-regulated wastes.

A key threshold question for the ARARs analysis is whether or not the contaminants at OU-1 constitute federal hazardous waste as defined under RCRA and the state's authorized program or qualify as non-RCRA, state-regulated hazardous waste. A discussion of waste characterization is included in Section B1.4.

B1.4 WASTE CHARACTERIZATION

Selection of ARARs involves the characterization of wastes as described below.

B1.4.1 RCRA Hazardous Waste Determination

A federal RCRA hazardous waste characterization process is required to determine whether a waste is subject to RCRA requirements at Title 22 CCR, Division 4.5, and other state requirements at Title 22 CCR, Division 3, Chapter 15. The first step in the RCRA hazardous waste characterization process is to evaluate contaminated media at the site(s) and determine whether the contaminant constitutes a "listed" RCRA waste. The preamble to the NCP states that "... it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, if such documentation is lacking, the lead agency may assume it is not a listed waste" (55 Fed. Reg. §§ 8666 and 8758 [EPA 1990]).

This approach is confirmed in EPA guidance for CERCLA compliance with other laws (EPA 1988a), as follows:

> "To determine whether a waste is a listed waste under RCRA, it is often necessary to know the source. However, at many Superfund sites, no information exists on the source of wastes. The lead agency should use available site information, manifests, storage records, and vouchers in an effort to ascertain the nature of these contaminants. When this documentation is not available, the lead agency may assume that the wastes are not listed RCRA hazardous wastes, unless further analysis or information becomes available that allows the lead agency to determine that the wastes are listed RCRA hazardous wastes."

RCRA hazardous wastes that have been assigned EPA hazardous waste numbers (or codes) are listed in Title 22 CCR §§ 66261.30 through 66261.33. The lists include hazardous waste codes beginning with the letters "F," "K," "P," and "U."

Available historical information manifests, and storage records were reviewed during the previous investigations at OU-1 and the RI. Interviews were conducted with past and current Alameda Point staff. No documentation of past waste disposal practices was found that would serve to classify the sources of contamination with respect to RCRA waste listings. Therefore, the Navy has made the determination that the soil and groundwater should not be classified as RCRA-listed hazardous wastes. By extension of this reasoning, any residuals generated during implementation of the response action will not be classified as RCRA-listed hazardous waste either.

The second step in the RCRA hazardous waste characterization process is to evaluate potential hazardous characteristics of the waste. The evaluation of characteristic waste is described in EPA guidance as follows (EPA 1988a):

> "Under certain circumstances, although no historical information exists about the waste, it may be possible to identify the waste as RCRA characteristic waste. This is important in the event that (1) remedial alternatives under consideration at the site involve on-site treatment, storage, or disposal, in which case RCRA may be triggered as discussed in this section; or (2) a remedial alternative involves off-site shipment. Since the generator (in this case, the agency or responsible party conducting the Superfund action) is responsible for determining whether the wastes exhibit any of these characteristics (defined in 40 CFR Sections 261.21 through 261.24), testing may be required. The lead agency must use best professional judgment to determine, on a site-specific basis, if testing for hazardous characteristics is necessary."
>
> "In determining whether to test for the toxicity characteristic using the extraction procedures (EP) toxicity test, it may be possible to assume that certain low concentrations of waste are not toxic. For example, if the total waste concentration in soil is 20 times or less the EP toxicity concentration, the waste cannot be characteristic hazardous waste. In such a case, RCRA requirements would not be applicable. In other instances, where it appears that the substances may be characteristic hazardous waste (ignitable, corrosive, reactive, or EP toxic), testing should be performed."

Hazardous waste characteristics, as defined in Title 40 CFR §§ 261.21 through 261.24, are commonly referred to as ignitability, corrosivity, reactivity, and toxicity. California environmental health standards for the management of hazardous waste set forth in Title 22 CCR, Division 4.5, were approved by EPA as a component of the federally authorized California RCRA program. Therefore, the characterization of RCRA waste is based on the state requirements.

The characteristics of ignitability, corrosivity, reactivity, and toxicity are defined in Title 22 CCR §§ 66261.21 through 66261.24. According to Title 22 CCR § 66261.24(a)(1)(A), "A waste that exhibits the characteristic of toxicity pursuant to subsection (a)(1) of this section has the EPA Hazardous Waste Number specified in Table I of this section which corresponds to the toxic contaminant causing it to be hazardous." Table I assigns hazardous waste codes beginning with the letter "D" to wastes that exhibit the characteristic of toxicity; D waste codes are limited to "characteristic" hazardous wastes.

According to Title 22 CCR § 66261.10, waste characteristics can be measured by an available standardized test method or be reasonably classified by generators of waste based on their knowledge of the waste provided that the waste has already been reliably tested or if there is documentation of chemicals used.

The requirements at Title 22 CCR § 66261.24 list the toxic contaminant concentrations that determine the characteristic of toxicity. The concentration limits are in milligrams per liter (mg/L). These units are directly comparable to total concentrations in waste groundwater and surface water. For waste soils, these concentrations apply to the extract or leachate produced by the toxicity characteristic leaching procedure (TCLP).

A waste is considered hazardous if the contaminants in the wastewater or in the soil TCLP extract equal or exceed the TCLP limits. TCLP testing is required only if total contaminant concentrations in soil equal or exceed 20 times the TCLP limits because TCLP uses a 20-to-1 dilution for the extract (EPA 1988a).

Total concentrations of contaminated soil at Sites 6, 7, 8 and 16 were compared to the TCLP limits at Title 22 CCR § 66261.24(a)(1). Lead at in soils at Sites 7 and 8 exceeded 20 times the extraction procedure toxicity concentration; therefore, excavation of these soils will trigger extraction procedure testing. For the purposes of this FS, it is assumed that extraction procedure testing will indicate that the soils are a RCRA characteristic hazardous waste; therefore, the soils are assumed to require stabilization prior to disposal. Any stabilization required would be conducted off site at the disposal facility.

B1.4.2 California-Regulated, Non-Resource Conservation and Recovery Act Hazardous Waste

A waste determined not to be a RCRA hazardous waste might still be considered a state-regulated non-RCRA hazardous waste. The state is broader in scope in its RCRA program in determining hazardous waste. Title 22 CCR § 66261.24(a)(2) lists the total threshold limit concentrations (TTLC) and the soluble threshold limit concentrations (STLC) for non-RCRA hazardous waste. The state applies its own leaching procedure, waste extraction test (WET), which uses a different acid reagent and has a different dilution factor (tenfold). There are other state requirements that may be broader in scope than federal ARARs for identifying non-RCRA wastes regulated by the state. These requirements may be potential ARARs for wastes not covered under federal ARARs. See additional subsections of Title 22 CCR § 66261.24. A waste is considered hazardous if its total concentrations exceed the TTLCs or if the extract concentrations from the WET exceed the STLCs. A WET is required when the total concentrations exceed the STLC but are less than the TTLCs (Title 22 CCR, Division 4.5, Chapter 11, Appendix II [b]).

The total concentrations of contaminated soil samples at Sites 6, 7, 8, and 16 were compared with the TTLCs and the STLCs for non-RCRA hazardous waste at Title 22 CCR § 66261.24(a)(2). Soil at Site 7 exceeded 10 times the listed concentrations for lead and arsenic at 12 locations. Soil at Site 8 exceeded 10 times the listed concentrations for lead at four locations.

B1.4.3 Other California Waste Classifications

For waste discharged after July 18, 1997, solid waste classifications at Title 27 CCR §§ 20210, 20220, and 20230 are used to determine applicability of waste management requirements. These are summarized below.

A "designated waste" under Title 27 CCR § 20210 is defined at California Water Code Section 13173. Under California Water Code Section 13173, designated waste is hazardous waste that has been granted a variance from hazardous waste management requirements or nonhazardous waste that consists of or contains pollutants that, under ambient environmental conditions at a waste management unit, could be released in concentrations exceeding applicable water quality objectives or that could reasonably be expected to affect beneficial uses of the waters of the state.

A nonhazardous solid waste under Title 27 CCR § 20220 is all putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and semisolid wastes, and other discarded waste (whether of solid or semisolid consistency), provided that such wastes do not contain wastes that must be managed as hazardous wastes or wastes that contain soluble pollutants in concentrations that exceed applicable water quality objectives or could cause degradation of waters of the state.

Under Title 27 CCR § 20230, inert waste is a solid waste that does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives and does not contain significant quantities of decomposable waste.

B2.0 CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Chemical-specific ARARs are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in the establishment of a cleanup level. Many potential ARARs associated with particular response alternatives (such as closure or discharge) can be characterized as action-specific but include numerical values or methodologies to establish them so they fit in both categories (chemical- and action-specific). To simplify the comparison of numerical values, most action-specific requirements that include numerical values are included in this chemical-specific section and, if repeated in the action-specific section, the discussion refers back to this section.

B2.1 DETAILED DISCUSSION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS BY MEDIUM

B2.1.1 Groundwater Applicable or Relevant and Requirements

Groundwater beneath Alameda Point was evaluated for potential beneficial uses in 2000 (Tetra Tech EM Inc. [Tetra Tech] 2000) (see Table 2-1 of the FS report). Based on federal total dissolved solids (TDS) and yield criteria, the first water-bearing zone (FWBZ) in the central and southeastern portion of Alameda Point is a Class II aquifer, making it a potential drinking water source. However, in a letter from Anna-Marie Cook, EPA, to Patricia McFadden, Navy (included in Attachment B3) the EPA stated the following:

> "Based on the shallow depth of the aquifer in this area [central portion], the likelihood of salt water intrusion (based on groundwater flow direction) if any significant pumping takes place, and the fact that no wells currently exist within or close to this area, it seems unlikely that groundwater in this area will be a potential source of drinking water in the future. EPA would concur with non-MCL cleanup levels for this area on condition that any contaminated groundwater beneath Sites 5, 6, 8, 10 and 12 is remediated to levels such that the threats posed by such exposures as inhalation (groundwater vapors into soils and from soils to residences), dermal contact, and those associated with irrigation use are eliminated, and any significant ongoing degradation of the groundwater from contaminant migration is prevented."

Based on this statement, groundwater at Sites 6 and 8 is not considered a drinking water source. Groundwater below Site 7 does not meet the EPA criteria for TDS (TDS less than 10,000 mg/L); therefore, it is not considered a drinking water source.

The FWBZ in the southeastern region of Alameda Point where Site 16 is located is contiguous to a Class II groundwater aquifer (Merritt Sand) that is being used as an irrigation supply by off-base residence. There are no limitations on the use of these wells, and the EPA Well Head Protection Area model indicated that plume capture at an off-base well was possible at pumping rates of 3 gallons per minute. The existence of the wells, in addition to the classification of the aquifer as Class II, indicates that groundwater in this area is a potential and possibly current drinking water source, thus groundwater below Site 16 is considered a potential drinking water source and will be evaluated accordingly.

B2.1.1.1 Federal ARARs

In evaluating chemical-specific ARARs, the Navy considered whether the federal or California MCL were ARARs.

One of the significant issues in identifying ARARs for groundwater under the Safe Drinking Water Act and RCRA is whether the groundwater at the site can be classified as a source of drinking water. EPA groundwater policy is set forth in the preamble to the NCP (55 Fed Reg. §§ 8666 and 8752 through 8756). Although this policy is guidance and not a potential ARAR, it is used along with other guidance to determine whether the groundwater at Sites 6, 7, 8, and 16 is a potential source of drinking water. This policy uses the groundwater classification system set forth in the draft EPA "Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy" (EPA 1986). Under this policy, groundwater is classified in one of three categories (Class I, II, or III), based on ecological importance, replaceability, and vulnerability considerations. Irreplaceable groundwater that is currently used by a substantial population or groundwater that supports a vital habitat is considered to be Class I. Class II groundwater is currently being used or might be used as a source of drinking water in the future. Groundwater that cannot be used for drinking water because of insufficient quality (for example, high salinity or widespread, naturally occurring contamination) or quantity is considered to be Class III. The EPA guidelines define Class III groundwater as groundwater with TDS concentrations over 10,000 mg/L and a yield of less than 150 gallons per day (EPA 1986). Class III groundwater can also be classified based on economic or technological treatability tests as well as quality or quantity (both criteria are not needed, just one or the other).

In 1999, a draft determination of beneficial uses of groundwater was performed at Alameda Point (Tetra Tech 1999). In their comments on this document, the EPA has determined that the groundwater underlying the central region of Alameda Point (which includes 6, 7, and 8) is a Class II aquifer, based on TDS and yield criteria. This decision was documented in a letter from Anna-Marie Cook, EPA to Patricia McFadden, Navy (see Attachment B3).

The EPA clarified further considerations for determining whether an aquifer should be considered a potential source of drinking water in a letter from EPA to the Navy (EPA 1998). These considerations include:

- The thickness of the aquifer
- The actual groundwater yield
- The proximity to saltwater and the potential for saltwater intrusion
- The quality of underlying water-bearing units and whether these units are current or potential drinking-water sources
- The existence of institutional controls on well construction or aquifer use
- The information on current or historical use of the aquifer
- The cost of cleanup to MCLs

In addition, on July 21, 2003, the San Francisco Bay Regional Water Quality Control Board (Water Board) issued a letter entitled "Concurrence that Groundwater Meets the Exemption Criteria in the State Water Resources Control Board Source of Drinking Water Policy Resolution 688-63, and San Francisco Bay Regional Water Quality Control Board Resolution 89-39 for Groundwater West of Saratoga Street at Alameda Point, City of Alameda, Alameda County." In that letter, presented as Attachment B4 to this appendix, the Water Board concurs that the quality and nature of the groundwater in the first and second water bearing zones beneath Alameda Point west of Saratoga Street are such that these waters are not potential sources of drinking water. As of August 2004, the Water Board had not determined whether or when it would consider the proposed removal of the designation of groundwater as MUN (or municipal and domestic water).

Safe Drinking Water Act

Federal MCLs and maximum contaminant level goals (MCLG) developed by EPA under the Safe Drinking Water Act are potential relevant and appropriate requirements for aquifers with Class I and Class II characteristics, and therefore are potential federal ARARs. The point of compliance for MCLGs and MCLs under the Safe Drinking Water Act is at the tap; therefore, the MCLs and MCLGs are not "applicable" ARARs for Navy sites. However, MCLs and MCLGs are generally considered relevant and appropriate as remediation goals for current or potential drinking water sources and thus are commonly identified as potential ARARs for groundwater response actions under CERCLA.

MCLs for the action at OU-1 are found at Title 40 CFR §§ 141.61(a) and (c), 141.62(b). Although MCLs are developed using cost and technical considerations, EPA considers them to be protective of human health as well.

EPA has also developed MCLGs to serve as guidance for establishing MCLs. MCLGs for organic contaminants are promulgated at Title 40 CFR § 141.50. MCLGs for inorganic contaminants are promulgated at Title 40 CFR § 141.51. An MCLG is set at a level at which no adverse health effects may arise, with a margin of safety. An MCL is required to be set as close

as possible to its corresponding MCLG, taking into consideration the best technology, treatment techniques, and other factors, including cost. For noncarcinogens, MCLs generally are set equal to MCLGs. MCLGs for carcinogens are set at the zero level.

For Sites 6, 7, and 8, because groundwater is not a source of drinking water, drinking water standards (MCLs, MCLGs, and secondary MCLs) are neither applicable nor relevant and appropriate. In the letter from January 3, 2000, EPA agreed that the groundwater beneath these sites is unlikely to be a potential source of drinking water in the future and concurred with non-MCL cleanup levels on the condition that any contaminated water beneath these sites is remediated to levels such that the threats posed by such exposures as inhalation, dermal contact, and those associated with irrigation use are eliminated, and any significant ongoing degradation of the groundwater from contaminant migration is prevented.

For Site 16 at OU-1, MCLs and MCLGs are potentially relevant and appropriate ARARs at and beyond the point of compliance. However, as discussed below, the Navy has determined that it will use the California MCL in two cases: (1) for vinyl chloride where the state MCL is more stringent than the federal MCL, and (2) for 1,4-DCB where there is no federal MCL .

B.2.1.1.2 State ARARs

Primary and Secondary State Maximum Contaminant Levels

The Navy has evaluated state and federal MCLs and has determined that the California MCLs will be relevant and appropriate to OU-1 for Site 16 where they are more stringent or where there is no federal MCL. In their 1996 ARARs response, DTSC identified the California MCLs as ARARs. Primary and secondary state MCLs are set forth in the following sections of Title 22 CCR.

- 64431 (MCLs – Inorganic Chemicals)
- 64444 (MCLs – Organic Chemicals)
- 64449(a) (Secondary MCLs)

The substantive provisions of the standards of 64444 constitute potential relevant and appropriate state ARARs. The table below compares the state and federal MCLs for the chemicals of concern for Site 16.

Chemical of Concern	State MCL (mg/L)	Federal MCL (mg/L)
1,4-Dichlorobenzene	0.005	No federal MCL
PCE	0.005	0.005
TCE	0.005	0.005
Vinyl Chloride	0.0005	0.002

The Navy has selected the state MCL for 1,4-dichlorobenzene, where there is no federal MCL, and the state MCL for vinyl chloride, where the state MCL is more stringent than the federal MCL.

Comprehensive Water Quality Control Plan for San Francisco (Basin Plan).

The Navy will consider the substantive provisions of the Basin Plan for the Water Board, June 1995, including beneficial use, water quality objectives (WQO), and waste discharge requirements for potential ARAR status (Water Board 1995). The pertinent WQOs and uses designated for the FWBZ are potential ARARs for this FS report.

The Basin Plan for the San Francisco Bay basin was prepared and implemented by the Water Board to protect and enhance the quality of the waters in the San Francisco Bay region. The Basin Plan establishes location-specific beneficial uses and WQOs for the surface water and groundwater of the region and is the basis of the Water Board San Francisco Bay basin regulatory programs. The Basin Plan includes both numeric and narrative WQOs for specific groundwater subbasins. The WQOs are intended to protect the beneficial uses of the waters of the region and to prevent nuisance.

Beneficial use and reuse of water are key aspects of the Basin Plan for the San Francisco Bay basin. OU-1 is located in the San Francisco Bay basin. OU-1 is located in the East Bay Plain groundwater subbasin. The East Bay Plain groundwater has the following beneficial use designations (Water Board 1995).

- Municipal and domestic supply
- Agricultural supply
- Industrial service supply
- Industrial process supply

The Basin Plan allows for exceptions for municipal and domestic water supplies, which are designated as "MUN" supplies (see Section 2 of the Basin Plan, Beneficial Uses, Present and Potential Beneficial Uses, Groundwater, at the end of page 2-5). The Navy considers the substantive provisions of this section to be an ARAR; therefore, the criteria that allow exceptions to a MUN designation are one of the following.

- The TDS exceed 3,000 mg/L (5,000 micromhos per centimeter electrical conductivity), and it is not reasonably expected by the Water Board that the groundwater could supply a public water system.
- The water source does not provide sufficient water to supply a single well capable of producing an average, sustain yield of 200 gallons per day.

In consideration of these criteria, the Water Board has proposed that the MUN designation for shallow bay-front groundwater in the artificial fill, Young Bay Mud, and San Antonio/Merritt San Formations in the Oakland shoreline/Alameda Point area be dedesignated (Water Board 2000). The Water Board adopted the Groundwater Basin Plan Amendments, including the dedesignation amendment, at its Board Meeting on April 19, 2000. These amendments are still subject to approval by the State Water Resources Control Board (SWRCB) and the State Office of Administrative Law. The amendments were transmitted in May 2000 to the SWRCB for consideration of approval. At this time, it is not known when these amendments will be considered by the SWRCB. Dedesignation is warranted because most of the groundwater is brackish or subject to saltwater intrusion and therefore meets the exemption criteria of the SWRCB's Sources of Drinking Water Policy (SWRCB 1988). This action remains contingent on SWRCB and Office of Administrative Law approval. OU-1 is within the specific area determined by Water Board as appropriate for MUN dedesignation. A copy of the Water Board's letter is included at the end of this appendix as Attachment B4. Therefore, the Navy has determined that the MUN designation is not an ARAR for OU-1 consistent with SWRCB Resolution 88-63 and the proposed dedesignation amendment (Water Board 2000).

WQOs for groundwater in the San Francisco Bay Basin Plan are primarily narrative with a limited number of numerical standards. As discussed above, groundwater in the vicinity of OU-1 is brackish and meets the exemption criteria of the SWRCB Sources of Drinking Water Policy. Remediation of naturally occurring concentrations of inorganic constituents that may exceed WQOs established by the RWQCB for the regional aquifer to below-background water quality conditions is not required by the SWRCB under the Porter-Cologne Act, SWRCB Resolution 68-16 of the State Water Board, and the Water Quality Control Plan of the state and regional water quality control boards. Chapter 3 of the Basin Plan contains water quality objectives for groundwater beneficial uses. For the beneficial uses of the groundwater at OU-1 identified above, there are only narrative standards for the chemicals of concern. The following narrative water quality objective has been determined to be a potential ARAR for OU-1: "All groundwater shall be maintained free of organic and inorganic chemical constituents in concentrations that adversely affect beneficial uses."

However, with regard to the designated nonresidential beneficial uses of groundwater beneath the site, the FS technical analysis has concluded the following.

- No agricultural-supply WQOs for organic chemicals (including the chemicals of concern addressed by this FS) are in the Basin Plan. Agricultural use of groundwater for watering livestock is considered unlikely at OU-1 on the basis of the Community Reuse Plan prepared for the Alameda Reuse and Redevelopment Authority (EDAW, Inc. 1996).

- No WQOs for industrial water supply are in the Basin Plan because of the wide range of potential uses with differing water quality requirements. The Basin Plan states that (1) so many different industrial processes exist with differing water quality requirements that no meaningful criteria can be established generally for quality of raw water supplies and (2) desired product waters tailored for specific industrial uses

can be created through treatment. The evaluation of groundwater beneficial uses for Alameda Point considered industrial supply as a potential beneficial use of groundwater and concluded that industrial supply does not have to be retained in development of remedies and cleanup goals for groundwater in the central region (Tetra Tech 2000). If any significant pumping were to take place for industrial uses, it is likely saltwater intrusion would take place, which would require groundwater pretreatment and would not be economical.

State Water Resources Control Board Resolution 92-49 and 68-16

SWRCB Resolution 92-49 (as Amended on April 21, 1994 and October 2, 1996) is titled "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Cal. Water Code Section 13304." This resolution contains policies and procedures for the regional boards that apply to all investigations and cleanup and abatement activities for all types of discharges subject to California Water Code § 13304.

SWRCB Resolution 68-16 Statement of Policy With Respect to Maintaining High Quality of Waters in California, establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the state." It provides that whenever the existing quality of water is better than the required applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge necessary to assure that (1) pollution or a nuisance will not occur and (2) the highest water quality consistent with maximum benefit to the people of the state will be maintained (SWRCB 1968).

Cleanup to below background water quality conditions is not required by the SWRCB under the Porter-Cologne Act. SWRCB Resolution 92-49 II.F.1 provides that regional boards may require cleanup and abatement to "conform to the provisions of the Resolution No. 68-16 of the State Water Board, and the Water Quality Control Plans of the State and Regional Water Quality Control Boards, provided that under no circumstances shall these provisions be interpreted to require cleanup and abatement which achieves water quality conditions that are better than background conditions" (SWRCB 1992).

The Navy's Position Regarding SWRCB Resolutions 92-49 and 68-16

The Navy recognizes that the key substantive requirements of Title 22 CCR § 66264.94 (and the identical requirements of Title 23 CCR § 2550.4 and Section III.G of SWRCB Resolution 92-49) require cleanup to background levels of constituents unless such restoration proves to be technologically or economically infeasible and an alternative cleanup level of constituents will

not pose a substantial present or potential hazard to human health or the environment. In addition, the Navy recognizes that these provisions are more stringent than corresponding provisions of Title 40 CFR § 264.94 and, although they are federally enforceable through the RCRA program authorization, they are also independently based on state law to the extent that they are more stringent than the federal regulations.

The Navy has also determined that SWRCB Resolution 68-16 is not a chemical-specific ARAR for determining response action goals. However, SWRCB Resolution 68-16 is an action-specific ARAR for regulating discharged treated groundwater back into the aquifer.

The Navy has determined that further migration of already-contaminated groundwater is not a discharge governed by the language in Resolution 68-16. More specifically, the language of SWRCB Resolution 68-16 indicates that it is prospective in intent, applying to new discharges in order to maintain existing high-quality waters. It is not intended to apply to restoration of waters that are already degraded.

The Navy's position is that SWRCB Resolution 68-16 and 92-49 and Title 23 CCR § 2550.4 do not constitute chemical-specific ARARs for this response action because they are state requirements and are not more stringent than federal ARAR provisions of Title 22 CCR § 66264.94. The NCP set forth in Title 40 CFR § 300.400(g)(4) provides that only state standards more stringent than federal standards may be ARARs (see also CERCLA § 121(d)(2)(A)(ii) [Title 42 USC § 9621(d)(2)(A)(ii)]).

The substantive technical standard in the equivalent state requirements (such as Title 23 CCR, Division 3, Chapter 15, and SWRCB Resolution 92-49 and 68-16) is identical to the substantive technical standard in Title 22 CCR § 66264.94. This section will likely be applied in a manner consistent with equivalent provisions of other regulations, including SWRCB Resolution 92-49 and 68-16.

State of California's Position Regarding SWRCB Resolutions

The state does not agree with the Navy determination that SWRCB Resolution 92-49 and 68-16 and certain provisions Title 23 CCR, Division 3, Chapter 15, are not ARARs for this response action. SWRCB has interpreted the term "discharges" in the California Water Code to include the movement of waste from soils to groundwater and from contaminated to uncontaminated water (SWRCB 1994). However, the state agrees that the proposed action would comply with SWRCB Resolution 92-49 and 68-16, and compliance with the Title 22 CCR provisions should result in compliance with the Title 23 CCR provisions. The state does not intend to dispute the FS, but reserves its rights if implementation of the Title 22 CCR provision is not as stringent as state implementation of Title 23 CCR provisions. Because Title 23 CCR regulation is part of the States' authorized hazardous waste control program, it is also the state's position that Title 22 CCR § 66264.94 is a state ARAR and not a federal ARAR (United States versus State of Colorado, 990 F.2d 1565 [1993]).

Whereas, the Navy and the state of California have not agreed on whether SWRCB Resolutions 92-49 and 68-16 and Title 23 CCR § 2550.4 are ARARs for this response action, this FS documents each of the parties' positions on the resolutions but does not attempt to resolve the issue.

State Water Resources Control Board Resolution 88-63, Adoption of Policy Entitled "Sources of Drinking Water."

SWRCB Resolution 88-63 establishes criteria to help Regional Water Quality Control Boards identify potential sources of drinking water (SWRCB 1988). According to this resolution, all groundwater in California is considered suitable or potentially suitable for domestic or municipal freshwater supply except in cases where any one of the following water quality and production criteria cannot be met.

- TDS exceed 3,000 mg/L (or electrical conductivity is greater than 5,000 micromhos per centimeter) and the Water Board does not reasonably expect the groundwater to supply a public supply system.
- Groundwater is contaminated, either by natural processes or by human activity unrelated to a specific pollution incident, and cannot reasonably be treated for domestic use either by best management practices or best economically available treatment practices.
- The groundwater does not provide sufficient water to supply a single well capable of producing an average sustained yield of 200 gallons per day.

SWRCB Resolution 88-63 has been incorporated by reference into the Basin Plan (Water Board 1995). The Navy has determined that the substantive provisions of this policy are potential state ARARs for this FS report.

B2.1.2 Soil ARARs

The key threshold question for soil ARARs is whether or not the wastes located at OU-1 would be classified as hazardous waste. The soil may be classified as a federal hazardous waste as defined by RCRA and the state-authorized program, or as non-RCRA, state regulated hazardous waste. If the soil is determined to be hazardous waste, appropriate requirements will apply.

B2.1.2.1 Federal ARARS

RCRA Hazardous Waste and Groundwater Protection Standards

The federal RCRA requirements at Title 40 CFR Part 261 do not apply in California because the state RCRA program is authorized. Therefore, the authorized state RCRA requirements are considered potential federal ARARs. The applicability of RCRA requirements depends on

whether the waste is a RCRA hazardous waste; whether the waste was initially treated, stored, or disposed of after the effective date of the particular RCRA requirement; and whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. However, RCRA requirements may be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, or disposal for waste that is similar to RCRA hazardous waste.

The determination of whether a waste is an RCRA hazardous waste can be made by comparing the site waste to the definition of RCRA hazardous waste. The RCRA requirements at Title 22 CCR §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potential ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristic of hazardous waste. This determination is made by using the toxicity characteristic leaching procedure (TCLP). The maximum concentrations allowable for the TCLP listed in Title 22 CCR § 66261.24(a)(1)(B) are potential federal ARARs for determining whether the site has hazardous waste. If the site waste has concentrations exceeding these values, it is determined to be a characteristic RCRA hazardous waste.

RCRA land disposal restrictions (LDR) at Title 22 CCR § 66268.1(f) are potential federal ARARs for discharging waste to land. This section prohibits the disposal of hazardous waste to land unless (1) it is treated in accordance with the treatment standards of Title 22 CCR § 66268.40 and the underlying hazardous constituents meet the Universal Treatment Standards at Title 22 CCR § 66268.48; (2) it is treated to meet the alternative soil treatment standards of Title 22 CCR § 66268.49; or (3) a treatability variance is obtained under Title 22 CCR § 66268.44. These are potentially applicable federal ARARs because they are part of the state-approved RCRA program. Although RCRA treatment standards for non-RCRA, state-regulated waste are not potentially applicable federal ARARs, they may be relevant and appropriate state ARARs. The regulations implementing the RCRA LDRs, including applicable LDR treatment standards at Title 22 CCR § 66268.7, are also ARARs. Before sending any waste off site, the Navy will determine whether the waste is subject to LDRs and will provide the required notices and certifications of Title 22 § CCR 66268.7.

Under the policy for areas of contamination, consolidation and in situ treatment of excavated material that remains inside the area of contamination does not create a new point of hazardous waste generation for purposes of RCRA, and LDRs do not apply. However, other RCRA requirements could potentially apply and will be evaluated. If the excavated material is moved outside the area of contamination, the substantive RCRA requirements managing hazardous waste (including LDRs described under the previous chemical-specific discussion) would be applicable.

Toxic Substances Control Act

The TSCA regulates the storage and disposal of PCBs. These requirements have both action- and chemical-specific aspects. They address storage and disposal activities, and they address only PCBs. Therefore, they may be discussed in this portion of Section B4. Under the TSCA, EPA has promulgated Title 40 CFR § 761.61 PCB remediation waste requirements that provide cleanup and disposal options for PCB remediation waste. The options include (1) self-

implementing on-site cleanup and disposal, (2) performance-based disposal, and (3) risk-based disposal. The self-implementing cleanup provisions are not binding on cleanups conducted under other authorities, including actions conducted under §§ 104 or 106 of CERCLA. Therefore, they are not applicable ARARs for actions at CERCLA sites. However, in the preamble of the final rule for Title 40 CFR Part 761, EPA indicated that it anticipates that the final rule "will be a potential ARAR at CERCLA sites where PCBs are present. EPA expects that CERCLA cleanups would typically comply with the substantive requirements of one of the three options, provided by § 761.61, upon completion of the cleanups" (63 Fed. Reg. 35,407, 29 June 1998). Therefore, Title 40 CFR § 761.61 is potentially relevant and appropriate at CERCLA sites where PCB contamination is present.

Self-Implementing Option

EPA designed self-implementing procedures for a general, moderate-size site where there should be low residual environmental impact from remedial activities. The self-implementing on-site cleanup and disposal option requirements are based on the concentration of PCBs. The cleanup levels are based on four general waste categories and on whether the wastes are in high- or low-occupancy areas. Under § 761.61(a)(4)(i), bulk PCB remediation waste cleanup levels are as follows: (1) for high-occupancy areas less than or equal to 1 part per million (ppm) without further conditions, where the concentration is greater than 1 and less than or equal to 10 ppm, a cap is required; and (2) for low-occupancy areas, less than or equal to 25 ppm unless an actual or proposed change in land use to high occupancy. Up to 50 ppm may remain if the site is secured with a fence and signed. Up to 100 ppm may remain if the site is capped.

Under § 761.61(a)(4)(ii), nonporous surface cleanup levels are less than or equal to 10 micrograms per 100 square centimeters ($\mu g/100\ cm^2$) in high-occupancy areas, and less than 100 $\mu g/100\ cm^2$ in low-occupancy areas. Under § 761.61(a)(4)(iii), porous surface cleanup levels are the same as for bulk PCB remediation waste at § 761.61(a)(4)(i). Under § 761.61(a)(4)(iv), liquid cleanup levels are in §§ 761.79(b)(1) and (b)(2). Under § 761.79(b)(1), the decontamination standard for water containing PCBs is (1) less than 200 $\mu g/L$ for noncontact use in a closed system where there are no releases, (2) less than 3 $\mu g/L$ for water discharged to treatment works or navigable waters, or a PCB discharge limit specified in a permit issued under §§ 307(b) or 402 of the Clean Water Act, or (3) less than or equal to 0.5 $\mu g/L$ for unrestricted use. Under § 761.79(b)(2), the decontamination standard for organic liquids and nonaqueous inorganic liquids is less than 2 mg/kg.

A high-occupancy area is defined as any area where PCB remediation waste has been disposed on-site and where occupancy for any individual not wearing dermal and respiratory protection for a year is 335 hours or more for bulk PCB remediation waste and 840 hours or more for nonporous surfaces. Criteria for low-occupancy areas are less than 335 hours for bulk PCB remediation waste and less than 840 hours for nonporous surfaces.

PCB remediation waste means waste containing PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations: materials disposed of prior to April 18, 1978 that are currently greater than or equal to 50 ppm regardless of the concentration of the

original spill; materials that are at any volume or concentration in which the original source was greater than or equal to 500 ppm beginning on April 18, 1978, or greater than or equal to 50 ppm beginning on July 2, 1979; and materials that are currently at any concentration if the PCBs are spilled or released from a source not authorized under this part. PCB remediation waste means soil, rags, and other debris generated as a result of any PCB spill cleanup, including but not limited to environmental media, sewage sludge, and buildings and other man-made structures, porous surfaces, and nonporous surfaces.

The substantive provisions of Title 40 CFR § 761.61(a)(4)(i) are potential chemical-specific ARARs for PCB contaminated soil.

B.2.1.2.2 State ARARs

Contaminated material that may be encountered during implementation of remedial actions is not a RCRA-listed hazardous waste. However, the waste will be tested for RCRA hazardous waste characteristics at the point of generation.

RCRA Requirements

State RCRA requirements included within the EPA-authorized RCRA program for California are considered to be potential federal ARARs and are discussed above. When state regulations are either broader in scope or more stringent than their federal counterparts, they are considered potential state ARARs. State requirements such as the non-RCRA, state-regulated hazardous waste requirements may be potential state ARARs because they are not within the scope of the federal ARARs (57 Fed. Reg. § 60848). The Title 22 CCR, Division 4.5, requirements that are part of the state-approved RCRA program would be potential state ARARs for non-RCRA, state-regulated hazardous wastes.

Title 27 CCR, Divisions 2, Subdivision 1

Title 27 CCR §20210 and 20220 are state definitions for designated waste and nonhazardous waste, respectively. These may be ARARs for soil that meets the definitions. These soil classifications determine state classification and siting requirements for discharging waste to land.

B2.1.3 Air ARARs

There are no chemical-specific ARARs for the vapor intrusion pathway. The Navy has derived the following risk-based cleanup levels for groundwater: 0.01 µg/L for TCE and 0.13 µg/L for PCE (see Appendix A of the FS report).

B3.0 LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Location-specific ARARs are restrictions placed on the concentrations of hazardous substances or the conduct of activities as a result of the characteristics of the site or its immediate environment. For example, location of the site or proposed removal action in a flood plain, wetland, historic place, or sensitive ecosystem may trigger location-specific ARARs. The Endangered Species Act, the National Historic Preservation Act, the Archeological and Historic Preservation Act, and the Coastal Zone Management Act were considered as potential location-specific ARARs. Sites 6, 7, 8, and 16 do not encompass any historic properties included or eligible for inclusion on the National Register of Historic Places, and they are not associated with any scientific, prehistoric, or archeological data.

B3.1 BIOLOGICAL RESOURCE ARARS

This section discusses biological resource ARARs.

B3.1.1 Federal

Endangered Species Act of 1973

The Endangered Species Act (Title 16 USC §§ 1531 through 1543) provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction. The Endangered Species Act defines an endangered species and provides for the designation of critical habitats. Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. Under Section 7(a) of the Endangered Species Act, federal agencies must carry out conservation programs for listed species. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented. Consultation regulations at Title 50 CFR Part 402 are administrative in nature and therefore are not ARARs; however, they may be TBCs to comply with the substantive provisions of the Endangered Species Act.

Because several endangered species are known to exist at Alameda Point, the substantive provisions of the Endangered Species Act are potential ARARS.

B3.1.2 State

California Endangered Species Act

The California Endangered Species Act is codified in the California Fish and Game Code §§ 2050 through 2116. It is the Navy's position that the requisite federal sovereign immunity waiver does not exist to authorize applicability of the California Endangered Species Act. Nevertheless, this act will be evaluated as a potentially relevant and appropriate requirement for

the Navy's CERCLA response actions. California Fish and Game Code § 2080 prohibits the take of endangered species.

B3.2 COASTAL RESOURCES

The Coastal Zone Management Act and the accompanying implementing regulations in Title 15 CFR Part 930 require that federal agencies conducting or supporting activities directly affecting the coastal zone conduct or support those activities in a manner that is consistent with the approved state coastal zone management programs. A state coastal zone management program (developed under state law and guided by the Coastal Zone Management Act) sets forth objectives, policies, and standards to guide public and private use of lands and water in the coastal zone. California's approved coastal management program includes the San Francisco Bay Plan, developed by the Bay Conservation and Development Commission. The Bay Conservation and Development Commission was formed under the authority of the McAteer-Petris Act, *California Government Code* 66600 *et seq.*, which authorizes the Bay Conservation and Development Commission to regulate activities within San Francisco Bay and the shoreline (100 feet landward from the shoreline) in conformity with the policies of the Bay Plan. The McAteer-Petris Act and the Bay Plan were developed primarily to halt uncontrolled development and filling of the Bay. Their broad goals include reducing Bay fill and disposal of dredged material in the Bay, maintaining marshes and mudflats to the fullest extent possible to conserve wildlife and abate pollution, and protecting the beneficial uses of the Bay. The Coastal Zone Management Act is relevant and appropriate and therefore the substantive provisions are potential ARARs.

B4.0 ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Action-specific ARARs are technology- or activity-based requirements or limitations for remedial activities. These requirements are triggered by the particular remedial activities conducted at the site and suggest how a selected remedial alternative should be achieved. These action-specific requirements are not used to identify a remedial alternative; rather, they indicate how a selected alternative must be conducted.

B4.1 NO-ACTION ALTERNATIVES

There are no action-specific ARARs for the no action alternatives. There is no need to identify ARARs for the no action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action (CERCLA Section § 121(e), Title 42 USC § 9621[e]). CERCLA § 121 (Title 42 USC § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no-action alternative (EPA 1991). Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.

B4.2 SITE 6 SOIL ALTERNATIVE 2: ONE-TIME SOIL SAMPLING AND INSTITUTIONAL CONTROLS

For Site 6, Alternative 2 consists of one time soil sampling for VOCs, SVOCs, and metals, institutional controls to prevent excavation without regulatory approval. Vapor removal and barrier technology may be required in the future. For this alternative, the RCRA hazardous waste determination requirements are ARARs, as are several State of California provisions relating to institutional controls.

B4.2.1 One-Time Soil Sampling

Resource Conservation and Recovery Act

If any waste is generated during the sampling activities or the installation of the vapor removal/barrier technology, the Navy will determine whether it is a hazardous waste in accordance with Title 22 CCR §§ 66261.10 and 66261.11. Any hazardous waste accumulated on site, including waste contained in soil, must comply with the RCRA requirements set forth at Title 22 CCR §66262.34. This section permits on-site hazardous waste accumulation for up to 90 days as long as the waste is properly stored and labeled. Additional ARARs will be triggered depending on the placement of waste (for example, in containers, tanks, drip pads, or containment buildings). For hazardous waste sent off site for disposal at a disposal facility, the following RCRA requirements are potential ARARs: the RCRA pretransport regulations at Title 22 CCR §§ 66262.30 (packaging), 66262.31 (labeling), 66262.32 (marking), and 66262.33 (placarding) and RCRA manifest requirements at Title 22 CCR §§ 66262.20, 66262.21, 66252.22, and 66262.23.

Federal Hazardous Materials Transportation Law

The Federal Hazardous Materials Transportation Law is not based on environmental law and is therefore not considered relevant or appropriate requirements. However, Title 49 USC §§ 5101 through 5127 and Title 49 CFR §§ 171.2(f), 171.2(g), 172.300, 172.301, 172.302, 172.303172.304, 172.312, 172.400, and 172.504 are potential relevant and appropriate requirements for transporting hazardous waste may be considered. These sections consist of requirements for transporting hazardous wastes, including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements.

B4.2.2 Institutional Controls

Institutional controls are mechanisms implemented to protect public health and the environment from residual hazardous substances during and after remediation, particularly at sites where cleanup levels or containment remedies are not compatible with unrestricted land uses. Remedial alternatives where cleanup will not result in unrestricted land use will require institutional controls that limit site access and future land and resource uses to prevent activities

that could expose the public or environment to contaminated materials. At Site 6, institutional controls may be implemented to prevent residential reuse of the property. Such institutional controls will consist of land use restrictions.

There are no federal ARARs for institutional controls.

State statutes that have been accepted by the Navy as ARARs for implementing institutional controls and entering into an Environmental Restriction Covenant and Agreement with DTSC include substantive provisions of the *California Civil Code* § 1471 and *California Health and Safety Code* §§ 25202.5, 25222.1, 25233(c), 25234, and 25355.5. DTSC promulgated a regulation on April 19, 2003 regarding "Requirements for Land Use Covenants" at Title 22 CCR § 67391.1. The substantive provisions of this regulation have been determined to be "relevant and appropriate" state ARARs by the Navy.

The substantive provisions of *California Civil Code* § 1471 are the following general narrative standard: ". . . to do or refrain from doing some act on his or her own land . . . where . . . : (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in Section 25260 of the Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive environmental covenants in the deed at the time of transfer. These covenants would be recorded with the environmental restriction covenant and agreement and run with the land.

The substantive provisions of *California Health and Safety Code* § 25202.5 are the general narrative standard to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . . ." These substantive provisions will be implemented by incorporation of restrictive environmental covenants in the Environmental Restriction Covenant and Agreement at the time of transfer for purposes of protecting present and future public health and safety.

California Health and Safety Code §§ 25222.1 and 25355.5(a)(1)(C) provide the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of property. The substantive requirements of the following California Health and Safety Code § 25222.1 provisions are "relevant and appropriate": (1) the general narrative standard: "restricting specified uses of the property,..." and (2) "...the agreement is irrevocable, and shall be recorded by the owner, ...as a hazardous waste easement, covenant, restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following *California Health and Safety Code* § 25355.5(a)(1)(C) provisions are "relevant and appropriate": "...execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof, as appropriate, upon the present and future uses of the land."

The Navy will comply with the substantive requirements of *California Health and Safety Code* §§ 25222.1 and 25355.5(a)(1)(C) by incorporating the CERCLA use restrictions into the Navy's deed of conveyance in the form of restrictive covenants under the authority of *California Civil*

Code § 1471 and into the environmental restriction covenant and agreement. The substantive provisions of *California Health and Safety Code* §§ 25222.1 and 25355.5(a)(1)(C) may be interpreted in a manner that is consistent with the substantive provisions of *California Civil Code* § 1471. The covenants shall be recorded with the deed and run with the land.

California Health and Safety Code § 25233(c) sets forth "relevant and appropriate" substantive criteria for granting variances from prohibited uses based upon specified environmental and health criteria. *California Health and Safety Code* § 25234 sets forth the following "relevant and appropriate" substantive criteria for the removal of a land-use restriction on the grounds that "...the waste no longer creates a significant existing or potential hazard to present or future public health or safety."

In addition to being implemented through the Environmental Restriction Covenant and Agreement between the Navy and DTSC, the appropriate and relevant portions of *California Health and Safety Code* §§ 25202.5, 25222.1, 25233(c), 25234, and 25355.5(a)(1)(C) and California Civil Code § 1471 shall also be implemented through the deed between the Navy and the transferee.

Title 22 CCR § 67391.1 provides that the DTSC shall not approve or concur in a response action decision document that includes land use controls unless the controls are clearly set forth and defined in the decision document. This section also states, among other requirements that DTSC shall not consider property owned by the federal government to be suitable for transfer to nonfederal entities where hazardous materials, hazardous wastes or constituents, or hazardous substances remain at the property at levels that are not suitable for unrestricted use without land use controls. The Navy has identified the substantive provisions of this section as potential ARARs.

Engineering Controls as Vapor Removal/Barrier Technology

In order to control vapor from entering buildings, it may be necessary in the future to implement engineering controls consisting of a vapor removal system. There are no federal or state ARARs specifically associated with construction of the vapor removal system. If it is necessary to install a vapor removal system, all ARARs will be reconsidered at that time and the system will be installed in accordance with all applicable or relevant and appropriate Bay Area Air Quality Management District regulations.

B4.3 SITE 6 SOIL ALTERNATIVE 3: ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL

For Site 6, Alternative 3 consists of one-time soil sampling, excavation, and off-site disposal or excavated soils.

Resource Conservation and Recovery Act

For this alternative the RCRA hazardous waste determination, pretransport, and manifest requirements described in Section B2.1 are potential ARARs.

Federal Hazardous Materials Transportation Law

The Federal Hazardous Materials Transportation Law requirements described in Section B2.0 are potential ARARs for this alternative.

Clean Air Act

In addition, the following Clean Air Act requirements are potential ARARs for excavation:

- Regulation 6-302: Opacity Limitation (prohibiting emissions for a period aggregating more than 3 minutes in any hour an emission equal to or greater than 20 percent opacity); and
- Regulation 8, Rule 40: Aeration of Contaminated Soil and Removal of Underground Storage Tanks (setting forth standards for maintaining, covering, and stockpiling soil).

City of Alameda Ordinance No. 2824

City of Alameda Ordinance No. 2824 sets forth restrictions for excavation in the Marsh Crust areas of Alameda Point. This ordinance is to be considered criteria for excavation that affects the Marsh Crust. If any excavation will be conducted as a result of sampling activities, this ordinance would be a "to be considered" criteria.

B4.4 SITE 6 GROUNDWATER ALTERNATIVE 2: PLUME BOUNDARY DELINEATION, GROUNDWATER CONTAMINANT EXAMINATION, AND INSTITUTIONAL CONTROLS

For Site 6, Alternative 2 consists of delineating the plume boundary, examining contaminants in groundwater, and institutional controls.

B4.4.1 Plume Boundary Delineation and Groundwater Contaminant Examination

There are no action-specific ARARs for groundwater sampling and monitoring. The only potential ARARs for groundwater monitoring would be the California MCLs. However, because Site 6 is not a drinking water source, the California MCLs are not ARARs.

B4.4.2 Institutional Controls

The same institutional controls ARARs identified in Section B2.0 are potential alternatives for this alternative.

B4.4.3 Land Use Controls as Vapor Removal/Barrier Technology

As stated in Section B2.0, there are no federal or state ARARs associated with construction of the vapor removal system.

B4.5 SITE 6 GROUNDWATER ALTERNATIVE 3: PLUME BOUNDARY DELINEATION, ACTIVE GROUNDWATER TREATMENT TO COMMERCIAL/INDUSTRIAL REUSE CRITERIA, GROUNDWATER CONTAMINANT EXAMINATION, AND INSTITUTIONAL CONTROLS

For Site 6, Alternative 3 consists of delineating the plume boundary, treating groundwater based on commercial and industrial reuse criteria, examining contaminants in groundwater, and institutional controls.

B4.5.1 Plume Boundary Delineation and Groundwater Contaminant Examination

There are no action-specific ARARs for groundwater sampling and monitoring. The only potential ARARs for groundwater monitoring would be the California MCLs. However, because Site 6 is not a drinking water source, the California MCLs are not ARARs.

B4.5.2 Active Groundwater Treatment to Commercial/Industrial Reuse In Situ Chemical Oxidation and Hydrogen Release Compound

Groundwater will be treated by in situ chemical oxidation (ISCO) or Hydrogen Release Compound (HRC). For both ISCO and HRC and as discussed in the following text, the federal action-specific ARARs consist of the Safe Drinking Water Act underground injection requirements. In the event that hazardous waste is generated as a result of soil cuttings, RCRA hazardous waste classification requirements, RCRA hazardous waste accumulation requirements, RCRA pretransport requirements, and U.S. Department of Transportation hazardous materials transport requirements will also be ARARs.

Underground injection control regulations, established under the Safe Drinking Water Act, Title 42 USC 300(f) and the sections that follow it, constitute action-specific ARARs. Injection wells used as part of ISCO and HRC will be designated Class V wells according to Title 40 CFR § 144.6(e). The general narrative provisions of Title 40 § CFR 144.12 prohibit injection of substances that allow movement of contaminants into underground sources of drinking water that may result in violations of MCLs or adversely affect health. This requirement is relevant and appropriate because substances will be injected into the groundwater.

The Navy does not expect large quantities of hazardous waste to be generated as a result of the ISCO and HRC processes. Soil cuttings and water generated during the course of installing and operating ISCO and HRC processes are, however, subject to the RCRA requirements to determine whether such wastes would be classified as hazardous. Any hazardous waste accumulated on site, including soil cuttings and contaminated groundwater, must comply with the RCRA requirements set forth at Title 22 CCR § 66262.34. This section permits on-site hazardous waste accumulation for up to 90 days as long as the waste is properly stored and labeled.

For hazardous waste sent off site for disposal at a disposal facility (such as excavated soil or dewatering water), the Navy will comply with the EPA Off-Site Disposal Policy, Title 40 CFR § 300.440. In addition, the following RCRA requirements are ARARs: the RCRA pretransport regulations at Title 22 CCR §§ 66262.30 (packaging), 66262.31 (labeling), 66262.32 (marking), and 66262.33 (placarding); and RCRA manifest requirements at 22 CCR 66262.20, 66262.21, 66252.22, and 66262.23. The regulations implementing the RCRA LDR, including applicable LDR treatment standards at Title 22 CCR § 66268.7, are also ARARs. Before sending any waste off site, the Navy will determine whether the waste is subject to LDR and will provide the required notices and certifications of Title 22 CCR § 66268.7. In addition, the Department of Transportation hazardous materials regulations at Title 49 CFR Parts 171 and 172 are also ARARs for transporting hazardous materials on site.

In addition, for any waste generated, the Navy will determine whether the waste meets the state definition for designated waste and nonhazardous waste pursuant to Title 22 CCR §§ 20210 and 20220, which have been identified as chemical-specific ARARs. These sections may be ARARs for soil that meets the definition of a designated or nonhazardous waste. These soil classifications institutional controls

The same institutional controls ARARs identified in Section B2.0 are potential ARARs for this alternative.

B4.5.~~4~~3 Vapor Removal/Barrier Technology

As stated in Section B2.0, there are no federal or state ARARs associated with construction of the vapor removal system.

B4.6 SITE 6 GROUNDWATER ALTERNATIVE 4: PLUME BOUNDARY DELINEATION, ACTIVE GROUNDWATER TREATMENT TO INSTITUTIONAL CONTROLS

For Site 6, Alternative 4 consists of delineating the plume boundary, treating groundwater based unrestricted reuse criteria, examining contaminants in groundwater, and institutional controls.

B4.6.1 Plume Boundary Delineation and Groundwater Contaminant Examination

There are no action-specific ARARs for groundwater sampling. The only potential ARARs for groundwater sampling would be the California MCLs. However, because Site 6 is not a drinking water source, the California MCLs are not ARARs

B4.6.2 Active Groundwater Treatment to Unrestricted Reuse

The same ARARs identified in Section B4.5.2 for groundwater treatment are potential ARARs for this alternative.

B4.6.3 Institutional Controls

The same institutional controls ARARs identified in Section B2.0 are potential ARARs for this alternative.

B4.6.4 Vapor Removal/Barrier Technology

As stated in Section B2.0, there are no federal or state ARARs associated with construction of the vapor removal system.

B4.7 SITE 7 SOIL ALTERNATIVE 2: ONE-TIME SOIL SAMPLING, EXCAVATION AND OFF-SITE DISPOSAL

For Site 7, Alternative 2 consists of one-time soil sampling, excavation, and off-site disposal of excavated soils.

B4.7.1 One-Time Soil Sampling and Excavation

The same ARARs identified in Sections B2.1 and B4.3 for sampling and excavation are potential ARARs for this alternative.

B4.8 SITE 8 SOIL ALTERNATIVE 2: ONE-TIME SOIL SAMPLING AND INSTITUTIONAL CONTROLS

For Site 8, Alternative 2 consists of one-time soil sampling and institutional controls.

B4.8.1 One-Time Soil Sampling and Excavation

The same ARARs identified in Sections B2.1 and B4.3 for sampling and excavation are potential ARARs for this alternative.

B4.8.2 Institutional Controls

The same institutional controls ARARs identified in Section B2.0 are potential ARARs for this alternative.

B4.9 SITE 8 SOIL ALTERNATIVE 3: ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL

For Site 8, Alternative 3 consists of one-time soil sampling, excavation, and off-site disposal of excavated soils. The same ARARs identified in Sections B4.2 and B4.3 for sampling and excavation are potential ARARs for this alternative.

B4.10 SITE 16 SOIL ALTERNATIVE 2: ONE-TIME SOIL SAMPLING AND INSTITUTIONAL CONTROLS

For Site 16, Alternative 16 consists of one-time soil sampling and institutional controls.

B4.10.1 One-Time Soil Sampling

The same ARARs identified in Sections B2.0 for soil sampling are potential ARARs for this alternative.

B4.10.2 Institutional Controls

The same institutional controls ARARs identified in Section B2.0 are potential ARARs for this alternative.

B4.10.3 Vapor Removal/Barrier Technology

As stated in Section B2.0, there are no federal or state ARARs associated with construction of the vapor removal system.

B4.11 SITE 16 SOIL ALTERNATIVE 3: ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL

For Site 16, Alternative 3 consists of one-time soil sampling, excavation, and off-site disposal of excavated soils. The same ARARs identified in Sections B4.2 and B.4.3 for sampling and excavation are potential ARARs for this alternative.

In addition, the TSCA is a potential action-specific ARAR for excavated soil containing PCBs. Title 40 CFR § 761.61(a)(5)(i)(B)(iii) requires that PCB remediated waste that contains more than 50 ppm taken off site must be disposed of in a landfill permitted under § 3004 of RCRA (referred to as a Title C landfill) or a permitted PCB disposal facility such as an incinerator. Under Title 40 CFR § 761.61(a)(5)(i)(B)(2)(ii), soil contaminated with PCBs at a concentration less than 50 ppm may be disposed of in a permitted state municipal landfill or a nonhazardous nonmunicipal landfill (Class III). If the concentration of PCBs does not meet any of the criteria for PCB remediation waste and if no contaminant analyzed meets the criteria for hazardous waste or as a state-designated waste, none of the TSCA regulations in Title 40 CFR Part 761 or the requirements at Titles 22, 23, or 27 CCR for storage, treatment, and disposal will be applicable.

Excavated soil that is PCB remediation waste will be managed in accordance with PCB remediation waste storage and disposal requirements and decontamination procedures specified in federal PCB regulations, including Title 40 CFR §§ 761.65(c)(9), 761.61, and 761.79(b)(1), which the Navy determined to be ARARs. The Navy has also determined that Title 40 CFR §§ 761.61(a)(5)(i)(B)(iii) and 761.61(a)(5)(i)(B)(ii), which provide options for disposal of PCB remediation waste, are ARARs. The Navy has determined that Title 40 CFR § 761.65(c)(4), which establishes the requirements for storage of PCB remediation waste, is an ARAR.

B4.12 SITE 16 GROUNDWATER ALTERNATIVE 2: PLUME BOUNDARY DELINEATION, GROUNDWATER CONTAMINANT EXAMINATION, AND INSTITUTIONAL CONTROLS

For Site 16, Alternative 2 consists of delineating the plume boundary, examining groundwater for contaminants, and institutional controls.

B4.12.1 Plume Boundary Delineation and Groundwater Contaminant Examination

The only ARARs for groundwater sampling and monitoring are the California MCLs identified under Section B2.0.

B4.12.2 Institutional Controls

The same institutional controls ARARs identified in Section B2.0 are potential ARARs for this alternative.

B4.12.3 Vapor Removal/Barrier Technology

As stated in Section B2.0, there are no federal or state ARARs associated with construction of the vapor removal system.

B4.13 SITE 16 GROUNDWATER ALTERNATIVE 3: PLUME BOUNDARY DELINEATION, ACTIVE GROUNDWATER TREATMENT TO COMMERCIAL/INDUSTRIAL REUSE CRITERIA, GROUNDWATER CONTAMINANT EXAMINATION, AND INSTITUTIONAL CONTROLS

For Site 16, Alternative 3 consists of delineating the plume boundary, treating groundwater based on commercial/industrial reuse criteria, examining groundwater for contaminants, and institutional controls.

B.4.13.1 Plume Boundary Delineation and Groundwater Contaminant Examination

The only potential ARARs for groundwater sampling are the California MCLs identified under Section B2.0.

B4.13.2 Active Groundwater Treatment to Commercial/Industrial Reuse

The same ARARs identified in Section B.4.5.2 for groundwater treatment are potential ARARs for this alternative.

B4.13.3 Institutional Controls

The same institutional controls ARARs identified in Section B2.0 are potential ARARs for this alternative.

B4.13.4 Vapor Removal/Barrier Technology

As stated in Section B2.0, there are no federal or state ARARs associated with construction of the vapor removal system.

B4.14 SITE 16 GROUNDWATER ALTERNATIVE 4: PLUME BOUNDARY DELINEATION, ACTIVE GROUNDWATER TREATMENT TO UNRESTRICTED REUSE CRITERIA, GROUNDWATER CONTAMINANT EXAMINATION, AND INSTITUTIONAL CONTROLS

For Site 16, Alternative 4 consists of delineating the plume boundary, treating groundwater based on unrestricted reuse criteria, examining groundwater for contaminants, and institutional controls.

B4.14.1 Plume Boundary Delineation and Groundwater Contaminant Examination

The only potential ARARs for groundwater sampling and monitoring are the California MCLs identified under Section B2.0.

B4.14.2 Active Groundwater Treatment to Unrestricted Reuse

The same ARARs identified in Section B4.5.2 for groundwater treatment are potential ARARs for this alternative.

B4.14.3 Institutional Controls

The same institutional controls ARARs identified in Section B2.0 are potential ARARs for this alternative.

B4.14.4 Vapor Removal/Barrier Technology

As stated in Section B2.0, there are no federal or state ARARs associated with construction of the vapor removal system.

B5.0 REFERENCES

California State Water Resources Control Board (SWRCB). 1968. "Resolution No. 68-16. Statement of Policy With Respect to Maintaining High Quality Waters in California."

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EPA. 1988b. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA." Office of Solid Waste and Emergency Response Directives 9355.3-01 and 9355.3-02. EPA/540G-89/004.

EPA. 1991. "Management of Investigation-Derived Wastes During Site Inspections." EPA/540/G-91/009. May.

EPA. 1998. Letter Regarding Groundwater Classification as A Potential Drinking Water Source. From Tom Huetteman, EPA Region IX. To Henry Gee, Department of the Navy. June 30.

TABLES

TABLE B-1: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Appendix B, Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
GROUNDWATER				
Federal Requirements				
Safe Drinking Water Act (Title 42 USC, Chapter 6A, §§ 300[f]–300[j]-26)[c]				
National primary drinking water standards are health-based standards for public water systems (MCLs).	Public water system	Title 40 CFR §§ 141.11–141.13, excluding §§ 141.11(d)(3), 141.15, 141.16, 141.61(a) and (c), and 141.62(b)	Relevant and appropriate	These are tap water standards that are potentially relevant and appropriate requirements for groundwater for PCE and TCE at Site 16.
State Requirements				
Cal/EPA Department of Toxic Substances Control				
State MCL list	Groundwater that is a source of drinking water	Title 22 CCR § 64444	Relevant and appropriate	Like federal MCLs, these are tap water standards and may be relevant and appropriate for Site 16.
Describes the water basins in the San Francisco Bay Region, establishes beneficial uses of groundwater and surface water, establishes WQOs, including narrative and numerical standards, establishes implementation plans to meet WQOs and protect beneficial uses, and incorporates statewide water quality control plans and policies.		Comprehensive Water Quality Control Plan for the San Francisco Bay (Basin Plan) (California Water Code § 13240)	Applicable	Substantive requirements pertaining to beneficial uses, WQOs, and certain statewide water quality control plans are potential state ARARs for the alternatives addressing groundwater
Incorporated into all regional board basin plans. 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.		SWRCB Resolution 88-63 (Sources of Drinking Water Policy)	Applicable	This resolution is potential ARAR for the alternatives addressing groundwater.

TABLE B-1: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix B, Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
SOIL				
Federal				
Resource Conservation and Recovery Act (Title 42 USC Chapter 82, §§ 6901 through 6991[i])[c]				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste	Title 22 CCR §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether waste is hazardous.
Land Disposal Restrictions prohibit disposal of hazardous waste unless treatment standards are met.	Hazardous waste land disposal	Title 22 CCR § 66268.1(f)	Applicable	This requirement is applicable if hazardous waste is to be disposed of on land.
Toxic Substances Control Act (Title 15 USC, Chapter 53, §§ 2601–2692)[c]				
Regulates storage and disposal of PCB remediation waste. There are three options: (1) self-implementing on-site cleanup and disposal, (2) performance-based disposal using existing approved disposal technologies, and (3) risk-based disposal.	Soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm.	Title 40 CFR § 761.61(a)(4), (b), and (c)	Relevant and Appropriate	This section is potentially relevant and appropriate for PCB contaminated soil. Section (a)(4) establishes a cleanup level for bulk PCB remediation waste in high-occupancy areas of less than or equal to 1 ppm. The cleanup level for bulk PCB remediation waste in low-occupancy areas is less than or equal to 25 ppm. Section (c) offers an alternative using risk-based levels and technologies.
State				
State and Regional Water Quality Control Board				
Definitions of designated waste, nonhazardous waste, and inert waste	Waste	Title 27 CCR §§ 20210, 20220 and 20230	Applicable	Potential ARAR for classifying waste.

TABLE B-1: POTENTIAL FEDERAL AND STATE CHEMICAL-SPECIFIC[a] APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix B, Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

a	many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables
b	only the substantive provisions of the requirements cited in this table are potential ARARs
c	statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs
ARAR	Applicable or relevant and appropriate requirement
CCR	*California Code of Regulations*
gpd	Gallon per day
MCL	Maximum contaminant level
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
ppm	Part per million
RCRA	Resource Conservation and Recovery Act
TCE	Trichloroethene
TCLP	Toxicity characteristic leaching procedure
TSCA	Toxic Substances Control Act
USC	*United States Code*

TABLE B-2: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Appendix B, Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Federal					
Endangered Species Act of 1973 (Title 16 USC §§ 1531–1543)[b]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	Title 16 USC § 1536(a), (h)(1)(B)	Applicable	Applicable if endangered species are found at Sites 6, 7, 8, or 16.
Coastal Zone Management Act (Title 16 USC §§ 1451–1464)[b]					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands under and adjacent to shore land.	Title 16 USC § 1456(c) Title 15 CFR § 930	Relevant and Appropriate	Remedial alternatives will comply with the Coastal Zone Management Act and Bay Plan
State					
Endangered species habitat	No person shall import, export, take, possess, or sell any endangered or threatened species or part or product thereof.	Threatened or endangered species determination on or before 01 January 1985 or a candidate species with proper notification.	California Fish and Game Code § 2080	Relevant and Appropriate	This section may be potentially relevant and appropriate if there are threatened or endangered species/habitats present at the site. If endangered species are present, the ecological assessment will evaluate potential effects of the contamination present and the planned response action.

TABLE B-2: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix B, Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

a	Only the substantive provisions of the requirements cited in this table are potential ARARs
b	Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs
ARAR	Applicable or relevant and appropriate requirement
CFR	*Code of Federal Regulations*
USC	*United States Code*

TABLE B-3: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Appendix B, Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
		SOIL SAMPLING AND EXCAVATION			
Resource Conservation and Recovery Act (Title 42 USC, Chapter 82, §§ 6901-6991[i]) *					
On-site waste generation	Person who generates waste shall determine if that waste is hazardous waste.	Generator of waste	Title 22 CCR §§ 66261.10(a), and 66262.11	Applicable	The requirements of 22 CCR, Division 4.5, Chapter 14 are applicable for determining whether material generated as a result of the soil sampling, excavation or ISCO process of HRC contains hazardous waste. These requirements may be relevant and appropriate to material that is similar or identical to RCRA hazardous waste or non-RCRA hazardous waste.
Hazardous waste accumulation	On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers or tanks, on drip pads or inside buildings, and is labeled and dated.	Accumulate hazardous waste	Title 22 CCR Section 66262.34	Applicable	These requirements are applicable if hazardous waste is generated and accumulated on site before transport.
Pre-transport requirements	Hazardous waste must be packaged in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR Section 66262.30	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Hazardous waste must be labeled in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR 22 Section 66262.31	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Provides requirements for marking hazardous waste prior to transporting.	Any operation where hazardous waste is generated	Title 22 CCR Section 66262.32	Applicable	These requirements are applicable if hazardous waste is to be transported.

TABLE B-3: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Appendix B, Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL SAMPLING AND EXCAVATION (Continued)					
Resource Conservation and Recovery Act (Title 42 USC, Chapter 82, §§ 6901-6991[i]) *					
Pre-transport requirements	A generator must ensure that the transport vehicle is correctly placarded prior to transport of hazardous waste.	Any operation where hazardous waste is generated	Title 22 CCR § 66262.33	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Requires preparation of a manifest for transport of hazardous waste off site.	Any operation where hazardous waste is generated	Title 22 CCR §§ 66262.20-66262.23	Applicable	These requirements are applicable if hazardous waste is to be transported.
Federal Hazardous Materials Transportation Law (Title 49 USC §§ 5101-5127) *					
Transportation of hazardous material 49 USC Sections 5101-5127	Sets forth requirements for transporting hazardous waste including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements, and placarding requirements.	Interstate carriers transporting hazardous waste and substance by motor vehicle.	Title 49 CFR §§ 171.2(f), 171.2(g), 172.300, 172.301, 172.302, 172.303, 172.304, 172.312, 172.400, 172.504	Relevant and appropriate	Relevant and appropriate for transporting hazardous materials on site.
Clean Air Act (Title 42 USC § 7401 et seq.) *					
Excavation	Sets forth opacity limitations.	Excavation	BAAQMD Regulation 6, Regulation 6-302	Applicable	These requirements are applicable for excavation activities.
Excavation	Provides requirements for maintaining, covering and stockpiling excavated soil.	Soil stockpile	BAAQMD Regulation 8, Rule 40	Relevant and appropriate	These requirements are applicable for excavation activities.

TABLE B-3: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Appendix B, Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
		INSTITUTIONAL CONTROLS (Land Use Controls)			
California Civil Code*					
Land use controls	Provides conditions under which land use restrictions will apply to successive owners of land.	Transfer property from the Navy to a nonfederal agency	California Civil Code § 1471	Applicable	Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land ... where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety of the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health & Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed at the time of transfer.
California Code Regulations Title 22*					
Land Use Controls	Sets forth recording requirements for land use covenants.	Recorded Land Use Control	Title 22 CCR § 67391.1	Applicable	The substantive provisions of Section 67391.1 are potential ARARs.
California Health and Safety Code*					
Land Use Controls	Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Transfer property from the Navy to a nonfederal agency	*California Health and Safety Code* § 25202.5	Applicable	The substantive provisions of this section are the general narrative standards to restrict "present and future uses of all or part of the land on which the facility ...is located."

TABLE B-3: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix B, Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
INSTITUTIONAL CONTROLS (Land Use Controls) (Continued)					
California Health and Safety Code **(Continued)**					
Land Use Controls	Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of Cal. Health & Safety Code Section 25232(b)(1)(A)–(E)	Transfer property from the Navy to a nonfederal agency.	*California Health and Safety Code* § 25222.1	Applicable	This section is a potential ARAR when the Navy is transferring property to a nonfederal entity. *California Health and Safety Code* § 25222.1 provides the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of the property. The substantive provision of Cal. Health and Safety Code § 25222.1 is the general narrative standard: "restricting specified uses of the property."
Land Use Controls	Provides a process for obtaining a written variance from a land use restriction.	Transfer property from the Navy to a nonfederal entity.	*California Health and Safety Code* § 25233(c)	Applicable	This section is a potential ARAR for institutional controls where the Navy is transferring property to a nonfederal entity. *California Health and Safety Code* Section 25233(c) sets forth substantive criteria for granting variances from the uses prohibited in § 25232(b)(1)(A)-(E) based on specific environmental and health criteria.
City of Alameda Ordinance No. 2824*					
Excavation	Regulates excavation activities in the Marsh Crust area of Alameda Point.	Excavation below threshold depths	City of Alameda Ordinance No. 2824	TBC	Ordinance No. 2824 is a TBC criterion for excavation activities in the Marsh Crust area at threshold depths.

TABLE B-3: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix B, Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Groundwater Treatment					
Safe Drinking Water Act (Title 42 USC § 300f et seq.) *					
	The UIC program prohibits injection activities that allow movement of contaminants into underground sources of drinking water that may result in violations of MCLs or adversely affect health.	An approved UIC program is required in states listed under SDWA Section 1422. Class I wells and Class IV wells are the relevant classifications for CERCLA sites. Class I wells are used to inject hazardous waste beneath the lowermost formation that contains a USDW within 0.25 mile of the well.	Title 40 CFR Section 144.12, excluding the reporting requirements in §§ 144.12(b) and 144.12(c)(1)	Relevant and appropriate	These requirements are relevant and appropriate for ISCO and HRC.
DISPOSAL OF PCB-CONTAMINATED SOIL					
Toxic Substances Control Act (Title 15 USC §§ 2601–2692)*					
Disposal of PCBs	This act regulates the storage and disposal of PCB remediation waste. There are three options: (1) self-implementing on-site cleanup and disposal; (2) performance-based disposal using existing approved disposal technologies; and (3) risk-based disposal. This act is applicable to soils, debris, sludge, or dredged materials contaminated with PCBs at concentrations greater than 50 ppm.	PCB-contaminated soil	Title 40 CFR §§ 761.61(a)(4), (b), and (c)	Relevant and appropriate	This section is relevant and appropriate for the disposal of soil containing PCBs.

TABLE B-3: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Appendix B, Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

1	The Clean Air Act ARARs apply only to the alternatives involving excavation.
*	Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of specific citations are considered potential ARARs
ARAR	Applicable or relevant and appropriate requirement
BAAQMD	Bay Area Air Quality Management District
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOT	U.S. Department of Transportation
DTSC	Department of Toxic Substances Control
HRC	Hydrogen Release Compound
ISCO	In situ chemical oxidation
MCL	Maximum contaminant level
PCB	Polychlorinated biphenyl
ppm	Part per million
SDWA	Safe Drinking Water Act
TBC	To be considered
TSCA	Toxic Substances Control Ac
UIC	Underground injection control
USC	*United States Code*
USDW	U.S. Drinking Water

ATTACHMENT B1
DTSC'S ARARS FOR NAVAL AIR STATION, ALAMEDA

NAS ALAMEDA
SSIC No. 5090.3

Cal/EPA

November 13, 1996

Department of
Toxic Substances
Control

700 Heinz Avenue
Suite 200
Berkeley, CA
94710-2737

Commander
Engineering Field Activity, West
Naval Facilities Engineering Command
Attn: Camille Garibaldi
900 Commodore Drive
San Bruno, California 94066-2402

Pete Wilson
Governor

James M. Strock
Secretary for
Environmental
Protection

Dear Ms. Garibaldi:

APPLICABLE RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE NAVAL AIR STATION, ALAMEDA

The California Department of Toxic Substances Control (DTSC), is in receipt of the Navy's September 12, 1996 letter requesting Applicable or Relevant and Appropriate Requirements (ARARs) from the State of California for the Remedial Investigation and Feasibility Study of the Naval Air Station, Alameda. Enclosed in this document are State laws and regulations that California State Agencies believe may apply to the environmental remediation of Naval Air Station (NAS) Alameda.

As lead regulatory agency and a partner with the Navy and the United States Environmental Protection Agency (EPA) in conducting the remediation of NAS Alameda, we propose that a workshop be scheduled with all responsible State and Federal agencies to establish the ARARs for the NAS Alameda remediation. We also encourage the participation of the Restoration Advisory Board in the workshop. The invitation to participate in the workshop shall include a new solicitation for ARARs from the invited agencies.

We hope you are in agreement with us on this proposal. We anticipate the process to establish ARARs to be a consensual process based on our mutual goals and our partnership as lead agencies responsible for the protection of human health and the environment at NAS Alameda.

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If you wish to discuss this letter, the enclosures, or the proposal, please call me at (510) 540-3809.

Sincerely,

Thomas P. Lanphar
Project Manager
Base Closure Branch

Enclosures

cc's: Ms. Gina Kathuria
Regional Water Quality Control Board
2101 Webster Street, Suite 500
Oakland, California 94612

Mr. Steve Edde
Base Environmental Coordinator
Alameda Naval Air Station
Building 1, Code 52
Alameda, California 94501

Mr. James Ricks
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

Mr. George Kikugawa
Engineering Field Activity, West
Naval Facilities Engineering Command
900 Commodore Drive
San Bruno, California 94066-2402

Ms. Ardella Dailey
Community Co-Chair
Restoration Advisory Board
2200 Central Avenue
Alameda, California 94501

California Laws, Regulations and Policies
for Potential Application at the
Naval Air Station, Alameda
November 12, 1996

I. Generation, Storage and Treatment of Hazardous Waste

A. California Code of Regulations (CCR), Title 22, Chapter 11, Identification and listing of hazardous wastes. Chapter identifies those waste that are subject to regulations hazardous waste and are subject to the notification requirements of Health and Safety Code section 25153.6.

1. Article 1: General; purpose and scope, definition of waste and hazardous waste, exclusions, requirements for recyclable materials and contaminated containers. (66261.1 - 66261.7)

2. Article 2: Criteria for identifying Characteristics of Hazardous Waste. (66261.10)

3. Article 3: Characteristics of Hazardous Waste. (66261.20 - 66261.35)

4. Article 4: List RCRA Hazardous Waste. (66261.30 - 66261.35)

5. Article 5: Categories of Hazardous Waste. (66261.100 - 66261.126)

B. CCR, Title 22, Chapter 12, Standards Applicable to generator of hazardous waste

1. Article 1: Applicability. A generator of a waste must determine if waste is hazardous, and if so obtain an identification number. (66262.10 - 66262.12)

2. Article 2: A generator who transports, or offers for transportation, hazardous waste for off-site transfer, treatment, storage or disposal shall prepare a Manifest. (66262.20 - 66262.23)

3. Article 3: Pre-transport Requirements include packaging, labeling, marking, and placarding. Article also identifies maximum accumulation time for hazardous waste prior to transport to permitted hazardous waste facility.

4. Article 4: Record keeping and Reporting. Establishes requirements for the generator to keep records of manifests and other hazardous waste generation activities.

5. Article 5: Export of Hazardous Waste. This article establishes requirements applicable to exports of hazardous waste to a foreign country from the State. Except to the extent 40 CFR section 262.58 provides otherwise, a primary exporter of hazardous waste shall comply with the requirements of this article.

C. CCR, Title 22, Chapter 14, Standards for Owners and operators of hazardous wastes transfer, treatment, storage and disposal facilities.

1. Article 2: Requirements apply to the owners and operators of hazardous waste facilities. These requirements are for inspection, Personal Training, General Requirements, Location Standards, Construction Quality Assurance Program, Seismic and precipitation design standards. (66264.13 - 66264.25)

2. Article 3: Preparedness and prevention apply to of hazardous waste facility. These are related to design and operation, required equipment, testing and maintenance of equipment, access to communication or alarm system, required aisle space and informing the local authorities. 66264.30 - 66264.37

3. Article 4: Contingency and emergency procedures apply to the owners and operators of hazardous waste facilities. The owners and operators shall have contingency plan for the facility. 66264.52 - 66264.56

4. Article 5: Manifest System, Recordkeeping, and Reporting. The regulations in this article apply to owners and operators of both on-site and off-site facilities. 66264.71 - 66264.77

5. Article 6: Water Quality Monitoring and Response Programs for Permitted Facilities.

6. Article 7: Closure and Post-Closure. Requirements apply to the owners and operators of hazardous waste management facilities. 66264.111 through 66264.120

7. Article 9: Use and management of containers.

8. Article 10: Requirements that apply to the owners and operators of facilities that use Tank Systems[66264.190 - 66264.199]

9. Article 11: Regulations in this article apply to owners and operators of facilities that use surface impoundment to treat, store or dispose of hazardous waste. 66264.221 through 66264.231

10. Article 12: Regulations in this article apply to owners and operators of facilities that store or treat hazardous waste in piles unless exempt. 66264.251 through 66264.259.

11. Article 13: Land Treatment. Applies to treatment or disposal of hazardous waste in land treatment units. Requires demonstration of treatment of waste prior to application. 66264.270 - 66264.283

12. Article 14: This article applies to disposal of hazardous waste in Landfills. 66264.300 - 66264.318

13. Article 15.5: The regulations in this article apply to the construction of Corrective Action Management Units for the management of remediation waste. The DTSC may designate one or more CAMUs. Placement of remediation waste does not constitute land disposal. Temporary units may also be designated for the storage or treatment of remediation waste. 66264.500 - 66264.553

14. Article 27: Regulations in this article apply to owners and operators of facilities that treat, store or dispose of RCRA hazardous waste by process vents associated with distillation, fraction, thin-film evaporation, solvent extraction, or air steam stripping. 66264.1030 through 1035

15. Article 28: Regulations in this article apply to owners and operators of facilities that treat, store or dispose of RCRA hazardous waste, unless exempt. 66264.1052 through 66264.1065

D. CCR, Title 22, Chapter 16, Recyclable Materials (Recyclable hazardous waste)

1. Article 1: Identifies recyclable hazardous waste types including: solvents, petroleum products, pickling liquor, unspent acids, unspent alkalis, unrinsed empty containers. 66266.1 - 66266.2

2. Article 2. This article applies to the generation,

transportation, and facility operation requirements. A generator of a recyclable hazardous material shall comply with all of the hazardous waste requirements except for the Extremely Hazardous Waste Disposal Permit requirements. 66266.3 - 66266.5

E. CCR, Title 22, Chapter 18, Land Disposal Restrictions

1. Article 1: Identifies hazardous waste that are restricted from land disposal. 66268.1 - 66268.9

2. Article 2: Contains schedule for land disposal prohibition and establishment of treatment standards. 66268.10 - 66268.29

3. Article 3: Contains prohibitions on Land Disposal. 66268.30 - 66268.38

4. Article 4: This article identifies treatment standards. 66268.40 - 66268.48

5. Article 5: Identifies prohibitions on storage of waste restricted from land disposal. 66268.50

6. Article 10: Identifies land disposal prohibitions of non-RCRA hazardous waste. 66268.100

7. Article 11: Contains treatment standards for non-RCRA waste categories. 66268.105 - 66268.114

II. Investigation and Remediation of Hazardous Substance Release Sites

A. California Health and Safety Code, Chapter 6.5. Hazardous Substance Account

1. Section 25187: Authorizes the Department to issue corrective action orders.

a. Remedial Action Order, Issued 1988 by the DTSC to the Naval Air Station, Alameda

B. California Health and Safety Code, Chapter 6.8. Hazardous Substance Account

1. Article 2: Definitions

a. 25319.5 "Preliminary Endangerment Assessment". Activity which is performed to determine whether current or past waste management practices have resulted in the release or threatened release of hazardous

substances which pose a threat to public health or the environment. 8-3-89

b. 25323.1 "Removal Action Workplan" A workplan approved by the DTSC or RWQCB to carry out a removal action. Includes: detailed engineering plan, description of onsite contamination, goals, and alternatives removal options that were considered and rejected and the basis for that rejection.

2. Article 5, Section 25355: Authorizes the Department to take over remedial actions at a hazardous substance release site if the Responsible Parties are not in compliance.

3. Article 5, Section 25355.5(a)(1)(B): Identifies requirements

4. Article 5, Section 25356.1, Remedial Action Plans and Removal Action Workplans

   a. Section 25356.1(d): All RAPs must be based upon Section 25350, Subpart F of the NCP and upon factors identified in this subsection.

   b. Section 25356.1(e): Identifies community involvement requirements as they relate to a RAP.

   c. Section 25356.1(f): Authorizes the DTSC to issue the final RAP.

   d. Section 25356.1(h): Exemptions to the RAP requirements.

      (1) Section 25356.1(h)(1): Authorizes the DTSC to prepare a Removal Action Workplan if the estimated cost of the removal action is less than $1,000,000. Identifies community involvement requirements for a RAW.

      (2) Section 25356.1(h)(2): A RAP is not required if the site listed on the National Priority List by the EPA.

      (3) Section 25356.1(h)(3): Authorizes DTSC to waive the RAP requirements in subdivision (d) if certain conditions apply, including estimated costs for remedial action below $2,000,000.

5. Article 5, Section 25358.1: Rights of the DTSC to

take actions at known or suspected hazardous substance release sites.

a. Section 25358.1(b)(1): The DTSC may require any potentially responsible party to furnish information on materials generated, stored, treated or disposed of at a hazardous substance release site

b. Section 25358.1(b)(2) The DTSC may require any potentially responsible party to furnish information on the nature or extent of a release or a threatened release of a hazardous substance at a hazardous substance release site.

6. Article 5, Section 25358.3(a): Authorizes the DTSC to take action in situations posing an imminent and substantial endangerment.

7. Article 5, Section 25358.3(b),(c): Authorizes the DTSC to undertake investigations whenever there has been a release or threat of a release of hazardous substances to the environment.

8. Article 5, Section 25358.4: Requires that all analysis of material to determine if it is hazardous must be done by a state certified and accredited laboratory.

9. Article 5, Section 25358.7: Identifies the right of any interested party who may be affected by remedial actions at a site to become involved in the DTSC decision making process.

10. Article 5, Section 25358.9: Authorizes the DTSC, to the extent consistent with RCRA, to exclude any portion of a response action conducted entirely onsite from the hazardous waste facility permit requirements of Section 25201 if both the following apply:

    a. The removal or remedial action is carried out pursuant to a removal action workplan or a remedial action plan approved by the DTSC.

    b. The RAW or RAP complies with all substantive requirements.

11. Article 5, Section 25359: Authorizes the DTSC to access punitive damages on Responsible Parties who fail to comply with clean-up and remediation orders.

12. Article 5, Section 25359.5: Authorizes the DTSC to issue 'Fence and Post' Orders and establishes their requirements.

13. Article 5, Section 25359.7: Requires a property owner to inform buyers of unmitigated hazardous substance releases on that property.

14. Article 6, Section 25367: Establishes penalties for the making of false claims and misrepresentations related to the release of hazardous substances to the environment.

C. California Health and Safety Code, Chapter 6.6: Safe Drinking Water and Toxic enforcement Act of 1986 (Prop. 65).

1. Section 25249.5: Prohibits the release, to drinking water, of hazardous substances which cause cancer or which have reproductive toxicity.

D. Preliminary Endangerment Assessment Guidelines, January 1995

III. Protection of Air Quality

A. Bay Area Air Quality Management District(BAQMD), Regulation 8, Rule 40, "Aeration of Contaminated Soil and Removal of Underground Storage Tanks:

B. BAAQMD, Regulation 8, Rule 47 "Air Stripping and Soil Vapor Extraction Operations"

IV. Soil Storage

A. Assembly Bill 1060, Richter (Chapter 627, Statutes of 1995): allow generators to hold contaminated soil from site cleanup projects in waste pile for up to one year or 18 months for purposes of offsite transportation, subject to certain conditions.

V. Sediment and Wetland Remediation

A. Endangered and Rare Species Protection

1. California Endangered Species Act of 1973

a. Fish and Game Code Section 2050; 2065

2. Requirements for endangered or rare species: Fish and Game Code Section 1900 et seq.; 2050 et seq. to 2068; 2070; 2080; 2090 et seq. to 2096;

3. Federal Endangered Species Act of 1973

B. Protection of fish and wildlife resources and their habitats

1. Designation of the Department of Fish and Game as trustee for State fish and wildlife resources: fish and Game Code Section 711.7;

2. Possession permit for scientific purposes, etc.: Fish and Game code Section 1002

3. Requirements for releasing substances deleterious to fish and wildlife: fish and Game Code Section 5650 (a)(b),(f): 5651; and 12016;

4. Illegal take of birds and mammals: Fish and Game Code Section 3003;

5. Relevant policies for the general protection and conservation of fish and wildlife resources: fish and Game Code Section 1600; 1700; 1750; 1801; and 2014; Water Code Section 1243

C. Federal Coastal Zone Management Act (16 USC 1456(c)(3)(A)): federal actions or federally funded or approved actions that affect the coastal zone must be consistent with the policies of the San Francisco Bay Conservation and Development Commission's federally approved coastal management program.

1. Elements of the BCDC's coastal management program:

a. McAteer-Petris Act

b. BCDC regulations

c. SF Bay Plan

d. SF Bay Area Seaport Plan: NAS Alameda designated as port priority

2. SFBCDC policies:

a. Fish and Wildlife: to the greatest extent feasible, remaining marshes and mudflats around the Bay, the remaining water volume and surface area of the Bay, and adequate freshwater inflow to the Bay should be maintained. Specific habitats that are needed to prevent the extinction of any species, or to maintain or increase any species that would provide substantial public benefits should be protected, whether in the

Bay or on the shoreline.

b. Water Quality: follow State Water Resources Control Board and the San Francisco Bay Regional Water Quality Control Board. Bay marshes, mudflats, and water surface area and volume should be maintained and, wherever possible, increased.

c. Marshes and Mudflats: Marshes and mudflats are integral part of the Bay tidal system and, therefore, should be protected in the same manner as open water area. Filling and diking should only be allowed for purposes providing substantial public benefits and only if there is no reasonable alternative.

d. Mitigation: Mitigation should consist of measures to compensate for the adverse impacts of Bay fill to the natural resources of the Bay, such as to water surface area, volume, or circulation, and to fish and wildlife habitat or marshes or mudflats. Mitigation is no a substitute for meeting the other requirements of the McAteer-Petris Act concerning fill.

VI. Protection and Remediation of Groundwater

A. CCR, Title 23, Division 3, Chapter 15

1. Governs the discharge of waste to land for treatment, storage, and disposal and establish siting, containment, monitoring, and closure requirements

B. State Water Resources Control Board Resolution Number 68-16 (Statement of Policy with Respect to Maintaining High Quality of Waters in California), October 28, 1968

1. Requires the continued maintenance of high quality waters of the state even where that quality is better than needed to protect beneficial uses, unless specific findings are made.

2. Chemical-specific and action-specific

3. Beneficial uses of groundwater must be defined for NAS Alameda

C. State Water Resources Control Board Resolution 88-63 (Adoption of Policy Entitled "Sources of Drinking

Water"), May 19, 1988

1. The Resolution states that, with few specific exceptions, all surface and groundwaters of the state are to be considered existing drinking water sources except where the TDS is greater than 3000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal

D. State Water Resources Control Board Resolution 92-49 (As Amended on April 21, 1994), (Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304), July 8, 1994

E. Water Quality Control Plan, San Francisco Bay Basin Region, December 1986; and September 29, 1992 Basin Plan Amendments

F. California Code of Regulations, Title 22, Chapter 15, Domestic Water Quality Criteria and Monitoring

1. Article 4: Primary Standard - Inorganic Chemicals. Identifies Maximum Contaminant Levels in drinking water supplies. 64431.0 - - 64437.0

2. Article 4.5: Primary Standard - Organic Chemicals. Identifies Maximum Contaminant Levels in drinking water supplies. 64444.0 - - 64445.2

G. Title 3, Food and Agriculture; Division 6, Pesticides and Pest Control Operations; Chapter 4, Environmental Protection; Subchapter 1, Groundwater; Article 1, Pesticide Contamination Prevention.

1. Lists of pesticides labeled for agricultural, outdoor institutional or outdoor industrial use that contain chemicals designated as having the potential to pollute groundwater.

S[illegible]e ARARs for Solid Waste Disposal Si[illegible]Closure and Postclosure Maintenanc[illegible]

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description	Comment	Associated Site
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17766 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Emergency Response Plan (ERP): potential emergency conditions that may exceed the design of the site and could endanger the public health or environment must be anticipated. Response procedures for these conditions must be addressed in the RD/RA plans.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17767 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Security at Closed Sites: all points of access to the site must be restricted, except permitted entry points. All monitoring, control, and recovery systems shall be protected from unauthorized access.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17773 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Cover: the design and construction of the final cover must meet specific prescriptive standards of 23 CCR 2581(a). These include minimum thickness and quality of the construction material. If the prescriptive standard is not feasible then an engineered alternative that meets the preformance goals (i.e. limiting infiltration, controlling gas emissions, compatibility with reuse) can be proposed.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17774 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Construction Quality Assurance (CQA): a CQA program must be designed and implemented. It must include specific parameters (and for some components specific testing methods) for each component of the final cover	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17776 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Grades: the final grades for the covered landfill must meet grading standards provided in 23 CCR 2581, they must be appropriate to control run-off and erosion.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17777 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Site Face: the design of the final site face must provide for the integrity of the final cover both under static and dynamic conditions	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17778 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Drainage: the design of the final cover must control runon and runoff produced by a 100 year 24 hour storm event and must be prepared according to CQA requirements.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17779 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Slope Protection and Erosion Control: the design and construction of the slopes must protect the integrity of the final cover and minimize soil erosion	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17781 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Leachate Control During Closure and Post Closure: leachate must be monitored, collected, treated, and discarded appropriately.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760. The state does not intend that subsurface leachate monitoring and collecting systems need to be added to existing landfills unless leachate production and/or accumulation is evident.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17783 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Gas Monitoring and Control During Closure and Post Closure: landfill gases must be collected and analyzed; the concentration of combustible gas at the landfill boundary must be 5% or less, trace gases must not be at levels that cause adverse health or environmental impacts.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites

State ARARs for Solid Waste Disposal Site Closure and Postclosure Maintenance

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description	Comment	Associated Site
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17788 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Post Closure Maintenance: the landfill must be maintained and monitored for no less than 30 years following closure.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17796 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Post Closure Land Use: Site Closure Design shall show one or more proposed uses of the closed site or show development that is compatible with open space. Changes in postclosure land use must be approved by the appropriate State agency prior to implementation.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18262.3 Chapter 5, Article 3.4 Closure and Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements for closure plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after January 1, 1988. Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18265.3 Chapter 5, Article 3.4 Closure and Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements for postclosure maintenance plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after January 1, 1988 Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18275 Chapter 5, Article 3.4 Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements to obtain certification that the solid waste disposal sites has closed pursuant to state standards.	Applies to solid waste disposal sites that received waste after January 1, 1988 Relevant and appropriate for closing sites that did not receive waste after January 1, 1988	For closing sites

14 CCR - California Code of Regulations, Title 14 ARAR - applicable or relevant and appropriate requirement ROD - Record of Decision RD/RA - remedial design/remedial action

ATTACHMENT B2
NAVY'S REQUEST FOR DTSC'S CHEMICAL-, LOCATION- AND ACTION-SPECIFIC ARARS FOR OU-1 SITES 6, 7, 8, AND 16

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132 - 5190

5090
Ser 06CA.GC/0269
March 8, 2004

Ms. Marcia Liao
Project Manager
State of California Environmental Protection Agency
Department of Toxic Substances Control
700 Heinz Avenue, Suite 200
Berkeley, CA 94710

Dear Ms. Liao:

Subj: IDENTIFICATION OF STATE "APPLICABLE" OR "RELEVANT AND APPROPRIATE" REQUIREMENTS (ARARS) FOR INSTALLATION RESTORATION SITES 6, 7, 8 AND 16 IN OPERABLE UNIT 1 AT ALAMEDA POINT, ALAMEDA, CALIFORNIA

Pursuant to previous discussions and to accomplish the goals of Alameda Point, Installation Restoration (IR) program, we are hereby requesting that the Department of Toxic Substances Control (DTSC) identify potential State chemical-specific, action specific, and location specific ARARs for Installation Restoration Sites 6, 7, 8, and 16 which are located in Operable Unit 1. Information on these sites can be found in the final *Operable Unit (OU) 1 Remedial Investigation Report*, of February 13, 2004.

In addition, the Department of the Navy (DON) is requesting that the State of California identify any other criteria, advisories, guidance, and proposed standards that the State requests be considered (TBCs) for the above identified sites. Please coordinate responses from all California state agencies.

Timely identification of potential State ARARs is required under Section 121(d)(2)(A) of CERCLA and under the National Contingency Plan (NCP), 40 CFR 300.400(g) and 300.515(d) & (h). Experience to date around the country has shown that a failure to identify ARARs with sufficient precision, early in the process, can cause severe disruptions in timely implementation of remedial action. To ensure timely and complete ARARs identification, please include the following information:

5090
Ser 06CA.GC/0269
March 8, 2004

1. A specific citation to the statutory or regulatory provision(s) for the potential State ARAR and the date of enactment or promulgation.

2. A brief description of why the potential STATE ARAR is applicable or relevant and appropriate to the particular IR Site.

3. A description of how the potential State ARAR would apply to potential remedial action, including: specific numeric discharge, effluent, or emission limitations; hazardous substance/constituent action or cleanup levels; etc., if the State intends to take the position that the potential State ARAR includes such limitations, levels, etc.

4. If the State believes its proposed ARAR is more stringent than the corresponding Federal ARAR, please provide the rationale and technical justification for this position.

5. If the State determines that there is not enough information to fully respond to our request, please identify any additional information that would be required to support identification of State ARARs and their application.

Consistent with 40 CFR 300.515(h)(2), we are requesting that you send a response via first class mail addressed to me and postmarked within 30 calendar days of receipt of this request. If you have any technical questions concerning this request, please call Ms. Glenna Clark at (619) 532-0951. For any legal questions, please call Mr. Rex Callaway, Environmental Counsel at (619) 532-0988.

Sincerely,

GREG A. LORTON
Lead Remedial Project Manager
By direction of the Commander

Copy to:
Ms. Judy Huang
Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

ATTACHMENT B-3
DTSC'S RESPONSE TO BENEFICIAL USE OF GROUNDWATER AT ALAMEDA'S OU-1, SITES 6, 7, 8, AND 16

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

January 3, 2000

Patricia McFadden, Code 5090
Department of the Navy
Engineering Field Activity West
900 Commodore Drive
San Bruno, CA 94066-5006

RE: Revised Draft Determination of the Beneficial Uses of Groundwater at Alameda Point, Alameda

Dear Ms. McFadden:

EPA has reviewed the above referenced document, prepared by Tetra Tech EM Inc, and submitted by the Navy to the regulatory agencies on November 4,1999. The document utilizes much of the information gained from groundwater studies conducted at NAS Alameda over the past five years in an effort to determine beneficial uses of groundwater at the Base, and ultimately the appropriate levels of any necessary remediation. The document has been revised to address the federal criteria EPA uses to protect potential sources of drinking water in addition to using those criteria set by the State of California.

Last May, EPA sent a letter to the Hunter's Point Navy team regarding the determination of the classification of aquifers using federal criteria. The letter also described how other factors may be considered in setting CERCLA clean up standards after the classification of the aquifer is determined. During a meeting with the Alameda Annex a few months ago, with Navy members from NAS Alameda attending the meeting, EPA again described in detail the criteria used in

determining aquifer classification. Therefore, EPA is disappointed to find that the document submitted by the Navy determining the beneficial uses of groundwater at NAS Alameda is not consistent with EPA's guidelines, the letter from Tom Huetteman to EFAWest for the Hunter's Point beneficial use determination and with the focus of the meeting between the Annex and EPA. The Navy must appreciate that the aquifer classification system is a set standard used for all federal environmental programs, and not exclusively reserved for CERCLA. EPA has concluded that in some circumstances other compelling site specific factors may be used in deciding what level of CERCLA cleanup is needed for an aquifer, but these site specific factors in no way affect the classification of an aquifer.

To determine the classification of an aquifer, the two criteria stipulated in the federal classification of drinking water sources are used. While the Navy's document does use the maximum 10,000 ppm TDS and minimum 150 gpd limits, it adds other criteria that are not relevant to the determination of an aquifer classification, although these criteria may be used to make a determination of whether the groundwater in a portion of the Base should be considered a potential drinking water source for CERCLA cleanup decisions. The results of the significant information presented in the document may be summarized using the steps outlined below.

The first step in establishing groundwater clean up is to determine the classification of the aquifer in question. It is important to understand that if an aquifer meets the State of California criteria, it will de facto meet the federal criteria. However, the reverse is not true (which means that the flow chart in Figure ES-1 is incorrect going from Step 1 to Step 2). Even if the aquifer exceeds the State criteria of 3,000 ppm TDS, if the aquifer is below 10,000 ppm TDS and yields 150 gpd, it is a Class II aquifer.

Based on Figure 3-2, the majority of NAS Alameda can be classified as a Class II aquifer under the federal classification criteria. After the aquifers have been classified, the flexibility given in the NCP preamble allows site specific factors to be acknowledged in order to determine whether all or part of the aquifer should be considered a potential drinking water source for making CERCLA cleanup decisions. The document divides the aquifer up into the Western, Central and

Southeastern portions. Each portion may be evaluated as a potential drinking water source for CERCLA cleanup decisions as described in the following sections.

1. Western Portion:

Based on TDS and yield criteria, the groundwater in the western portion of the Base beneath Sites 1, 14, and 15 is classified as a Class II aquifer and groundwater beneath Site 2 is classified as Class III. Other criteria may be evaluated to determine whether the Class II groundwater in this area should be considered a potential drinking water source. The NAS Alameda BCT have concluded that the groundwater beneath Sites 1, and 14 is unlikely to be used as a potential drinking water source due to the location of the landfill over the aquifer and the reuse restrictions that will be inherent with turning Site 1 and 14 into a golf course. At these sites, and also at Site 2, the impact of the groundwater migrating out to the Bay and any inhalation and dermal threats posed by digging into the groundwater in the course of construction work must be evaluated for remediation purposes. At Site 15, there appears to be no indication of groundwater contamination and so no remediation of groundwater will be necessary.

II. Central Portion:

Based on TDS and yield criteria the groundwater beneath the central portion of the Base is classified as a Class II aquifer. Reuse plans by the City of Alameda call for mixed use for this part of the Base and taking a conservative approach means that a residential scenario must be applied for risk assessments over this area. It is already apparent that the levels of contamination in the groundwater beneath IR Sites 5 and 10 are at levels that are unacceptable for human health based on a residential and industrial scenario using such potential exposure pathways as inhalation from vapors from groundwater into soils and dermal contact and inhalation exposure from any moderately deep digging. Therefore the groundwater in this area will need active remediation of some sort. The question remains on whether the groundwater in this area should be considered a potential drinking water source, making MCLs apply as clean up ARARs. Based on the shallow depth of the aquifer in this area, the likelihood of salt water intrusion (based on groundwater flow directions) if any significant pumping takes place, and the fact that no wells currently exist within or close to this area, it seems unlikely that groundwater in this area will be

a potential source of drinking water in the future. EPA would concur with non-MCL cleanup levels for this area on condition that any contaminated groundwater beneath Sites 5, 6, 8, 10 and 12 is remediated to levels such that the threats posed by such exposures as inhalation (groundwater vapors into soils and from soils into residences), dermal contact, and those associated with irrigation use are eliminated, and any significant ongoing degradation of the groundwater from contaminant migration is prevented.

III. Southeastern portion:

In the southeastern portion of the Base, the groundwater meets the TDS and yield criteria and is classified as a Class II aquifer. It appears from Figure 1-2, that existing potential domestic supply wells are located immediately adjacent to this portion of the Base. The existence of these wells, in addition to the classification of the aquifer, make the groundwater in this area a potential and possibly current drinking water source. This determination means that contaminated groundwater beneath and migrating from Sites 3, 4, 9, 11, 13, 16, 19, 21, 22, and 23 must be remediated to clean up levels that meet MCLs.

EPA would also like to supply some clarification on the concept of treatment feasibility as it applies to groundwater remediation. (1) Stating that because the groundwater is above the SMCL of 500 ppm TDS and therefore the water can't be used for drinking purposes is not only incorrect (e.g. bottled mineral water often exceeds 500 ppm TDS), but also misses the point that groundwater is often and routinely treated to bring TDS levels down to the SMCL. Groundwater that has TDS levels just under 10,000 ppm (i.e. 9,000 ppm) can and is treated to below 500 ppm TDS levels for drinking water in parts of the U.S.A. In fact some parts of the country have found that treating sea water (around 35,000 ppm TDS) is a cost effective means of providing water to the inhabitants of certain areas. (2) A condition for an ARAR waiver for groundwater remediation is that existing technology is unable to treat the water to MCLs, which is very unlikely to be the case for NAS Alameda. Indeed, the many treatability studies and pilot projects performed on the groundwater at the Base have shown the opposite to be true, i.e. that the types of contaminants, the aquifer conditions and the depth of groundwater lend themselves very well to many types of remediation and source reduction. (3) It is important to be aware of

the distinction between concentrations of ambient contaminants and concentrations of anthropogenically released contaminants. The aquifers do not need to be remediated beyond the levels of ambient concentrations for inorganic contaminants. However, organic contaminants, pesticides and PCBs need to be remediated to the appropriate CERCLA clean up levels. In other words, even if high levels of inorganics are naturally occurring in the aquifer, it does not preclude the aquifer from being considered a potential drinking water source and does not reduce the level of clean up needed for all other anthropogenically placed contaminants present within the aquifer.

Aside from the issues already mentioned, some remaining items must also be addressed. The groundwater beneath Site 25 is not shown on the TDS maps and must be included for beneficial use determinations. The other issue that needs to be resolved is how the beneficial use determinations outlined in this letter for each portion of the Base should be documented. The most recently submitted document on beneficial use at NAS Alameda is not satisfactory and EPA is reluctant to request a further round of revisions on this document. Instead, we propose that the Feasibility Studies describe the groundwater classification and the applicable CERCLA cleanup decisions for the sites within each FS, as well as the remedial alternatives that will achieve the desired level of cleanup. Alternatively, the determination of beneficial uses of groundwater may be incorporated into a Technical Memorandum, with the contents of this letter forming the basis of the memo.

If you have any questions regarding this letter, please contact me at (415) 744-2367.

Sincerely,

Anna-Marie Cook

Anna-Marie Cook
Remedial Project Manager

cc list next page

ATTACHMENT B-4
WATER BOARD'S CONCURRENCE FOR DRINKING WATER EXEMPTION FOR GROUNDWATER WEST OF SARATOGA STREET

California Regional Water Quality Control Board
San Francisco Bay Region

Winston H. Hickox
Secretary for Environmental Protection

Internet Address: http://www.swrcb.ca.gov
1515 Clay Street, Suite 1400, Oakland, California 94612
Phone (510) 622-2300 ∃ FAX (510) 622-2460

Gray Davis
Governor

Date: JUL 2 1 2003
File No. 2199.9285 (JCH)

Ms. Glenna M. Clark
Remedial Project Manager
Department of the Navy
Southwest Division
Naval Facilities Engineering Command
1230 Columbia Street, Suite 1100
San Diego, California 92101-8517

SUBJECT: CONCURRENCE THAT GROUNDWATER MEETS THE EXEMPTION CRITERIA IN THE STATE WATER RESOURCES CONTROL BOARD SOURCE OF DRINKING WATER POLICY RESOLUTION 88-63, AND SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD RESOLUTION 89-39 FOR GROUNDWATER WEST OF SARATOGA STREET AT ALAMEDA POINT, CITY OF ALAMEDA, ALAMEDA COUNTY

Dear Ms. Clark:

This is in response to the U.S. Navy's July 10, 2003, request for an exemption from the municipal and domestic water supply designation in accordance to San Francisco Bay Regional Water Quality Control Board (Regional Board) Resolution 89-39 and State Water Resources Control Board (State Board) Source of Drinking Water Policy, Resolution 88-63.

Staff has reviewed the accompany report titled "Determination of The Beneficial Uses of Groundwater, Alameda Point, Alameda, California" (Report) dated July 2000, and finds that the quality and nature of the groundwater in the first and second water bearing zones beneath Alameda Point west of Saratoga Street are such that these waters are not potential sources of drinking water pursuant to State Board Resolution No. 88-63 and Regional Board Resolution 89-39. Furthermore, as the U.S. Navy demonstrated in the Report, the artificial land surface west of Saratoga Avenue lies entirely within what was the San Francisco Bay prior to the early 1900's.

Staff concurs with the U.S. Navy that the groundwater in the first and second water bearing zones west of Saratoga Avenue are not potential sources of drinking water, based on the high total dissolved solids (TDS) data. However, the U.S. Navy must consider all other potential beneficial uses of the groundwater west of Saratoga Avenue as outlined in the 1995 Water Quality Control Plan, San Francisco Bay Regional Board.

Hydrogeology of the Subsurface at Alameda Point west of Saratoga Avenue

There are two water-bearing zones at Alameda Point west of Saratoga Avenue. The first is an unconfined aquifer composed of artificial fill material from just below ground surface to the top of the Bay Sediment Unit. The natural groundwater gradient for the shallow fill slopes toward the Bay. The Bay Sediment Unit west of Saratoga Avenue is about 10 to 110 feet thick. The second water-bearing zone is a semi-confined aquifer composed of the lower portion of the Bay Sediment Unit, the Merrit Sand Formation (where present), and the upper unit of the San Antonio Formation. Beneath the second water bearing zone is the Alameda Formation.

Total Dissolved Solids Levels in the Shallow Fill Aquifer at Alameda Point west of Saratoga Avenue

The TDS exemption criteria in the State Board's Sources of Drinking Water Policy, Resolution No. 88-63, states that all groundwater in California are considered a potential drinking water source unless the TDS levels exceed 3,000 mg/L, and it is not reasonably expected by the Board that the groundwater could supply a public water system. The first and second water bearing zones at Alameda Point west of Saratoga Avenue contain water with high TDS contents due to naturally occurring saltwater intrusion. Information submitted by the U.S. Navy indicates that the maximum TDS concentrations in the first water bearing zone range from 80 – 52,000 mg/L and the maximum TDS concentrations in the second water bearing zone range from 1,600 – 78,600 mg/L.

Additional Issues

While the U.S. Navy has adequately demonstrated that the groundwater in the first and second water bearing zones are brackish and their TDS concentrations exceed the State Board's Sources of Drinking Water Policy exemption criteria, there are several other issues that must still be addressed. Other potential groundwater beneficial uses as outlined in the 1995 Basin Plan (Table 2-9), still apply to Alameda Point west of Saratoga Avenue (i.e. agricultural supply, industrial process supply, and industrial service supply).

Pursuant to State Board Resolution 92-49, the U.S. Navy must still demonstrate that 1) adequate source removal has occurred, 2) the plume or plumes have been adequately defined both laterally and vertically, and 3) a long-term monitoring program is established to verify that the plume or plumes are stable and will not impact ecological receptors or human health (e.g. from volatilization into trenches and buildings).

Please contact me at (510) 622-2363 or email jch@rb2.swrcb.ca.gov if you have any questions.

Very Truly Yours,

Judy C. Huang, P.E.
Associate Water Resource Control Engineer
Groundwater Protection and Waste Containment Division

cc:

Mr. Mark Ripperda
Project Manager
U.S. EPA Region IX (SFD-8-2)
75 Hawthorne Street
San Francisco, CA 94105-3901

Ms. Marcia Liao
Department of Toxic Substances Control
700 Heinz Avenue, Suite 200
Berkeley, CA 94710

Mr. Charlie Huang
Cal EPA
Department of Fish and Game
1700 K Street, Room 250
P.O. Box 9444204
Sacramento, CA 94244-2090

Ms. Elizabeth Johnson
Alameda Reuse and Redevelopment Authority
950 West Mall Square, Building 1
Alameda, CA 94501

Dr. Jim Polisini
Cal EPA/DTSC
1011 Grandview Dr.
Glendale, CA 91201

N00236.003008
ALAMEDA POINT
SSIC NO. 5090.3.A.

SENSITIVE RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT FOR PUBLIC VIEWING

PRIVATE CITIZEN'S HOME ADDRESS HAS BEEN REDACTED IN ACCORDANCE WITH THE PRIVACY ACT

QUESTIONS MAY BE DIRECTED TO:

DIANE C. SILVA
RECORDS MANAGEMENT SPECIALIST
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

Mr. Bert Morgan
RAB Community Co-Chair

Ms. Lea Loizos
ARC Ecology
833 Market Street, #1107
San Francisco, CA 94103

Mr. Steve Eddie
BRAC
Environmental Liaison
Navy SWDIV Detachment
410 Palm Avenue, Building 1, Suite 161
Treasure Island
San Francisco, CA 94130-1802

Mr. Mike McClelland, SWDIV
1230 Columbia Street, Suite 1100
San Diego, California 92101-8517

Mr. Dan Baden
IT Corporation
4005 Port Chicago Hwy.
Concord, CA 94520

Ms. Beth Kelly
Tetra Tech EMI
10670 White Rock Road, Suite 100
Rancho Cordova, CA 95670

California Environmental Protection Agency

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Web-site at http://www.swrcb.ca.gov.

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C-6A Alternative 2 Site 16, Plume Boundary Delineation, MNA, and LUCs, Total Remedial Cost

C-6B Alternative 3A Site 16, Plume Boundary Delineation, ISCO Treatment, MNA, and LUCs, Total Remedial Cost

C-6C Alternative 3B Site 16, Plume Boundary Delineation, HRC Treatment, MNA, and LUCs, Total Remedial Cost

C-6D Alternative 4A Site 16, Plume Boundary Delineation, ISCO Treatment to Unrestricted Reuse, MNA, and LUCs, Total Remedial Cost

C-6E Alternative 4B Site 16, Plume Boundary Delineation, HRC Treatment to Unrestricted Reuse, MNA, and LUCs, Total Remedial Cost

ACRONYMS AND ABBREVIATIONS

µg/L	Microgram per liter
bgs	Below ground surface
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
gpm	Gallon per minute
HRC	Hydrogen releasing compound
IC	Institutional control
ISCO	In situ chemical oxidation
ISOTEC	In-Situ Oxidative Technologies, Inc.
LUC	Land use control
LUCIP	Land use control implementation plan
MCL	Maximum contaminant level
MNA	Monitored natural attenuation
O&M	Operation and maintenance
PCB	Polychlorinated biphenyl
POTW	Publicly owned treatment works
PVC	Polyvinyl chloride
QA/QC	Quality assurance and quality control
RACER™	Remedial Action Cost Engineering and Requirements System™
RCRA	Resource Conservation and Recovery Act
SVOC	Semivolatile organic compound
TPH	Total petroleum hydrocarbons
UST	Underground storage tank
VOC	Volatile organic compound

C1.0 INTRODUCTION

This appendix describes each alternative and its associated components and the assumptions used to develop the cost estimate. Following the text are the backup spreadsheets and specific assumptions used to estimate the costs associated with each alternative proposed for cleanup activities at Sites 6, 7, 8, and 16.

C2.0 PURPOSE OF ESTIMATES

Cost estimates are developed during the feasibility study (FS) primarily for the purpose of comparing remedial alternatives during the remedy selection process, not for establishing project budgets or negotiating Superfund enforcement settlements. During remedy selection, the cost estimate is typically carried over from the FS to the proposed plan for public comment. The cost estimate in the record of decision reflects any changes to the remedial alternative that occurs during the remedy selection process as a result of new information or public comment (U.S. Environmental Protection Agency [EPA] 2000).

Cost estimates developed during the detailed analysis phase are used to compare alternatives and support remedy selection. The National Oil and Hazardous Substances Pollution Contingency Plan includes the following language in its description of the cost criterion for the detailed analysis and remedy selection (EPA 2000).

> "The types of costs that shall be assessed include the following: (1) Capital costs, including both direct and indirect costs; (2) Annual operations and maintenance costs; and (3) Net present value of capital and O&M costs (40CFR 300.430 (e)(9)(iii)(G))."

C3.0 TYPES OF COST ESTIMATING METHODS

The cost estimates presented in this appendix were developed using both detailed and parametric approaches, both of which are accepted by EPA, as described below.

The detailed approach estimates cost on an item-by-item basis. Detailed methods typically rely on compiled sources of unit cost data for each item, taken from either a built-in database (if part of a software package, for example) or from other sources (for example, cost estimating references). This method, also known as "bottom up" estimating, is used when design information is available.

The parametric approach relies on relationships between cost and design parameters. These relationships are usually statistically based or model-based. Statistically based approaches rely on scaled-up or scaled-down versions of projects where historical cost data are available. Model-based approaches use a generic design linked to a cost database and adjusted for site-specific information. This method, also know as "top down" estimating, is used when design information is not available (EPA 2000).

C4.0 METHODOLOGY

Cost estimates for this FS report were prepared in accordance with the "Guide for Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000). The Remedial Action Cost Engineering and Requirements System™ (RACER™) 2003 was the primary source of cost data (Earth Tech 2003). Costs for unique line items not included in RACER™ were based on vender quotes. Excel® spreadsheets were used to tabulate costs and calculate net present values in 2004 dollars; RACER outputs are presented in 2003 dollars.

C4.1 DESCRIPTION OF REMEDIAL ACTION COST ENGINEERING AND REQUIREMENTS SYSTEM™

RACER™ is a tool used to estimate costs for all phases of remediation (Earth Tech 2003). RACER™ can be used to evaluate costs for interim studies and measures, remedial design and corrective measures design, remedial action and corrective action, operations and maintenance (O&M), long-term monitoring, and site closeout. The system was originally developed in 1991 under funding from the U.S. Department of the Air Force. Numerous revisions and updates have been incorporated through several releases since RACER™'s introduction.

RACER™ is a parametric cost modeling system that uses a patented methodology for estimating costs. The RACER™ cost database is a duplicate of the Environmental Cost Handling Options and Solutions cost database, which was published by the R.S. Means Company. RACER™ cost estimates are based on generic engineering solutions for environmental projects, technologies, and processes. Historical project information, industry data, government laboratories, construction management agencies, vendors, contractors, and engineering analysis were used to develop generic solutions to engineering problems. Cost estimates in RACER™ are tailored specifically to each project by adding site-specific parameters to reflect project-specific conditions and requirements. The tailored design is then translated into specific quantities of work, and the quantities of work are priced using current price data.

C4.2 USER-DEFINED COSTS

Because of unique characteristics for some elements of the remedial alternatives, it was not always possible to develop RACER™ cost estimates (Earth Tech 2003). The costs of these elements were estimated using vendor quotes and were evaluated and adjusted as necessary to account for inflation.

C5.0 COST ESTIMATE COMPONENTS

Cost estimates for the remediation alternatives include capital costs, annual O&M costs and/or periodic costs, cost of capital, net present value of O&M costs and/or periodic costs, contingency allowances, and escalation costs for dated data. Each of these elements is discussed in further detail below.

C5.1 CAPITAL COSTS

Capital costs include direct and indirect costs. Costs incurred for equipment, material, labor, construction, development and implementation of remedial technologies are included as direct costs. Indirect costs include health and safety items, site supervision, engineering, overhead and profit, and start up. Indirect costs are included in the estimate as either a separate line item or as a percentage of the direct capital cost.

C5.2 ANNUAL OPERATION AND MAINTENANCE AND/OR PERIODIC COSTS

Annual O&M costs include costs incurred after construction. These costs are necessary to assure the effectiveness of a remedial action. Annual O&M costs typically include power, operating labor, consumable materials, purchased services (for example, laboratory analyses), equipment replacement, maintenance, sampling, permit fees, annual reports, and site reviews.

Periodic costs occur once every few years or once during the entire O&M period. Examples include 5-year reviews, equipment replacement, site closeout, and remedy failure and replacement.

C5.3 PRESENT VALUE ANALYSIS

Remedial action projects typically involve construction costs that are expended at the beginning of a project (capital costs) and costs in subsequent years (operation and maintenance and/or periodic costs). Present value analysis is a method to evaluate expenditures which occur over different periods of time. This standard methodology allows for cost comparisons of different remedial alternatives on the basis of a single cost figure for each alternative. This single value, referred to as the present value, is the amount needed to be set aside at the initial point in time (base year) to assure that funds will be available in the future as they are needed. Present value analysis uses a discount rate and period of analysis to calculate the present value of each expenditure.

C5.3.1 Discount Rate

A discount rate is similar to an interest rate and is used to account for the time value of money. A dollar is worth more today than in the future because, if invested in an alternative use today, the dollar would earn interest. If the capital were not employed in a specific use, it would have a productivity value in alternate uses. The choice of a discount rate is important because the selected rate directly impacts the present value of a cost estimate, which is then used in making a remedy selection decision.

EPA policy on the use of discount rates for remedial investigation and FS cost analysis is stated in the preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (Title 55 *Federal Register* Section 8722) and in Office of Solid Waste and Emergency Response Directive 9355.3-20 (EPA 1993). Discount rates used in economic analysis by the federal

government are specified in the Office of Management and Budget Circular A-94. The current discount rate for a 30-year stream of payments is 3.5 percent (Office of Management and Budget 1993).

C5.3.2 Present Value

The PV of a series of equal annual future payments such as annual O&M payments is calculated using the equation below.

$$PV = \sum_{t=1}^{n} \frac{x_t}{(1+i)^t}$$

where

PV	=	Present value
x_t	=	Payment in year t (t = 0 for present or base year)
i	=	Discount factor
t	=	Number of years following construction that expenditure start
n	=	Number of years that the stream of equal annual future payments will run

The present value of a single periodic future payment is calculated using the equation below.

$$PV = \frac{x_t}{(1+i)^t}$$

where

PV	=	Present value
x_t	=	Payment in year t (t = 0 for present or base year)
i	=	Discount factor
t	=	Number of years following construction that expenditure occur

The present value of a remedial alternative represents the sum of the present values of all future payments associated with the project. The present value for this cost estimate is determined using 2004 dollars (see Section C5.5, Escalation Costs, for adjustment of capital costs).

C5.4 CONTINGENCY ALLOWANCES

Contingency is factored into a cost estimate to cover unknowns, unforeseen circumstances, or unanticipated conditions that are not possible to evaluate from the data on hand at the time the estimate is prepared. The two main types of contingency are scope and bid. Scope contingency covers unknown costs resulting from scope changes that may occur during design. Bid contingency covers unknown costs associated with constructing or implementing a given project scope. Exhibit 5-6 of EPA's guide for developing cost estimates for FSs gives some expected ranges in contingency fees for certain remedial technologies (EPA 2000).

C5.5 ESCALATION COSTS

RACER™ output costs are expressed in 2004 dollars (Earth Tech 2003). Escalation costs reflect the increase in project costs over time as a result of inflation. An inflation rate of 1.0392 percent was assumed to bring costs into 2004 (McGraw Hill Construction 2004).

C6.0 INDIVIDUAL COST ESTIMATE ASSUMPTIONS

This section identifies the assumptions and parameters used in developing cost estimates for remediation at Sites 6, 7, 8, and 16. Tables C-1 and C-2 present the total remedial costs for soil and groundwater at Site 6, respectively. Table C-3 presents the total remedial costs for soil at Site 7. Table C-4 presents the total remedial costs for Site 8. Tables C-5 and C-6 present the total remedial costs for soil and groundwater at Site 16, respectively.

C6.1 SITE 6

The following subsections briefly describe soil and groundwater alternatives proposed for Site 6 and the assumptions used in preparation of the costs.

C6.1.1 Costs and Assumptions Associated with Remedial Alternatives for Site 6 Soil

C6.1.1.1 Alternative 2: One-Time Soil Sampling and Institutional Controls

The major components of Alternative 2 for Site 6 soil are (1) sampling of soil surrounding oil-water separator (OWS)-040A and OWS-040B to gather data on extent and depth of contamination, (2) institutional controls (IC) to prohibit excavation of soil adjacent to OWS-040A and OWS-040B without regulatory approval for 100 years. Remedial activities for soils at different sites may be combined into one action to take advantage of one mobilization, demobilization, and possible economies of scale. These potential cost savings were not incorporated into Site 6 cost estimates because of the uncertainty associated with the timing of soil and groundwater remediation at Site 6 in relation to each other or other sites. Table C1-A presents the costs for Alternative 2 for Site 6 soil.

Sampling Activities

- Two technicians will drive approximately 50 miles each way to Site 6.
- Data management and reporting costs are included in estimate.
- Nine samples will be collected near each OWS (-040A and -040B). One groundwater sample and eight soil samples will be collected from 2.5 feet below ground surface (bgs) and 5 feet bgs at four sampling locations. Samples will be analyzed for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides and polychlorinated biphenyls (PCB), total petroleum hydrocarbons (TPH), and metals. Quality assurance/quality control (QA/QC) samples will be collected at 10 percent.
- Samples will be collected by direct-push technology.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated and validated and submitted electronically.

Institutional Controls

- A land use control implementation plan (LUCIP) and deed restrictions will be prepared.
- Environmental restrictions in deed will be registered and filed.
- A drive by inspection will be conducted annually for 100 years to determine if site activities comply with ICs.
- Contingency (25 percent) and Navy oversight (25 percent) are included in all ICs.

C6.1.1.2 Alternative 3: One-Time Soil Sampling, Excavation, and Off-Site Disposal

The major components of Alternative 3 for Site 6 soil are (1) sampling of soil surrounding OWS-040A and OWS-040B to gather data on extent and depth of contamination, (2) excavating the soil source area and OWSs, and (3) disposing of contaminated soil and OWSs at a permitted off-site facility. Remedial activities for soils at different sites may be combined into one action to take advantage of one mobilization, demobilization, and possible economies of scale. These potential cost savings were not incorporated into Site 6 cost estimates because of the uncertainty associated with the timing of soil and groundwater remediation at Site 6 in relation to each other or other sites. Table C-1B presents the costs for Alternative 3 for Site 6 soil.

The list below provides the assumptions made for Alternative 3 for Site 6 soil.

- Site 6 is accessible, and no specialized equipment or services (aside from those described in this FS report) would be necessary to gain access to the site.
- All activities would be performed using EPA Level D personal protective equipment.
- Soil excavation boundary is assumed to be 15 feet by 15 feet by 5 feet deep.

Pre-Excavation Sampling

- Two technicians will drive approximately 50 miles each way to Site 6.
- Data management and reporting costs are included in estimate.
- Nine samples will be collected near each OWS (-040A and -040B). One groundwater sample and eight soil samples will be collected from 2.5 feet bgs and 5 feet bgs at four sampling locations. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. QA/QC samples will be collected at 10 percent.
- Samples will be collected by direct-push technology.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated and validated and submitted electronically.

Excavation

- The excavation area will be assessed for underground utilities using ground-penetrating radar; one crew for 1 day.
- Excavation volume is approximately 85 cubic yards (in place), or approximately 125 tons (see Figure 5-1 of the FS report).
- No rocks are present that will require ripping or blasting; no drums will need to be removed; no dewatering is required.
- No sheeting is required.
- The soil type is sand-silt/sand-clay mixture.
- A centralized area at Site 6 would be used for temporary soil storage, segregation, and characterization sampling.
- None of the excavated soil will be used as backfill.
- Volume expected to be sent off-site for disposal is 105 cubic yards (based on 25 percent bulking factor), or approximately 125 tons, for Site 6. The expected volume includes two OWSs, which will be broken down and transported with the soil.

- Confirmation samples will be collected from the sidewalls and at depth in the excavations of OWS-040A and OWS-040B (five per excavation) and from groundwater (one per excavation). Confirmation samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. QA/QC samples will be collected at 10 percent.

- Backfill material will come from an off-site source. The original asphalt surface will be restored. Original grading would be maintained and, if appropriate, increased to facilitate surface runoff.

- Original grading would be maintained and, if appropriate, increased to aid surface runoff. Existing cover and replacement cover are asphalt.

Decontamination Facilities

- A centralized decontamination area for equipment and personnel will be constructed at Site 6 to be used for decontamination activities for all four sites. Wastewater generated from the decontamination area would be sampled and, if acceptable, transported for disposal to the wastewater collection system operated by the local publicly owned treatment works (POTW). Wastewater failing to meet the POTW disposal requirements would require off-site disposal at an appropriate permitted facility.

- Equipment decontamination operations will last 4 week.

Residual Waste Management

- A vendor quote was obtained for hauling and disposal. The cost will be $55 per ton for disposal to a Class II facility, $80 per ton for disposal to a Class I facility provided waste is not Resource Conservation and Recovery Act (RCRA) waste, and $190 for disposal of RCRA waste at a Class I facility. The quote includes transportation and disposal and associated taxes. The quote was obtained on October 12, 2004, from Stuart Levang, Operations Manager at DenBeste Transportation, Inc., 820 DenBeste Court, Windsor, California 95492, (800) 838-1477.

Other

- Professional labor management percentages are calculated by RACER™ based on the total capital cost of the project.

- Professional labor costs include preparation of the work plan and the health and safety plan, as well as technical oversight during planning, implementation, and permitting. A contingency factor of 25 percent was applied based on EPA guidance (EPA 2000).

- Fencing (280 feet) will be in place as a boundary for the excavation area. One hazardous waste sign will be placed on each side of the fenced area.

C6.1.2 Costs and Assumptions Associated with Site 6 Groundwater

This section provides the assumptions used to prepare costs for the remedial alternatives proposed for groundwater at Site 6. The proposed remedial alternatives are summarized in Section 5.3 of the FS report, and detailed descriptions and analyses of the remedial alternatives are presented in Section 5.6 of the FS report. Tables C-2T presents a detailed cost summary for the screened technologies.

As discussed in Section 5.3 of the FS report, a preliminary screening of technologies and response actions was conducted for Site 6, and three groundwater treatment technologies were retained, including air sparging, in situ chemical oxidation (ISCO), and enhanced bioremediation with hydrogen releasing compounds (HRC). The retained technologies were screened further (secondary screening of technologies) using the following criteria: implementability, cost, and effectiveness. Of these five technologies, ISCO and HRC were considered the most suitable for Site 6. Using these technologies and other general response actions, five remedial alternatives were developed and presented in Section 5.6 of the FS report. Section C6.1.2.1 presents the general assumptions used for costs during the secondary screening process, and Section C6.1.2.2 describes the assumptions used to develop the cost for the screening of technology for Site 6.

C6.1.2.1 General Assumptions Used During the Secondary Screening of Technologies

The following assumptions were used to develop costs for the secondary screening of treatment technologies for Site 6. For this screening, it was assumed that each technology would be implemented until the maximum contaminant level (MCL) for vinyl chloride (0.5 microgram per liter [µg/L]) is obtained. The general assumptions below were made for Site 6.

- Remediation goals are based on achieving inhalation goals.
- One plume at Site 6 requires treatment. The plume is approximately 129,625 square feet in size. Depth to groundwater at Site 6 is approximately 5 feet bgs. Groundwater contamination extends from the top of the water table to approximately 10 feet bgs.

Project management, remedial design, construction oversight, planning documents, reporting, as-built drawings, public notice, and permitting labor are costs are based on a percentage of total cost as assumed in RACER™ (Earth Tech 2003).

C6.1.2.2 Assumptions for Technology Screen at Site 6

This section summarizes assumptions for the technologies screened at Site 6, including (1) air sparging, (2) ISCO using modified Fenton's Reagent, and (3) in situ HRC. Table C-2T presents the costs for the screening of technologies at Site 6.

Site 6 – Air Sparging

- Air sparing costs are based on outputs from RACER™.
- One hundred thirty-five (135) soil vapor extraction (SVE) wells will be installed with a radius of influence of 18 feet bgs. Although the vadose zone is from 0 to 5 foot bgs, no short-circuiting is assumed based on successful soil vapor extraction systems previously installed at the site by the remedial action contractor.
- Four hundred thirteen (413) sparge wells will be installed to an average depth of 10 feet bgs.
- The radius of influence for each sparge point is approximately 11 feet bgs.
- Six wells will be installed to 10 feet bgs to monitor the effectiveness of the remediation. The wells will be sampled quarterly for 2 years.
- The remediation timeframe for air sparging will be approximately 2 years.

Site 6 – In situ Chemical Oxidation Using Modified Fenton's Reagent

- ISCO costs are primarily based on a vendor quote received from In-Situ Oxidative Technologies, Inc. (ISOTEC) (2004).
- Pilot scale test will be conducted before full-scale design.
- Primary treatment will require three injection events. One direct-push injection point will be required per 707 square feet of plume for 50 percent of the original plume area. Primary treatment will require 6 months to 1 year to complete. Three rounds of sampling will be performed following primary treatment to measure results. Samples will be analyzed for VOCs and monitored natural attenuation (MNA) parameters.
- Follow-up treatment will require three injection events. One direct-push injection point will be required per 707 square feet of plume. Follow-up treatment will require 6 months to 1 year to complete. One round of sampling will be performed after the follow-up treatment to measure results. Samples will be analyzed for VOCs and MNA parameters.
- Six wells will be installed to 10 feet bgs to monitor the effectiveness of the remediation. The wells will be monitored quarterly for the duration of treatment, or for 2 years.
- The remediation timeframe for ISCO is 2 years.

Site 6 – In Situ Hydrogen Releasing Compounds

- HRC material costs are primarily based on vendor quotes received from Regenesis, Inc. (2004). Drilling costs associated with in situ HRC treatments are primarily based on vendor quotes receive from ResonantSonic International (2004).
- A pilot-scale test will be conducted prior to a full-scale design.
- Two injection events (primary treatment and 50 percent follow-up treatment) will be required to achieve treatment goals.
- Six wells will be installed to 10 feet bgs to monitor the effectiveness of the remediation. The six wells will be monitored quarterly for 3 years. Samples will be analyzed for VOCs and MNA parameters.
- The remediation timeframe for in situ HRC is 3 years.

C6.1.3 Costs and Assumptions Associated with Site 6 Groundwater Remedial Alternatives

C6.1.3.1 Alternative 2: Plume Boundary Delineation, Monitored Natural Attenuation, and Land Use Controls

The major components of Alternative 2 for Site 6 groundwater are (1) sampling of Site 6 groundwater to further delineate the VOC plume; (2) monitoring the VOC plume for 30 years; and (3) land use controls (LUC) to restrict domestic use of groundwater, prevent installation of drinking water wells, and require installation of vapor removal system under Building 41. Table C-2A presents the costs for Alternative 2 for Site 6 groundwater.

Plume Boundary Delineation

- Soil and groundwater samples will be collected by direct-push technology to further delineate the VOCs plume.
- Two technicians will drive approximately 100 miles round trip to Site 6 to collect groundwater samples.
- Sampling includes QA/QC and data management and reporting.
- Samples will be collected from 16 locations on 100-foot centers at Site 6.
- Samples will be collected from the groundwater interface (5 feet bgs) in soil and from 8 feet and 18 feet bgs in groundwater. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated and validated and submitted electronically.

Installation of Monitoring Wells

- Six groundwater monitoring wells will be installed to 10 feet bgs.
- Depth to groundwater is approximately 5 feet bgs; wells will reach one aquifer; formation is unconsolidated.
- Guard posts will not be included, and wells will be constructed of 2-inch, schedule 40 polyvinyl chloride (PVC) and will be drilled by hollow-stem auger.
- Drill cuttings will be drummed, and no soil samples will be collected.

Monitored Natural Attenuation

- Samples will be collected and analyzed for VOCs quarterly in the first year to further delineate the plume and annually for 29 additional years to monitor VOCs in Site 6 groundwater. Monitored natural attenuation has been limited to 30 years for the purpose of estimating cost, actual monitoring timeframes have been approximated using Natural Attenuation Software and are presented as an attachment to this appendix.
- Two technicians will drive approximately 100 miles round trip to Site 6 to collect groundwater samples.
- Sampling includes QA/QC and data management and reporting.
- Samples will be collected from 7 to 10 feet bgs in six wells using pumps. Samples will be analyzed for MNA parameters (such as chloride, sulfate, sulfide, ferrous iron, acidity/alkalinity, and nitrogen/nitrate/nitrite), dissolved gases, and VOCs. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated and validated and submitted electronically.

Vapor Removal System

- Engineering controls (subslab depressurization systems) were included as part of this the cost estimate to prevent vapor intrusion to indoor air at existing Building 41 at Site 6. Engineering controls may be unnecessary if direct measurements from indoor air sampling inside the building indicate vapors are not presents at levels of concern. Building 41 is slab on-grade construction and is approximately 41,000 square feet. System costs include installation of depressurization points through the slab foundation into the subgrade and installation of blowers at each point or manifolded between several points to provide a small vacuum to remove vapors. Annual O&M

costs include checking and replacing fans and manometers, electrical costs for operating the fans, and quarterly sampling and analysis for VOCs by EPA Method TO-15. It was assumed that no off-gas treatment would be required.

Land Use Controls

- LUCs will be in place to restrict domestic use of groundwater, prevent installation of drinking water wells, and/or require vapor barrier/removal technology.
- A LUCIP and deed restrictions will be prepared.
- Environmental restrictions in deed will be registered and filed.
- A drive-by inspection will be conducted annually for 30 years to determine if site activities are in compliance with LUCs.
- Contingency (25 percent) and Navy oversight (25 percent) are included in all LUCs.

C6.1.3.2 *Alternative 3: Plume Boundary Delineation, Active Groundwater Treatment to Commercial/industrial Reuse Criteria, Monitored Natural Attenuation, and Land Use Controls*

The major components of Alternative 3 are (1) sampling of Site 6 groundwater to further delineate the VOC plume; (2) actively treating groundwater to commercial/industrial reuse by ISCO or HRC; (3) monitoring of the VOC plume for 30 years; and (4) implementing LUCs to restrict domestic use of groundwater, prevent installation of drinking water wells, and require installation of vapor removal system under Building 41. Table C-2B presents the costs for Alternative 3 for Site 6 groundwater.

Plume Boundary Delineation

- Soil and groundwater samples will be collected by direct-push technology to further delineate the VOCs plume.
- Two technicians will drive approximately 100 miles round trip to Site 6 to collect groundwater samples.
- Sampling includes QA/QC and data management and reporting.
- Samples will be collected from 16 locations on 100-foot centers at Site 6.
- Samples will be collected from the groundwater interface (5 feet bgs) in soil and from 8 feet and 18 feet bgs in groundwater. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.

- An abbreviated monitoring report will be prepared and included with each round of sampling.

- Data will be evaluated and validated and submitted electronically.

Active Groundwater Treatment (ISCO or HRC)

- Hot spot concentrations at Site 6 will be treated down to commercial/industrial reuse levels. The plume area is approximately 2,000 square feet, and the contaminated interval is between 5 and 10 feet bgs.

- Hydraulic conductivity is approximately 1 foot per day; hydraulic gradient is approximately 0.0035 foot per foot; seepage velocity is approximately 5.1 feet per year.

- For HRC, approximately 420 lbs of material will be required for primary injection. There will be 21 injection points across the plume (3 rows of 7 points with a 10-foot radius of influence).

- HRC quote was obtained from Angelica Hurtado at Regenesis, Inc. (949) 366-8000 on February 18, 2004.

- ISCO quote was obtained from Prasad Kakarla at ISOTEC (609) 275-8500 on February 20, 2004.

- For either treatment technology, one injection event will be required for primary treatment, and one injection event will be required for follow-up treatment (50 percent of the original plume area). A pilot-scale test will be conducted before primary treatment.

- Groundwater will be monitored quarterly during the first year to follow the progress of active groundwater remediation.

Installation of Monitoring Wells

- Six groundwater monitoring wells will be installed to 10 feet bgs.

- Depth to groundwater is approximately 5 feet bgs, wells will reach one aquifer, and formation is unconsolidated.

- Guard posts will not be included, and wells will be constructed of 2-inch, schedule 40 PVC and will be drilled by hollow-stem auger.

- Drill cuttings will be drummed, and no soil samples will be collected.

Monitored Natural Attenuation

- Samples will be collected quarterly in the first year to further delineate the plume and annually for 29 additional years to monitor VOCs in Site 6 groundwater. Monitored natural attenuation has been limited to 30 years for the purpose of estimating cost, actual monitoring timeframes have been approximated using Natural Attenuation Software and are presented as an attachment to this appendix.

- Two technicians will drive approximately 100 miles round trip to Site 6 to collect groundwater samples.

- Sampling includes QA/QC and data management and reporting.

- Samples will be collected from 7 to 10 feet bgs in six wells using pumps. Samples will be analyzed for MNA parameters (such as chloride, sulfate, sulfide, ferrous iron, acidity/alkalinity, and nitrogen/nitrate/nitrite), dissolved gases, and VOCs. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.

- An abbreviated monitoring report will be prepared and included with each round of sampling.

- Data will be evaluated and validated and submitted electronically.

Vapor Removal System

- Engineering controls (subslab depressurization systems) were included as part of this the cost estimate to prevent vapor intrusion to indoor air at existing Building 41 at Site 6. Engineering controls may be unnecessary if direct measurements from indoor air sampling inside the building indicate vapors are not presents at levels of concern. Building 41 is slab on-grade construction and is approximately 41,000 square feet. System costs include installing depressurization points through the slab foundation into the subgrade and installing blowers at each point or manifolded between several points to provide a small vacuum to remove vapors. Annual O&M costs include checking and replacing fans and manometers, operating the fans, and sampling quarterly sampling and analysis for VOCs by EPA Method TO-15. It was assumed that no off-gas treatment would be required.

Land Use Controls

- LUCs will be in place to restrict domestic use of groundwater, prevent installation of drinking water wells, and/or require vapor barrier/removal technology.

- A LUCIP and deed restrictions will be prepared.

- Environmental restrictions in deed will be registered and filed.
- A drive-by inspection will be conducted annually for 30 years to determine if site activities are comply with LUCs.
- Contingency (25 percent) and Navy oversight (25 percent) are included in all LUCs.

C6.1.3.3 Alternative 4: Plume Boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, Monitored Natural Attenuation, and Land Use Controls

The major components of Alternative 4 are (1) sampling of Site 6 groundwater to further delineate the VOC plume; (2) actively treating groundwater to residential (unrestricted) reuse by ISCO or HRC; (3) monitoring the VOC plume for 30 years; and (4) LUCs to restrict domestic use of groundwater, prevent installation of drinking water wells, and require installation of vapor removal system under Building 41. Table C-2C presents the costs for Alternative 4 for Site 6 groundwater.

Plume Boundary Delineation

- Soil and groundwater samples will be collected by direct-push technology to further delineate the VOCs plume.
- Two technicians will drive approximately 100 miles round trip to Site 6 to collect groundwater samples.
- Sampling includes QA/QC and data management and reporting.
- Samples will be collected from 16 locations on 100-foot centers at Site 6.
- Samples will be collected from the groundwater interface (5 feet bgs) in soil and from 8 feet and 18 feet bgs in groundwater. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated and validated and submitted electronically.

Active Groundwater Treatment (ISCO or HRC)

- Hot spot concentrations at Site 6 will be treated down to unrestricted reuse levels. The plume area is approximately 80,000 square feet, and the contaminated interval is between 5 and 10 feet bgs.

- Hydraulic conductivity is approximately 1 foot per day; hydraulic gradient is approximately 0.0035 foot per foot; seepage velocity is approximately 5.1 feet per year.

- HRC quote was obtained from Angelica Hurtado at Regenesis, Inc. (949) 366-8000 on February 18, 2004.

- HRC will require three injection events over a 4.5-year period. Costs include a pilot-scale test. Approximately 15,000 lbs of material will be required for primary injection. There will be 10 injection points across the plume (2 rows of 5 points with a 10-foot radius of influence). Six wells will be monitored quarterly during the active remediation.

- ISCO quote was obtained from Prasad Kakarla at ISOTEC (609) 275-8500 on February 20, 2004.

- ISCO will require three rounds (nine injections) over a 3-year period. Costs include a pilot-scale test. Six wells will be monitored quarterly during active remediation.

Installation of Monitoring Wells

- Six groundwater monitoring wells will be installed to 10 feet bgs.

- Depth to groundwater is approximately 5 feet bgs; wells will reach one aquifer; formation is unconsolidated.

- Guard posts will not be included, and wells will be constructed of 2-inch, schedule 40 PVC and will be drilled by hollow-stem auger.

- Drill cuttings will be drummed, and no soil samples will be collected.

Monitored Natural Attenuation

- Samples will be collected quarterly in the first year to further delineate the plume and annually for 29 additional years to monitor VOCs in Site 6 groundwater. Monitored natural attenuation has been limited to 30 years for the purpose of estimating cost, actual monitoring timeframes have been approximated using Natural Attenuation Software and are presented as an attachment to this appendix.

- Two technicians will drive approximately 100 miles round trip to Site 6 to collect groundwater samples.

- Sampling includes QA/QC and data management and reporting.

- Samples will be collected from 7 to 10 feet bgs in six wells using pumps. Samples will be analyzed for MNA parameters (such as chloride, sulfate, sulfide, ferrous iron, acidity/alkalinity, and nitrogen/nitrate/nitrite), dissolved gases, and VOCs. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.

- An abbreviated monitoring report will be prepared and included with each round of sampling.

- Data will be evaluated and validated and submitted electronically.

Vapor Removal System

- Engineering controls (subslab depressurization systems) were included as part of this the cost estimate to prevent vapor intrusion to indoor air at existing Building 41 at Site 6 during the active remediation phase. Engineering controls may be unnecessary if direct measurements from indoor air sampling inside the building indicate vapors are not presents at levels of concern. Building 41 is slab on-grade construction and is approximately 41,000 square feet. System costs include installing depressurization points through the slab foundation into the subgrade and installing blowers at each point or manifolded between several points to provide a small vacuum to remove vapors. Annual O&M costs include checking and replacing fans and manometers, operating the fans, and quarterly sampling and analysis for VOC by EPA Method TO-15. It was assumed that no off-gas treatment would be required.

Land Use Controls

- LUCs will be in place to restrict domestic use of groundwater, prevent installation of drinking water wells, and/or require vapor barrier/removal technology during the active treatment phase.

- A LUCIP and deed restrictions will be prepared.

- Environmental restrictions in deed will be registered and filed.

- A drive-by inspection will be conducted annually for the duration of active remediation to determine if site activities are in compliance with LUCs.

- Contingency (25 percent) and Navy oversight (25 percent) are included in all LUCs.

C6.2 SITE 7

The following subsections briefly describe soil and groundwater remedial alternatives proposed for Site 7 and the assumptions used to prepare the costs.

C6.2.1 Costs and Assumptions Associated with Remedial Alternatives for Site 7 Soil

C6.2.1.1 Alternative 2: One-Time Soil Sampling, Excavation, and Off-Site Disposal

The major components of Alternative 2 for Site 7 soil are (1) excavating the soil source area and OWS-459 and separating contaminated soil from noncontaminated soil, (2) analyzing soil for metals using x-ray fluorescence technology to obtain real time data on extent and depth of contamination, and (3) disposing of contaminated soil at a permitted off-site facility. Remedial activities for soils at different sites may be combined into one action to take advantage of one mobilization, demobilization, and possible economies of scale. Table C-3A presents the costs for Alternative 2 for Site 7 soil.

The assumptions below were made for Site 7 soil.

- If lead and arsenic concentrations exceed acceptance criteria in samples collected below Building 459, the remedial approach may need to be reevaluated.
- Site 7 is accessible, and no specialized equipment or services (aside from those described in this report) would be necessary to gain access to the sites.
- All activities would be performed using EPA Level D personal protective equipment.

Sampling

- Two technicians will drive approximately 50 miles each way to Site 7.
- Data management and reporting costs are included in estimate.
- One groundwater sample and eight soil samples will be collected from 2.5 feet bgs and 5 feet bgs at four sampling locations surrounding OWS-459. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. QA/QC samples will be collected at 10 percent.
- Samples will be collected by direct-push technology.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated and validated and submitted electronically.

Excavation

- The excavation area will be assessed for underground utilities using ground-penetrating radar; one crew for 4 days.

- Twenty samples will be collected and analyzed using x-ray fluorescence (EPA Method 6200) to characterize the extent of contamination beneath Building 459. Ten percent of these samples will be submitted to an off-site certified laboratory for analysis of lead and arsenic.

- Excavation volume is approximately 1,820 cubic yards (in place), or approximately 2,700 tons.

- No rocks are present that would require ripping or blasting; no drums will need to be removed; no dewatering is required.

- A centralized area at Site 7 would be used for temporary soil storage, segregation, and characterization sampling.

- OWS-459 is located within the soil excavation area. OWS-459 will be excavated, broken down, and disposed of with soil from Site 7.

- Sheeting is required where excavation is adjacent to a building; the excavation is 5 feet deep and sheeting will be installed to 15 feet. The soil type is sand-silt/sand-clay mixture.

- None of the excavated soil is expected to be suitable for use as backfill; all backfill will come from an off-site source.

- Volume expected to be sent off site for disposal is 2,300 cubic yards based on a 25 percent bulking factor, or approximately 2,700 tons.

- Confirmation samples will be collected from the excavation area and analyzed using x-ray fluorescence technologies (EPA Method 6200). Sidewall confirmation sampling will be performed using approximately 50-foot centers along the excavation perimeter (one to two per sidewall, based on estimated excavation dimensions summarized in Figure 6-1 of the FS report). Two confirmation samples from the excavation area will be submitted to a certified off-site laboratory for metals analysis. Five confirmation samples from the excavation of OWS-459 will be submitted to an off-site laboratory for analysis of VOCs, SVOCs, pesticides and PCBs, TPH, and metals analysis.

- Five samples (approximately one per 500 cubic yards) will also be sent to a certified laboratory for analysis using toxicity characteristic leaching procedure, total threshold limit concentration, and soluble threshold limit concentration.

- Original grading would be maintained and, if appropriate, increased to aid surface runoff. Existing cover and replacement cover are asphalt.

Decontamination Facilities

- A new decontamination pad will be constructed (medium equipment rating). The pad will be 400 square feet in area, will have a flexible membrane liner, and will be in use approximately 25 percent of the time, one shift per day. The decontamination area will be in place for use in decontamination procedures for Sites 6, 7, 8, and 16.

- Wastewater generated from the decontamination area would be sampled and, if acceptable, transported for disposal to the wastewater collection system operated by the local POTW. Wastewater failing to meet the POTW disposal requirements would require off-site disposal at an appropriate permitted facility.

- Equipment decontamination operations will last 6 months.

- Personnel decontamination trailers are not necessary.

Residual Waste Management

- A vendor quote was obtained for hauling and disposal. The cost will be $55 per ton for disposal to a Class II facility, $80 per ton for disposal to a Class I facility provided waste is not RCRA waste, and $190 for disposal of RCRA waste at a Class I facility requiring stabilization before disposal. For arsenic-, cadmium-, and lead-contaminated soil at Site 7, it was assumed that the waste would qualify as a RCRA waste requiring stabilization for lead before disposal at a Class I facility. The quote includes transportation and disposal and associated taxes. The quote was obtained on October 12, 2004, from Stuart Levang, Operations Manager at DenBeste Transportation, Inc., 820 DenBeste Court, Windsor, California 95492, (800) 838-1477.

Other

- Professional labor management percentages are calculated by RACER™ based on the total capital cost of the project.

- Professional labor costs include preparation of the work plan and the health and safety plan, as well as technical oversight during planning, implementation, and permitting. A contingency factor of 25 percent was applied based on EPA guidance (EPA 2000).

- Fencing (300 feet) will be in place as a boundary for the excavation area. Hazardous waste signs will be placed on each side of the fenced area.

C6.2.2 Costs and Assumptions Associated with Site 7 Groundwater Remedial Alternatives

No alternatives or costs were evaluated for Site 7 groundwater because no chemicals of concern under Comprehensive Environmental Response, Compensation, and Liability Act were identified at Site 7.

C6.3 SITE 8

The following subsections briefly describe soil and groundwater alternatives proposed for Site 8 and the assumptions used to prepare the costs.

C6.3.1 Costs and Assumptions Associated with Remedial Alternatives for Site 8 Soil

C6.3.1.1 Alternative 2: One-Time Soil Sampling and Institutional Controls

The major components of this alternative are (1) sampling of soil surrounding OWS-411 to gather data on extent and depth of contamination and (2) ICs to prohibit excavation of soil adjacent to OWS-411 without regulatory approval for 100 years. Remedial activities for soils at different sites may be combined into one action to take advantage of one mobilization, demobilization, and possible economies of scale. These potential cost savings were not incorporated into Site 8 cost estimates because of the uncertainty associated with the timing of soil remediation at Site 8 in relation to other sites. Table C-4A presents the costs for Alternative 2 for Site 8 soil.

Sampling

- Two technicians will drive approximately 50 miles each way to Site 8.
- Data management and reporting costs are included in estimate.
- One groundwater sample and eight soil samples will be collected from 2.5 feet bgs and 5 feet bgs at four sampling locations surrounding OWS-411. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. QA/QC samples will be collected at 10 percent.
- Samples will be collected by direct-push technology.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated, validated, and submitted electronically.

Institutional Controls

- A LUCIP and deed restrictions will be prepared.
- Environmental restrictions in deed will be registered and filed.
- A drive-by inspection will be conducted annually for 100 years to determine if site activities comply with ICs.
- Contingency (25 percent) and Navy oversight (25 percent) are included in all ICs.

C6.3.1.2 Alternative 3: One-Time Soil Sampling, Excavation, and Off-Site Disposal

The major components of Alternative 3 for Site 8 soil are (1) sampling of soil surrounding OWS-411 to gather data on extent and depth of contamination, (2) excavating the soil source area, (3) analyzing soil for metals using x-ray fluorescence technology to obtain real-time data on extent and depth of contamination, and (4) disposing of contaminated soil at a permitted off-site facility. Remedial activities for soils at different sites may be combined into one action to take advantage of one mobilization, demobilization, and possible economies of scale. These potential cost savings were not incorporated into Site 8 cost estimates because of the uncertainty associated with the timing of soil remediation at Site 8 in relation to other sites. Table C-4B presents the costs for Alternative 3 for Site 8 soil.

The assumptions below were made for Alternative 3 for Site 8 soil.

- Site 8 is accessible, and no specialized equipment or services (aside from those described in this report) would be necessary to gain access to the sites.
- All activities would be performed using EPA Level D personal protective equipment.
- Soil excavation boundaries were based on data contained in the remedial investigation.

Sampling

- Two technicians will drive approximately 50 miles each way to Site 8.
- Data management and reporting costs are included in estimate.
- One groundwater sample and eight soil samples will be collected from 2.5 feet bgs and 5 feet bgs at four sampling locations surrounding OWS-411. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. QA/QC samples will be collected at 10 percent.
- Samples will be collected by direct-push technology.

- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated, validated, and submitted electronically.

Excavation of Lead in Shallow Soil and OWS-114

- The excavation area will be assessed for underground utilities using ground penetrating radar, one crew for 2 days.
- Excavation volume is approximately 135 cubic yards, or approximately 200 tons.
- No rocks are present that will require ripping or blasting; no drums will need to be removed; no dewatering is required.
- No sheeting is required because this excavation is only 2 feet deep.
- A centralized area at Site 8 would be used for temporary soil storage, segregation, and characterization sampling.
- The soil type is sand-silt/sand-clay mixture.
- None of the excavated soil will be used as backfill.
- Volume expected to be sent off site for disposal is 170 cubic yards, or approximately 200 tons, based on 25 percent bulking factor. One hundred thirty-five (135) tons will be sent to a Class I facility, and 65 tons will be sent to a Class II facility.
- Confirmation samples will be collected from the excavation areas and analyzed using x-ray fluorescence technologies (EPA Method 6200). Sidewall confirmation sampling would be performed along the excavation perimeter (one per sidewall, and one at depth based on estimated excavation dimensions summarized in Figure 7-1 of the FS report). Two samples from the shallow lead area will be submitted to an off-site certified laboratory for confirmation lead analysis. Five soil samples and one groundwater sample from the OWS-411 excavation area will be submitted to an off-site certified laboratory for analysis of VOCs, SVOCs, pesticides and PCBs, TPH, and metals.
- Two samples will also be sent to a certified laboratory for analysis using toxicity characteristic leaching procedure, total threshold limit concentration, and soluble threshold limit concentration.
- Original grading would be maintained and, if appropriate, increased to aid surface runoff. Existing cover and replacement cover are asphalt.

Decontamination Facilities

- A centralized decontamination area for equipment and personnel will be constructed at Site 7 to be used for decontamination activities for all four sites. Wastewater generated from the decontamination area would be sampled and, if acceptable, transported for disposal to the wastewater collection system operated by the local POTW. Wastewater failing to meet the POTW disposal requirements would require off-site disposal at an appropriate permitted facility.

- Equipment decontamination operations will last 1 week.

Residual Waste Management

- A vendor quote was obtained for hauling and disposal. The cost will be $55 per ton for disposal to a Class II facility, $80 per ton for disposal to a Class I facility provided waste is not RCRA waste, and $190 for disposal of RCRA waste at a Class I facility. For lead-contaminated soil at Site 8, approximately 135 tons will be disposed of at a Class I without stabilization (toxicity characteristic leaching procedure less than 7.5 milligrams per liter) and 65 tons will be disposed of at a Class II facility. The quote includes transportation and disposal and associated taxes. The quote was obtained on October 12, 2004, from Stuart Levang, Operations Manager at DenBeste Transportation, Inc., 820 DenBeste Court, Windsor, California 95492, (800) 838-1477.

Other

- Professional labor management percentages are calculated by RACER™ based on the total capital cost of the project.

- Professional labor costs include preparation of the work plan and the health and safety plan as well as technical oversight during planning, implementation, and permitting. A contingency factor of 25 percent was applied based on EPA guidance (EPA 2000).

- Fencing (250 feet) will be in place as a boundary for the excavation area.

C6.3.2 Costs and Assumptions Associated with Site 8 Groundwater Remedial Alternatives

No alternatives or costs were evaluated for Site 8 groundwater because no chemicals of concern under Comprehensive Environmental Response, Compensation, and Liability Act were identified at Site 8.

C6.4 SITE 16

The following subsections briefly describe soil and groundwater alternatives proposed for Site 16 and the assumptions used in preparation of the costs.

C6.4.1 Costs and Assumptions Associated with Remedial Alternatives for Site 16 Soil

C6.4.1.1 Alternative 2: One-Time Soil Sampling and Institutional Controls

The major components of Alternative 2 for Site 16 soil are (1) sampling of soil surrounding OWS-608A, OWS-608B, and previous excavation area to gather data on extent and depth of contamination and (2) ICs to prohibit excavation of soil adjacent to OWS-608A and -608B without regulatory approval for 100 years. Remedial activities for soils at different sites may be combined into one action to take advantage of one mobilization, demobilization, and possible economies of scale. These potential cost savings were not incorporated into Site 16 cost estimates because of the uncertainty associated with the timing of soil and groundwater remediation at Site 16 in relation each other and to other sites. Table C-5A presents the costs for Alternative 2 for Site 16 soil.

Sampling

- Two technicians will drive approximately 50 miles each way to Site 16.
- Data management and reporting costs are included in estimate.
- Nine samples will be collected near each OWS (-608A and -608B). One groundwater sample and eight soil samples will be collected from 2.5 feet bgs and 5 feet bgs at four sampling locations. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. QA/QC samples will be collected at 10 percent. Additionally, 10 soil samples will be collected from the previous excavation area and will be analyzed for PCBs. QA/QC samples will be collected at 10 percent.
- Samples will be collected by direct-push technology.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated, validated, and submitted electronically.

Institutional Controls

- A LUCIP and deed restrictions will be prepared.
- Environmental restrictions in deed will be registered and filed.

- A drive-by inspection will be conducted annually for 100 years to determine if site activities comply with ICs.
- Contingency (25 percent) and Navy oversight (25 percent) are included in all ICs.

C6.4.1.2 Alternative 3: One-Time Soil Sampling, Excavation, and Off-Site Disposal

The major components of Alternative 3 for Site 16 soil are (1) sampling of soil surrounding OWS-608A, OWS-608B, and the previous excavation area to gather data on extent and depth of contamination, (2) excavating the soil source areas and OWS-608A and OWS-608B, and (3) disposing of contaminated soil and OWS-608A and OWS-608B at a permitted off-site facility. Remedial activities for soils at different sites may be combined into one action to take advantage of one mobilization, demobilization, and possible economies of scale. These potential cost savings were not incorporated into Site 16 cost estimates because of the uncertainty associated with the timing of soil and groundwater remediation at Site 16 in relation each other and to other sites. Table C-5B presents the costs for Alternative 3 for Site 16 soil.

The assumptions below were made for Alternative 3 Site 16 soil.

- Site 16 is accessible, and no specialized equipment or services (aside from those described in this report) would be necessary to gain access to the sites.
- All activities would be performed using EPA Level D personal protective equipment.
- Soil excavation boundary for each OWS is assumed to be 15 feet by 15 feet by 5 feet deep. For the excavation of the previous excavation area, the boundary is assumed to be 50 percent of the previous excavation boundary for the northernmost excavation area (the only area containing elevated levels of PCBs).

Pre-Excavation Sampling

- Two technicians will drive approximately 50 miles each way to Site 16.
- Data management and reporting costs are included in estimate.
- Twelve samples will be collected from 5 feet bgs in the PCB-contaminated area and will be analyzed for PCBs. Nine samples will be collected near each OWS (-608A and -608B). One groundwater sample and eight soil samples will be collected from 2.5 feet bgs and 5 feet bgs at four sampling locations. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. QA/QC samples will be collected at 10 percent.
- Samples will be collected by direct-push technology.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated, validated, and submitted electronically.

Excavation of OWS-608A, OWS-608B, and Previous Excavation Area

- The excavation area will be assessed for underground utilities using ground penetrating radar; one crew for 5 days.
- Excavation volume is approximately 2,300 cubic yards, or approximately 3,400 tons.
- No rocks are present that will require ripping or blasting; no drums will need to be removed; no dewatering is required.
- No sheeting is required.
- The soil type is sand-silt/sand-clay mixture.
- None of the excavated soil will be used as backfill.
- A centralized area at Site 16 would be used for temporary soil storage, segregation, and characterization sampling.
- Volume expected to be sent off site for disposal is 2,900 cubic yards, or approximately 3,400 tons, based on a 25 percent bulking factor. The expected volume includes the two OWSs.
- Confirmation samples will be collected from the excavation area and analyzed using x-ray fluorescence technologies (EPA Method 6200). Sidewall confirmation sampling would be performed along the excavation perimeter on 50-foot centers and at depth based on estimated excavation dimensions for the previous excavation area and five samples from the OWS-608A excavation. Figure 8-1 of the FS report summarizes the estimated excavation dimensions. Two samples from each the previous excavation area will be submitted to an off-site certified laboratory to confirm the x-ray fluorescence results. Five confirmation soil samples and one groundwater sample each from the excavation of OWS-608A and OWS-608B will be submitted to a certified off-site laboratory for analysis of VOCs, SVOCs, pesticides and PCBs, TPH and metals.
- Original grading would be maintained and, if appropriate, increased to aid surface runoff. Existing cover and replacement cover are asphalt.

Decontamination Facilities

- A centralized decontamination area for equipment and personnel will be constructed at Site 7 to be used for decontamination activities for all four sites. Wastewater generated from the decontamination area would be sampled and, if acceptable, transported for disposal to the wastewater collection system operated by the local POTW. Wastewater failing to meet the POTW disposal requirements would require off-site disposal at an appropriate permitted facility.
- Equipment decontamination operations will last 6 months.

Residual Waste Management

- A vendor quote was obtained for hauling and disposal. The cost will be $55 per ton for disposal to a Class II facility, $80 per ton for disposal to a Class I facility provided waste is not RCRA waste, and $190 for disposal of RCRA waste at a Class I facility. The quote includes transportation and disposal and associated taxes. The quote was obtained on October 12, 2004, from Stuart Levang, Operations Manager at DenBeste Transportation, Inc., 820 DenBeste Court, Windsor, California 95492, (800) 838-1477.

Other

- Professional labor management percentages are calculated by RACER™ based on the total capital cost of the project.

- Professional labor costs include preparation of the work plan and the health and safety plan, as well as technical oversight during planning, implementation, and permitting. A contingency factor of 25 percent was applied based on EPA guidance (EPA 2000).

- Fencing (700 feet) will be in place as a boundary for the excavation area, hazardous waste signs will be placed on each side of the excavation area.

C6.4.2 Costs and Assumptions Associated with Remedial Alternatives for Site 16 Groundwater

This section provides the assumptions used to prepare the costs for remedial alternatives proposed for groundwater at Site 16. The proposed remedial alternatives are summarized in Section 8.3 of the FS report, and detailed descriptions and analyses of the alternatives are presented in Section 8.6 of the FS report.

As discussed in Section 8.3 of FS report, a preliminary screening of technologies and response actions was conducted for Site 16, and four groundwater treatment technologies were retained, including ISCO, enhanced bioremediation with HRC, pump and treat with air stripping, and pump and treat with chemical/ultraviolet oxidation. The retained technologies were screened further (secondary screening of technologies) using the following criteria: implementability, cost, and effectiveness. Of these five technologies, ISCO and HRC were considered the most suitable for Site 16. Using these technologies and other response actions, five remedial alternatives were developed and presented in Section 8.6 of the main FS text. The general assumptions used for costs during the secondary screening process are presented in Section C6.4.2.1. Section C6.4.2.2 describes the assumptions used to develop the cost for the technology screens for Site 6. Sections C6.4.2.3, C6.4.2.4, and C6.4.2.5 provide the assumptions for the costs used for the detailed analysis of alternatives. Table C-6T presents a detailed cost summary for the screened technologies.

C6.4.2.1 General Assumptions Used During the Secondary Screening of Technologies

The following assumptions were used for developing costs for the secondary screening of treatment technologies for Site 16. For this screening, it was assumed that each technology would be implemented until the MCL for vinyl chloride (0.5 µg/L) is obtained. The general assumptions below were made for groundwater at Site 16.

- Remediation goals are based on achieving MCLs.
- Two plumes require treatment at Site 16: (1) the scrap yard area plume, which is approximately 292,500 square feet in size, and (2) the former underground storage tank (UST) area plume, which is 70,200 square feet in size. Depth to groundwater at Site 16 is approximately 5 feet bgs. Groundwater contamination extends from the top of water table to 25 feet bgs.

Project management, remedial design, construction oversight, planning documents, reporting, as-built drawings, public notice, and permitting labor are costs are based on a percentage of total cost as assumed in RACER™ (Earth Tech 2003).

C6.4.2.2 Assumptions for Technology Screen at Site 16

The assumptions for the technologies screened at Site 16 are listed in the following text. Technologies screened include (1) pump and treat with advanced oxidation, (2) pump and treat with air stripping, (3) ISCO using modified Fenton's Reagent, and (4) in situ HRC. Costs are presented in Table C-6T.

Site 16 – Assumptions for Pump and Treat

- Pump and treat costs are based on outputs from RACER™.
- 21 extraction wells will be required and will pump at 2.6 gallons per minute (gpm) per well.
- Effluent water will discharge at a rate of approximately 54 gpm for 20 hours per day by gravity flow to the sanitary sewer located on site and will be treated at a POTW.
- Four sampling events (12 wells each) will be conducted in the first year of monitoring, and one sampling event (12 wells) will be conducted in each subsequent year for 14 years. Samples will be analyzed for MNA parameters and VOCs for all sampling events. An abbreviated monitoring report will be prepared in the initial year, and abbreviated monitoring reports will be prepared in years 2 through 14. O&M will start in January 2006 and last for 15 years.

- Discharge water will be sampled one time in the first year and analyzed for pH, cyanide, oil and grease, phenols, VOCs, total metals, and mercury based on discharge permit requirements for groundwater from East Bay Municipal Utilities District. Discharge water will be sampled one time during each subsequent year for 14 years. Samples collected during years 2 through 14 will be analyzed for oil and grease, phenols, and VOCs.

- Periodic costs will include four 5-year reviews after 5, 10, and 15 years of operation. A remedial action report will be prepared in year 16.

- Influent flow rate will be 54.2 gpm.

- Contaminants exhibit moderate volatility.

- For air stripping, one packed tower (30 feet by 2 feet) and two air strippers are required. Carbon filter influent flow rate is approximately 727 cubic feet per minute. One 5-horsepower blower is required. Two permanent modular carbon adsorbers, connected in series, are required.

- The remediation timeframe will take approximately 15 years.

Site 16 – ISCO Modified Fenton's Reagent

- ISCO costs are primarily based on a vendor quote received from ISOTEC (2004).

- A pilot-scale test will be conducted before a full-scale design.

- Primary treatment will require three injection events. One direct-push injection point will be required per 707 square feet of plume. Primary treatment will require 6 months to 1 year to complete. Three sampling rounds will be performed following primary treatment to measure results. Samples will be analyzed for VOCs and MNA parameters.

- Follow-up treatment will require three injection events. One direct-push injection point will be required per 707 square feet of plume. Follow-up treatment will require 6 months to 1 year to complete. One sampling round will be performed after the follow-up treatment to measure results. Samples will be analyzed for VOCs and MNA parameters.

- Six wells will be installed to 10 feet bgs and six wells will be installed to 25 feet bgs in each plume to monitor the effectiveness of remediation. The wells will be monitored quarterly for 2 years.

- The remediation timeframe for ISCO is 2 years.

Site 16 – In Situ HRC

- HRC costs are based primarily on vendor quotes received from Regenesis, Inc. (2004). Drilling costs associated with in situ HRC treatments are primarily based on vendor quotes receive from ResonantSonic International (2004).
- A pilot-scale test will be conducted prior to a full-scale design.
- Two injection events (primary and 50 percent follow-up) will be required to achieve treatment goals.
- Twelve wells will be installed to 10 feet to monitor the effectiveness of remediation. The wells will be monitored quarterly each year for 3 years. Samples will be analyzed for VOCs and MNA parameters.
- The remediation timeframe for in situ HRC is 3 years.

C6.4.2.3 Alternative 2: Plume Boundary Delineation, Monitored Natural Attenuation, and Land Use Controls

The major components of Alternative 2 are (1) sampling of Site 16 groundwater to further delineate the VOC plume, (2) monitoring plumes for 30 years, (3) LUCs to restrict domestic use of groundwater and require installation of a vapor removal system under Building 608. Table C-6A presents the costs for Alternative 2 for Site 16 groundwater.

Plume Boundary Delineation

- Soil and groundwater samples will be collected by direct-push technology to further delineate the VOCs plumes.
- Two technicians will drive approximately 100 miles round trip to Site 16 to collect groundwater samples.
- Sampling includes QA/QC and data management and reporting.
- Samples will be collected from 34 locations on 100-foot centers at Site 16: 26 locations will be within the scrapyard area, and 8 locations within the UST area.
- Samples will be collected from the groundwater interface (5 feet bgs) in soil and from 8 feet and 18 feet bgs in groundwater. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. Laboratories will analyze using standard turnaround time and will operate at QC level 3.
- An abbreviated monitoring report will be included and included with each round of sampling.
- Data will be evaluated, validated, and submitted electronically.

Installation of Monitoring Wells

- Twelve groundwater monitoring wells will be installed: six to 10 feet bgs and six to 25 feet bgs.
- Depth to groundwater is approximately 5 feet bgs; wells will reach one aquifer; formation is unconsolidated.
- Guard posts will not be included, and wells will be constructed of 2-inch, schedule 40 PVC and will be drilled by hollow-stem auger.
- Drill cuttings will be drummed, and no soil samples will be collected.

Monitored Natural Attenuation

- Samples will be collected and analyzed for VOCs quarterly in the first year and annually for 30 additional years, depending on the treatment technology selected, to monitor VOCs in Site 16 groundwater. Monitored natural attenuation has been limited to 30 years for the purpose of estimating cost, actual monitoring timeframes have been approximated using Natural Attenuation Software and are presented as an attachment to this appendix.
- Two technicians will drive approximately 100 miles round trip, for 2 days, to Site 16 to collect groundwater samples.
- Sampling includes QA/QC and data management and reporting.
- Samples will be collected from 8 feet bgs in 12 wells and from 18 feet bgs in 12 wells using pumps. Samples will be analyzed for MNA parameters (such as chloride, sulfate, sulfide, ferrous iron, acidity/alkalinity, and nitrogen/nitrate/nitrite), dissolved gases, and VOCs. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated, validated, and submitted electronically.

Vapor Removal System

- Engineering controls (subslab depressurization systems) were included as part of this the cost estimate to prevent vapor intrusion to indoor air at existing Building 608 at Site 16. Engineering controls may be unnecessary if direct measurements from indoor air sampling inside the building indicate vapors are not presents at levels of concern. Building 608 is slab on-grade construction and is approximately

8,200 square feet. System costs include installing depressurization points through the slab foundation into the subgrade and installing blowers at each point or manifolded between several points to provide a small vacuum to remove vapors. Annual O&M costs include checking and replacing fans and manometers, operating the fans, and quarterly sampling and analysis for VOCs by EPA Method TO-15. It was assumed that no off-gas treatment would be required.

Land Use Controls

- LUCs will be in place to restrict domestic use of groundwater and/or require vapor barrier/removal technology.
- A LUCIP and deed restrictions will be prepared.
- Environmental restrictions in deed will be registered and filed.
- A drive-by inspection will be conducted annually for 30 years to determine if site activities comply with LUCs.
- Contingency (25 percent) and Navy oversight (25 percent) are included in all LUCs.

C6.4.2.4 Alternative 3: Plume Boundary Delineation, Active Groundwater Treatment to Commerciallindustrial Reuse Criteria, Monitored Natural Attenuation, and Land Use Controls

The major components of Alternative 3 are (1) sampling of Site 16 groundwater to further delineate the VOC plume; (2) actively treating groundwater to commercial/industrial reuse criteria by ISCO or HRC; (3) monitoring the plume for 30 years; and (4) implementing LUCs to restrict domestic use of groundwater, prevent installation of drinking water wells, and require installation of vapor removal system under Building 608. Tables C-6B and C-6C present the costs for Alternative 3 for Site 16 groundwater.

Plume Boundary Delineation

- Soil and groundwater samples will be collected by direct-push technology to further delineate the VOCs plumes.
- Two technicians will drive approximately 100 miles round trip for 2 days to Site 16 to collect groundwater samples.
- Sampling includes QA/QC and data management and reporting.
- Samples will be collected from 34 locations on 100-foot centers at Site 16: 26 locations within the scrapyard area, and 8 locations within the UST area.

- Samples will be collected from the groundwater interface (5 feet bgs) in soil and from 8 feet and 18 feet bgs in groundwater. Samples will be analyzed for VOCs, SVOCs, pesticides and PCBs, TPH, and metals. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.

- An abbreviated monitoring report will be prepared and included with each round of sampling.

- Data will be evaluated, validated, and submitted electronically.

Active Groundwater Treatment (ISCO or HRC)

- Hot spot concentrations at the site will be treated down to commercial/industrial reuse criteria based on inhalation. The plume area is approximately 6,500 square feet, and the contaminated interval is between 5 and 25 feet bgs.

- Hydraulic conductivity is approximately 1 foot per day; hydraulic gradient is approximately 0.0035 foot per foot; seepage velocity is approximately 5.1 feet per year.

- For HRC, approximately 1,410 lbs of material will be required for primary injection. There will be 70 injection points across the plume (14 rows of 5 points with a 10-foot radius of influence).

- HRC quote was obtained from Angelica Hurtado at Regenesis, Inc. (949) 366-8000 on February 18, 2004.

- ISCO quote was obtained from Prasad Kakarla at ISOTEC (609) 275-8500 on February 20, 2004.

- For either treatment technology, one injection event will be required for primary treatment, and one injection event will be required for follow-up treatment (50 percent of the original plume area). A pilot-scale test will be conducted before primary treatment.

- Groundwater will be monitored quarterly during the first year to follow the progress of active groundwater remediation.

Installation of Monitoring Wells

- Twenty-four groundwater monitoring wells will be installed: 12 wells to 10 feet bgs and 12 wells to 25 feet bgs.

- Depth to groundwater is approximately 5 feet bgs; wells will reach one aquifer; formation is unconsolidated.

- Guard posts will not be included, and wells will be constructed of 2-inch, schedule 40 PVC and will be drilled by hollow-stem auger.

- Drill cuttings will be drummed, and no soil samples will be collected.

Monitored Natural Attenuation

- Samples will be collected and analyzed for VOCs quarterly in the first year and annually for 30 additional years, depending on the treatment technology selected, to monitor VOCs in Site 16 groundwater. Monitored natural attenuation has been limited to 30 years for the purpose of estimating cost, actual monitoring timeframes have been approximated using Natural Attenuation Software and are presented as an attachment to this appendix.

- Two technicians will drive approximately 100 miles round trip for 2 days to Site 16 to collect groundwater samples.

- Sampling includes QA/QC and data management and reporting.

- Samples will be collected from 8 feet bgs in 12 wells and from 18 feet bgs in 12 wells using pumps. Samples will be analyzed for MNA parameters (such as chloride, sulfate, sulfide, ferrous iron, acidity/alkalinity, and nitrogen/nitrate/nitrite), dissolved gases, and VOCs. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.

- An abbreviated monitoring report will be prepared and included with each round of sampling.

- Data will be evaluated, validated, and submitted electronically.

Vapor Removal System

- Engineering controls (subslab depressurization systems) were included as part of this the cost estimate to prevent vapor intrusion to indoor air at existing Building 608 at Site 16. Engineering controls may be unnecessary if direct measurements from indoor air sampling inside the building indicate vapors are not present at levels of concern. Building 608 is slab on-grade construction and is approximately 8,200 square feet. System costs include installing depressurization points through the slab foundation into the subgrade and installing blowers at each point or manifolded between several points to provide a small vacuum to remove vapors. Annual O&M costs include checking and replacing fans and manometers, operating the fans, and quarterly sampling and analysis for VOCs by EPA Method TO-15. It was assumed that no off-gas treatment would be required.

Land Use Controls

- LUCs will be in place to restrict domestic use of groundwater and/or require vapor barrier/removal technology.
- A LUCIP and deed restrictions will be prepared.
- Environmental restrictions in deed will be registered and filed.
- A drive-by inspection will be conducted annually for 30 years to determine if site activities comply with LUCs.
- Contingency (25 percent) and Navy oversight (25 percent) are included in all LUCs.

C6.4.2.5 Alternative 4: Plume Boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, Monitored Natural Attenuation, and Land Use Controls

The major components of Alternative 4 are (1) sampling of Site 16 groundwater to further delineate the VOC plume; (2) actively treating groundwater to residential (unrestricted) reuse criteria by ISCO or HRC; (3) monitoring the plumes for 30 years; and (4) implementing LUCs to restrict domestic use of groundwater, prevent installation of drinking water wells, and require installation of vapor removal system under Building 608. Table C-6D and C-6E present the costs for Alternative 4 for Site 16 groundwater.

Plume Boundary Delineation

- Soil and groundwater samples will be collected by direct-push technology to further delineate the VOCs plumes.
- Two technicians will drive approximately 100 miles round trip to Site 16 to collect groundwater samples.
- Sampling includes QA/QC and data management and reporting.
- Samples will be collected from 34 locations on 100-foot centers at Site 16: 26 locations within the scrapyard area, and 8 locations within the UST area.
- Samples will be collected from the groundwater interface (5 feet bgs) in soil and from 8 feet and 18 feet bgs in groundwater. Samples will be analyzed for VOCs. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.
- An abbreviated monitoring report will be prepared and included with each round of sampling.
- Data will be evaluated, validated, and submitted electronically.

Active Groundwater Treatment (ISCO or HRC)

- Hot spot concentrations at the site will be treated down to unrestricted reuse levels. The plume area is approximately 362,700 square feet, and the contaminated interval is between 5 and 25 feet bgs.

- Hydraulic conductivity is approximately 1 foot per day; hydraulic gradient is approximately 0.0035 foot per foot; seepage velocity is approximately 5.1 feet per year.

- HRC quote was obtained from Angelica Hurtado at Regenesis, Inc. (949) 366-8000 on February 18, 2004.

- HRC will require three injection events over a 4.5-year period (primary, 100 percent retreat and 50 percent retreat). Costs include a pilot-scale test. Approximately 196,600 lbs of material will be required for primary injection. There will be approximately 2,000 injection points across the plumes. Groundwater will be monitored quarterly during the first year of active remediation, and annually thereafter.

- ISCO quote was obtained from Prasad Kakarla at ISOTEC (609) 275-8500 on February 20, 2004.

- ISCO will require three rounds (nine injections) over a 3-year period (primary, 100 percent retreat and 50 percent retreat). Costs include a pilot-scale test. Groundwater will be monitored quarterly during the first year of active remediation, and annually thereafter.

Installation of Monitoring Wells

- Twenty-four groundwater monitoring wells will be installed: 12 wells to 10 feet bgs and 12 wells to 25 feet bgs.

- Depth to groundwater is approximately 5 feet bgs; wells will reach one aquifer; formation is unconsolidated.

- Guard posts will not be included, and wells will be constructed of 2-inch, schedule 40 PVC and will be drilled by hollow-stem auger.

- Drill cuttings will be drummed, and no soil samples will be collected.

Monitored Natural Attenuation

- Samples will be collected and analyzed for VOCs quarterly in the first year and annually for 30 additional years, depending on the treatment technology selected, to monitor VOCs in Site 16 groundwater. Monitored natural attenuation has been limited to 30 years for the purpose of estimating cost, actual monitoring timeframes have been approximated using Natural Attenuation Software and are presented as an attachment to this appendix.

- Two technicians will drive approximately 100 miles round trip for 2 days to Site 16 to collect groundwater samples.

- Sampling includes QA/QC and data management and reporting.

- Samples will be collected from 8 feet bgs in 12 wells and from 18 feet bgs in 12 wells using pumps. Samples will be analyzed for MNA parameters (such as chloride, sulfate, sulfide, ferrous iron, acidity/alkalinity, and nitrogen/nitrate/nitrite), dissolved gases, and VOCs. Laboratories will analyze samples using standard turnaround time and will operate at QC level 3.

- An abbreviated monitoring report will be prepared and included with each round of sampling.

- Data will be evaluated, validated, and submitted electronically.

LUCs will remain during active remediation period.

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TABLES

TABLE C-1: SITE 6 COST SUMMARY FOR SOIL REMEDIATION ALTERNATIVES

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

TOTAL REMEDIAL COST SUMMARY FOR SITE 6 SOIL

Site:	Operable Unit 1, CERCLA Site 6	**Base Year:**	2004
Location:	Alameda Point, Alameda, California	**Date:**	October 8, 2004
Phase:	Feasibility Study		

	Alternative 1	Alternative 2	Alternative 3
Description	**No Action**	**One-time Soil Sampling and ICs**	**One-time Soil Sampling, Excavation, and Off-site Disposal**
Total Project Duration (Years)	0	100	1
Capital Cost	$0	$149,995	$239,549
Annual O & M Cost	$0	$102,795	$0
Total Periodic Cost	$0	$0	$0
Total Present Value of Alternative	**$0**	**$252,790**	**$239,549**

TABLE C-1A: ALTERNATIVE 2 SITE 6, ONE-TIME SOIL SAMPLING AND ICS, TOTAL REMEDIAL COST
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One-time sampling, institutional controls to prevent domestic use of groundwater for 100 years. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
One Time Soil Sampling[a]							
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	1.00	DAY	264.41	0.00	0.00	$264	
Mobilize Direct Push Rig and Crew	1.00	DAY	881.37	0.00	0.00	$881	
Demobilize Direct Push Rig and Crew	1.00	DAY	881.37	0.00	0.00	$881	
TAL Metals (EPA 6010/7000s), Soil Analysis	18.00	EA	498.16	0.00	0.00	$8,967	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	18.00	EA	394.11	0.00	0.00	$7,094	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	18.00	EA	464.33	0.00	0.00	$8,358	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	18.00	EA	264.41	0.00	0.00	$4,759	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	18.00	EA	101.79	0.00	0.00	$1,832	
TAL Metals (EPA 6010/7000s), Water Analysis	2.00	EA	489.86	0.00	0.00	$980	
Volatile Organic Analysis (EPA 624), Water Analysis	2.00	EA	310.03	0.00	0.00	$620	
Pesticides/PCBs (EPA 608), Water Analysis	2.00	EA	260.00	0.00	0.00	$520	
Total Petroleum Hydrocarbons (EPA 418.1), Water Analysis	2.00	EA	100.09	0.00	0.00	$200	
Car or Van Mileage Charge	100.00	MI	0.55	0.00	0.00	$55	
Project Scientist	41.00	HR	0.00	146.81	0.00	$6,019	
Field Technician	7.00	HR	0.00	97.98	0.00	$686	
Word Processing/Clerical	5.00	HR	0.00	81.20	0.00	$406	
Draftsman/CADD	5.00	HR	0.00	125.83	0.00	$629	
SUBTOTAL ($2004)						**$43,153**	
Institutional Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Restrictions in Deed						$31,470	
Register and File Deed						$133	
Contingency	25%					$17,807	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$106,842**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$149,995**	

O & M COSTS:

Institutional Controls		
Annual Drive-by Inspection		$2,478
Contingency	25%	$620
Navy Oversight	25%	$620
SUBTOTAL ($2003)		**$3,717**

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[b]	Present Value	Notes
Capital Cost	0	$149,995	$149,995	1.0000	$149,995	
Annual O&M	1-100	$371,700	$3,717	27.6554	$102,795	
		$521,695			**$252,790**	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$252,790**	

Notes:
a Cost supplied by RACER 2004.
b Multi-year discount factor = $\frac{(1+i)^n - 1}{i(1+i)^n}$ where i = 0.035 for a 30+ year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-1B: ALTERNATIVE 3 SITE 6, ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL, TOTAL REMEDIAL COST
Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One time sampling and excavation of oil/water separators OWS-040A and OWS-040B with confirmation sampling.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Fencing[a]							
Boundary Fence, 5' Galvanized	280.00	LF	2.26	8.33	3.17	$3,853	
Hazardous Waste Signing	8.00	EA	25.11	112.08	0.00	$1,098	
SUBTOTAL ($2004)						**$4,950**	
One Time Soil Sampling[a]							
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	1.00	DAY	264.41	0.00	0.00	$264	
Mobilize Direct Push Rig and Crew	1.00	DAY	881.37	0.00	0.00	$881	
Demobilize Direct Push Rig and Crew	1.00	DAY	881.37	0.00	0.00	$881	
TAL Metals (EPA 6010/7000s), Soil Analysis	18.00	EA	498.16	0.00	0.00	$8,967	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	18.00	EA	394.11	0.00	0.00	$7,094	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	18.00	EA	464.33	0.00	0.00	$8,358	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	18.00	EA	264.41	0.00	0.00	$4,759	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	18.00	EA	101.79	0.00	0.00	$1,832	
TAL Metals (EPA 6010/7000s), Water Analysis	2.00	EA	489.86	0.00	0.00	$980	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	2.00	EA	310.03	0.00	0.00	$620	
Pesticides/PCBs (EPA 608), Water Analysis	2.00	EA	260.00	0.00	0.00	$520	
Total Petroleum Hydrocarbons (EPA 418.1), Water Analysis	2.00	EA	100.09	0.00	0.00	$200	
Car or Van Mileage Charge	100.00	MI	0.55	0.00	0.00	$55	
Project Scientist	41.00	HR	0.00	146.81	0.00	$6,019	
Field Technician	7.00	HR	0.00	97.98	0.00	$686	
Word Processing/Clerical	5.00	HR	0.00	81.20	0.00	$406	
Draftsman/CADD	5.00	HR	0.00	125.83	0.00	$629	
SUBTOTAL ($2004)						**$43,153**	
Excavation of OWS-040A and OWS-040B[a]							
Ground Penetrating Radar	1.00	DAY	1600.00	0.00	0.00	$1600	
Demolish Bituminous Road with Power Equipment	8.33	CY	0.00	48.38	10.27	$489	
Hand Excavation, Medium Clay	15.44	CY	0.00	152.60	0.00	$2356	
1 CY, Crawler-mounted, Hydraulic Excavator	83.33	CY	0.00	5.32	3.06	$698	
Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	110.00	CY	8.55	3.55	2.81	$1640	
Asphalt Pavement - 10" Subgrade, 9" Base, 1 1/2" Topping	50.00	SY	10.18	24.09	14.36	$2432	
Disposable Materials per Sample	11.00	EA	12.47	0.00	0.00	$137	
TAL Metals (EPA 6010/7000s), Soil Analysis	11.00	EA	481.55	0.00	0.00	$5297	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	11.00	EA	304.78	0.00	0.00	$3353	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	11.00	EA	448.85	0.00	0.00	$4937	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	11.00	EA	264.41	0.00	0.00	$2,909	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	11.00	EA	101.79	0.00	0.00	$1,120	
TAL Metals (EPA 6010/7000s), Water Analysis	2.00	EA	489.86	0.00	0.00	$980	
Volatile Organic Analysis (EPA 624), Water Analysis	2.00	EA	310.03	0.00	0.00	$620	
Pesticides/PCBs (EPA 608), Water Analysis	2.00	EA	260.00	0.00	0.00	$520	
Total Petroleum Hydrocarbons (EPA 418.1), Water Analysis	2.00	EA	100.09	0.00	0.00	$200	
Plastic Laminate Waste Pile Cover	1040.11	SF	0.18	0.06	0.00	$250	
Decontaminate Heavy Equipment	1.00	EA	0.00	970.92	0.00	$971	
SUBTOTAL ($ 2004)						**$30,507**	
Decontamination[b]							
1,800 PSI Pressure Washer Rental	1.00	MO	1753.14	0.00	0.00	$1,753	
Operation of Pressure Washer, Including Water, Soap, Electricity, Labor	40.00	HR	9.96	112.08	0.00	$4,882	
SUBTOTAL ($2004)						**$6,635**	

TABLE C-1B: ALTERNATIVE 3 SITE 6, ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One time sampling and excavation of oil/water separators OWS-040A and OWS-040B with confirmation sampling.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Transportation and Disposal of Debris Offsite[b]							
T & D of Debris to a Class I Facility, Assuming RCRA Stabilization for Lead	0.00	TON	0.00	192.91	0.00	$0	Assuming TCLP > 5 ppm Pb
T & D of Debris to a Class I Facility, Assuming Cal-Haz Material	150.00	TON	0.00	80.21	0.00	$12,032	Assuming TCLP < 5 ppm Pb
T & D of Debris to a Class II Facility	0.00	TON	0.00	55.20	0.00	$ 0	Assuming STLC < 5 ppm Pb
TCLP (RCRA) (EPA 1311), Soil Analysis	2.00	EA	821.93	0.00	0.00	$1644	
SUBTOTAL ($ 2004)						**$13,676**	
Remedial Action Report							
Remedial Action Report	1.00	EA		47928.91		$47,929	
SUBTOTAL ($ 2004)						**$47,929**	
SUBTOTAL ($2004)						$146,850	
Contingency	25%					$36,712	10% scope + 15% bid
SUBTOTAL ($2004)						**$183,562**	
Professional Labor Management[a]							
Design	9.00%					$16,521	
Project Management Labor Cost	5.00%					$9,178	
Planning Documents Labor Cost	4.00%					$7,342	
Construction Oversight Labor Cost	3.25%					$5,966	
Reporting Labor Cost	0.75%					$1,377	
As-Built Drawings Labor Cost	0.75%					$1,377	
Public Notice Labor Cost	0.25%					$459	
Site Closure Activities Labor Cost	2.50%					$4,589	
Permitting Labor Cost	5.00%					$9,178	
SUBTOTAL ($ 2004)						**$55,987**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$239,549**	

Notes
[a] Costs supplied by RACER 2004
[b] Costs supplied by Stuart Levang of Denbeste Transportation, Inc.(707) 838 1407 on October 12, 2004.

TABLE C-2T: SITE 6 SUMMARY FOR GROUNDWATER TREATMENT TECHNOLOGIES
Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

TOTAL REMEDIAL COST SUMMARY FOR SITE 6 GROUNDWATER

Site:	Operable Unit 1, CERCLA Site 6	**Base Year:**	2004
Location:	Alameda Point, Alameda, California	**Date:**	March 5, 2004
Phase:	Feasibility Study		

	Technology	Technology	Technology
Description	**In-situ Air Sparging and Soil Vapor Extraction**	**In Situ Chemical Oxidation**	**Hydrogen Release Compounds**
Total Project Duration (Years)	2	2	3
Capital Cost	$3,452,315	$1,848,951	$1,638,224
Annual O & M Cost	$1,078,662	$0	$0
Total Periodic Cost	$56,189	$56,189	$54,289
Total Present Value of Alternative	**$4,587,167**	**$1,905,141**	**$1,692,513**

TABLE C-2T1: SITE 6 GROUNDWATER AIR SPARGING AND SOIL VAPOR EXTRACTION
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In situ treatment of contaminated groundwater by air sparging and soil vapor extraction processes at CERCLA Site 6. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost[a]	Notes
Air Sparging[a]							
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2159.38	2729.99	$4,889	
Organic Vapor Analyzer Rental, per Day 8260B), Soil Analysis	57.00	DAY	152.44	0.00	0.00	$8,689	
Equipment Enclosure, 8' x 15', Portable Building/Shed; lined, insulated, skid mounted, w/exhaust fan	1.00	EA	3306.43	0.00	0.00	$3,306	
Air Sparge System, Blower 163 SCFM, 15 HP, 15 PSI, base, intake filter, silencer, pulleys, belt, belt guard.	13.00	EA	15682.14	0.00	0.00	$203,868	
Decontaminate Rig, Augers, Screen (Rental Equipment)	57.00	DAY	144.13	0.00	0.00	$8,215	
Field Technician	912.00	HR	0.00	97.98	0.00	$89,359	
2" PVC, Schedule 40, Well Casing	3304.00	LF	1.52	7.20	9.10	$58,860	
2" PVC, Schedule 40, Well Screen	826.00	LF	3.50	9.29	11.74	$20,259	
2" PVC, Well Plug	413.00	EA	7.38	10.80	13.65	$13,144	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	4543.00	LF	0.00	19.74	24.95	$203,038	
Split Spoon Sampling	1239.00	LF	0.00	30.85	39.00	$86,542	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	413.00	EA	100.38	0.00	0.00	$41,457	
2" Screen, Filter Pack	1652.00	LF	3.94	6.12	7.73	$29,388	
2" Well, Portland Cement Grout	2065.00	LF	1.47	0.00	0.00	$3,027	
2" Well, Bentonite Seal	413.00	EA	11.70	24.29	30.71	$27,549	
2" PVC, Schedule 80, Connection Piping	6195.00	LF	1.11	7.87	0.00	$55,629	
4" PVC, Schedule 80, Manifold Piping	4130.00	LF	3.31	16.95	0.00	$83,697	
2" PVC, Schedule 80, Tee	413.00	EA	15.92	0.00	0.00	$6,575	
2" PVC, Schedule 80, 90 Degree, Elbow	413.00	EA	4.33	0.00	0.00	$1,788	
4" x 2" Reducer, PVC Schedule 80	413.00	EA	46.65	0.00	0.00	$19,265	
2" PVC, Sch 80, Ball Valve	413.00	EA	111.30	0.00	0.00	$45,965	
Pressure Gauge	413.00	EA	88.90	114.61	0.00	$84,051	
SUBTOTAL ($2003)						$1,098,559	
SUBTOTAL ($2004)	1.0398					**$1,142,324**	
Soil Vapor Extraction[a]							
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2159.38	2729.99	$4,889	
Organic Vapor Analyzer Rental, per Day	19.00	DAY	152.44	0.00	0.00	$2,896	
1000 SCFM, Vapor Recovery System	3.00	EA	33387.63	0.00	0.00	$100,163	
Decontaminate Rig, Augers, Screen (Rental Equipment)	19.00	DAY	144.13	0.00	0.00	$2,739	
Field Technician	304.00	HR	0.00	97.98	0.00	$29,786	
4" PVC, Schedule 40, Well Casing	675.00	LF	3.56	10.80	13.65	$18,905	
4" PVC, Schedule 40, Well Screen	675.00	LF	7.98	14.47	18.29	$27,500	
4" PVC, Well Plug	135.00	EA	30.91	15.84	20.02	$9,014	
Hollow Stem Auger, 11" Dia Borehole, Depth <= 100 ft	1485.00	LF	0.00	30.84	38.99	$103,701	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	135.00	EA	100.38	0.00	0.00	$13,551	
4" Screen, Filter Pack	945.00	LF	6.95	10.80	13.65	$29,667	
4" Well, Portland Cement Grout	270.00	LF	2.20	0.00	0.00	$594	
4" Well, Bentonite Seal	135.00	EA	29.25	60.74	76.79	$22,517	
2" PVC, Schedule 80, Connection Piping	3543.75	LF	1.11	7.87	0.00	$31,821	
4" PVC, Schedule 80, Manifold Piping	2362.50	LF	3.31	16.95	0.00	$47,877	
2" PVC, Schedule 80, Tee	135.00	EA	15.92	0.00	0.00	$2,149	
2" PVC, Schedule 80, 90 Degree, Elbow	135.00	EA	4.33	0.00	0.00	$584	
4" PVC, Schedule, 90 Degree, Elbow	135.00	EA	17.90	0.00	0.00	$2,416	
4" x 2" Reducer, PVC Schedule 80	135.00	EA	46.65	0.00	0.00	$6,297	
2" PVC, Sch 80, Ball Valve	135.00	EA	111.30	0.00	0.00	$15,025	
Pressure Gauge	135.00	EA	88.90	114.61	0.00	$27,474	
SUBTOTAL ($2003)						$499,566	
SUBTOTAL ($2004)	1.0398					**$519,468**	

TABLE C-2T1: SITE 6 GROUNDWATER AIR SPARGING AND SOIL VAPOR EXTRACTION
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: *In situ treatment of contaminated groundwater by air sparging and soil vapor extraction processes at CERCLA Site 6. Capital costs occur in year 0.*

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost[a]	Notes
Overhead Electrical Distribution[a]							
4/0 ACSR Conductor	1272.00	LF	0.57	2.11	0.10	$3,535	
1/C #2 Aluminum, Bare, Wire	559.00	LF	0.22	1.46	0.07	$977	
45' Class 3 Treated Power Pole	3.00	EA	464.91	950.01	67.28	$4,447	
Straight-line Structure, 5 KV Pole Top	1.00	EA	145.60	768.53	54.43	$969	
Terminal Structure, 5 KV Pole Top	2.00	EA	1645.57	2916.22	206.52	$9,537	
5 KV, 500 MCM, Shielded Cable, Copper	135.00	LF	7.83	6.58	0.47	$2,008	
5 KV, 3/0 to 500 MCM Conductor, Terminations & Splicing	6.00	EA	376.87	1018.78	0.00	$8,374	
4" Rigid Steel Conduit	45.00	LF	12.59	23.46	0.00	$1,622	
SUBTOTAL ($2003)						$31,468	
SUBTOTAL ($2004)	1.0398					**$32,722**	
Decontamination Facilities[a]							
Pad Subgrade Preparation	17.78	CY	0.00	4.72	3.25	$142	
Cat 215, 1.0 CY, Soil, Shallow, Trenching	1.24	CY	0.00	1.47	0.95	$3	
Compact Subgrade, 2 Lifts	17.78	CY	0.00	0.48	0.35	$15	
Dry Roll Gravel, Steel Roller	53.33	SY	0.00	1.28	0.37	$88	
Gravel, Delivered & Dumped	7.41	CY	27.74	5.54	2.07	$262	
Gravel (90%) & Sand Base (10%), with Calcium Chloride 3/4 - 1 Lb/CY	7.41	CY	27.67	6.15	2.19	$267	
Asphalt Curb 8" W x 6" H	86.00	LF	1.96	6.34	4.87	$1,133	
Prime Coat	44.44	SY	0.41	0.08	0.04	$24	
Asphalt Wearing Course, 1 Pass (Line Item Includes 5% Waste)	9.67	TON	40.71	44.18	19.31	$1,008	
26" x 26", 5' Deep Area Drain with Grate	1.00	EA	2148.87	2830.83	32.50	$5,012	
5' x 5' x 5' Reinforced Concrete Sump	1.00	EA	2050.28	4016.02	107.60	$6,174	
12" x 12" CIP Concrete In-Ground Trench Drain with Metal Grate	14.00	LF	54.82	129.62	0.70	$2,592	
1,500 Gallon Steel Sump, Aboveground with Supports & Fittings	1.00	EA	2304.82	2122.22	0.00	$4,427	
Polymeric Liner Anchor Trench, 3' x 1.5'	103.20	LF	0.07	1.61	0.24	$198	
8 oz/sy Erosion Control/Drainage Filter Fabric (80 Mil)	53.33	SY	0.96	1.30	0.03	$122	
40 Mil Polymeric Liner, High-density	480.00	SF	0.37	2.76	0.23	$1,616	
1,800 PSI Pressure Washer Rental	1.00	MO	1453.78	0.00	0.00	$1,454	
Operation of Pressure Washer, Including Water, Soap, Electricity, Labor	40.00	HR	8.65	100.74	0.00	$4,376	
High Sump Level Switch for Avoiding Overflow	1.00	EA	295.65	419.15	0.00	$715	
(2 1/2", 4") PVC Double-wall Piping, with Fittings	30.00	LF	22.22	54.86	0.00	$2,312	
25 GPM, 1 1/2" Discharge, Cast-iron	1.00	EA	2882.26	978.92	0.00	$3,861	
SUBTOTAL ($2003)						$35,800	
SUBTOTAL ($2004)	1.0398					**$37,227**	
Residual Waste Management[a]							
Liquid Loading Into 5,000 Gallon Bulk Tank Truck	3.00	EA	0.00	724.11	141.08	$2,596	
Bulk Solid Hazardous Waste Loading Into Truck	187.00	CY	0.00	1.99	1.65	$681	
Transport Bulk Solid Hazardous Waste, Maximum 20 CY (per Mile)	55.00	MI	2.10	0.00	0.00	$116	
Transport Bulk Liquid/Sludge Hazardous Waste, Maximum 5,000 Gallon (per Mile)	15.00	MI	2.19	0.00	0.00	$33	
Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	2.00	EA	602.28	0.00	0.00	$1,205	
Landfill Nonhazardous Nonfuel Liquid/Sludge	12000.00	GAL	2.06	0.00	0.00	$24,717	
Landfill hazardous solid bulk waste, Requiring stabilization	187.00	CY	64.37	0.00	0.00	$12,037	
SUBTOTAL ($2003)						$41,383	
SUBTOTAL ($2004)	1.0398					**$43,032**	

TABLE C-2T1: SITE 6 GROUNDWATER AIR SPARGING AND SOIL VAPOR EXTRACTION
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In situ treatment of contaminated groundwater by air sparging and soil vapor extraction processes at CERCLA Site 6. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost[a]	Notes
Air Monitoring (First Year)[a]							
Portable Air Sampler, Continuous, Weekly Rental	2.00	WK	114.33	0.00	0.00	$229	1 sample collected quarterly
Tentative ID Compunds, GC/MS, Air (30/5041/8260B - TO-14), Air Analysis	10.00	EA	191.07	0.00	0.00	$1,911	
Car or Van Mileage Charge	800.00	MI	0.48	0.00	0.00	$384	
Project Manager	8.00	HR	0.00	243.91	0.00	$1,951	
Project Engineer	60.00	HR	0.00	180.58	0.00	$10,835	
Project Scientist	126.00	HR	0.00	146.81	0.00	$18,498	
Staff Scientist	160.00	HR	0.00	140.14	0.00	$22,422	
Field Technician	10.00	HR	0.00	97.98	0.00	$980	
Word Processing/Clerical	30.00	HR	0.00	81.20	0.00	$2,436	
Draftsman/CADD	22.00	HR	0.00	125.83	0.00	$2,768	
SUBTOTAL ($2003)						$62,414	
SUBTOTAL ($2004)	1.0398					**$64,900**	
Installation of Groundwater Monitoring Wells [a]							6 wells
Organic Vapor Analyzer Rental, per Day	1.00	DAY	154.46	0.00	0.00	$154	
Decontaminate Rig, Augers, Screen (Rental Equipment)	1.00	DAY	146.04	0.00	0.00	$146	
Field Technician	16.00	HR	0.00	97.98	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	30.00	LF	1.54	7.41	9.42	$551	
2" PVC, Schedule 40, Well Screen	30.00	LF	3.55	9.55	12.15	$758	
2" PVC, Well Plug	6.00	EA	7.48	11.11	14.13	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	66.00	LF	0.00	20.31	25.83	$3,045	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	6.00	EA	101.71	0.00	0.00	$610	
2" Screen, Filter Pack	42.00	LF	3.99	6.30	8.01	$768	
2" Well, Portland Cement Grout	12.00	LF	1.49	0.00	0.00	$18	
2" Well, Bentonite Seal	6.00	EA	11.85	25.00	31.79	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2221.97	2825.78	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	51.93	231.57	5.33	$1,733	
SUBTOTAL ($2003)						$15,007	
SUBTOTAL ($2004)[a]	1.0398					**$15,605**	
Groundwater Monitoring (First Year)[a]							
Remedial Design - User Defined Cost	54.00	EA	96.55	0.00	0.00	$5,214	
Disposable Materials per Sample	54.00	EA	10.62	0.00	0.00	$573	
Decontamination Materials per Sample	54.00	EA	9.55	0.00	0.00	$516	
Nylon Tubing, 1/4" Outside Diameter	530.00	LF	0.55	0.00	0.00	$292	
Water Level Indicator, Manual,	2.00	WK	87.65	0.00	0.00	$175	
Polyethylene Tape, 100' Cable, Weekly Rental						$0 $0	
Flow Through Monitor, Weekly Rental	2.00	WK	297.25	0.00	0.00	$595	
Water Quality Parameter Testing Device	2.00	WK	303.22	0.00	0.00	$606	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	54.00	EA	54.96	0.00	0.00	$2,968 $0	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	54.00	EA	38.08	0.00	0.00	$2,056 $0	
Volatile Organic Analysis (EPA 624), Water Analysis	54.00	EA	272.65	0.00	0.00	$14,723 $0	
Chloride (EPA 300), Water Analysis	54.00	EA	28.04	0.00	0.00	$1,514	
Sulfate (EPA 300.0), Water Analysis	54.00	EA	28.56	0.00	0.00	$1,542	
Sulfide (EPA 376.1), Water Analysis	54.00	EA	48.46	0.00	0.00	$2,617	
Ferrous Iron (S.M. 3500 Fe - D)	54.00	EA	144.39	0.00	0.00	$7,797	
55 Gallon 17C Closed Head Steel Drum	16.00	EA	90.00	0.00	0.00	$1,440	
4" Submersible Pump Rental, Day	8.00	DAY	101.95	0.00	0.00	$816	
Car or Van Mileage Charge	800.00	MI	0.48	0.00	0.00	$384	
Project Manager	16.00	HR	0.00	243.91	0.00	$3,903	
Project Engineer	80.00	HR	0.00	180.58	0.00	$14,446	

TABLE C-2T1: SITE 6 GROUNDWATER AIR SPARGING AND SOIL VAPOR EXTRACTION
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In situ treatment of contaminated groundwater by air sparging and soil vapor extraction processes at CERCLA Site 6. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost[a]	Notes
Project Scientist	404.00	HR	0.00	146.81	0.00	$59,311	
Staff Scientist	240.00	HR	0.00	140.14	0.00	$33,634	
Field Technician	156.00	HR	0.00	97.98	0.00	$15,285	
Word Processing/Clerical	92.00	HR	0.00	81.20	0.00	$7,470	
Draftsman/CADD	60.00	HR	0.00	125.83	0.00	$7,550	
SUBTOTAL ($2003)						$185,427	
SUBTOTAL ($2004)	1.0398					**$192,814**	
SUBTOTAL ($2004)						$2,048,092	
Contingency		25%				$512,023	10% scope + 15% bid
SUBTOTAL ($2004)						**$2,560,115**	
Professional Labor Management[a]							
Design and Work Plan		9.00%				$230,410	
Project Management Labor Cost		5.00%				$128,006	
Planning Documents Labor Cost		5.00%				$128,006	
Construction Oversight Labor Cost		6.25%				$160,007	
Reporting Labor Cost		0.63%				$16,129	
As-Built Drawings Labor Cost		0.63%				$16,129	
Public Notice Labor Cost		0.09%				$2,304	
Site Closure Activities Labor Cost		2.00%				$51,202	
Permitting Labor Cost		6.25%				$160,007	
SUBTOTAL						**$892,200**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$3,452,315**	
OPERATIONS AND MAINTENANCE COSTS:							
Treatment Train Miscellaneous							
Per Diem (per person)	144.00	DAY	160.00	0.00	0.00	$23,040	
Mobilize Crew, 50 Miles, per Person	72.00	EA	94.81	0.00	0.00	$6,826	
Disposable Gloves (Latex)	253.00	PAIR	0.28	0.00	0.00	$72	
Disposable Coveralls (Tyvek)	253.00	EA	6.04	0.00	0.00	$1,528	
Non Haz Drummed Site Waste - Load, Transp, & Landfill Disp (55-Gal Drums)	7.00	EA	277.55	0.00	0.00	$1,943	
DOT Steel Drum, 55 Gallon	7.00	EA	100.38	0.00	0.00	$703	
Senior Staff Engineer	17.00	HR	0.00	243.46	0.00	$4,139	
Staff Engineer	48.00	HR	0.00	143.89	0.00	$6,907	
Field Technician	96.00	HR	0.00	97.98	0.00	$9,406	
Startup Costs	1.00	LS	37475.48	46429.80	19235.20	$103,140	
Annual Maintenance Materials and Labor	1.00	LS	13467.62	16685.54	6912.58	$37,066	
SUBTOTAL						**$194,769**	
Air Sparging							
Staff Engineer	71.00	HR	0.00	143.89	0.00	$10,216	
Field Technician	355.00	HR	0.00	97.98	0.00	$34,784	
Electrical Charge	904470.00	KWH	0.09	0.00	0.00	$81,622	
SUBTOTAL						**$126,622**	
Soil Vapor Extraction							
Staff Engineer	98.00	HR	0.00	143.89	0.00	$14,101	
Field Technician	487.00	HR	0.00	97.98	0.00	$47,717	
Electrical Charge	886950.00	KWH	0.09	0.00	0.00	$80,041	
SUBTOTAL						**$141,860**	
SUBTOTAL ($2003)						$463,251	
Runtime Percent Cost Adjustment	97%					$449,353	
Contingency	25%					$115,813	10% scope + 15% bid
SUBTOTAL ($2003)						$565,166	
SUBTOTAL ($2004)	1.0398					$587,682	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						$587,682	

TABLE C-2T1: SITE 6 GROUNDWATER AIR SPARGING AND SOIL VAPOR EXTRACTION
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In situ treatment of contaminated groundwater by air sparging and soil vapor extraction processes at CERCLA Site 6. Capital costs occur in year 0.

PERIODIC COSTS:

DESCRIPTION[a]	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost[a]	Notes
Remedial Action Report	3	1	EA		$47,929		$47,929	Close out report
SUBTOTAL							$47,929	
Contingency		25%					$11,982	10% scope + 15% bid
SUBTOTAL ($2004)[a]		1.0398					$62,298	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[b]	Present Value	Notes
Capital Cost	0	$3,452,315	$3,452,315	1.0000	$3,452,315	
Annual O&M	1-2	$1,175,363	$587,682	1.8355	$1,078,662	
Periodic Cost	3	$62,298	$62,298	0.9019	$56,189	Remedial action report
		$4,689,977			$4,587,167	

TOTAL PRESENT VALUE OF ALTERNATIVE $4,587,167

a RACER 2003 outputs are in 2003 dollars. The average ENR Construction Cost Index for 2003 was 6694.5, the ENR Construction Cost Index for March 2004 was 6957. The inflation rate from 2003 to March 2004 was 3.92% or a multiplier of 1.0392, which was used to bring RACER 2003 outputs forward to 2004 dollars.

b Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

TABLE C-2T2: SITE 6 IN SITU CHEMICAL OXIDATION SOURCE AREA REDUCTION TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In-situ chemical oxidation of contaminated groundwater followed by monitored natural attenuation and land-use controls at the scrap yard at CERCLA Site 6. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost[a]	Notes
Pretreatment Costs[a]							
Bench Test							
Injection System Design							
Work Plan						$10,000	
Install Groundwater Monitoring Wells[b]							6 wells to be installed
Organic Vapor Analyzer Rental, per Day	1.00	DAY	154.46	0.00	0.00	$154.46	
Decontaminate Rig, Augers, Screen (Rental Equipment)	1.00	DAY	146.04	0.00	0.00	$146.04	
Field Technician	16.00	HR	0.00	97.98	0.00	$1,567.71	
2" PVC, Schedule 40, Well Casing	30.00	LF	1.54	7.41	9.42	$550.88	
2" PVC, Schedule 40, Well Screen	30.00	LF	3.55	9.55	12.15	$757.62	
2" PVC, Well Plug	6.00	EA	7.48	11.11	14.13	$196.29	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	66.00	LF	0.00	20.31	25.83	$3,045.26	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	6.00	EA	101.71	0.00	0.00	$610.27	
2" Screen, Filter Pack	42.00	LF	3.99	6.30	8.01	$768.20	
2" Well, Portland Cement Grout	12.00	LF	1.49	0.00	0.00	$17.82	
2" Well, Bentonite Seal	6.00	EA	11.85	25.00	31.79	$411.85	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2,221.97	2,825.78	$5,047.75	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	51.93	231.57	5.33	$1,733.00	
SUBTOTAL ($2003)						$15,007.15	
SUBTOTAL ($2004)[c]	1.0398					$15,605.01	
Treatment Costs[a]							
Pilot Test							
Mobilization						$5,000	
Materials costs (reagent)							
Injector Fabrication/Installation and Injection						$70,000	
Other							
SUBTOTAL ($2004)						$75,000	
Pilot Test Groundwater Monitoring[b]							3 wells sampled quarterly
RSK175 analysis for dissolved gases	15.00	EA	97.83	0.00	0.00	$1,467.45	
Disposable Materials per Sample	15.00	EA	10.76	0.00	0.00	$ 161.40	
Decontamination Materials per Sample	15.00	EA	9.68	0.00	0.00	$ 145.20	
Nylon Tubing, 1/4" Outside Diameter	350.00	LF	0.56	0.00	0.00	$ 196.00	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$ 355.28	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,204.80	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,228.96	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	15.00	EA	55.69	0.00	0.00	$ 835.35	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	15.00	EA	38.58	0.00	0.00	$ 578.70	
Volatile Organic Analysis (EPA 624), Water Analysis	15.00	EA	276.27	0.00	0.00	$4,144.05	
Chloride (EPA 300), Water Analysis	15.00	EA	28.41	0.00	0.00	$ 426.15	
Sulfate (EPA 300.0), Water Analysis	15.00	EA	28.94	0.00	0.00	$ 434.10	
Sulfide (EPA 376.1), Water Analysis	15.00	EA	49.10	0.00	0.00	$ 736.50	
Ferrous Iron (S.M. 3500 Fe - D)	15.00	EA	146.31	0.00	0.00	$2,194.65	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$ 364.76	
4" Submersible Pump Rental, Day	3.00	DAY	103.31	0.00	0.00	$ 309.93	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$ 192.00	
Project Manager	8.00	HR	0.00	243.91	0.00	$1,951.28	
Project Engineer	40.00	HR	0.00	180.58	0.00	$7,223.20	
Project Scientist	202.00	HR	0.00	146.81	0.00	$29,655.62	
Staff Scientist	120.00	HR	0.00	140.14	0.00	$16,816.80	
Field Technician	78.00	HR	0.00	97.98	0.00	$7,642.44	
Word Processing/Clerical	46.00	HR	0.00	81.20	0.00	$3,735.20	
Draftsman/CADD	30.00	HR	0.00	125.83	0.00	$3,774.90	
SUBTOTAL ($2003)						$85,775	
SUBTOTAL ($2004)[c]	1.0398					$89,192	

TABLE C-2T2: SITE 6 IN SITU CHEMICAL OXIDATION SOURCE AREA REDUCTION TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In-situ chemical oxidation of contaminated groundwater followed by monitored natural attenuation and land-use controls at the scrap yard at CERCLA Site 6. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost[a]	Notes
Primary Treatment							
Mobilization						$11,500	
Materials costs (reagent)							
Injector Fabrication/Installation and Injection						$512,750	
Other							
SUBTOTAL ($2004)						$524,250	
Follow up Treatment (if necessary)							
Mobilization						$11,500	
Materials costs (reagent)							
Injector Fabrication/Installation and Injection						$256,375	
Other							
SUBTOTAL ($2004)						$267,875	
Contingency	15%					$239,079	Scope
SUBTOTAL ($2004) all Treatment costs						**$956,317**	
Groundwater Monitoring (First Year)[b]							6 wells monitored quarterly for 2 years
RSK175 Analysis Dissolved Gases	54.00	EA	97.83	0.00	0.00	$5,282.82	
Disposable Materials per Sample	54.00	EA	10.76	0.00	0.00	$ 581.04	
Decontamination Materials per Sample	54.00	EA	9.68	0.00	0.00	$ 522.72	
Nylon Tubing, 1/4" Outside Diameter	530.00	LF	0.56	0.00	0.00	$ 296.80	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	2.00	WK	88.82	0.00	0.00	$ 177.64	
Flow Through Monitor, Weekly Rental	2.00	WK	301.20	0.00	0.00	$ 602.40	
Water Quality Parameter Testing Device	2.00	WK	307.24	0.00	0.00	$ 614.48	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	54.00	EA	55.69	0.00	0.00	$3,007.26	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	54.00	EA	38.58	0.00	0.00	$2,083.32	
Volatile Organic Analysis (EPA 624), Water Analysis	54.00	EA	276.27	0.00	0.00	$14,918.58	
Chloride (EPA 300), Water Analysis	54.00	EA	28.41	0.00	0.00	$1,534.14	
Sulfate (EPA 300.0), Water Analysis	54.00	EA	28.94	0.00	0.00	$1,562.76	
Sulfide (EPA 376.1), Water Analysis	54.00	EA	49.10	0.00	0.00	$2,651.40	
Ferrous Iron (S.M. 3500 Fe - D)	54.00	EA	146.31	0.00	0.00	$7,900.74	
55 Gallon 17C Closed Head Steel Drum	16.00	EA	91.19	0.00	0.00	$1,459.04	
4" Submersible Pump Rental, Day	8.00	DAY	103.31	0.00	0.00	$ 826.48	
Car or Van Mileage Charge	800.00	MI	0.48	0.00	0.00	$ 384.00	
Project Manager	16.00	HR	0.00	243.91	0.00	$3,902.56	
Project Engineer	80.00	HR	0.00	180.58	0.00	$14,446.40	
Project Scientist	404.00	HR	0.00	146.81	0.00	$59,311.24	
Staff Scientist	240.00	HR	0.00	140.14	0.00	$33,633.60	
Field Technician	156.00	HR	0.00	97.98	0.00	$15,284.88	
Word Processing/Clerical	92.00	HR	0.00	81.20	0.00	$7,470.40	
Draftsman/CADD	60.00	HR	0.00	125.83	0.00	$7,549.80	
SUBTOTAL ($2003)						$186,004.50	
SUBTOTAL ($2004)[c]	1.0398					**$193,414.65**	
SUBTOTAL ($2004)						$1,175,337	
Contingency		25%				$293,834	10% scope + 15% bid
SUBTOTAL ($2004)						$1,469,171	
Professional Labor Management[b]							
Project Management Labor Cost		5.00%				$73,458.53	
Planning Documents Labor Cost		5.00%				$73,458.53	
Construction Oversight Labor Cost		6.25%				$91,823.17	
Reporting Labor Cost		0.63%				$ 9,255.78	
As-Built Drawings Labor Cost		0.63%				$ 9,255.78	
Public Notice Labor Cost		0.09%				$ 1,322.25	
Site Closure Activities Labor Cost		2.00%				$29,383.41	
Permitting Labor Cost		6.25%				$91,823.17	
SUBTOTAL						$379,780.62	
TOTAL CAPITAL COST IN 2004 DOLLARS						$1,848,951	

TABLE C-2T2: SITE 6 IN SITU CHEMICAL OXIDATION SOURCE AREA REDUCTION TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In-situ chemical oxidation of contaminated groundwater followed by monitored natural attenuation and land-use controls at the scrap yard at CERCLA Site 6. Capital costs occur in year 0.

OPERATIONS AND MAINTENANCE COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost[a]	Notes
Treatment Train Miscellaneous							
Per Diem (per person)	0.00	DAY	160.00	0.00	0.00	$ 0.00	
Mobilize Crew, 50 Miles, per Person	0.00	EA	73.65	0.00	0.00	$ 0.00	
Staff Engineer	0.00	HR	0.00	47.66	0.00	$ 0.00	
Field Technician	0.00	HR	0.00	32.45	0.00	$ 0.00	
Startup Costs	0.00	LS	4355.82	4355.82	2177.91	$ 0.00	
Annual Maintenance Materials and Labor	0.00	LS	0.00	0.00	0.00	$ 0.00	
SUBTOTAL						0.00	
SUBTOTAL ($2003)						$0	
Runtime Percent Cost Adjustment	97%					$0	
Contingency	25%					$0	10% scope + 15% bid
SUBTOTAL ($2003)						$0	
SUBTOTAL ($2004)	1.0398					$0	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$0**	

PERIODIC COSTS:

DESCRIPTION[b]	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost[a]	Notes
Remedial Action Report	3	1	EA		$47,929		$47,929	Cost supplied by ISOTEC
SUBTOTAL							$47,929	
Contingency		25%					$11,982	10% scope + 15% bid
SUBTOTAL ($2004)[d]		1.0398					$62,298	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[c]	Present Value	Notes
Capital Cost	0	$1,848,951	$1,848,951	1.0000	$1,848,951	
Annual O&M	1-2	$0	$0	1.8997	$0	
Periodic Cost	3	$62,298	$62,298	0.9019	$56,189	
		$1,911,249			$1,905,141	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$1,905,141**	

[a]Cost estimated based on cost provided by Isotech (Chris Nelson).
[b]Costs based on RACER.
[c]Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 and t = year (i.e., the present value of the dollar paid in year t at 3.5%)
[d] RACER 2003 outputs are in 2003 dollars. The average ENR Construction Cost Index for 2003 was 6690.5, the ENR Construction Cost Index for March 2004 was 6957. The inflation rate from 2003 to March 2004 was 3.98% or a multiplier of 1.0398, which was used to bring RACER 2003 outputs forward to 2004 dollars.

TABLE C-2T3: SITE 6 IN SITU HRC TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Addition of hydrogen release compounds to contaminated groundwater followed by monitored natural attenuation and land-use controls at CERCLA Site 6. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Pilot Test							
Work Plan						$10,000.00	
HRC material						$1,440.00	
shipping						$ 576.00	
Mobilization[a]						$ 500.00	
Drill Rig[a]	1.00	DAY			1250.00	$1,250.00	Drilling 200 feet per day
Local Travel[a]	1.00	DAY		150.00		$ 150.00	
Additional Crew Member for Injection[a]	1.00	DAY		450.00		$ 450.00	
Injection Pump[a]	1.00	DAY			300.00	$ 300.00	
Borehole Abandonment[a]	40.00	LF			1.00	$ 40.00	Upper 5 feet will be abandoned
Steam Cleaner[a]	1.00	DAY			95.00	$ 95.00	
Analytical[b]						$8,800.00	
Staff Scientist[b]	78.00	HR	0.00	140.14	0.00	$10,930.92	
Install Monitoring Wells[b]	3.00					$7,500.00	
SUBTOTAL ($2004)						**$42,032**	
Pilot Test Groundwater Monitoring[b]							3 wells sampled quarterly
RSK175 analysis for dissolved gases	15.00	EA	97.83	0.00	0.00	$1,467.45	
Disposable Materials per Sample	15.00	EA	10.76	0.00	0.00	$ 161.40	
Decontamination Materials per Sample	15.00	EA	9.68	0.00	0.00	$ 145.20	
Nylon Tubing, 1/4" Outside Diameter	350.00	LF	0.56	0.00	0.00	$ 196.00	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$ 355.28	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,204.80	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,228.96	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	15.00	EA	55.69	0.00	0.00	$ 835.35	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	15.00	EA	38.58	0.00	0.00	$ 578.70	
Volatile Organic Analysis (EPA 624), Water Analysis	15.00	EA	276.27	0.00	0.00	$4,144.05	
Chloride (EPA 300), Water Analysis	15.00	EA	28.41	0.00	0.00	$ 426.15	
Sulfate (EPA 300.0), Water Analysis	15.00	EA	28.94	0.00	0.00	$ 434.10	
Sulfide (EPA 376.1), Water Analysis	15.00	EA	49.10	0.00	0.00	$ 736.50	
Ferrous Iron (S.M. 3500 Fe - D)	15.00	EA	146.31	0.00	0.00	$2,194.65	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$ 364.76	
4" Submersible Pump Rental, Day	3.00	DAY	103.31	0.00	0.00	$ 309.93	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$ 192.00	
Project Manager	8.00	HR	0.00	243.91	0.00	$1,951.28	
Project Engineer	40.00	HR	0.00	180.58	0.00	$7,223.20	
Project Scientist	202.00	HR	0.00	146.81	0.00	$29,655.62	
Staff Scientist	120.00	HR	0.00	140.14	0.00	$16,816.80	
Field Technician	78.00	HR	0.00	97.98	0.00	$7,642.44	
Word Processing/Clerical	46.00	HR	0.00	81.20	0.00	$3,735.20	
Draftsman/CADD	30.00	HR	0.00	125.83	0.00	$3,774.90	
SUBTOTAL ($2003)						$85,775	
SUBTOTAL ($2004)[c]	1.0398					**$89,192**	
Primary Treatment							
HRC material	15090.00	LB	5.50			$82,995.00	
Shipping						$4,527.00	
Mobilization[a]						$1,000.00	
Drill Rig[a]	38.00	DAY			1250.00	$47,500.00	Drilling 200 feet per day
Local Travel[a]	38.00	DAY		150.00		$5,700.00	
Additional Crew Member for Injection[a]	38.00	DAY		450.00		$17,100.00	
Injection Pump[a]	38.00	DAY			300.00	$11,400.00	
Borehole Abandonment[a]	3800.00	LF			1.00	$3,800.00	Only upper 5 feet will be abandoned
Steam Cleaner[a]	38.00	DAY			95.00	$3,610.00	
Hand Auger[a]	13.00	DAY			750.00	$9,750.00	Assumes 15 cores per day
Local Travel for Hang Auger Crew[a]	13.00	DAY		150.00		$1,950.00	
Concrete Coring[a]	10.00	DAY			1100.00	$11,000.00	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[a]	10.00	DAY		150.00		$1,500.00	
Car or Van Mileage Charge[b]	7500.00	MI	0.48	0.00	0.00	$3,600.00	
SUBTOTAL ($2004)						**$205,432**	

TABLE C-2T3: SITE 6 IN SITU HRC TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Addition of hydrogen release compounds to contaminated groundwater followed by monitored natural attenuation and land-use controls at CERCLA Site 6. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Follow up Treatment (If Necessary)							
HRC material	7545.00	LB	5.50			$41,497.50	
Shipping						$4,527.00	
Mobilization[a]						$1,000.00	
Drill Rig[a]	19.00	DAY			1250.00	$23,750.00	Drilling 200 feet per day
Local Travel[a]	19.00	DAY		150.00		$2,850.00	
Additional Crew Member for Injection[a]	19.00	DAY		450.00		$8,550.00	
Injection Pump[a]	19.00	DAY			300.00	$5,700.00	
Borehole Abandonment[a]	1900.00	LF			1.00	$1,900.00	Only upper 5 feet will be abandoned
Steam Cleaner[a]	19.00	DAY			95.00	$1,805.00	
Hand Auger[a]	6.50	DAY			750.00	$4,875.00	Assumes 15 cores per day
Local Travel for Hang Auger Crew[a]	7.00	DAY		150.00		$1,050.00	
Concrete Coring[a]	5.00	DAY			1100.00	$5,500.00	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[a]	5.00	DAY		150.00		$ 750.00	
Car or Van Mileage Charge[b]	3750.00	MI	0.48	0.00	0.00	$1,800.00	
SUBTOTAL ($2004)						$105,555	
Contingency	15%					$109,698	Scope
SUBTOTAL ($2004) all HRC and Injection Material						**$548,491**	
Install Groundwater Monitoring Wells[b]							6 wells to be installed
Organic Vapor Analyzer Rental, per Day	1.00	DAY	154.46	0.00	0.00	$154.46	
Decontaminate Rig, Augers, Screen (Rental Equipment)	1.00	DAY	146.04	0.00	0.00	$146.04	
Field Technician	16.00	HR	0.00	97.98	0.00	$1,567.71	
2" PVC, Schedule 40, Well Casing	30.00	LF	1.54	7.41	9.42	$550.88	
2" PVC, Schedule 40, Well Screen	30.00	LF	3.55	9.55	12.15	$757.62	
2" PVC, Well Plug	6.00	EA	7.48	11.11	14.13	$196.29	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	66.00	LF	0.00	20.31	25.83	$3,045.26	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	6.00	EA	101.71	0.00	0.00	$610.27	
2" Screen, Filter Pack	42.00	LF	3.99	6.30	8.01	$768.20	
2" Well, Portland Cement Grout	12.00	LF	1.49	0.00	0.00	$17.82	
2" Well, Bentonite Seal	6.00	EA	11.85	25.00	31.79	$411.85	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2,221.97	2,825.78	$5,047.75	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	51.93	231.57	5.33	$1,733.00	
SUBTOTAL ($2003)						$15,007.15	
SUBTOTAL ($2004)[c]	1.0398					**$15,605**	
Groundwater Monitoring (First Year)[b]							6 wells sampled quarterly for 2 years
RSK 175 for dissolved gases	84.00	EA	97.83	0.00	0.00	$8217.72	
Disposable Materials per Sample	84.00	EA	10.76	0.00	0.00	$903.84	
Decontamination Materials per Sample	84.00	EA	9.68	0.00	0.00	$813.12	
Nylon Tubing, 1/4" Outside Diameter	795.00	LF	0.56	0.00	0.00	$445.20	
Water Level Indicator, Manual,	3.00	WK	88.82	0.00	0.00	$266.46	
Polyethylene Tape, 100' Cable, Weekly						$ 0.00	
Rental						$ 0.00	
Flow Through Monitor, Weekly Rental	3.00	WK	301.20	0.00	0.00	$903.60	
Water Quality Parameter Testing Device	3.00	WK	307.24	0.00	0.00	$921.72	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	84.00	EA	55.69	0.00	0.00	$4677.96	
						$ 0.00	
Acidity/Alkalinity (EPA 305.1/310.1),	84.00	EA	38.58	0.00	0.00	$3240.72	
Water Analysis						$ 0.00	
Volatile Organic Analysis (EPA 624),	84.00	EA	276.27	0.00	0.00	$23206.68	
Water Analysis						$ 0.00	
Chloride (EPA 300), Water Analysis	84.00	EA	28.41	0.00	0.00	$2386.44	
Sulfate (EPA 300.0), Water Analysis	84.00	EA	28.94	0.00	0.00	$2430.96	
Sulfide (EPA 376.1), Water Analysis	84.00	EA	49.10	0.00	0.00	$4124.40	
Ferrous Iron (S.M. 3500 Fe - D)	84.00	EA	146.31	0.00	0.00	$12290.04	
55 Gallon 17C Closed Head Steel Drum	24.00	EA	91.19	0.00	0.00	$2188.56	
4" Submersible Pump Rental, Day	12.00	DAY	103.31	0.00	0.00	$1239.72	
Car or Van Mileage Charge	1200.00	MI	0.48	0.00	0.00	$576.00	
Project Manager	24.00	HR	0.00	243.91	0.00	$5853.84	
Project Engineer	120.00	HR	0.00	180.58	0.00	$21669.60	
Project Scientist	606.00	HR	0.00	146.81	0.00	$88966.86	
Staff Scientist	360.00	HR	0.00	140.14	0.00	$50450.40	
Field Technician	234.00	HR	0.00	97.98	0.00	$22927.32	
Word Processing/Clerical	138.00	HR	0.00	81.20	0.00	$11205.60	
Draftsman/CADD	90.00	HR	0.00	125.83	0.00	$11324.70	
SUBTOTAL ($2003)						$281,231	
SUBTOTAL ($2004)[c]	1.0398					**$292,435**	

TABLE C-2T3: SITE 6 IN SITU HRC TOTAL REMEDIAL COST SUMMARY

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Addition of hydrogen release compounds to contaminated groundwater followed by monitored natural attenuation and land-use controls at CERCLA Site 6. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
SUBTOTAL ($2004)						$856,532	
Contingency		25%				$214,133	10% scope + 15% bid
SUBTOTAL ($2004)						$1,070,665	
Professional Labor Management[b]							
Design		9.00%				$96,359.82	
Project Management Labor Cost		9.38%				$100,428.35	
Planning Documents Labor Cost		8.75%				$93,683.16	
Construction Oversight Labor Cost		7.50%				$80,299.85	
Reporting Labor Cost		1.25%				$13,383.31	
As-Built Drawings Labor Cost		1.25%				$13,383.31	
Public Notice Labor Cost		0.38%				$ 4,068.53	
Site Closure Activities Labor Cost		3.00%				$32,119.94	
Permitting Labor Cost		12.50%				$133,833.09	
SUBTOTAL						$567,559.36	
TOTAL CAPITAL COST IN 2004 DOLLARS						$1,638,224	
OPERATIONS AND MAINTENANCE COSTS:							
Treatment Train Miscellaneous							
Per Diem (per person)	0.00	DAY	0.00	0.00	0.00	$ 0.00	
Mobilize Crew, 50 Miles, per Person	0.00	EA	0.00	0.00	0.00	$ 0.00	
Staff Engineer	0.00	HR	0.00	0.00	0.00	$ 0.00	
Field Technician	0.00	HR	0.00	0.00	0.00	$ 0.00	
Startup Costs	0.00	LS	0.00	0.00	0.00	$ 0.00	
Annual Maintenance Materials and Labor	0.00	LS	0.00	0.00	0.00	$ 0.00	
SUBTOTAL						$ 0.00	
SUBTOTAL ($2003)						$ 0.00	
Runtime Percent Cost Adjustment	97%					$ 0.00	
Contingency	25%					$ 0.00	10% scope + 15% bid
SUBTOTAL ($2003)						$ 0.00	
SUBTOTAL ($2004)	1.0398					$ 0.00	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$0**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	4	1	EA		47928.91		$47,929	(RACER)
SUBTOTAL							$47,929	
Contingency		25%					$11,982	10% scope + 15% bid
SUBTOTAL ($2004)[d]		1.0398					$62,298	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[c]	Present Value	Notes
Capital Cost	0	$1,638,224	$1,638,224	1.0000	$1,638,224	
Annual O&M	1-3	$0	$0	1.8997	$0	
Periodic	4	$62,298	$62,298	0.8714	$54,289	End of Project Report (RACER)
		$1,700,522			$1,692,513	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$1,692,513**	

[a]HRC injections based on vendor quote from Regenesis ((9490 366-8090 on March 4, 2004

[b]Racer Costs

[c]Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

[a] RACER 2003 outputs are in 2003 dollars. The average ENR Construction Cost Index for 2003 was 6690.5, the ENR Construction Cost Index for March 2004 was 6957. The inflation rate from 2003 to March 2004 was 3.98% or a multiplier of 1.0398, which was used to bring RACER 2003 outputs forward to 2004 dollars.

TABLE C-2: SITE 6 COST SUMMARY FOR GROUNDWATER REMEDIAL ALTERNATIVES
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

TOTAL REMEDIAL COST SUMMARY FOR SITE 6 GROUNDWATER

Site:	Operable Unit 1, CERCLA Site 6	**Base Year:**	2004
Location:	Alameda Point, Alameda, California	**Date:**	October 18, 2004
Phase:	Feasibility Study		

Description	Alternative 2 Plume Delineation, MNA, LUCs	Alternative 3A Plume Delineation, In Situ Chemical Oxidation to Commercial/ Industrial Reuse Criteria, MNA, LUCs	Alternative 3B Plume Delineation, Hydrogen Release Compounds to Commercial/ Industrial Reuse Criteria, MNA, LUCs	Alternative 4A Plume Delineation, In Situ Chemical Oxidation to Residential Reuse Criteria, MNA, LUCs	Alternative 4B Plume Delineation, Hydrogen Release Compounds to Residential Reuse Criteria, MNA, LUCs
Total Project Duration (Years)	30	33	34	34	35
Capital Cost	$544,642	$855,889	$689,072	$2,993,229	$1,531,878
Annual O & M Cost	$487,830	$609,787	$487,830	$462,965	$462,965
Total Periodic Cost	$93,033	$136,262	$134,800	$140,078	$136,894
Total Present Value of Alternative	**$1,125,505**	**$1,601,938**	**$1,311,702**	**$3,596,272**	**$2,131,737**

TABLE C-2A: ALTERNATIVE 2 SITE 6, PLUME BOUNDARY DELINEATION, MNA, AND LUCS, TOTAL REMEDIAL COST
Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, MNA, and LUCs to restrict residential reuse and/or require vapor removal/barrier technology.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
CAPITAL COSTS:							
Sampling to Further Delineate the VOC Plume[a]							32 water samples (plus 3 QC)
Disposable Materials per Sample	35.00	EA	12.68	0.00	0.00	$444	and 16 soil samples (plus 2 QC)
Decontamination Materials per Sample	35.00	EA	11.32	0.00	0.00	$396	from 16 borings
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	3.00	DAY	260.00	0.00	0.00	$780	
Mobilize Direct Push Rig and Crew	3.00	DAY	866.68	0.00	0.00	$2,600	
Demobilize Direct Push Rig and Crew	3.00	DAY	866.68	0.00	0.00	$2,600	
Water Quality Parameter Testing Device	1.00	WK	359.56	0.00	0.00	$360	
Peristaltic Pump, Weekly Rental	1.00	WK	173.34	0.00	0.00	$173	
Volatile Organic Analysis (EPA 624), Water Analysis	35.00	EA	310.03	0.00	0.00	$10,851	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	18.00	EA	394.11	0.00	0.00	$7,094	
Car or Van Mileage Charge	300.00	MI	0.54	0.00	0.00	$162	
Project Scientist	153.00	HR	0.00	146.81	0.00	$22,462	
Field Technician	28.00	HR	0.00	97.98	0.00	$2,743	
Word Processing/Clerical	17.00	HR	0.00	81.20	0.00	$1,380	
Draftsman/CADD	17.00	HR	0.00	125.83	0.00	$2,139	
SUBTOTAL ($2004)						**$54,185**	
Installation of Groundwater Monitoring Wells[a]							6 groundwater monitoring wells
Organic Vapor Analyzer Rental, per Day	1.00	DAY	176.27	0.00	0.00	$176	(6 wells to 10 feet bgs)
Decontaminate Rig, Augers, Screen (Rental Equipment)	1.00	DAY	173.49	0.00	0.00	$173	
Field Technician	16.00	HR	0.00	97.98	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	30.00	LF	1.73	8.48	11.53	$652	
2" PVC, Schedule 40, Well Screen	30.00	LF	4.00	10.94	14.87	$894	
2" PVC, Well Plug	6.00	EA	8.43	12.72	17.29	$231	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	66.00	LF	0.00	23.25	31.62	$3,621	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	6.00	EA	121.17	0.00	0.00	$727	
2" Screen, Filter Pack	42.00	LF	4.50	7.21	9.80	$903	
2" Well, Portland Cement Grout	12.00	LF	1.67	0.00	0.00	$20	
2" Well, Bentonite Seal	6.00	EA	13.37	28.62	38.91	$485	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2,543.68	3,458.87	$6,003	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	58.56	264.35	9.75	$1,996	
SUBTOTAL ($2004)						**$17,450**	
Groundwater Monitoring[a]							6 wells monitored
Disposable Materials per Sample	28.00	EA	12.90	0.00	0.00	$361	quarterly for first year
Decontamination Materials per Sample	28.00	EA	11.51	0.00	0.00	$322	
Nylon Tubing, 1/4" Outside Diameter	245.00	LF	0.67	0.00	0.00	$164	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	4.00	DAY	39.66	0.00	0.00	$159	
Flow Through Monitor, Weekly Rental	4.00	WK	343.74	0.00	0.00	$1,375	
Water Quality Parameter Testing Device	4.00	WK	365.66	0.00	0.00	$1,463	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	28.00	EA	50.84	0.00	0.00	$1,424	
RSK175 analysis for dissolved gases	28.00	EA	97.83	0.00	0.00	$2,739	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	28.00	EA	39.41	0.00	0.00	$1,103	
Volatile Organic Analysis (EPA 624), Water Analysis	28.00	EA	315.29	0.00	0.00	$8,828	
Chloride (EPA 300), Water Analysis	28.00	EA	29.67	0.00	0.00	$831	
Sulfate (EPA 300.0), Water Analysis	28.00	EA	29.67	0.00	0.00	$831	
Sulfide (EPA 376.1), Water Analysis	28.00	EA	43.42	0.00	0.00	$1,216	

TABLE C-2A: ALTERNATIVE 2 SITE 6, PLUME BOUNDARY DELINEATION, MNA, AND LUCS, TOTAL REMEDIAL COST
Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, MNA, and LUCs to restrict residential reuse and/or require vapor removal/barrier technology.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Ferrous Iron (S.M. 3500 Fe - D)	28.00	EA	137.58	0.00	0.00	$3,852	
4" Submersible Pump Rental, Day	4.00	DAY	116.50	0.00	0.00	$466	
Well Development Equipment Rental (weekly)	4.00	WK	365.66	0.00	0.00	$1,463	
Furnish 55 Gallon Drum for Development/Purge Water	8.00	EA	121.17	0.00	0.00	$969	
Car or Van Mileage Charge	400.00	MI	0.55	0.00	0.00	$220	
Project Scientist	203.00	HR	0.00	146.81	0.00	$29,802	
Field Technician	57.00	HR	0.00	97.98	0.00	$5,585	
Word Processing/Clerical	23.00	HR	0.00	81.20	0.00	$1,868	
Draftsman/CADD	23.00	HR	0.00	125.83	0.00	$2,894	
SUBTOTAL ($2004)						**$67,935**	
Vapor Removal System[b]							
Design System for Building 41						$10,000	
Installation of Soil Depressurization System						$100,000	
SUBTOTAL ($2004)						**$110,000**	
Land Use Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Resrtrictions in Deed						$31,470	
Register and File Deed						$133	
Contingency	25%					$17,807	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$106,842**	
SUBTOTAL ($2004)						$356,412	
Contingency	25%					$89,103	10% scope + 15% bid
SUBTOTAL ($2004)						**$445,515**	
Professional Labor							
Design and Work Plan	9.00%					$40,096	
Project Management Labor Cost	5.00%					$22,276	
Planning Documents Labor Cost	4.00%					$17,821	
Construction Oversight Labor Cost	0.75%					$3,341	
Reporting Labor Cost	0.75%					$3,341	
As-Built Drawings Labor Cost	0.25%					$1,114	
Public Notice Labor Cost	0.25%					$1,114	
Site Closure Activities Labor Cost	2.00%					$8,910	
Permitting Labor Cost	0.25%					$1,114	
SUBTOTAL ($2004)						**$99,127**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$544,642**	

OPERATIONS AND MAINTENANCE COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Groundwater Monitoring[a]							6 wells monitored annually
Disposable Materials per Sample	7.00	EA	12.90	0.00	0.00	$90	
Decontamination Materials per Sample	7.00	EA	11.51	0.00	0.00	$81	
Nylon Tubing, 1/4" Outside Diameter	63.00	LF	0.67	0.00	0.00	$42	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	1.00	DAY	39.66	0.00	0.00	$40	
Flow Through Monitor, Weekly Rental	1.00	WK	343.74	0.00	0.00	$344	
Water Quality Parameter Testing Device	1.00	WK	365.66	0.00	0.00	$366	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	7.00	EA	50.84	0.00	0.00	$356	
RSK175 analysis for dissolved gases	7.00	EA	97.83	0.00	0.00	$685	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	7.00	EA	39.41	0.00	0.00	$276	
Volatile Organic Analysis (EPA 624), Water Analysis	7.00	EA	315.29	0.00	0.00	$2,207	
Chloride (EPA 300), Water Analysis	7.00	EA	29.67	0.00	0.00	$208	
Sulfate (EPA 300.0), Water Analysis	7.00	EA	29.67	0.00	0.00	$208	
Sulfide (EPA 376.1), Water Analysis	7.00	EA	43.42	0.00	0.00	$304	

TABLE C-2A: ALTERNATIVE 2 SITE 6, PLUME BOUNDARY DELINEATION, MNA, AND LUCS, TOTAL REMEDIAL COST
Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, MNA, and LUCs to restrict residential reuse and/or require vapor removal/barrier technology.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Ferrous Iron (S.M. 3500 Fe - D)	7.00	EA	137.58	0.00	0.00	$963	
4" Submersible Pump Rental, Day	1.00	DAY	116.50	0.00	0.00	$117	
Well Development Equipment Rental (weekly)	1.00	WK	365.66	0.00	0.00	$366	
Furnish 55 Gallon Drum for Development/Purge Water	2.00	EA	121.17	0.00	0.00	$242	
Car or Van Mileage Charge	100.00	MI	0.55	0.00	0.00	$55	
Project Scientist	23.00	HR	0.00	146.81	0.00	$3,377	
Field Technician	19.00	HR	0.00	97.98	0.00	$1,862	
Word Processing/Clerical	3.00	HR	0.00	81.20	0.00	$244	
Draftsman/CADD	3.00	HR	0.00	125.83	0.00	$377	
SUBTOTAL ($2004)						**$12,807**	
Vapor Removal System[b]							
Annual O&M						$10,000	
SUBTOTAL ($2004)						**$10,000**	
Land Use Controls							
Annual Drive-by Inspection						$2,478	
Contingency	25%					$620	
Navy Oversight	25%					$620	
SUBTOTAL ($2004)						**$3,717**	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$26,524**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Five Year Reviews	5-30	6.00	EA		20163.00		$120,978	One every five years
Well Abandonment	30	6.00	EA		837.00		$5,022	
Close-out Report	30	1.00	EA		47928.91		$47,929	
SUBTOTAL							**$52,951**	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[c,d]	Present Value	Notes
Capital Cost	0	$544,642	$544,642	1.0000	$544,642	
Annual O&M	1-30	$928,338	$26,524	18.3920	$487,830	Land Use controls
Periodic Cost	5-30	$120,978	$20,163	3.6784	$74,168	One every five years
Periodic Cost	30	$52,951	$52,951	0.3563	$18,865	
		$1,646,909			$1,125,505	
TOTAL PRESENT VALUE OF ALTERNATIVE						**$1,125,505**

Notes:
[a] Cost generated in RACER 2004.
[b] Vender quote from Colorado Vintage Companies Doug Kladder, (719) 632-1215, March 22, 2004.
[c] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 for a 30 year technology and t = year (i.e., the present value of the dollar paid in year t at 3.5%)
[d] Multi-year discount factor = $\frac{(1+i)^n - 1}{i(1+i)^n}$ where i = 0.035 for a 30 year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-2B: ALTERNATIVE 3A SITE 6, PLUME BOUNDARY DELINEATION, ISCO TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST

Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (in situ chemical oxidation) to commercial/industrial reuse, MNA, LUCs to restrict residential reuse

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
CAPITAL COSTS:							
Sampling to Further Delineate the VOC Plume[a]							32 water samples (plus 3 QC)
Disposable Materials per Sample	35.00	EA	12.68	0.00	0.00	$444	and 16 soil samples (plus 2 QC)
Decontamination Materials per Sample	35.00	EA	11.32	0.00	0.00	$396	from 16 borings
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	3.00	DAY	260.00	0.00	0.00	$780	
Mobilize Direct Push Rig and Crew	3.00	DAY	866.68	0.00	0.00	$2,600	
Demobilize Direct Push Rig and Crew	3.00	DAY	866.68	0.00	0.00	$2,600	
Water Quality Parameter Testing Devic	1.00	WK	359.56	0.00	0.00	$360	
Peristaltic Pump, Weekly Rental	1.00	WK	173.34	0.00	0.00	$173	
Volatile Organic Analysis (EPA 624), Water Analysis	35.00	EA	310.03	0.00	0.00	$10,851	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	18.00	EA	394.11	0.00	0.00	$7,094	
Car or Van Mileage Charge	300.00	MI	0.54	0.00	0.00	$162	
Project Scientist	153.00	HR	0.00	146.81	0.00	$22,462	
Field Technician	28.00	HR	0.00	97.98	0.00	$2,743	
Word Processing/Clerical	17.00	HR	0.00	81.20	0.00	$1,380	
Draftsman/CADD	17.00	HR	0.00	125.83	0.00	$2,139	
SUBTOTAL ($2004)						**$54,185**	
Pretreatment Costs[b]							
Work Plan						$10,000	
SUBTOTAL ($2004)						**$10,000**	
Treatment Costs[b]							
Pilot Test							
Mobilization						$5,000	
Materials Costs (reagent), Injector Fabrication/Installation and Injection						$18,600	
Pilot Test Groundwater Monitoring[b]							3 wells sampled quarterly
RSK175 analysis for dissolved gases	14.00	EA	97.83	0.00	0.00	$1,370	
Disposable Materials per Sample	14.00	EA	10.76	0.00	0.00	$151	
Decontamination Materials per Sample	14.00	EA	9.68	0.00	0.00	$136	
Nylon Tubing, 1/4" Outside Diameter	350.00	LF	0.56	0.00	0.00	$196	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Devic	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	14.00	EA	55.69	0.00	0.00	$780	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	14.00	EA	38.58	0.00	0.00	$540	
Volatile Organic Analysis (EPA 624), Water Analysis	14.00	EA	276.27	0.00	0.00	$3,868	
Chloride (EPA 300), Water Analysis	14.00	EA	28.41	0.00	0.00	$398	
Sulfate (EPA 300.0), Water Analysis	14.00	EA	28.94	0.00	0.00	$405	
Sulfide (EPA 376.1), Water Analysis	14.00	EA	49.10	0.00	0.00	$687	
Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	146.31	0.00	0.00	$2,048	
55 Gallon 17C Closed Head Steel Drun	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	3.00	DAY	103.31	0.00	0.00	$310	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Scientist	63.00	HR	0.00	146.81	0.00	$9,249	
Field Technician	71.00	HR	0.00	97.98	0.00	$6,957	
Word Processing/Clerical	7.00	HR	0.00	81.20	0.00	$568	
Draftsman/CADD	7.00	HR	0.00	125.83	0.00	$881	

TABLE C-2B: ALTERNATIVE 3A SITE 6, PLUME BOUNDARY DELINEATION, ISCO TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST

Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (in situ chemical oxidation) to commercial/industrial reuse, MNA, LUCs to restrict residential reuse

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Primary Treatment							
Mobilization						$11,500	
Materials Costs (reagent), Injector Fabrication/Installation and Injection						$24,081	
Follow up Treatment (50% retreat if necessary)							
Mobilization						$11,500	
Materials Costs (reagent), Injector Fabrication/Installation and Injection						$18,730	
Contigency (percent of treatment cost)	15%					$18,194.88	Scope
SUBTOTAL ($2004) all Treatment costs						**$139,494**	
Installation of Groundwater Monitoring Wells[a]							6 groundwater monitoring wells
Organic Vapor Analyzer Rental, per Da	1.00	DAY	176.27	0.00	0.00	$176	(6 wells to 10 feet bgs)
Decontaminate Rig, Augers, Screen (Rental Equipment)	1.00	DAY	173.49	0.00	0.00	$173	
Field Technician	16.00	HR	0.00	97.98	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	30.00	LF	1.73	8.48	11.53	$652	
2" PVC, Schedule 40, Well Screen	30.00	LF	4.00	10.94	14.87	$894	
2" PVC, Well Plug	6.00	EA	8.43	12.72	17.29	$231	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	66.00	LF	0.00	23.25	31.62	$3,621	
Furnish 55 Gallon Drum for Drill Cutting & Development Water	6.00	EA	121.17	0.00	0.00	$727	
2" Screen, Filter Pack	42.00	LF	4.50	7.21	9.80	$903	
2" Well, Portland Cement Grout	12.00	LF	1.67	0.00	0.00	$20	
2" Well, Bentonite Seal	6.00	EA	13.37	28.62	38.91	$485	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2,543.68	3,458.87	$6,003	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	58.56	264.35	9.75	$1,996	
SUBTOTAL ($2004)						**$17,450**	
Groundwater Monitoring[a]							6 wells monitored
Disposable Materials per Sample	28.00	EA	12.90	0.00	0.00	$361	quarterly
Decontamination Materials per Sample	28.00	EA	11.51	0.00	0.00	$322	
Nylon Tubing, 1/4" Outside Diameter	245.00	LF	0.67	0.00	0.00	$164	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	4.00	DAY	39.66	0.00	0.00	$159	
Flow Through Monitor, Weekly Rental	4.00	WK	343.74	0.00	0.00	$1,375	
Water Quality Parameter Testing Devic	4.00	WK	365.66	0.00	0.00	$1,463	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	28.00	EA	50.84	0.00	0.00	$1,424	
RSK175 analysis for dissolved gases	28.00	EA	97.83	0.00	0.00	$2,739	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	28.00	EA	39.41	0.00	0.00	$1,103	
Volatile Organic Analysis (EPA 624), Water Analysis	28.00	EA	315.29	0.00	0.00	$8,828	
Chloride (EPA 300), Water Analysis	28.00	EA	29.67	0.00	0.00	$831	
Sulfate (EPA 300.0), Water Analysis	28.00	EA	29.67	0.00	0.00	$831	
Sulfide (EPA 376.1), Water Analysis	28.00	EA	43.42	0.00	0.00	$1,216	
Ferrous Iron (S.M. 3500 Fe - D)	28.00	EA	137.58	0.00	0.00	$3,852	
4" Submersible Pump Rental, Day	4.00	DAY	116.50	0.00	0.00	$466	
Well Development Equipment Rental (weekly)	4.00	WK	365.66	0.00	0.00	$1,463	
Furnish 55 Gallon Drum for Development/Purge Water	8.00	EA	121.17	0.00	0.00	$969	
Car or Van Mileage Charge	400.00	MI	0.55	0.00	0.00	$220	
Project Scientist	203.00	HR	0.00	146.81	0.00	$29,802	
Field Technician	57.00	HR	0.00	97.98	0.00	$5,585	
Word Processing/Clerical	23.00	HR	0.00	81.20	0.00	$1,868	
Draftsman/CADD	23.00	HR	0.00	125.83	0.00	$2,894	
SUBTOTAL ($2004)						**$67,935**	

TABLE C-2B: ALTERNATIVE 3A SITE 6, PLUME BOUNDARY DELINEATION, ISCO TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST

Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (in situ chemical oxidation) to commercial/industrial reuse, MNA, LUCs to restrict residential reuse

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Vapor Removal System[c]							
Design System for Building 41						$10,000	
Installation of Soil Depressurization System						$100,000	
SUBTOTAL ($2004)						**$110,000**	
Land Use Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Resrtrictions in Deed						$31,470	
Register and File Deed						$133	
Contingency	25%					$17,807	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$106,842**	
SUBTOTAL ($2004)						$560,091	
Contingency	25%					$140,023	10% scope + 15% bid
SUBTOTAL ($2004)						**$700,114**	
Professional Labor[a]							
Design and Work Plan	9.00%					$63,010	
Project Management Labor Cost	5.00%					$35,006	
Planning Documents Labor Cost	4.00%					$28,005	
Construction Oversight Labor Cost	0.75%					$5,251	
Reporting Labor Cost	0.75%					$5,251	
As-Built Drawings Labor Cost	0.25%					$1,750	
Public Notice Labor Cost	0.25%					$1,750	
Site Closure Activities Labor Cost	2.00%					$14,002	
Permitting Labor Cost	0.25%					$1,750	
SUBTOTAL ($2003)						**$155,775**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$855,889**	
OPERATIONS AND MAINTENANCE COSTS:							
Groundwater Monitoring[a]							6 wells monitored
Disposable Materials per Sample	7.00	EA	12.90	0.00	0.00	$90	annually
Decontamination Materials per Sample	7.00	EA	11.51	0.00	0.00	$81	
Nylon Tubing, 1/4" Outside Diameter	63.00	LF	0.67	0.00	0.00	$42	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	1.00	DAY	39.66	0.00	0.00	$40	
Flow Through Monitor, Weekly Rental	1.00	WK	343.74	0.00	0.00	$344	
Water Quality Parameter Testing Devic	1.00	WK	365.66	0.00	0.00	$366	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	7.00	EA	50.84	0.00	0.00	$356	
RSK175 analysis for dissolved gases	7.00	EA	$98	$0	$0	$685	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	7.00	EA	39.41	0.00	0.00	$276	
Volatile Organic Analysis (EPA 624), Water Analysis	7.00	EA	315.29	0.00	0.00	$2,207	
Chloride (EPA 300), Water Analysis	7.00	EA	29.67	0.00	0.00	$208	
Sulfate (EPA 300.0), Water Analysis	7.00	EA	29.67	0.00	0.00	$208	
Sulfide (EPA 376.1), Water Analysis	7.00	EA	43.42	0.00	0.00	$304	
Ferrous Iron (S.M. 3500 Fe - D)	7.00	EA	137.58	0.00	0.00	$963	
4" Submersible Pump Rental, Day	1.00	DAY	116.50	0.00	0.00	$117	
Well Development Equipment Rental (weekly)	1.00	WK	365.66	0.00	0.00	$366	
Furnish 55 Gallon Drum for Development/Purge Water	2.00	EA	121.17	0.00	0.00	$242	
Car or Van Mileage Charge	100.00	MI	0.55	0.00	0.00	$55	
Project Scientist	23.00	HR	0.00	146.81	0.00	$3,377	
Field Technician	19.00	HR	0.00	97.98	0.00	$1,862	
Word Processing/Clerical	3.00	HR	0.00	81.20	0.00	$244	
Draftsman/CADD	3.00	HR	0.00	125.83	0.00	$377	
SUBTOTAL ($2004)						**$12,807**	

TABLE C-2B: ALTERNATIVE 3A SITE 6, PLUME BOUNDARY DELINEATION, ISCO TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST

Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (in situ chemical oxidation) to commercial/industrial reuse, MNA, LUCs to restrict residential reuse

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Vapor Removal System[c]							
Annual O&M						$10,000	
SUBTOTAL ($2004)						**$10,000**	
Land Use Controls							
Annual Drive-by Inspection						$2,478	
Contingency	25%					$620	
Navy Oversight	25%					$620	
SUBTOTAL ($2004)						**$3,717**	
SUBTOTAL ($2003)						$26,524	
Contingency	25%					$6,631	10% scope + 15% bid
SUBTOTAL ($2004)						**$33,155**	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$33,155**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	3	1	EA		$47,929		$47,929	
SUBTOTAL							**$47,929**	
Five Year Reviews	5-30	6	EA		$20,163		$120,978	One every five years
SUBTOTAL							**$120,978**	
Well Abandonment	30	6	EA		$837		$ 5,022	
Close-out Report	30	1	EA		$47,929		$47,929	
SUBTOTAL							**$52,951**	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[d,e]	Present Value	Notes
Capital Cost	0	$855,889	$855,889	1.0000	$855,889	
Annual O&M	1-30	$1,060,958	$33,155	18.3920	$609,787	Land Use controls
Periodic Cost	3	$47,929	$47,929	0.9019	$43,229	
Periodic Cost	5-30	$120,978	$20,163	3.6784	$74,168	One every five years
Periodic Cost	30	$52,951	$52,951	0.3563	$18,865	
		$2,138,705			$1,601,938	
TOTAL PRESENT VALUE OF ALTERNATIVE					**$1,601,938**	

Notes:

a Cost generated in RACER 2004

b Vendor quote from ISOTEC, Chris Nelson of Chris Nelson. Quote includes labor, materials, equipment and reports.

c Vender quote from Colorado Vintage Companies Doug Kladder, (719) 632-1215, March 22, 2004.

d Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 for a 3 year technology and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

e Multi-year discount factor = $\frac{(1+i)^n - 1}{i(1+i)^n}$ where i = 0.035 for a 30 year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-2C: ALTERNATIVE 3B SITE 6, PLUME BOUNDARY DELINEATION, HRC TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (hydrogen release compounds) to commercial/industrial reuse, MNA, LUCs to restrict residential reuse

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
CAPITAL COSTS:							
Sampling to Further Delineate the VOC Plume[a]							32 water samples (plus 3 QC)
Disposable Materials per Sample	35.00	EA	12.68	0.00	0.00	$444	and 16 soil samples (plus 2 QC)
Decontamination Materials per Sample	35.00	EA	11.32	0.00	0.00	$396	from 16 borings
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	3.00	DAY	260.00	0.00	0.00	$780	
Mobilize Direct Push Rig and Crew	3.00	DAY	866.68	0.00	0.00	$2,600	
Demobilize Direct Push Rig and Crew	3.00	DAY	866.68	0.00	0.00	$2,600	
Water Quality Parameter Testing Device	1.00	WK	359.56	0.00	0.00	$360	
Peristaltic Pump, Weekly Rental	1.00	WK	173.34	0.00	0.00	$173	
Volatile Organic Analysis (EPA 624), Water Analysis	35.00	EA	310.03	0.00	0.00	$10,851	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	18.00	EA	394.11	0.00	0.00	$7,094	
Car or Van Mileage Charge	300.00	MI	0.54	0.00	0.00	$162	
Project Scientist	153.00	HR	0.00	146.81	0.00	$22,462	
Field Technician	28.00	HR	0.00	97.98	0.00	$2,743	
Word Processing/Clerical	17.00	HR	0.00	81.20	0.00	$1,380	
Draftsman/CADD	17.00	HR	0.00	125.83	0.00	$2,139	
SUBTOTAL ($2004)						**$54,185**	
HRC Injection and Materials[b]							
Pilot Test							
Work Plan	1.00	LS	0.00	0.00	0.00	$10,000	
HRC material	180.00	LB	8.00	0.00	0.00	$1,440	
Shipping	1.00	LS	0.00	0.00	0.00	$576	
Mobilization[c]	1.00	LS	0.00	0.00	0.00	$500	
Drill Rig[c]	1.00	DAY	0.00	0.00	1250.00	$1,250	Drilling 200 feet per day
Local Travel[c]	1.00	DAY	0.00	150.00	0.00	$150	
Additional Crew Member for Injection[c]	1.00	DAY	0.00	450.00	0.00	$450	
Injection Pump[c]	1.00	DAY	0.00	0.00	300.00	$300	
Borehole Abandonment[c]	40.00	LF	0.00	0.00	1.00	$40	Upper 5 feet will be abandoned
Steam Cleaner[c]	1.00	DAY	0.00	0.00	95.00	$95	
Staff Scientist[c]	78.00	HR	0.00	140.14	0.00	$10,931	
Install Monitoring Wells[c]	3.00	EA	0.00	0.00	0.00	$7,500	
Pilot Test Groundwater Monitoring[a]							3 wells sampled quarterly
RSK175 analysis for dissolved gases	14.00	EA	97.83	0.00	0.00	$1,370	
Disposable Materials per Sample	14.00	EA	10.76	0.00	0.00	$151	
Decontamination Materials per Sample	14.00	EA	9.68	0.00	0.00	$136	
Nylon Tubing, 1/4" Outside Diameter	350.00	LF	0.56	0.00	0.00	$196	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	14.00	EA	55.69	0.00	0.00	$780	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	14.00	EA	38.58	0.00	0.00	$540	
Volatile Organic Analysis (EPA 624), Water Analysis	14.00	EA	276.27	0.00	0.00	$3,868	
Chloride (EPA 300), Water Analysis	14.00	EA	28.41	0.00	0.00	$398	
Sulfate (EPA 300.0), Water Analysis	14.00	EA	28.94	0.00	0.00	$405	
Sulfide (EPA 376.1), Water Analysis	14.00	EA	49.10	0.00	0.00	$687	
Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	146.31	0.00	0.00	$2,048	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	3.00	DAY	103.31	0.00	0.00	$310	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Scientist	63.00	HR	0.00	146.81	0.00	$9,249	
Field Technician	71.00	HR	0.00	97.98	0.00	$6,957	
Word Processing/Clerical	7.00	HR	0.00	81.20	0.00	$568	
Draftsman/CADD	7.00	HR	0.00	125.83	0.00	$881	

TABLE C-2C: ALTERNATIVE 3B SITE 6, PLUME BOUNDARY DELINEATION, HRC TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (hydrogen release compounds) to commercial/industrial reuse, MNA, LUCs to restrict residential reuse

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Primary Treatment							
HRC material	420.00	LB	8.00	0.00	0.00	$3,360	
Shipping	1.00	LS	0.00	0.00	0.00	$795	
Mobilization[c]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	1.00	DAY	0.00	0.00	1250.00	$1,250	Drilling 200 feet per day
Local Travel[c]	1.00	DAY	0.00	150.00	0.00	$150	
Additional Crew Member for Injection[c]	1.00	DAY	0.00	450.00	0.00	$450	
Injection Pump[c]	1.00	DAY	0.00	0.00	300.00	$300	
Borehole Abandonment[c]	50.00	LF	0.00	0.00	1.00	$50	Only upper 5 feet will be abandoned
Steam Cleaner[c]	1.00	DAY	0.00	0.00	95.00	$95	
Hand Auger[c]	1.00	DAY	0.00	0.00	750.00	$750	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	1.00	DAY	0.00	150.00	0.00	$150	
Concrete Coring[c]	1.00	DAY	0.00	0.00	1100.00	$1,100	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	1.00	DAY	0.00	150.00	0.00	$150	
Car or Van Mileage Charge[c]	100.00	MI	0.48	0.00	0.00	$48	
Follow up Treatment (50% retreat, if necessary)							
HRC material	210.00	LB	5.50	0.00	0.00	$1,155	
Shipping	1.00	LS	0.00	0.00	0.00	$795	
Mobilization[c]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	1.00	DAY	0.00	0.00	1250.00	$1,250	Drilling 200 feet per day
Local Travel[c]	1.00	DAY	0.00	150.00	0.00	$150	
Additional Crew Member for Injection[c]	1.00	DAY	0.00	450.00	0.00	$450	
Injection Pump[c]	1.00	DAY	0.00	0.00	300.00	$300	
Borehole Abandonment[c]	25.00	LF	0.00	0.00	1.00	$25	Only upper 5 feet will be abandoned
Steam Cleaner[c]	1.00	DAY	0.00	0.00	95.00	$95	
Hand Auger[c]	1.00	DAY	0.00	0.00	750.00	$750	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	1.00	DAY	0.00	150.00	0.00	$150	
Concrete Coring[c]	1.00	DAY	0.00	0.00	1100.00	$1,100	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	1.00	DAY	0.00	150.00	0.00	$150	
Car or Van Mileage Charge[c]	100.00	MI	0.48	0.00	0.00	$48	
Contigency (percent of treatment cost)	15%					$12,328	Scope
SUBTOTAL ($2004) HRC and Injection Material						**$94,514**	
Installation of Groundwater Monitoring Wells[a]							6 groundwater monitoring wells
Organic Vapor Analyzer Rental, per Day	1.00	DAY	176.27	0.00	0.00	$176	(6 wells to 10 feet bgs)
Decontaminate Rig, Augers, Screen (Rental Equipment)	1.00	DAY	173.49	0.00	0.00	$173	
Field Technician	16.00	HR	0.00	97.98	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	30.00	LF	1.73	8.48	11.53	$652	
2" PVC, Schedule 40, Well Screen	30.00	LF	4.00	10.94	14.87	$894	
2" PVC, Well Plug	6.00	EA	8.43	12.72	17.29	$231	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	66.00	LF	0.00	23.25	31.62	$3,621	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	6.00	EA	121.17	0.00	0.00	$727	
2" Screen, Filter Pack	42.00	LF	4.50	7.21	9.80	$903	
2" Well, Portland Cement Grout	12.00	LF	1.67	0.00	0.00	$20	
2" Well, Bentonite Seal	6.00	EA	13.37	28.62	38.91	$485	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2,543.68	3,458.87	$6,003	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	58.56	264.35	9.75	$1,996	
SUBTOTAL ($2004)						**$17,450**	

TABLE C-2C: ALTERNATIVE 3B SITE 6, PLUME BOUNDARY DELINEATION, HRC TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (hydrogen release compounds) to commercial/industrial reuse, MNA, LUCs to restrict residential reuse

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Groundwater Monitoring[a]							6 wells monitored
Disposable Materials per Sample	28.00	EA	12.90	0.00	0.00	$361	quarterly
Decontamination Materials per Sample	28.00	EA	11.51	0.00	0.00	$322	
Nylon Tubing, 1/4" Outside Diameter	245.00	LF	0.67	0.00	0.00	$164	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	4.00	DAY	39.66	0.00	0.00	$159	
Flow Through Monitor, Weekly Rental	4.00	WK	343.74	0.00	0.00	$1,375	
Water Quality Parameter Testing Device	4.00	WK	365.66	0.00	0.00	$1,463	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	28.00	EA	50.84	0.00	0.00	$1,424	
RSK175 analysis for dissolved gases	28.00	EA	97.83	0.00	0.00	$2,739	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	28.00	EA	39.41	0.00	0.00	$1,103	
Volatile Organic Analysis (EPA 624), Water Analysis	28.00	EA	315.29	0.00	0.00	$8,828	
Chloride (EPA 300), Water Analysis	28.00	EA	29.67	0.00	0.00	$831	
Sulfate (EPA 300.0), Water Analysis	28.00	EA	29.67	0.00	0.00	$831	
Sulfide (EPA 376.1), Water Analysis	28.00	EA	43.42	0.00	0.00	$1,216	
Ferrous Iron (S.M. 3500 Fe - D)	28.00	EA	137.58	0.00	0.00	$3,852	
4" Submersible Pump Rental, Day	4.00	DAY	116.50	0.00	0.00	$466	
Well Development Equipment Rental (weekly)	4.00	WK	365.66	0.00	0.00	$1,463	
Furnish 55 Gallon Drum for Development/Purge Water	8.00	EA	121.17	0.00	0.00	$969	
Car or Van Mileage Charge	400.00	MI	0.55	0.00	0.00	$220	
Project Scientist	203.00	HR	0.00	146.81	0.00	$29,802	
Field Technician	57.00	HR	0.00	97.98	0.00	$5,585	
Word Processing/Clerical	23.00	HR	0.00	81.20	0.00	$1,868	
Draftsman/CADD	23.00	HR	0.00	125.83	0.00	$2,894	
SUBTOTAL ($2004)						**$67,935**	
Vapor Removal System[d]							
Design System for Building 41						$10,000	
Installation of Soil Depressurization System						$100,000	
SUBTOTAL ($2004)						**$110,000**	
Land Use Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Resrtrictions in Deed						$31,470	
Register and File Deed						$133	
Contingency	25%					$17,807	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$106,842**	
SUBTOTAL ($2004)						$450,926	
Contingency	25%					$112,732	10% scope + 15% bid
SUBTOTAL ($2004)						**$563,658**	
Professional Labor							
Design and Work Plan	9.00%					$50,729	
Project Management Labor Cost	5.00%					$28,183	
Planning Documents Labor Cost	4.00%					$22,546	
Construction Oversight Labor Cost	0.75%					$4,227	
Reporting Labor Cost	0.75%					$4,227	
As-Built Drawings Labor Cost	0.25%					$1,409	
Public Notice Labor Cost	0.25%					$1,409	
Site Closure Activities Labor Cost	2.00%					$11,273	
Permitting Labor Cost	0.25%					$1,409	
SUBTOTAL ($2004)						**$125,414**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$689,072**	

TABLE C-2C: ALTERNATIVE 3B SITE 6, PLUME BOUNDARY DELINEATION, HRC TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (hydrogen release compounds) to commercial/industrial reuse, MNA, LUCs to restrict residential reuse

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
OPERATIONS AND MAINTENANCE COSTS:							
Groundwater Monitoring[a]							6 wells monitored
Disposable Materials per Sample	7.00	EA	12.90	0.00	0.00	$90	annually
Decontamination Materials per Sample	7.00	EA	11.51	0.00	0.00	$81	
Nylon Tubing, 1/4" Outside Diameter	63.00	LF	0.67	0.00	0.00	$42	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	1.00	DAY	39.66	0.00	0.00	$40	
Flow Through Monitor, Weekly Rental	1.00	WK	343.74	0.00	0.00	$344	
Water Quality Parameter Testing Device	1.00	WK	365.66	0.00	0.00	$366	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	7.00	EA	50.84	0.00	0.00	$356	
RSK175 analysis for dissolved gases	7.00	EA	97.83	0.00	0.00	$685	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	7.00	EA	39.41	0.00	0.00	$276	
Volatile Organic Analysis (EPA 624), Water Analysis	7.00	EA	315.29	0.00	0.00	$2,207	
Chloride (EPA 300), Water Analysis	7.00	EA	29.67	0.00	0.00	$208	
Sulfate (EPA 300.0), Water Analysis	7.00	EA	29.67	0.00	0.00	$208	
Sulfide (EPA 376.1), Water Analysis	7.00	EA	43.42	0.00	0.00	$304	
Ferrous Iron (S.M. 3500 Fe - D)	7.00	EA	137.58	0.00	0.00	$963	
4" Submersible Pump Rental, Day	1.00	DAY	116.50	0.00	0.00	$117	
Well Development Equipment Rental (weekly)	1.00	WK	365.66	0.00	0.00	$366	
Furnish 55 Gallon Drum for Development/Purge Water	2.00	EA	121.17	0.00	0.00	$242	
Car or Van Mileage Charge	100.00	MI	0.55	0.00	0.00	$55	
Project Scientist	23.00	HR	0.00	146.81	0.00	$3,377	
Field Technician	19.00	HR	0.00	97.98	0.00	$1,862	
Word Processing/Clerical	3.00	HR	0.00	81.20	0.00	$244	
Draftsman/CADD	3.00	HR	0.00	125.83	0.00	$377	
SUBTOTAL ($2004)						**$12,807**	
Vapor Removal System[d]							
Annual O&M						$10,000	
SUBTOTAL ($2004)						**$10,000**	
Land Use Controls							
Annual Drive-by Inspection						$2,478	
Contingency	25%					$620	
Navy Oversight	25%					$620	
SUBTOTAL ($2004)						**$3,717**	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$26,524**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	4	1	EA		$47,929		$47,929	
SUBTOTAL							**$47,929**	
Five Year Reviews	5-30	6	EA		$20,163		$120,978	One every five years
SUBTOTAL							**$120,978**	
Well Abandonment	30	6	EA		$ 837		$ 5,022	
Close-out Report	30	1	EA		$47,929		$47,929	
SUBTOTAL							**$52,951**	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[e,f]	Present Value	Notes
Capital Cost	0	$689,072	$689,072	1.0000	$689,072	
Annual O&M	1-30	$875,290	$26,524	18.3920	$487,830	Land Use controls
Periodic Cost	4	$47,929	$47,929	0.8714	$41,767	
Periodic Cost	5-30	$120,978	$20,163	3.6784	$74,168	One every five years
Periodic Cost	30	$52,951	$52,951	0.3563	$18,865	
		$1,786,220			$1,311,702	
TOTAL PRESENT VALUE OF ALTERNATIVE						**$1,311,702**

Notes:
[a] Costs provided by RACER 2004
[b] Vendor quote from Dave Reilly at Regenesis, (949) 366-8001 x 125 on March 17, 2004
[c] Vendor quote from Derrik M Sandberg at ResonantSonic International on March 17, 2004, (530) 668-2424
[d] Vender quote from Colorado Vintage Companies Doug Kladder, (719) 632-1215, March 22, 2004.
[e] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 and t = year (i.e., the present value of the dollar paid in year t at 3.5%)
[f] Multi-year discount factor = $\frac{(1+i)^n - 1}{i(1+i)^n}$ where i = 0.035 for a 30 year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-2D: ALTERNATIVE 4A SITE 6 PLUME BOUNDARY DELINEATION, ISCO TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (in situ chemical oxidation) to residential reuse, MNA and LUCs including vapor barriers until residential criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
CAPITAL COSTS:							
Sampling to Further Delineate the VOC Plume[a]							32 water samples (plus 3 QC)
Disposable Materials per Sample	35.00	EA	12.68	0.00	0.00	$444	and 16 soil samples (plus 2 QC)
Decontamination Materials per Sample	35.00	EA	11.32	0.00	0.00	$396	from 16 borings
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	3.00	DAY	260.00	0.00	0.00	$780	
Mobilize Direct Push Rig and Crew	3.00	DAY	866.68	0.00	0.00	$2,600	
Demobilize Direct Push Rig and Crew	3.00	DAY	866.68	0.00	0.00	$2,600	
Water Quality Parameter Testing Device	1.00	WK	359.56	0.00	0.00	$360	
Peristaltic Pump, Weekly Rental	1.00	WK	173.34	0.00	0.00	$173	
Volatile Organic Analysis (EPA 624), Water Analysis	35.00	EA	310.03	0.00	0.00	$10,851	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	18.00	EA	394.11	0.00	0.00	$7,094	
Car or Van Mileage Charge	300.00	MI	0.54	0.00	0.00	$162	
Project Scientist	153.00	HR	0.00	146.81	0.00	$22,462	
Field Technician	28.00	HR	0.00	97.98	0.00	$2,743	
Word Processing/Clerical	17.00	HR	0.00	81.20	0.00	$1,380	
Draftsman/CADD	17.00	HR	0.00	125.83	0.00	$2,139	
SUBTOTAL ($2004)						**$54,185**	
Pretreatment Costs[b]							
Work Plan	1.00	LS	0.00	0.00	0.00	$10,000	
SUBTOTAL ($2004)						**$10,000**	
Treatment Costs[b]							
Pilot Test							
Mobilization	1.00	LS	0.00	0.00	0.00	$5,000	
Materials Costs (reagent), Injector Fabrication/Installation and Injection	1.00	LS	0.00	0.00	0.00	$70,000	
Pilot Test Groundwater Monitoring[a]							3 wells sampled quarterly
RSK175 analysis for dissolved gases	14.00	EA	97.83	0.00	0.00	$1,370	
Disposable Materials per Sample	14.00	EA	10.76	0.00	0.00	$151	
Decontamination Materials per Sample	14.00	EA	9.68	0.00	0.00	$136	
Nylon Tubing, 1/4" Outside Diameter	350.00	LF	0.56	0.00	0.00	$196	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	14.00	EA	55.69	0.00	0.00	$780	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	14.00	EA	38.58	0.00	0.00	$540	
Volatile Organic Analysis (EPA 624), Water Analysis	14.00	EA	276.27	0.00	0.00	$3,868	
Chloride (EPA 300), Water Analysis	14.00	EA	28.41	0.00	0.00	$398	
Sulfate (EPA 300.0), Water Analysis	14.00	EA	28.94	0.00	0.00	$405	
Sulfide (EPA 376.1), Water Analysis	14.00	EA	49.10	0.00	0.00	$687	
Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	146.31	0.00	0.00	$2,048	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	3.00	DAY	103.31	0.00	0.00	$310	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Scientist	63.00	HR	0.00	146.81	0.00	$9,249	
Field Technician	71.00	HR	0.00	97.98	0.00	$6,957	
Word Processing/Clerical	7.00	HR	0.00	81.20	0.00	$568	
Draftsman/CADD	7.00	HR	0.00	125.83	0.00	$881	

TABLE C-2D: ALTERNATIVE 4A SITE 6 PLUME BOUNDARY DELINEATION, ISCO TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (in situ chemical oxidation) to residential reuse, MNA and LUCs including vapor barriers until residential criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Primary Treatment							
Mobilization	1.00	LS	0.00	0.00	0.00	$11,500	
Materials Costs (reagent), Injector Fabrication/Installation and Injection	1.00	LS	0.00	0.00	0.00	$512,750	
Follow up Treatment (100% retreat, if necessary)							
Mobilization	1.00	LS	0.00	0.00	0.00	$11,500	
Materials costs (reagent) Injector Fabrication/Installation and Injection	1.00	LS	0.00	0.00	0.00	$512,750	
Follow up Treatment (2) (50% retreat, if necessary)							
Mobilization	1.00	LS	0.00	0.00	0.00	$11,500	
Materials Costs (reagent), Injector Fabrication/Installation and Injection	1.00	LS	0.00	0.00	0.00	$256,375	
Contigency (percent of treatment cost)	15%					$213,489.53	Scope
SUBTOTAL ($2004) all Treatment costs						**$1,636,753**	
Installation of Groundwater Monitoring Wells							6 groundwater monitoring wells
Organic Vapor Analyzer Rental, per Day	1.00	DAY	176.27	0.00	0.00	$176	(6 wells to 10 feet bgs)
Decontaminate Rig, Augers, Screen (Rental Equipment)	1.00	DAY	173.49	0.00	0.00	$173	
Field Technician	16.00	HR	0.00	97.98	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	30.00	LF	1.73	8.48	11.53	$652	
2" PVC, Schedule 40, Well Screen	30.00	LF	4.00	10.94	14.87	$894	
2" PVC, Well Plug	6.00	EA	8.43	12.72	17.29	$231	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	66.00	LF	0.00	23.25	31.62	$3,621	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	6.00	EA	121.17	0.00	0.00	$727	
2" Screen, Filter Pack	42.00	LF	4.50	7.21	9.80	$903	
2" Well, Portland Cement Grout	12.00	LF	1.67	0.00	0.00	$20	
2" Well, Bentonite Seal	6.00	EA	13.37	28.62	38.91	$485	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2,543.68	3,458.87	$6,003	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	58.56	264.35	9.75	$1,996	
SUBTOTAL ($2004)						**$17,450**	
Groundwater Monitoring							6 wells monitored
Disposable Materials per Sample	28.00	EA	12.90	0.00	0.00	$361	quarterly
Decontamination Materials per Sample	28.00	EA	11.51	0.00	0.00	$322	
Nylon Tubing, 1/4" Outside Diameter	245.00	LF	0.67	0.00	0.00	$164	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	4.00	DAY	39.66	0.00	0.00	$159	
Flow Through Monitor, Weekly Rental	4.00	WK	343.74	0.00	0.00	$1,375	
Water Quality Parameter Testing Device	4.00	WK	365.66	0.00	0.00	$1,463	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	28.00	EA	50.84	0.00	0.00	$1,424	
RSK175 analysis for dissolved gases	28.00	EA	97.83	0.00	0.00	$2,739	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	28.00	EA	39.41	0.00	0.00	$1,103	
Volatile Organic Analysis (EPA 624), Water Analysis	28.00	EA	315.29	0.00	0.00	$8,828	
Chloride (EPA 300), Water Analysis	28.00	EA	29.67	0.00	0.00	$831	
Sulfate (EPA 300.0), Water Analysis	28.00	EA	29.67	0.00	0.00	$831	
Sulfide (EPA 376.1), Water Analysis	28.00	EA	43.42	0.00	0.00	$1,216	
Ferrous Iron (S.M. 3500 Fe - D)	28.00	EA	137.58	0.00	0.00	$3,852	
4" Submersible Pump Rental, Day	4.00	DAY	116.50	0.00	0.00	$466	
Well Development Equipment Rental (weekly)	4.00	WK	365.66	0.00	0.00	$1,463	
Furnish 55 Gallon Drum for Development/Purge Water	8.00	EA	121.17	0.00	0.00	$969	
Car or Van Mileage Charge	400.00	MI	0.55	0.00	0.00	$220	
Project Scientist	203.00	HR	0.00	146.81	0.00	$29,802	
Field Technician	57.00	HR	0.00	97.98	0.00	$5,585	
Word Processing/Clerical	23.00	HR	0.00	81.20	0.00	$1,868	
Draftsman/CADD	23.00	HR	0.00	125.83	0.00	$2,894	
SUBTOTAL ($2004)						**$67,935**	

TABLE C-2D: ALTERNATIVE 4A SITE 6 PLUME BOUNDARY DELINEATION, ISCO TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (in situ chemical oxidation) to residential reuse, MNA and LUCs including vapor barriers until residential criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Vapor Removal System[c]							
Design System for Building 41						$10,000	
Installation of Soil Depressurization System						$100,000	
SUBTOTAL ($2004)						**$110,000**	
Land Use Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Resrtrictions in Deed						$31,470	
Register and File Deed						$133	
Contingency	25%					$17,807	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$106,842**	
SUBTOTAL ($2004)						$2,003,165	
Contingency	25%					$500,791	10% scope + 15% bid
SUBTOTAL ($2004)						**$2,503,956**	
Professional Labor							
Design and Work Plan	8.00%					$200,317	
Project Management Labor Cost	2.00%					$50,079	
Planning Documents Labor Cost	2.00%					$50,079	
Construction Oversight Labor Cost	2.50%					$62,599	
Reporting Labor Cost	0.25%					$6,260	
As-Built Drawings Labor Cost	0.25%					$6,260	
Public Notice Labor Cost	0.04%					$1,002	
Site Closure Activities Labor Cost	2.00%					$50,079	
Permitting Labor Cost	2.50%					$62,599	
SUBTOTAL ($2004)						**$489,273**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$2,993,229**	
OPERATIONS AND MAINTENANCE COSTS:							
Groundwater Monitoring[p]							6 wells monitored
Disposable Materials per Sample	7.00	EA	12.90	0.00	0.00	$90	annually
Decontamination Materials per Sample	7.00	EA	11.51	0.00	0.00	$81	
Nylon Tubing, 1/4" Outside Diameter	63.00	LF	0.67	0.00	0.00	$42	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	1.00	DAY	39.66	0.00	0.00	$40	
Flow Through Monitor, Weekly Rental	1.00	WK	343.74	0.00	0.00	$344	
Water Quality Parameter Testing Device	1.00	WK	365.66	0.00	0.00	$366	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	7.00	EA	50.84	0.00	0.00	$356	
RSK175 analysis for dissolved gases	7.00	EA	97.83	0.00	0.00	$685	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	7.00	EA	39.41	0.00	0.00	$276	
Volatile Organic Analysis (EPA 624), Water Analysis	7.00	EA	315.29	0.00	0.00	$2,207	
Chloride (EPA 300), Water Analysis	7.00	EA	29.67	0.00	0.00	$208	
Sulfate (EPA 300.0), Water Analysis	7.00	EA	29.67	0.00	0.00	$208	
Sulfide (EPA 376.1), Water Analysis	7.00	EA	43.42	0.00	0.00	$304	
Ferrous Iron (S.M. 3500 Fe - D)	7.00	EA	137.58	0.00	0.00	$963	
4" Submersible Pump Rental, Day	1.00	DAY	116.50	0.00	0.00	$117	
Well Development Equipment Rental (weekly)	1.00	WK	365.66	0.00	0.00	$366	
Furnish 55 Gallon Drum for Development/Purge Water	2.00	EA	121.17	0.00	0.00	$242	
Car or Van Mileage Charge	100.00	MI	0.55	0.00	0.00	$55	
Project Scientist	23.00	HR	0.00	146.81	0.00	$3,377	
Field Technician	19.00	HR	0.00	97.98	0.00	$1,862	
Word Processing/Clerical	3.00	HR	0.00	81.20	0.00	$244	
Draftsman/CADD	3.00	HR	0.00	125.83	0.00	$377	
SUBTOTAL ($2004)						**$12,807**	

TABLE C-2D: ALTERNATIVE 4A SITE 6 PLUME BOUNDARY DELINEATION, ISCO TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (in situ chemical oxidation) to residential reuse, MNA and LUCs including vapor barriers until residential criteria is met.

DESCRIPTION		Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Vapor Removal System[c]								
Annual O&M							$10,000	
SUBTOTAL ($2004)							**$10,000**	
Land Use Controls								
Annual Drive-by Inspection							$2,478	
Contingency	25%						$620	
Navy Oversight	25%						$620	
SUBTOTAL ($2004)							**$3,717**	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS							**$26,524**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	4	1	EA		$47,929		$47,929	
SUBTOTAL							**$47,929**	
Five Year Reviews	5-30	6	EA		$20,163		$120,978	One every five years
SUBTOTAL							**$120,978**	
Well Abandonment	30	6	EA		$ 837		$ 5,022	
Close-out Report	30	1	EA		$47,929		$47,929	
SUBTOTAL							**$52,951**	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[d,e]	Present Value	Notes
Capital Cost	0	$2,993,229	$2,993,229	1.0000	$2,993,229	
Annual O&M	1-34	$752,629	$22,807	19.7007	$449,313	
Annual O&M	1-4	$14,868	$3,717	3.6731	$13,653	Land Use controls
Periodic Cost	4	$47,929	$47,929	0.8714	$41,767	
Periodic Cost	5-30	$120,978	$20,163	3.9401	$79,445	One every five years
Periodic Cost	30	$52,951	$52,951	0.3563	$18,865	
		$3,982,585			$3,596,272	
TOTAL PRESENT VALUE OF ALTERNATIVE						**$3,596,272**

Notes:

[a] Cost generated in RACER 2004

[b] Vendor quote from ISOTEC, (303) 843-9079, Chris Nelson, phone number. Quote includes labor, materials, equipment and reports.

[c] Vender quote from Colorado Vintage Companies Doug Kladder, (719) 632-1215, March 22, 2004.

[d] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

[e] Multi-year discount factor = $\frac{(1+i)^n - 1}{i(1+i)^n}$ where i = 0.035 for a 30 year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-2E: ALTERNATIVE 4B SITE 6 (PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (hydrogen release compunds) to residential reuse, MNA, and LUCs including vapor barriers until residentil criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
CAPITAL COSTS:							
Sampling to Further Delineate the VOC Plume[a]							32 water samples (plus 3 QC)
Disposable Materials per Sample	35.00	EA	12.68	0.00	0.00	$444	and 16 soil samples (plus 2 QC)
Decontamination Materials per Sample	35.00	EA	11.32	0.00	0.00	$396	from 16 borings
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	3.00	DAY	260.00	0.00	0.00	$780	
Mobilize Direct Push Rig and Crew	3.00	DAY	866.68	0.00	0.00	$2,600	
Demobilize Direct Push Rig and Crew	3.00	DAY	866.68	0.00	0.00	$2,600	
Water Quality Parameter Testing Device	1.00	WK	359.56	0.00	0.00	$360	
Peristaltic Pump, Weekly Rental	1.00	WK	173.34	0.00	0.00	$173	
Volatile Organic Analysis (EPA 624), Water Analysis	35.00	EA	310.03	0.00	0.00	$10,851	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	18.00	EA	394.11	0.00	0.00	$7,094	
Car or Van Mileage Charge	300.00	MI	0.54	0.00	0.00	$162	
Project Scientist	153.00	HR	0.00	146.81	0.00	$22,462	
Field Technician	28.00	HR	0.00	97.98	0.00	$2,743	
Word Processing/Clerical	17.00	HR	0.00	81.20	0.00	$1,380	
Draftsman/CADD	17.00	HR	0.00	125.83	0.00	$2,139	
SUBTOTAL ($2004)						**$54,185**	
HRC Injection and Materials[b]							
Pilot Test							
Work Plan			0.00	0.00	0.00	$10,000	
HRC Material	180.00	LB	8.00	0.00	0.00	$1,440	
Shipping	1.00	LS	0.00	0.00	0.00	$576	
Mobilization[c]	1.00	LS	0.00	0.00	0.00	$500	
Drill Rig[a]	1.00	DAY	0.00	0.00	1250.00	$1,250	
Local Travel[c]	1.00	DAY	0.00	150.00	0.00	$150	
Additional Crew Member for Injection[c]	1.00	DAY	0.00	450.00	0.00	$450	
Injection Pump[c]	1.00	DAY	0.00	0.00	300.00	$300	
Borehole Abandonment[c]	40.00	LF	0.00	0.00	1.00	$40	upper 5 feet will be abandoned
Steam Cleaner[c]	1.00	DAY	0.00	0.00	95.00	$95	
Staff Scientist[a]	78.00	HR	0.00	140.14	0.00	$10,931	
Install Monitoring Wells[a]	3.00		0.00	0.00	0.00	$7,500	
Pilot Test Groundwater Monitoring[a]							3 wells sampled quarterly
RSK175 analysis for dissolved gases	14.00	EA	97.83	0.00	0.00	$1,370	
Disposable Materials per Sample	14.00	EA	10.76	0.00	0.00	$151	
Decontamination Materials per Sample	14.00	EA	9.68	0.00	0.00	$136	
Nylon Tubing, 1/4" Outside Diameter	350.00	LF	0.56	0.00	0.00	$196	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	14.00	EA	55.69	0.00	0.00	$780	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	14.00	EA	38.58	0.00	0.00	$540	
Volatile Organic Analysis (EPA 624), Water Analysis	14.00	EA	276.27	0.00	0.00	$3,868	
Chloride (EPA 300), Water Analysis	14.00	EA	28.41	0.00	0.00	$398	
Sulfate (EPA 300.0), Water Analysis	14.00	EA	28.94	0.00	0.00	$405	
Sulfide (EPA 376.1), Water Analysis	14.00	EA	49.10	0.00	0.00	$687	
Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	146.31	0.00	0.00	$2,048	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	3.00	DAY	103.31	0.00	0.00	$310	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Scientist	63.00	HR	0.00	146.81	0.00	$9,249	
Field Technician	71.00	HR	0.00	97.98	0.00	$6,957	
Word Processing/Clerical	7.00	HR	0.00	81.20	0.00	$568	
Draftsman/CADD	7.00	HR	0.00	125.83	0.00	$881	

TABLE C-2E: ALTERNATIVE 4B SITE 6 (PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (hydrogen release compunds) to residential reuse, MNA, and LUCs including vapor barriers until residentil criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Primary Treatment							
HRC Material	15090.00	LB	5.50	0.00	0.00	$82,995	
Shipping	1.00	LS	0.00	0.00	0.00	$4,527	
Mobilization[c]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	38.00	DAY	0.00	0.00	1250.00	$47,500	Drilling 200 feet per day
Local Travel[c]	38.00	DAY	0.00	150.00	0.00	$5,700	
Additional Crew Member for Injection[c]	38.00	DAY	0.00	450.00	0.00	$17,100	
Injection Pump[c]	38.00	DAY	0.00	0.00	300.00	$11,400	
Borehole Abandonment[c]	3800.00	LF	0.00	0.00	1.00	$3,800	Upper 5 feet will be abandoned
Steam Cleaner[c]	38.00	DAY	0.00	0.00	95.00	$3,610	
Hand Auger[c]	13.00	DAY	0.00	0.00	750.00	$9,750	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	13.00	DAY	0.00	150.00	0.00	$1,950	
Concrete Coring[c]	10.00	DAY	0.00	0.00	1100.00	$11,000	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	10.00	DAY	0.00	150.00	0.00	$1,500	
Car or Van Mileage Charge[e]	7500.00	MI	0.48	0.00	0.00	$3,600	
Follow up Treatment (1) (100% retreat, if necessary)							
HRC Material	15090.00	LB	5.50	0.00	0.00	$82,995	
Shipping	1.00	LS	0.00	0.00	0.00	$4,527	
Mobilization[c]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	38.00	DAY	0.00	0.00	1250.00	$47,500	Drilling 200 feet per day
Local Travel[c]	38.00	DAY	0.00	150.00	0.00	$5,700	
Additional Crew Member for Injection[c]	38.00	DAY	0.00	450.00	0.00	$17,100	
Injection Pump[c]	38.00	DAY	0.00	0.00	300.00	$11,400	
Borehole Abandonment[c]	3800.00	LF	0.00	0.00	1.00	$3,800	Upper 5 feet will be abandoned
Steam Cleaner[c]	38.00	DAY	0.00	0.00	95.00	$3,610	
Hand Auger[c]	13.00	DAY	0.00	0.00	750.00	$9,750	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	13.00	DAY	0.00	150.00	0.00	$1,950	
Concrete Coring[c]	10.00	DAY	0.00	0.00	1100.00	$11,000	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	10.00	DAY	0.00	150.00	0.00	$1,500	
Car or Van Mileage Charge[c]	7500.00	MI	0.48	0.00	0.00	$3,600	
Follow up Treatment (2) (50% retreat, if necessary)							
HRC Material	7545.00	LB	5.50	0.00	0.00	$41,498	
Shipping	1.00	LS	0.00	0.00	0.00	$4,527	
Mobilization[c]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	19.00	DAY	0.00	0.00	1250.00	$23,750	Drilling 200 feet per day
Local Travel[c]	19.00	DAY	0.00	150.00	0.00	$2,850	
Additional Crew Member for Injection[c]	19.00	DAY	0.00	450.00	0.00	$8,550	
Injection Pump[c]	19.00	DAY	0.00	0.00	300.00	$5,700	
Borehole Abandonment[c]	1900.00	LF	0.00	0.00	1.00	$1,900	Upper 5 feet will be abandoned
Steam Cleaner[c]	19.00	DAY	0.00	0.00	95.00	$1,805	
Hand Auger[c]	6.50	DAY	0.00	0.00	750.00	$4,875	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	7.00	DAY	0.00	150.00	0.00	$1,050	
Concrete Coring[c]	5.00	DAY	0.00	0.00	1100.00	$5,500	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	5.00	DAY	0.00	150.00	0.00	$750	
Car or Van Mileage Charge[c]	3750.00	MI	0.48	0.00	0.00	$1,800	
Contigency (percent of treatment cost)	15%					$87,230.84	Scope
SUBTOTAL ($2004) HRC and Injection Material						**$668,770**	
Installation of Groundwater Monitoring Wells[a]							6 groundwater monitoring wells
Organic Vapor Analyzer Rental, per Day	1.00	DAY	176.27	0.00	0.00	$176	(6 wells to 10 feet bgs)
Decontaminate Rig, Augers, Screen (Rental Equipment)	1.00	DAY	173.49	0.00	0.00	$173	
Field Technician	16.00	HR	0.00	97.98	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	30.00	LF	1.73	8.48	11.53	$652	
2" PVC, Schedule 40, Well Screen	30.00	LF	4.00	10.94	14.87	$894	
2" PVC, Well Plug	6.00	EA	8.43	12.72	17.29	$231	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	66.00	LF	0.00	23.25	31.62	$3,621	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	6.00	EA	121.17	0.00	0.00	$727	
2" Screen, Filter Pack	42.00	LF	4.50	7.21	9.80	$903	
2" Well, Portland Cement Grout	12.00	LF	1.67	0.00	0.00	$20	
2" Well, Bentonite Seal	6.00	EA	13.37	28.62	38.91	$485	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2,543.68	3,458.87	$6,003	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	58.56	264.35	9.75	$1,996	
SUBTOTAL ($2004)						**$17,450**	

TABLE C-2E: ALTERNATIVE 4B SITE 6 (PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (hydrogen release compunds) to residential reuse, MNA, and LUCs including vapor barriers until residentil criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Groundwater Monitoring[a]							6 wells monitored
Disposable Materials per Sample	28.00	EA	12.90	0.00	0.00	$361	quarterly
Decontamination Materials per Sample	28.00	EA	11.51	0.00	0.00	$322	
Nylon Tubing, 1/4" Outside Diameter	245.00	LF	0.67	0.00	0.00	$164	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	4.00	DAY	39.66	0.00	0.00	$159	
Flow Through Monitor, Weekly Rental	4.00	WK	343.74	0.00	0.00	$1,375	
Water Quality Parameter Testing Device	4.00	WK	365.66	0.00	0.00	$1,463	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	28.00	EA	50.84	0.00	0.00	$1,424	
RSK175 analysis for dissolved gases	28.00	EA	97.83	0.00	0.00	$2,739	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	28.00	EA	39.41	0.00	0.00	$1,103	
Volatile Organic Analysis (EPA 624), Water Analysis	28.00	EA	315.29	0.00	0.00	$8,828	
Chloride (EPA 300), Water Analysis	28.00	EA	29.67	0.00	0.00	$831	
Sulfate (EPA 300.0), Water Analysis	28.00	EA	29.67	0.00	0.00	$831	
Sulfide (EPA 376.1), Water Analysis	28.00	EA	43.42	0.00	0.00	$1,216	
Ferrous Iron (S.M. 3500 Fe - D)	28.00	EA	137.58	0.00	0.00	$3,852	
4" Submersible Pump Rental, Day	4.00	DAY	116.50	0.00	0.00	$466	
Well Development Equipment Rental (weekly)	4.00	WK	365.66	0.00	0.00	$1,463	
Furnish 55 Gallon Drum for Development/Purge Water	8.00	EA	121.17	0.00	0.00	$969	
Car or Van Mileage Charge	400.00	MI	0.55	0.00	0.00	$220	
Project Scientist	203.00	HR	0.00	146.81	0.00	$29,802	
Field Technician	57.00	HR	0.00	97.98	0.00	$5,585	
Word Processing/Clerical	23.00	HR	0.00	81.20	0.00	$1,868	
Draftsman/CADD	23.00	HR	0.00	125.83	0.00	$2,894	
SUBTOTAL ($2004)						**$67,935**	
Vapor Removal System[d]							
Design System for Building 41						$10,000	
Installation of Soil Depressurization System						$100,000	
SUBTOTAL ($2004)						**$110,000**	
Land Use Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Resrtrictions in Deed						$31,470	
Register and File Deed						$133	
Contingency	25%					$17,807	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$106,842**	
SUBTOTAL ($2004)						$1,025,182	
Contingency	25%					$256,295	10% scope + 15% bid
SUBTOTAL ($2004)						**$1,281,477**	
Professional Labor							
Design and Work Plan	8.00%					$102,518	
Project Management Labor Cost	2.00%					$25,630	
Planning Documents Labor Cost	2.00%					$25,630	
Construction Oversight Labor Cost	2.50%					$32,037	
Reporting Labor Cost	0.25%					$3,204	
As-Built Drawings Labor Cost	0.25%					$3,204	
Public Notice Labor Cost	0.04%					$513	
Site Closure Activities Labor Cost	2.00%					$25,630	
Permitting Labor Cost	2.50%					$32,037	
SUBTOTAL ($2004)						**$250,401**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$1,531,878**	

TABLE C-2E: ALTERNATIVE 4B SITE 6 (PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 6
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (hydrogen release compunds) to residential reuse, MNA, and LUCs including vapor barriers until residentil criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
OPERATIONS AND MAINTENANCE COSTS:							
Groundwater Monitoring[a]							6 wells monitored
Disposable Materials per Sample	7.00	EA	12.90	0.00	0.00	$90	annually
Decontamination Materials per Sample	7.00	EA	11.51	0.00	0.00	$81	
Nylon Tubing, 1/4" Outside Diameter	63.00	LF	0.67	0.00	0.00	$42	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	1.00	DAY	39.66	0.00	0.00	$40	
Flow Through Monitor, Weekly Rental	1.00	WK	343.74	0.00	0.00	$344	
Water Quality Parameter Testing Device	1.00	WK	365.66	0.00	0.00	$366	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	7.00	EA	50.84	0.00	0.00	$356	
RSK175 analysis for dissolved gases	7.00	EA	$98	$0	$0	$685	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	7.00	EA	39.41	0.00	0.00	$276	
Volatile Organic Analysis (EPA 624), Water Analysis	7.00	EA	315.29	0.00	0.00	$2,207	
Chloride (EPA 300), Water Analysis	7.00	EA	29.67	0.00	0.00	$208	
Sulfate (EPA 300.0), Water Analysis	7.00	EA	29.67	0.00	0.00	$208	
Sulfide (EPA 376.1), Water Analysis	7.00	EA	43.42	0.00	0.00	$304	
Ferrous Iron (S.M. 3500 Fe - D)	7.00	EA	137.58	0.00	0.00	$963	
4" Submersible Pump Rental, Day	1.00	DAY	116.50	0.00	0.00	$117	
Well Development Equipment Rental (weekly)	1.00	WK	365.66	0.00	0.00	$366	
Furnish 55 Gallon Drum for Development/Purge Water	2.00	EA	121.17	0.00	0.00	$242	
Car or Van Mileage Charge	100.00	MI	0.55	0.00	0.00	$55	
Project Scientist	23.00	HR	0.00	146.81	0.00	$3,377	
Field Technician	19.00	HR	0.00	97.98	0.00	$1,862	
Word Processing/Clerical	3.00	HR	0.00	81.20	0.00	$244	
Draftsman/CADD	3.00	HR	0.00	125.83	0.00	$377	
SUBTOTAL ($2004)						**$12,807**	
Vapor Removal System[d]							
Annual O&M						$10,000	
SUBTOTAL ($2004)						**$10,000**	
Land Use Controls							
Annual Drive-by Inspection						$2,478	
Contingency	25%					$620	
Navy Oversight	25%					$620	
SUBTOTAL ($2004)						**$3,717**	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$26,524**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	5	1	EA		$47,929		$47,929	
SUBTOTAL							**$47,929**	
Five Year Reviews	5-30	6	EA		$20,163		$120,978	One every five years
SUBTOTAL							**$120,978**	
Well Abandonment	35	6	EA		$ 837		$ 5,022	
Close-out Report	35	1	EA		$47,929		$47,929	
SUBTOTAL							**$52,951**	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[e,f]	Present Value	Notes
Capital Cost	0	$1,531,878	$1,531,878	1.0000	$1,531,878	
Annual O&M	1-34	$752,629	$22,807	19.7007	$449,313	
Annual O&M	1-4	$14,868	$3,717	3.6731	$13,653	Land Use controls
Periodic Cost	5	$47,929	$47,929	0.8420	$40,355	
Periodic Cost	5-30	$120,978	$20,163	4.0001	$80,655	One every five years
Periodic Cost	35	$52,951	$52,951	0.3000	$15,884	
		$2,521,233			$2,131,737	
TOTAL PRESENT VALUE OF ALTERNATIVE						**$2,131,737**

TABLE C-2E: ALTERNATIVE 4B SITE 6 (PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

[a] Costs provided by RACER 2004

[b] Vendor quote from Dave Reilly at Regenesis, (949) 366-8001 x 125 on March 17, 2004

[c] Vendor quote from Derrik M Sandberg at ResonantSonic International on March 17, 2004, (530) 668-2424

[d] Vender quote from Colorado Vintage Companies Doug Kladder, (719) 632-1215, March 22, 2004.

[e] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

[f] Multi-year discount factor = $\frac{(1+i)^n - 1}{i(1+i)^n}$ where i = 0.035 for a 30 year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-3: SITE 7 COST SUMMARY FOR SOIL REMEDIATION ALTERNATIVES

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

TOTAL REMEDIAL COST SUMMARY FOR SITE 7 SOIL

Site:	Operable Unit 1, CERCLA Site 7	**Base Year:**	2004
Location:	Alameda Point, Alameda, California	**Date:**	October 8, 2004
Phase:	Feasibility Study		

	Alternative 1	Alternative 2
Description	**No Action**	**Excavation and Off-site Disposal**
Total Project Duration (Years)	0	1
Capital Cost	$0	$1,421,163
Annual O & M Cost	$0	$0
Total Preriodic Cost	$0	$0
Total Cost in 2004 Dollars	**$0**	**$1,421,163**

TABLE C-3A: ALTERNATIVE 2 SITE 7, SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL, TOTAL REMEDIAL COST

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 7
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One-time sampling, excavation and off-site disposal of lead contaminated soil at CERCLA Site 7, also indludes backfill and restoration. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Fencing*							
Boundary Fence, 5' Galvanized	300.00	LF	2.26	8.33	3.17	$4,128	
Hazardous Waste Signing	5.00	EA	25.11	112.08	0.00	$686	
SUBTOTAL ($2004)						**$4,814**	
One Time Soil Sampling*							
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	1.00	DAY	264.41	0.00	0.00	$264	
Mobilize Direct Push Rig and Crew	1.00	DAY	881.37	0.00	0.00	$881	
Demobilize Direct Push Rig and Crew	1.00	DAY	881.37	0.00	0.00	$881	
TAL Metals (EPA 6010/7000s), Soil Analysis	9.00	EA	498.16	0.00	0.00	$4,483	
Volatile Organic Analysis (SW 5035/S 8260B), Soil Analysis	9.00	EA	394.11	0.00	0.00	$3,547	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	9.00	EA	464.33	0.00	0.00	$4,179	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	9.00	EA	264.41	0.00	0.00	$2,380	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	9.00	EA	101.79	0.00	0.00	$916	
TAL Metals (EPA 6010/7000s), Water Analysis	2.00	EA	489.86	0.00	0.00	$980	
Volatile Organic Analysis (EPA 624), Water Analysis	2.00	EA	310.03	0.00	0.00	$620	
Pesticides/PCBs (EPA 608), Water Analysis	2.00	EA	260.00	0.00	0.00	$520	
Total Petroleum Hydrocarbons (EPA 418.1), Water Analysis	2.00	EA	100.09	0.00	0.00	$200	
Car or Van Mileage Charge	100.00	MI	0.55	0.00	0.00	$55	
Project Scientist	41.00	HR	0.00	146.81	0.00	$6,019	
Field Technician	7.00	HR	0.00	97.98	0.00	$686	
Word Processing/Clerical	5.00	HR	0.00	81.20	0.00	$406	
Draftsman/CADD	5.00	HR	0.00	125.83	0.00	$629	
SUBTOTAL ($2004)						**$27,648**	
Excavation*							
Ground Penetrating Radar	4.00	DAY	1600.00	0.00	0.00	$6400	
Demolish Bituminous Road with Powe Equipment	181.48	CY	0.00	47.38	9.85	$10,386	
2 CY, Crawler-mounted, Hydraulic Excavator	1,814.82	CY	0.00	2.78	2.25	$9,129	
Unclassified Fill, 6" Lifts, Off-Site, Incl Delivery, Spreading, and Compaction	2,260.00	CY	8.44	3.47	2.69	$32,996	
Steel Sheeting, Install, Pull and Salva to 15 ft	2,505.00	SF	2.73	9.67	4.93	$43,412	
Asphalt Pavement - 10" Subgrade, 9" Base, 1 1/2" Topping	1,088.89	SY	10.04	23.59	13.77	$51,613	
Plastic Laminate Waste Pile Cover	16,979.52	SF	0.18	0.06	0.00	$4,075	
Disposable Materials per Sample	6.00	EA	12.47	0.00	0.00	$ 75	
TAL Metals (EPA 6010/7000s), Soil Analysis	6.00	EA	481.55	0.00	0.00	$2889	
Volatile Organic Analysis (SW 5035/S 8260B), Soil Analysis	6.00	EA	304.78	0.00	0.00	$1829	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	6.00	EA	448.85	0.00	0.00	$2693	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	6.00	EA	264.41	0.00	0.00	$1,586	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	6.00	EA	101.79	0.00	0.00	$611	
Plastic Laminate Waste Pile Cover	1040.11	SF	0.18	0.06	0.00	$250	
Decontaminate Heavy Equipment	1.00	EA	0.00	970.92	0.00	$971	
SUBTOTAL ($2004)						**$168,914**	
X-Ray Fluorescence for Real-time Quantification of Contamination							
X-Ray Fluorescence Unit, Rental	6.00	MO	0.00	5190.00	0.00	$31,140	
TAL Metals (EPA 6010/7000s), Soil Analysis	2.00	EA	481.55	0.00	0.00	$963	
SUBTOTAL ($2004)						**$32,103**	

TABLE C-3A: ALTERNATIVE 2 SITE 7, SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 7
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One-time sampling, excavation and off-site disposal of lead contaminated soil at CERCLA Site 7, also indludes backfill and restoration. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Decontamination[a]							
Pad Subgrade Preparation	17.78	CY	0.00	5.26	3.66	$159	
Cat 215, 1.0 CY, Soil, Shallow, Trench	1.24	CY	0.00	1.63	0.92	$3	
Compact Subgrade, 2 Lifts	17.78	CY	0.00	0.53	0.40	$17	
Dry Roll Gravel, Steel Roller	53.33	SY	0.00	1.43	0.38	$97	
Gravel, Delivered & Dumped	7.41	CY	30.23	6.13	2.32	$287	
Gravel (90%) & Sand Base (10%), wit Calcium Chloride 3/4 - 1 Lb/CY	7.41	CY	30.16	6.82	2.45	$292	
Asphalt Curb 8" W x 6" H	86.00	LF	2.14	7.05	5.06	$1,226	
Prime Coat	44.44	SY	0.48	0.09	0.02	$26	
Asphalt Wearing Course, 1 Pass (Line Item Includes 5% Waste)	9.67	TON	46.81	49.77	17.53	$1,103	
26" x 26", 5' Deep Area Drain with Gra	1.00	EA	2,342.53	3,155.72	36.12	$5,534	
5' x 5' x 5' Reinforced Concrete Sump	1.00	EA	2,250.84	4,493.24	118.39	$6,862	
12" x 12" CIP Concrete In-Ground Tre Drain with Metal Grate	14.00	LF	59.78	144.34	0.82	$2,869	
1,500 Gallon Steel Sump, Abovegroun with Supports & Fittings	1.00	EA	2,483.96	2,360.77	0.00	$4,845	
Polymeric Liner Anchor Trench, 3' x 1	103.20	LF	0.08	1.79	0.25	$219	
8 oz/sy Erosion Control/Drainage Filte Fabric (80 Mil)	53.33	SY	1.04	1.45	0.04	$135	
40 Mil Polymeric Liner, High-density Polyethylene	480.00	SF	0.40	0.39	0.01	$384	
1,800 PSI Pressure Washer Rental	6.00	MO	1,672.79	0.00	0.00	$10,037	
Operation of Pressure Washer, Includ Water, Soap, Electricity, Labor	240.00	HR	9.96	112.08	0.00	$29,290	
High Sump Level Switch for Avoiding Overflow	1.00	EA	318.63	465.42	0.00	$784	
(2 1/2", 4") PVC Double-wall Piping, w Fittings	30.00	LF	24.22	60.81	0.00	$2,551	
25 GPM, 1 1/2" Discharge, Cast-iron Sump Pump	1.00	EA	3,142.54	1,088.61	0.00	$4,231	
SUBTOTAL ($2004)						**$70,950**	
Transportation and Disposal of Debris Offsite[b]							
T & D of Debris to a Class I Facility, Assuming RCRA Stabilization for Lead	2700.00	TON	0.00	192.91	0.00	$520,864	Assuming TCLP > 5 ppm Pb and As
T & D of Debris to a Class I Facility, Assuming Cal-Haz Material	0.00	TON	0.00	80.21	0.00	$0	Assuming TCLP < 5 ppm Pb and As
T & D of Debris to a Class II Facility	0.00	TON	0.00	55.20	0.00	$0	Assuming STLC < 5 ppm Pb and As
TCLP (RCRA) (EPA 1311), Soil Analy	5.00	EA	821.93	0.00	0.00	$4,110	one per 500 CY soil
SUBTOTAL ($ 2004)						**$524,973**	
Remedial Action Report							
Remedial Action Report	1	EA		$47,929		$47,929	
SUBTOTAL ($ 2004)						**$47,929**	
SUBTOTAL ($ 2004)						$352,358	
Contingency	25%					$88,089	10% scope + 15% bid
SUBTOTAL ($ 2004)						**$440,447**	
Professional Labor Management[a]							
Design	9.00%					$39,640	
Project Management Labor Cost	5.00%					$22,022	
Planning Documents Labor Cost	4.00%					$17,618	
Construction Oversight Labor Cost	3.25%					$14,315	
Reporting Labor Cost	0.75%					$3,303	
As-Built Drawings Labor Cost	0.75%						
Public Notice Labor Cost	0.25%					$1,101	
Site Closure Activities Labor Cost	2.50%					$11,011	
Permitting Labor Cost	5.00%					$22,022	
SUBTOTAL ($2004)						**$131,033**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$1,421,163**	

Notes:

a Costs supplied by RACER 2004.

b Vendor is Denbeste Transportation Inc. (800-838-1477)

c Vendor is Niton, Rental Rate is $5,190 per month or $1,980 per week for recommended model (model number XL-702s). Includes equipment for soil preparation and gathering. (877-255-6943)

TABLE C-4: SITE 8 COST SUMMARY FOR SOIL REMEDIAL ALTERNATIVES

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

TOTAL REMEDIAL COST SUMMARY FOR SITE 8 SOIL

Site:	Operable Unit 1, CERCLA Site 8	**Base Year:**	2004
Location:	Alameda Point, Alameda, California	**Date:**	October 8, 2004
Phase:	Feasibility Study		

	Alternative 1	Alternative 2	Alternative 3
Description	**No Action**	**One-time Soil Sampling and ICs**	**One-time Soil Sampling, Excavation and Off-site Disposal**
Total Project Duration (Years)	0	100	1
Capital Cost	$0	$134,490	$158,339
Annual O&M Cost	$0	$102,795	$0
Total Periodic Cost	$0	$0	$0
Total Cost in 2004 Dollars	**$0**	**$237,285**	**$158,339**

TABLE C-4A: ALTERNATIVE 2 SITE 8, ONE-TIME SOIL SAMPLING AND ICS, TOTAL REMEDIAL COST
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Sites 8
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One-time sampling, institutional controls to prevent domestic use of groundwater for 100 years. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Sampling Near OWS-411[a]							
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	1.00	DAY	264.41	0.00	0.00	$264	
Mobilize Direct Push Rig and Crew	1.00	DAY	881.37	0.00	0.00	$881	
Demobilize Direct Push Rig and Crew	1.00	DAY	881.37	0.00	0.00	$881	
TAL Metals (EPA 6010/7000s), Soil Analysis	9.00	EA	498.16	0.00	0.00	$4,483	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	9.00	EA	394.11	0.00	0.00	$3,547	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	9.00	EA	464.33	0.00	0.00	$4,179	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	9.00	EA	264.41	0.00	0.00	$2,380	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	9.00	EA	101.79	0.00	0.00	$916	
TAL Metals (EPA 6010/7000s), Water Analysis	2.00	EA	489.86	0.00	0.00	$980	
Volatile Organic Analysis (EPA 624), Water Analysis	2.00	EA	310.03	0.00	0.00	$620	
Pesticides/PCBs (EPA 608), Water Analysis	2.00	EA	260.00	0.00	0.00	$520	
Total Petroleum Hydrocarbons (EPA 418.1), Water Analysis	2.00	EA	100.09	0.00	0.00	$200	
Car or Van Mileage Charge	100.00	MI	0.55	0.00	0.00	$55	
Project Scientist	41.00	HR	0.00	146.81	0.00	$6,019	
Field Technician	7.00	HR	0.00	97.98	0.00	$686	
Word Processing/Clerical	5.00	HR	0.00	81.20	0.00	$406	
Draftsman/CADD	5.00	HR	0.00	125.83	0.00	$629	
SUBTOTAL ($2004)						**$27,648**	
Institutional Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Restrictions in Deed						$31,470	
Register and File Deed						$133	
Contingency	25%					$17,807	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$106,842**	
TOTAL PRESENT VALUE OF ALTERNATIVE						**$134,490**	

O & M COSTS:

Institutional Controls							
Annual Drive-by Inspection						$2,478	
Contingency	25%					$620	
Navy Oversight	25%					$620	
SUBTOTAL ($2004)						**$3,717**	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[b]	Present Value		Notes
Capital Cost	0	$134,490	$134,490	1.0000	$134,490		
Annual O&M	1-100	$371,700	$3,717	27.6554	$102,795		
		$506,190			**$237,285**		
TOTAL PRESENT VALUE OF ALTERNATIVE						**$237,285**	

Notes:

a Cost supplied by RACER 2004.

b Multi-year discount factor = $\frac{(1+i)^n - 1}{i(1+i)^n}$ where i = 0.035 for a 30+ year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-4B: ALTERNATIVE 3 SITE 8, ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL, TOTAL REMEDIAL COST
Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 8
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One-time sampling, excavation and off-site disposal of lead contaminated soil at CERCLA Site 8, also includes backfill and restoration.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Fencing*							
Boundary Fence, 5' Galvanized	250.00	LF	2.26	8.33	3.17	$3,440	
Hazardous Waste Signing	2.00	EA	25.11	112.08	0.00	$274	
SUBTOTAL ($2004)						**$3,714**	
Sampling Near OWS-411*							
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	1.00	DAY	264.41	0.00	0.00	$264	
Mobilize Direct Push Rig and Crew	1.00	DAY	881.37	0.00	0.00	$881	
Demobilize Direct Push Rig and Crew	1.00	DAY	881.37	0.00	0.00	$881	
TAL Metals (EPA 6010/7000s), Soil Analysis	9.00	EA	498.16	0.00	0.00	$4,483	
Volatile Organic Analysis (SW 5035/S\ 8260B), Soil Analysis	9.00	EA	394.11	0.00	0.00	$3,547	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	9.00	EA	464.33	0.00	0.00	$4,179	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	9.00	EA	264.41	0.00	0.00	$2,380	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	9.00	EA	101.79	0.00	0.00	$916	
TAL Metals (EPA 6010/7000s), Water Analysis	1.00	EA	489.86	0.00	0.00	$490	
Volatile Organic Analysis (EPA 624), Water Analysis	1.00	EA	310.03	0.00	0.00	$310	
Pesticides/PCBs (EPA 608), Water Analysis	1.00	EA	260.00	0.00	0.00	$260	
Total Petroleum Hydrocarbons (EPA 418.1), Water Analysis	1.00	EA	100.09	0.00	0.00	$100	
Car or Van Mileage Charge	100.00	MI	0.55	0.00	0.00	$55	
Project Scientist	41.00	HR	0.00	146.81	0.00	$6,019	
Field Technician	7.00	HR	0.00	97.98	0.00	$686	
Word Processing/Clerical	5.00	HR	0.00	81.20	0.00	$406	
Draftsman/CADD	5.00	HR	0.00	125.83	0.00	$629	
SUBTOTAL ($2004)						**$26,488**	
Excavation of Shallow Lead Area*							
Ground Penetrating Radar	2.00	DAY	1600.00	0.00	0.00	$3200	
Demolish Bituminous Road with Powe Equipment	22.69	CY	0.00	51.71	12.36	$1,454	
1 CY, Crawler-mounted, Hydraulic Excavator	90.74	CY	0.00	5.68	3.68	$849	
Unclassified Fill, 6" Lifts, Off-Site, Incl Delivery, Spreading, and Compaction	123.43	CY	9.21	3.79	3.38	$2,022	
Asphalt Pavement - 10" Subgrade, 9" Base, 1 1/2" Topping	136.11	SY	10.96	25.75	17.28	$7,349	
Disposable Materials per Sample	2.00	EA	13.43	0.00	0.00	$27	
Soil Moisture Content ASTM D2216	2.00	EA	39.14	0.00	0.00	$78	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	9.00	EA	264.41	0.00	0.00	$2,380	
Plastic Laminate Waste Pile Cover	919.77	SF	0.19	0.07	0.00	$239	
Decontaminate Heavy Equipment	1.00	EA	0.00	1037.88	0.00	$1,038	
SUBTOTAL ($2004)						**$18,635**	
Excavation of OWS-114*							
Demolish Bituminous Road with Powe Equipment	4.17	CY	0.00	51.71	12.36	$267	
1 CY, Crawler-mounted, Hydraulic Excavator	41.67	CY	0.00	5.68	3.68	$390	
Unclassified Fill, 6" Lifts, Off-Site, Incl Delivery, Spreading, and Compaction	62.08	CY	9.21	3.79	3.38	$1,017	
Asphalt Pavement - 10" Subgrade, 9" Base, 1 1/2" Topping	25.00	SY	10.96	25.75	17.28	$1,350	
Disposable Materials per Sample	6.00	EA	13.43	0.00	0.00	$81	
Soil Moisture Content ASTM D2216	6.00	EA	39.14	0.00	0.00	$235	
TAL Metals (EPA 6010/7000s), Soil Analysis	6.00	EA	518.92	0.00	0.00	$3,114	
Volatile Organic Analysis (SW 5035/S\ 8260B), Soil Analysis	6.00	EA	394.11	0.00	0.00	$2,365	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	6.00	EA	464.33	0.00	0.00	$2,786	

TABLE C-4B: ALTERNATIVE 3 SITE 8, ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 8
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One-time sampling, excavation and off-site disposal of lead contaminated soil at CERCLA Site 8, also indludes backfill and restoration.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	6.00	EA	264.41	0.00	0.00	$1,586	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	6.00	EA	101.79	0.00	0.00	$611	
TAL Metals (EPA 6010/7000s), Water Analysis	1.00	EA	489.86	0.00	0.00	$490	
Volatile Organic Analysis (EPA 624), Water Analysis	1.00	EA	310.03	0.00	0.00	$310	
Pesticides/PCBs (EPA 608), Water Analysis	1.00	EA	260.00	0.00	0.00	$260	
Total Petroleum Hydrocarbons (EPA 418.1), Water Analysis	1.00	EA	100.09	0.00	0.00	$100	
Plastic Laminate Waste Pile Cover	462.65	SF	0.19	0.07	0.00	$120	
Decontaminate Heavy Equipment	1.00	EA	0.00	1037.88	0.00	$1,038	
SUBTOTAL ($2004)						**$16,119**	
Decontamination[b]							
1,800 PSI Pressure Washer Rental	1.00	MO	1753.14	0.00	0.00	$1,753	
Operation of Pressure Washer, Includi Water, Soap, Electricity, Labor	10.00	HR	9.96	112.08	0.00	$1,220	
Disposal of Nonhazardous Liquid Bulk	1000.00	GAL	3.11	0.00	0.00	$3,110	
SUBTOTAL ($2004)						**$6,084**	
Transportation and Disposal of Debris Offsite[b]							
T & D of Debris to a Class I Facility, Assuming RCRA Stabilization for Lead		TON	0.00	192.91	0.00	$0	Assuming TCLP > 5 ppm lead
T & D of Debris to a Class I Facility, Assuming Cal-Haz Material	200.00	TON	0.00	80.21	0.00	$16,043	Assuming TCLP < 5 ppm lead
T & D of Debris to a Class II Facility		TON	0.00	55.20	0.00	$0	Assuming STLC < 5 ppm lead
TCLP (RCRA) (EPA 1311), Soil Analys	2.00	EA	821.93	0.00	0.00	$1,644	
SUBTOTAL ($2004)						**$17,686**	
Sampling Vendor Quote[d]							
X-Ray Fluorescence Unit, Rental	1.00	WK	0.00	1980.00	0.00	$1,980	
TAL Metals (EPA 6010/7000s), Soil Analysis	2.00	EA	518.92	0.00	0.00	$1,038	
SUBTOTAL ($2004)						**$3,018**	
Remedial Action Report							
Remedial Action Report	1	EA		$47,929		$47,929	
SUBTOTAL ($ 2004)						**$47,929**	
SUBTOTAL ($ 2004)						$97,066	
Contingency	25%					$24,267	10% scope + 15% bid
SUBTOTAL ($ 2004)						**$121,333**	
Professional Labor Management[a]							
Design		9.00%				$10,920	
Project Management Labor Cost		5.00%				$6,067	
Planning Documents Labor Cost		4.00%				$4,853	
Construction Oversight Labor Cost		3.25%				$3,943	
Reporting Labor Cost		0.75%				$910	
As-Built Drawings Labor Cost		0.75%				$910	
Public Notice Labor Cost		0.25%				$303	
Site Closure Activities Labor Cost		2.50%				$3,033	
Permitting Labor Cost		5.00%				$6,067	
SUBTOTAL ($2004)						**$37,007**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$158,339**	

Notes:
a Costs supplied by RACER 2004.
b Site 8 decontamination operations will take place at the decon pad constructed at Site 7.
c Vendor is Denbeste Transportation Inc. (800-838-1477)
d Vendor is Niton, Rental Rate is $5,190 per month or $1,980 per week for recommended model (model number XL-702s). Includes equipment for soil preparation and gathering. (877-255-6943)

TABLE C-5: SITE 16 COST SUMMARY FOR SOIL REMEDIAL ALTERNATIVES
Feasibility Study Report, Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

TOTAL REMEDIAL COST SUMMARY FOR SITE 16 SOIL

Site:	Operable Unit 1, CERCLA Site 16	**Base Year:**	2004
Location:	Alameda Point, Alameda, California	**Date:**	October 8, 2004
Phase:	Feasibility Study		

Description	Alternative 1 No Action	Alternative 2 One-time Soil Sampling and ICs	Alternative 3 One-time Soil Sampling, Excavation, and Off-site Disposal
Total Project Duration (Years)	0	100	1
Capital Cost	$0	$164,953	$1,270,639
Annual O&M Cost	$0	$102,795	$0
Total Periodic Cost	$0	$0	$0
Total Cost in 2004 Dollars	**$0**	**$267,748**	**$1,270,639**

TABLE C-5A: ALTERNATIVE 2 SITE 16, ONE-TIME SOIL SAMPLING AND ICS, TOTAL REMEDIAL COST
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Sites 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One-time sampling of PCB contaminated soils and near OWS-608A and OWS-608B. Institutional controls to prevent domestic use of groundwater for 100 years. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
One Time Soil Sampling[a]							
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	1.00	DAY	252.29	0.00	0.00	$252.29	
Mobilize Direct Push Rig and Crew	1.00	DAY	840.98	0.00	0.00	$840.98	
Demobilize Direct Push Rig and Crew	1.00	DAY	840.98	0.00	0.00	$840.98	
Soil Moisture Content ASTM D2216	29.00	EA	44.82	0.00	0.00	$1299.78	
TAL Metals (EPA 6010/7000s), Soil Analysis	18.00	EA	594.16	0.00	0.00	$10694.88	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	18.00	EA	300.84	0.00	0.00	$5415.12	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	18.00	EA	443.05	0.00	0.00	$7974.90	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	18.00	EA	101.79	0.00	0.00	$1,832	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	29.00	EA	252.29	0.00	0.00	$7316.41	
TAL Metals (EPA 6010/7000s), Water Analysis	2.00	EA	489.86	0.00	0.00	$980	
Volatile Organic Analysis (EPA 624), Water Analysis	2.00	EA	310.03	0.00	0.00	$620	
Pesticides/PCBs (EPA 608), Water Analysis	2.00	EA	260.00	0.00	0.00	$520	
Total Petroleum Hydrocarbons (EPA 418.1), Water Analysis	2.00	EA	100.09	0.00	0.00	$200	
Car or Van Mileage Charge	100.00	MI	0.53	0.00	0.00	$ 53.00	
Project Scientist	90.00	HR	0.00	186.88	0.00	$16819.20	
Field Technician	12.00	HR	0.00	123.28	0.00	$1479.36	
Word Processing/Clerical	10.00	HR	0.00	97.18	0.00	$971.80	
SUBTOTAL ($2004)						**$58,111**	
Institutional Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Restrictions in Deed						$31,470	
Register and File Deed						$133	
Contingency	25%					$17,807	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$106,842**	
TOTAL CAPITAL COST						**$164,953**	

O & M COSTS:

Institutional Controls							
Annual Drive-by Inspection						$2,478	
Contingency	25%					$620	
Navy Oversight	25%					$620	
SUBTOTAL ($2004)						**$3,717**	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[b]	Present Value		Notes
Capital Cost	0	$164,953	$164,953	1.0000	$164,953		
Annual O&M	1-100	$371,700	$3,717	27.6554	$102,795		
		$536,653			**$267,748**		
TOTAL PRESENT VALUE OF ALTERNATIVE						**$267,748**	

Notes:
a Cost supplied by RACER 2004.
b Multi-year discount factor = $\frac{(1+i)^n - 1}{i(1+i)^n}$ where i = 0.035 for a 30 year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-5B: ALTERNATIVE 3 SITE 16, ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL, TOTAL REMEDIAL COST
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One-time sampling of PCB contaminated soils and near OWS-608A and OWS-608B. Excavation and off-site disposal of PCB and lead contaminated soil and OWS-608A and OWS-608B, also includes backfill and restoration.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Fencing[a]							
Boundary Fence, 5' Galvanized	700.00	LF	2.26	8.33	3.17	$9,632	
Hazardous Waste Signing	8.00	EA	25.11	112.08	0.00	$1,098	
SUBTOTAL ($2004)						**$10,730**	
One Time Soil Sampling[a]							
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	1.00	DAY	252.29	0.00	0.00	$252.29	
Mobilize Direct Push Rig and Crew	1.00	DAY	840.98	0.00	0.00	$840.98	
Demobilize Direct Push Rig and Crew	1.00	DAY	840.98	0.00	0.00	$840.98	
Soil Moisture Content ASTM D2216	29.00	EA	44.82	0.00	0.00	$1299.78	
TAL Metals (EPA 6010/7000s), Soil Analysis	18.00	EA	594.16	0.00	0.00	$10694.88	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	18.00	EA	300.84	0.00	0.00	$5415.12	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	18.00	EA	443.05	0.00	0.00	$7974.90	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	18.00	EA	101.79	0.00	0.00	$1,832	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	29.00	EA	252.29	0.00	0.00	$7316.41	
TAL Metals (EPA 6010/7000s), Water Analysis	2.00	EA	489.86	0.00	0.00	$980	
Volatile Organic Analysis (EPA 624), Water Analysis	2.00	EA	310.03	0.00	0.00	$620	
Pesticides/PCBs (EPA 608), Water Analysis	2.00	EA	260.00	0.00	0.00	$520	
Total Petroleum Hydrocarbons (EPA 418.1), Water Analysis	2.00	EA	100.09	0.00	0.00	$200	
Car or Van Mileage Charge	100.00	MI	0.53	0.00	0.00	$ 53.00	
Project Scientist	90.00	HR	0.00	186.88	0.00	$16819.20	
Field Technician	12.00	HR	0.00	123.28	0.00	$1479.36	
Word Processing/Clerical	10.00	HR	0.00	97.18	0.00	$971.80	
SUBTOTAL ($2004)						**$58,111**	
Excavation[a]							
Ground Penetrating Radar	5.00	DAY	1600.00	0.00	0.00	$8,000	
Demolish Bituminous Road with Power Equipment	204.63	CY	0.00	47.38	9.85	$11,711	
2 CY, Crawler-mounted, Hydraulic Excavator	1,653.71	CY	0.00	2.78	2.25	$8,318	
Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	2,447.48	CY	8.44	3.47	2.69	$35,733	
Asphalt Pavement - 10" Subgrade, 9" Base, 1 1/2" Topping	1,227.78	SY	10.04	23.59	13.77	$58,197	
Disposable Materials per Sample	13.00	EA	12.30	0.00	0.00	$160	
TAL Metals (EPA 6010/7000s), Soil Analysis	11.00	EA	475.33	0.00	0.00	$5,229	
Pesticides/PCBs (SW 3550B/SW 8081/8082), Soil Analysis	11.00	EA	252.29	0.00	0.00	$2,775	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	11.00	EA	300.84	0.00	0.00	$3,309	
Semi-Volatile Organics, GC/MS (SW 8270C), with prep, Soil Analysis	11.00	EA	443.05	0.00	0.00	$4,874	
Total Petroleum Hydrocarbons (EPA 9074), Soil Analysis	11.00	EA	101.79	0.00	0.00	$1,120	
TAL Metals (EPA 6010/7000s), Water Analysis	2.00	EA	489.86	0.00	0.00	$980	
Volatile Organic Analysis (EPA 624), Water Analysis	2.00	EA	310.03	0.00	0.00	$620	
Pesticides/PCBs (EPA 608), Water Analysis	2.00	EA	260.00	0.00	0.00	$520	
Total Petroleum Hydrocarbons (EPA 418.1), Water Analysis	2.00	EA	100.09	0.00	0.00	$200	
Plastic Laminate Waste Pile Cover	24,361.74	SF	0.18	0.06	0.00	$5,847	
Project Scientist	40.00	HR	0.00	186.88	0.00	$7,475	
Field Technician	40.00	HR	0.00	123.28	0.00	$4,931	
SUBTOTAL ($2004)						**$159,998**	
Sampling Vendor Quote[d]							
X-Ray Fluorescence Unit, Rental	1.00	MO	0.00	5190.00	0.00	$5,190	
TAL Metals (EPA 6010/7000s), Soil Analysis	2.00	EA	475.33	0.00	0.00	$951	
SUBTOTAL ($2004)						**$6,141**	

TABLE C-5B: ALTERNATIVE 3 SITE 16, ONE-TIME SOIL SAMPLING, EXCAVATION, AND OFF-SITE DISPOSAL, TOTAL REMEDIAL COST
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 8, 2004

Description: One-time sampling of PCB contaminated soils and near OWS-608A and OWS-608B. Excavation and off-site disposal of PCB and lead contaminated soil and OWS-608A and OWS-608B, also includes backfill and restoration.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Decontamination[b]							
1,800 PSI Pressure Washer Rental	6.00	MO	1753.14	0.00	0.00	$10,519	
Operation of Pressure Washer, Including Water, Soap, Electricity, Labor	240.00	HR	9.96	112.08	0.00	$29,290	
SUBTOTAL ($2004)						**$39,808**	
Transportation and Disposal of Debris Offsite[b]							
T & D of Debris to a Class I Facility, Assuming RCRA Stabilization for Lead	2324.15	TON	0.00	192.91	0.00	$448,358	Assuming TCLP > 5 ppm Pb and >1 ppm Cd
T & D of Debris to a Class I Facility, Assuming Cal-Haz Material	123.33	TON	0.00	80.21	0.00	$9,893	Assuming TCLP < 5 ppm Pb and > 1 ppm Cd
T & D of Debris to a Class II Facility	0.00	TON	0.00	55.20	0.00	$0	Assuming STLC < 5 ppm Pb and > 1 ppm Cd
TCLP (RCRA) (EPA 1311), Soil Analysis	5.00	EA	821.93	0.00	0.00	$4,110	Approximately one per 500 CY soil
SUBTOTAL ($2004)						**$462,360**	
Remedial Action Report							
Remedial Action Report	1	EA		$47,929		$47,929	
SUBTOTAL ($ 2004)						**$47,929**	
SUBTOTAL ($ 2004)						$778,936	
Contingency	25%					$194,734	10% scope + 15% bid
SUBTOTAL ($ 2004)						**$973,670**	
Professioanl Labor Management							
Design	9.00%					$87,630	
Project Management Labor Cost	5.00%					$48,684	
Planning Documents Labor Cost	4.00%					$38,947	
Construction Oversight Labor Cost	3.25%					$31,644	
Reporting Labor Cost	0.75%					$7,303	
As-Built Drawings Labor Cost	0.75%					$7,303	
Public Notice Labor Cost	0.25%					$2,434	
Site Closure Activities Labor Cost	2.50%					$24,342	
Permitting Labor Cost	5.00%					$48,684	
SUBTOTAL ($2004)						**$296,969**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$1,270,639**	

Notes:
a Costs supplied by RACER 2004.
b Site 8 decontamination operations will take place at the decon pad constructed at Site 7.
c Vendor is Denbeste Transportation Inc. (800-838-1477)

TABLE C-6T: SITE 16 COST SUMMARY FOR GROUNDWATER TREATMENT TECHNOLOGIES

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COMPARISON OF TOTAL COST OF REMEDIAL TECHNOLOGIES

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 5, 2004

Description	Technology Pump and Treat Advanced Oxidation Processes	Technology Pump and Treat Air Stripping	Technology In Situ Chemical Oxidation[a]	Technology Hydrogen Release Compounds[a]
Total Project Duration (Years)	15	15	2	3
Capital Cost	$2,646,674	$2,013,067	$11,892,797	$7,494,356
Annual O & M Cost	$20,284,733	$15,991,157	$0	$0
Total Periodic Cost	$129,918	$129,918	$116,312	$112,378
Total Present Value of Alternative	**$23,061,325**	**$18,134,142**	**$12,009,109**	**$7,606,734**

[a] Includes total costs for both plumes (UST and Scrapyard) at Site 16

TABLE C-6T1 ALTERNATIVE 2 - SITE 16 GROUNDWATER PUMP AND TREAT BY AIR STRIPPING
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Pump and treat of contaminated groundwater by air stripping processes at CERCLA Site 16. Capital costs occur in year 0.

CAPITAL COSTS[a]:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Groundwater Extraction Wells[a]							
Demolish Bituminous Pavement with Air Equipment	8.60	CY	0.00	78.31	9.64	$756	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2159.38	2729.99	$4,889	
Organic Vapor Analyzer Rental, per Day	95.00	DAY	152.44	0.00	0.00	$14,482	
30,000 Gallon Single-wall Steel Aboveground Tank	2.00	EA	25884.00	7598.46	547.19	$68,059	
Decontaminate Rig, Augers, Screen (Rental Equipment)	74.00	DAY	144.13	0.00	0.00	$10,666	
Field Technician	245.00	HR	0.00	97.98	0.00	$24,006	
6" PVC, Schedule 40, Well Casing	215.00	LF	5.29	10.37	13.10	$6,183	
2" Pitless Adapter	43.00	EA	249.04	0.00	20.55	$11,592	
6" PVC, Schedule 40, Well Screen	817.00	LF	12.04	17.27	21.84	$41,794	
6" PVC, Well Plug	43.00	EA	81.07	26.99	34.12	$6,114	
4" Submersible Pump, 0.3-7 GPM, Head <=140', 1/3 hp, w/ controls	43.00	EA	2501.51	0.00	0.00	$107,565	
Hollow Stem Auger, 11" Dia Borehole, Depth <= 100 ft	1032.00	LF	0.00	30.84	38.99	$72,067	
Split Spoon Sample, 2" x 24", During Drilling	104.00	EA	55.07	0.00	0.00	$5,727	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	268.00	EA	100.38	0.00	0.00	$26,902	
Well Development Equipment Rental (weekly)	43.00	WK	303.22	0.00	0.00	$13,038	
6" Screen, Filter Pack	817.00	LF	10.07	15.66	19.79	$37,190	
6" Well, Portland Cement Grout	1.00	LF	12.46	0.00	0.00	$12	
6" Well, Bentonite Seal	43.00	EA	46.80	97.17	122.85	$11,473	
Restricted Area, Well Protection (with 4 Posts & Explosionproof Receptacle)	43.00	EA	717.88	810.51	2.22	$65,816	
1" PVC, Schedule 40, Connection Piping	10750.00	LF	0.34	5.69	0.00	$64,733	
SUBTOTAL						$593,066	
Overhead Electrical Distribution[a]							
4/0 ACSR Conductor	1272.00	LF	0.57	2.11	0.10	$3,535	
1/C #2 Aluminum, Bare, Wire	559.00	LF	0.22	1.46	0.07	$977	
45' Class 3 Treated Power Pole	3.00	EA	464.91	950.01	67.28	$4,447	
Straight-line Structure, 15 KV Pole Top	1.00	EA	179.41	768.53	54.43	$1,002	
Terminal Structure, 15 KV Pole Top	2.00	EA	1663.00	2916.22	206.52	$9,571	
15 KV, 3/0, Shielded Cable, Copper	270.00	LF	3.91	4.12	0.29	$2,249	
15 KV, 1/0 to 4/0 Conductor, Terminations & Splicing	6.00	EA	300.25	1131.97	0.00	$8,593	
4" Rigid Steel Conduit	90.00	LF	12.59	23.46	0.00	$3,244	
SUBTOTAL						$33,619	
Air Stripping[a]							
6" Structural Slab on Grade	70.00	SF	3.50	5.97	0.23	$679	
2", Class 200, PVC Piping	100.00	LF	0.57	11.02	0.41	$1,200	
550 Gallon Horizontal Plastic Sump with 4" NPT Connection	1.00	EA	1799.91	640.67	0.00	$2,441	
10 Gallon Bypass Chemical Shot Feeder, Floor Mount, 150 Lb ASME	1.00	EA	1959.53	1923.71	0.00	$3,883	
Install Air Stripper Tower, 1' - 3' Diameter, > 30' High	1.00	EA	0.00	11872.59	854.98	$12,728	
Internal Parts for Air Stripper, >= 20' High, per Foot of Tower Diameter	2.00	FT	6887.12	0.00	0.00	$13,774	
1" - 3.5" Packing for Air Stripper Tower	126.00	CF	21.67	0.00	0.00	$2,730	
Electrical Controls for Air Stripper	1.00	EA	5683.57	4087.33	131.33	$9,902	
2.0' Diameter x Height, Prefabricated, Fiberglass Reinforced Plastic, Air Stripper Column/Shell Only	45.00	FT	449.98	0.00	0.00	$20,249	
High Sump Level Switch for Avoiding Overflow	1.00	EA	295.65	419.15	0.00	$715	
75 GPM, 3 HP, Transfer Pump with Motor, Valves, Piping	2.00	EA	4987.85	3449.52	0.00	$16,875	
500 CFM, 9" Pressure, 2 HP, Blower System	1.00	EA	1592.23	583.16	0.00	$2,175	
SUBTOTAL						$87,350	

TABLE C-6T1 ALTERNATIVE 2 - SITE 16 GROUNDWATER PUMP AND TREAT BY AIR STRIPPING
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Pump and treat of contaminated groundwater by air stripping processes at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Carbon Adsorbtion[a]							
8" Structural Slab on Grade	50.00	SF	5.18	7.60	0.50	$664	
Saturation Indicator	1.00	EA	62.30	0.00	0.00	$62	
Monitoring Port with Gas Monitor	2.00	EA	1.43	39.44	0.00	$82	
500 CFM, 1,400 Lb Fill, Closed Upflow, 11.5" Pressure Drop	4.00	EA	8722.65	1823.63	131.33	$42,710	
750 CFM, 12" Pressure, 5 HP, Blower System	1.00	EA	3497.52	1108.00	0.00	$4,606	
Pressure Gauge	2.00	EA	88.90	114.61	0.00	$407	
SUBTOTAL						$48,531	
Discharge to Publicly Owned Treatment Works[a]							
Medium Brush, Medium Trees, Clear, Grub, Haul	1.00	ACRE	0.00	10222.02	3939.59	$14,162	
Cat 225, 1.5 CY, Soil/Sand, Trenching	112.00	CY	0.00	1.12	0.72	$206	
Cat 225, 1.5 CY, Soil/Sand, 10' - 20' Deep Trench Box, Trench	112.00	CY	1.34	3.71	2.40	$834	
Pull Trench Box, Cat 225, 1.5 CY, Soil/Sand, Trenching	112.00	CY	0.67	3.71	2.40	$759	
950, 3.00 CY, Backfill with Excavated Material	110.00	CY	0.00	1.41	0.89	$254	
Seeding, Vegetative Cover	1.00	ACRE	4719.13	209.36	72.45	$5,001	
6" PVC Pipe Sanitary	200.00	LF	3.43	11.92	2.50	$3,570	
Sewer Connection Fee	1.00	EA	6436.76	0.00	0.00	$6,437	
SUBTOTAL						$31,221	
Residual Waste Management[a]							
Load Drums on Disposal Vehicle	270.00	EA	0.00	4.97	2.01	$1,885	
Transport 55 Gallon Drums of Hazardous Waste, Max 80 drums (per Mile)	400.00	MI	2.19	0.00	0.00	$875	
Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1.00	EA	602.28	0.00	0.00	$602	
Landfill Hazardous Solid Waste, 55 Gallon Drum	270.00	EA	324.41	0.00	0.00	$87,591	
SUBTOTAL						$90,954	
Groundwater Monitoring (First Year)[a]							
Remedial Design - User Defined Cost	53.00	EA	96.55	0.00	0.00	$5,117	
Disposable Materials per Sample	53.00	EA	10.62	0.00	0.00	$563	
Decontamination Materials per Sample	53.00	EA	9.55	0.00	0.00	$506	
Nylon Tubing, 1/4" Outside Diameter	1225.00	LF	0.55	0.00	0.00	$678	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	2.00	WK	87.65	0.00	0.00	$175	
Flow Through Monitor, Weekly Rental	2.00	WK	297.25	0.00	0.00	$595	
Water Quality Parameter Testing Device	2.00	WK	303.22	0.00	0.00	$606	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	53.00	EA	54.96	0.00	0.00	$2,913	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	53.00	EA	38.08	0.00	0.00	$2,018	
Volatile Organic Analysis (EPA 624), Water Analysis	53.00	EA	272.65	0.00	0.00	$14,451	
Chloride (EPA 300), Water Analysis	53.00	EA	28.04	0.00	0.00	$1,486	
Sulfate (EPA 300.0), Water Analysis	53.00	EA	28.56	0.00	0.00	$1,513	
Sulfide (EPA 376.1), Water Analysis	53.00	EA	48.46	0.00	0.00	$2,568	
Ferrous Iron (S.M. 3500 Fe - D)	53.00	EA	144.39	0.00	0.00	$7,653	
55 Gallon 17C Closed Head Steel Drum	8.00	EA	90.00	0.00	0.00	$720	
4" Submersible Pump Rental, Week	2.00	WK	305.86	0.00	0.00	$612	
Car or Van Mileage Charge	800.00	MI	0.48	0.00	0.00	$381	
Project Manager	44.00	HR	0.00	243.91	0.00	$10,732	
Project Engineer	220.00	HR	0.00	180.58	0.00	$39,727	
Project Scientist	626.00	HR	0.00	146.81	0.00	$91,905	
Staff Scientist	660.00	HR	0.00	140.14	0.00	$92,491	
Field Technician	128.00	HR	0.00	97.98	0.00	$12,542	
Word Processing/Clerical	176.00	HR	0.00	81.20	0.00	$14,290	
Draftsman/CADD	88.00	HR	0.00	125.83	0.00	$11,073	
SUBTOTAL						$315,315	

TABLE C-6T1 ALTERNATIVE 2 - SITE 16 GROUNDWATER PUMP AND TREAT BY AIR STRIPPING
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Pump and treat of contaminated groundwater by air stripping processes at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Surface Water Monitoring (First Year)[a]							
Nylon Tubing, 1/4" Outside Diameter	25.00	LF	0.55	0.00	0.00	$14	
pH (EPA 150.1), Water Analysis	5.00	EA	10.38	0.00	0.00	$52	
Cyanide (EPA 335.2), Water Analysis	5.00	EA	70.52	0.00	0.00	$353	
Oil And Grease (EPA 413.2), Water Analysis	5.00	EA	81.80	0.00	0.00	$409	
Phenols (Method 420.1), Water Analysis	5.00	EA	48.54	0.00	0.00	$243	
Volatile Organic Analysis (EPA 624), Water Analysis	5.00	EA	272.65	0.00	0.00	$1,363	
Metals Screen, ICP Flame, Per Each (EPA 200.7), Water Analysis	5.00	EA	85.27	0.00	0.00	$426	
Mercury, Cold Vapor (EPA 245.1), Water Analysis	5.00	EA	59.49	0.00	0.00	$297	
Portable Air Sampler, Continuous, Weekly Rental	1.00	WK	114.33	0.00	0.00	$114	
Tentative ID Compunds, GC/MS, Air (30/5041/8260B - TO-14), Air Analysis	5.00	EA	238.83	0.00	0.00	$1,194	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$190	
Project Manager	8.00	HR	0.00	243.91	0.00	$1,951	
Project Engineer	40.00	HR	0.00	180.58	0.00	$7,223	
Project Scientist	125.00	HR	0.00	146.81	0.00	$18,352	
Staff Scientist	120.00	HR	0.00	140.14	0.00	$16,816	
Field Technician	16.00	HR	0.00	97.98	0.00	$1,568	
Word Processing/Clerical	37.00	HR	0.00	81.20	0.00	$3,004	
Draftsman/CADD	21.00	HR	0.00	125.83	0.00	$2,642	
SUBTOTAL						$56,213	
SUBTOTAL ($2003)						$819,363	
Contingency		25%				$204,841	10% scope + 15% bid
SUBTOTAL ($2003)						$1,024,203	
Project Management Labor Cost		9.38%				$96,070	
Planning Documents Labor Cost		8.75%				$89,618	
Construction Oversight Labor Cost		7.50%				$76,815	
Reporting Labor Cost		1.25%				$12,803	
As-Built Drawings Labor Cost		1.25%				$12,803	
Public Notice Labor Cost		0.38%				$3,892	
Site Closure Activities Labor Cost		2.00%				$20,484	
Permitting Labor Cost		12.50%				$128,025	
SUBTOTAL						$440,510	
SUBTOTAL ($2004)[b]	1.0398					$1,523,065	
TOTAL CAPITAL COST IN 2004 DOLLARS						$1,523,065	
OPERATIONS AND MAINTENANCE COSTS:							
Treatment Train Miscellaneous[a]							
Per Diem (per person)	144.00	DAY	160.00	0.00	0.00	$23,040	
Mobilize Crew, 50 Miles, per Person	72.00	EA	94.81	0.00	0.00	$6,826	
Disposable Gloves (Latex)	260.00	PAIR	0.28	0.00	0.00	$74	
Disposable Coveralls (Tyvek)	260.00	EA	6.04	0.00	0.00	$1,570	
Non Haz Drummed Site Waste - Load, Transp, & Landfill Disp (55-Gal Drums)	7.00	EA	277.55	0.00	0.00	$1,943	
DOT Steel Drum, 55 Gallon	7.00	EA	100.38	0.00	0.00	$703	
Senior Staff Engineer	18.00	HR	0.00	243.46	0.00	$4,382	
Staff Engineer	48.00	HR	0.00	143.89	0.00	$6,907	
Field Technician	96.00	HR	0.00	97.98	0.00	$9,406	
Startup Costs	1.00	LS	97872.52	119525.74	49369.33	$266,768	
Electrical Charge	15003.00	KWH	0.09	0.00	0.00	$1,354	
Annual Maintenance Materials and Labor	1.00	LS	5641.99	6890.22	2845.96	$15,378	
SUBTOTAL						$338,350	
Groundwater Extraction Wells[a]							
Staff Engineer	84.00	HR	0.00	143.89	0.00	$12,087	
Field Technician	417.00	HR	0.00	97.98	0.00	$40,858	
Electrical Charge	5171.00	KWH	0.09	0.00	0.00	$467	
SUBTOTAL						$53,412	

TABLE C-6T1 ALTERNATIVE 2 - SITE 16 GROUNDWATER PUMP AND TREAT BY AIR STRIPPING
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Pump and treat of contaminated groundwater by air stripping processes at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Discharge to Publicly Owned Treatment Works							
Wastewater Disposal Fee	23652.00	KGAL	25.75	0.00	0.00	$608,969	
Staff Engineer	5.00	HR	0.00	143.89	0.00	$719	
Field Technician	25.00	HR	0.00	97.98	0.00	$2,450	
Electrical Charge	7380.00	KWH	0.09	0.00	0.00	$666	
SUBTOTAL						$612,804	
Air Stripping							
Staff Engineer	31.00	HR	0.00	143.89	0.00	$4,461	
Field Technician	154.00	HR	0.00	97.98	0.00	$15,089	
Electrical Charge	325986.00	KWH	0.09	0.00	0.00	$29,418	
SUBTOTAL						$48,968	
Carbon Adsorption[a]							
Coal-based, 4 mm Pellet, for Solvent Recovery 2,000 - 10,000 Lb	1820.00	LB	1.37	0.00	0.00	$2,495	
Removal, Transport, Regeneration of Spent Carbon, < 2K lb	1820.00	LB	0.84	0.00	0.00	$1,526	
Staff Engineer	54.00	HR	0.00	143.89	0.00	$7,770	
Field Technician	268.00	HR	0.00	97.98	0.00	$26,259	
Electrical Charge	31856.00	KWH	0.09	0.00	0.00	$2,875	
SUBTOTAL						$40,924	
SUBTOTAL ($2003)						$1,094,458	
Runtime Percent Cost Adjustment	97%					$1,061,625	
Contingency	25%					$273,615	10% scope + 15% bid
SUBTOTAL ($2003)						$1,335,239	
SUBTOTAL ($2004)	1.0398					$1,388,433	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						$1,388,433	

PERIODIC COSTS[a]**:**

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Five Year review Report	5	1	EA		$47,141		$47,141	End of year 5
Five Year review Report	10	1	EA		$47,929		$47,929	End of year 10
Five Year review Report	15	1	EA		$47,929		$47,929	End of year 15
Five Year review Report	16	1	EA		$47,929		$47,929	Close out report
SUBTOTAL							$190,927	
Contingency		25%					$47,732	10% scope + 15% bid
SUBTOTAL							$238,659	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[b]	Present Value	Notes
Capital Cost	0	$1,523,065	$1,523,065	1.0000	$1,523,065	
Annual O&M	1-15	$20,826,499	$1,388,433	11.5174	$15,991,157	
Monitoring	2-15	$270,017	$19,287	10.5512	$203,501	Groundwater
Monitoring	2-15	$380,146	$27,153	10.5512	$286,501	Surface water and air
Periodic Cost	5	$47,141	$47,141	0.8420	$39,691	5-year review
Periodic Cost	10	$47,929	$47,929	0.7089	$33,978	5-year review
Periodic Cost	15	$47,929	$47,929	0.5969	$28,608	5-year review
Periodic Cost	16	$47,929	$47,929	0.5767	$27,641	Close out report
		$23,190,655			$18,134,142	

TOTAL PRESENT VALUE OF P&T WITH AIR STRIPPING $18,134,142

Notes:

[a] RACER 2003 outputs are in 2003 dollars. The average ENR Construction Cost Index for 2003 was 6694.5, the ENR Construction Cost Index for March 2004 was 6957. The inflation rate from 2003 to March 2004 was 3.92% or a multiplier of 1.0392, which was used to bring RACER 2003 outputs forward to 2004 dollars.

[b] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

TABLE C-6T2: ALTERNATIVE 3 - SITE 16 GROUNDWATER PUMP AND TREAT BY ADVANCED OXIDATION PROCESSES
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Pump and treat of contaminated groundwater by advanced oxidation processes at CERCLA Site 16. Capital costs occur in year 0.

CAPITAL COSTS[a]:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Groundwater Extraction wells[a]							
Demolish Bituminous Pavement with Air Equipment	8.60	CY	0.00	78.31	9.64	$756	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2159.38	2729.99	$4,889	
Organic Vapor Analyzer Rental, per Day	95.00	DAY	152.44	0.00	0.00	$14,482	
30,000 Gallon Single-wall Steel Aboveground Tank	2.00	EA	25884.00	7598.46	547.19	$68,059	
Decontaminate Rig, Augers, Screen (Rental Equipment)	74.00	DAY	144.13	0.00	0.00	$10,666	
Field Technician	245.00	HR	0.00	97.98	0.00	$24,006	
6" PVC, Schedule 40, Well Casing	215.00	LF	5.29	10.37	13.10	$6,183	
2" Pitless Adapter	43.00	EA	249.04	0.00	20.55	$11,592	
6" PVC, Schedule 40, Well Screen	817.00	LF	12.04	17.27	21.84	$41,794	
6" PVC, Well Plug	43.00	EA	81.07	26.99	34.12	$6,114	
4" Submersible Pump, 0.3-7 GPM, Head <=140', 1/3 hp, w/ controls	43.00	EA	2501.51	0.00	0.00	$107,565	
Hollow Stem Auger, 11" Dia Borehole, Depth <= 100 ft	1032.00	LF	0.00	30.84	38.99	$72,067	
Split Spoon Sample, 2" x 24", During Drilling	104.00	EA	55.07	0.00	0.00	$5,727	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	268.00	EA	100.38	0.00	0.00	$26,902	
Well Development Equipment Rental (weekly)	43.00	WK	303.22	0.00	0.00	$13,038	
6" Screen, Filter Pack	817.00	LF	10.07	15.66	19.79	$37,190	
6" Well, Portland Cement Grout	1.00	LF	12.46	0.00	0.00	$12	
6" Well, Bentonite Seal	43.00	EA	46.80	97.17	122.85	$11,473	
Restricted Area, Well Protection (with 4 Posts & Explosionproof Receptacle)	43.00	EA	717.88	810.51	2.22	$65,816	
1" PVC, Schedule 80, Connection Piping	10750.00	LF	0.48	5.69	0.00	$66,318	
SUBTOTAL						$594,651	
Overhead Electrical Distribution[a]							
4/0 ACSR Conductor	1272.00	LF	0.57	2.11	0.10	$3,535	
1/C #2 Aluminum, Bare, Wire	559.00	LF	0.22	1.46	0.07	$977	
45' Class 3 Treated Power Pole	3.00	EA	464.91	950.01	67.28	$4,447	
Straight-line Structure, 15 KV Pole Top	1.00	EA	179.41	768.53	54.43	$1,002	
Terminal Structure, 15 KV Pole Top	2.00	EA	1663.00	2916.22	206.52	$9,571	
15 KV, 3/0, Shielded Cable, Copper	270.00	LF	3.91	4.12	0.29	$2,249	
15 KV, 1/0 to 4/0 Conductor, Terminations & Splicing	6.00	EA	300.25	1131.97	0.00	$8,593	
4" Rigid Steel Conduit	90.00	LF	12.59	23.46	0.00	$3,244	
SUBTOTAL						$33,619	
Advanced Oxidation Processes[a]							
6" Structural Slab on Grade	1000.00	SF	3.50	5.97	0.23	$9,697	
1,575 Gallon Conical Bottom Vertical XLPE Tank	1.00	EA	3463.12	323.04	13.68	$3,800	
1,575 Gallon Conical Tank Stand	1.00	EA	2358.71	0.00	0.00	$2,359	
Ozone System On-site Operator Training	1.00	EA	0.00	10970.61	0.00	$10,971	
Operator Health and Safety Course	3.00	EA	565.35	3288.55	0.00	$11,562	
Supervisor Health and Safety Course	1.00	EA	96.92	1097.06	0.00	$1,194	
100 GPM Ultraviolet Reactor, Ozone and Peroxide Capital Equipment	1.00	EA	200778.78	31661.20	23297.79	$255,738	
Fugitive Emission Control System	1.00	EA	32305.52	4888.86	3597.45	$40,792	
100 gpm Ozone Assembly & Shakedown	1.00	EA	13883.14	0.00	0.00	$13,883	
0 - 50 GPM Cartridge Filter Equipment	2.00	EA	3058.61	139.79	0.00	$6,397	
2" Stainless Steel Piping, Schedule 40, Threaded	100.00	LF	22.42	26.29	0.00	$4,872	
75 GPM, 3 HP, Transfer Pump with Motor, Valves, Piping	1.00	EA	4987.85	3449.52	0.00	$8,437	
SUBTOTAL						$369,700	

TABLE C-6T2: ALTERNATIVE 3 - SITE 16 GROUNDWATER PUMP AND TREAT BY ADVANCED OXIDATION PROCESSES
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Pump and treat of contaminated groundwater by advanced oxidation processes at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Discharge to Publicly Owned Treatment Works[a]							
Demolish Bituminous Road with Power Equipment	18.52	CY	0.00	42.52	9.21	$958	
Cat 225, 1.5 CY, Soil/Sand, Trenching	89.00	CY	0.00	1.12	0.72	$164	
950, 3.00 CY, Backfill with Excavated Material	52.20	CY	0.00	1.41	0.89	$120	
Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	34.80	CY	7.49	3.11	2.85	$468	
Asphalt Wearing Course, 1 Pass (Line Item Includes 5% Waste)	72.50	TON	40.71	44.18	19.31	$7,554	
6" PVC Pipe Sanitary	200.00	LF	3.43	11.92	2.50	$3,570	
Sewer Connection Fee	1.00	EA	6436.76	0.00	0.00	$6,437	
SUBTOTAL						$19,271	
Residual Waste Management[a]							
Load Drums on Disposal Vehicle	269.00	EA	0.00	4.97	2.01	$1,878	
Transport 55 Gallon Drums of Hazardous Waste, Max 80 drums (per Mile)	400.00	MI	2.19	0.00	0.00	$875	
Waste Stream Evaluation Fee, Not Including 50% Rebate on 1st Shipment	1.00	EA	602.28	0.00	0.00	$602	
Landfill Hazardous Solid Waste, 55 Gallon	269.00	EA	324.41	0.00	0.00	$87,267	
SUBTOTAL						$90,622	
Groundwater Monitoring (First Year)[a]							
Remedial Design - User Defined Cost	53.00	EA	96.55	0.00	0.00	$5,117	
Disposable Materials per Sample	53.00	EA	10.62	0.00	0.00	$563	
Decontamination Materials per Sample	53.00	EA	9.55	0.00	0.00	$506	
Nylon Tubing, 1/4" Outside Diameter	1225.00	LF	0.55	0.00	0.00	$678	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	2.00	WK	87.65	0.00	0.00	$175	
Flow Through Monitor, Weekly Rental	2.00	WK	297.25	0.00	0.00	$595	
Water Quality Parameter Testing Device	2.00	WK	303.22	0.00	0.00	$606	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	53.00	EA	54.96	0.00	0.00	$2,913	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	53.00	EA	38.08	0.00	0.00	$2,018	
Volatile Organic Analysis (EPA 624), Water Analysis	53.00	EA	272.65	0.00	0.00	$14,451	
Chloride (EPA 300), Water Analysis	53.00	EA	28.04	0.00	0.00	$1,486	
Sulfate (EPA 300.0), Water Analysis	53.00	EA	28.56	0.00	0.00	$1,513	
Sulfide (EPA 376.1), Water Analysis	53.00	EA	48.46	0.00	0.00	$2,568	
Ferrous Iron (S.M. 3500 Fe - D)	53.00	EA	144.39	0.00	0.00	$7,653	
55 Gallon 17C Closed Head Steel Drum	8.00	EA	90.00	0.00	0.00	$720	
4" Submersible Pump Rental, Week	2.00	WK	305.86	0.00	0.00	$612	
Car or Van Mileage Charge	800.00	MI	0.48	0.00	0.00	$381	
Project Manager	44.00	HR	0.00	243.91	0.00	$10,732	
Project Engineer	220.00	HR	0.00	180.58	0.00	$39,727	
Project Scientist	626.00	HR	0.00	146.81	0.00	$91,905	
Staff Scientist	660.00	HR	0.00	140.14	0.00	$92,491	
Field Technician	128.00	HR	0.00	97.98	0.00	$12,542	
Word Processing/Clerical	176.00	HR	0.00	81.20	0.00	$14,290	
Draftsman/CADD	88.00	HR	0.00	125.83	0.00	$11,073	
SUBTOTAL						$182,245	
Surfacewater Monitoring (First Year)[a]							
Nylon Tubing, 1/4" Outside Diameter	25.00	LF	0.55	0.00	0.00	$14	
pH (EPA 150.1), Water Analysis	5.00	EA	10.38	0.00	0.00	$52	
Cyanide (EPA 335.2), Water Analysis	5.00	EA	70.52	0.00	0.00	$353	
Oil And Grease (EPA 413.2), Water Analysis	5.00	EA	81.80	0.00	0.00	$409	
Phenols (Method 420.1), Water Analysis	5.00	EA	48.54	0.00	0.00	$243	
Volatile Organic Analysis (EPA 624), Water Analysis	5.00	EA	272.65	0.00	0.00	$1,363	
Metals Screen, ICP Flame, Per Each (EPA 200.7), Water Analysis	5.00	EA	85.27	0.00	0.00	$426	
Mercury, Cold Vapor (EPA 245.1), Water Analysis	5.00	EA	59.49	0.00	0.00	$297	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$190	
Project Scientist	23.00	HR	0.00	146.81	0.00	$3,377	
Field Technician	28.00	HR	0.00	97.98	0.00	$2,743	
Word Processing/Clerical	3.00	HR	0.00	81.20	0.00	$244	
Draftsman/CADD	3.00	HR	0.00	125.83	0.00	$377	
SUBTOTAL						$10,089	

TABLE C-6T2: ALTERNATIVE 3 - SITE 16 GROUNDWATER PUMP AND TREAT BY ADVANCED OXIDATION PROCESSES
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Pump and treat of contaminated groundwater by advanced oxidation processes at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
SUBTOTAL ($2003)						$1,300,197	
Contingency	25%					$325,049	10% scope + 15% bid
SUBTOTAL ($2003)						$1,625,246	
Project Management Labor Cost		6.25%				$101,578	
Planning Documents Labor Cost		6.25%				$101,578	
Construction Oversight Labor Cost		6.88%				$111,817	
Reporting Labor Cost		0.88%				$14,302	
As-Built Drawings Labor Cost		0.88%				$14,302	
Public Notice Labor Cost		0.19%				$3,088	
Site Closure Activities Labor Cost		2.00%				$32,505	
Permitting Labor Cost		12.50%				$203,156	
SUBTOTAL						$582,326	
SUBTOTAL ($2004) [b]	1.0398					$2,295,518	
TOTAL CAPITAL COST IN 2004 DOLLARS						$2,295,518	
OPERATIONS AND MAINTENANCE COSTS:							
Treatment Train Miscellaneous[a]							
Per Diem (per person)	144.00	DAY	160.00	0.00	0.00	$23,040	
Mobilize Crew, 50 Miles, per Person	72.00	EA	94.81	0.00	0.00	$6,826	
Disposable Gloves (Latex)	227.00	PAIR	0.28	0.00	0.00	$64	
Disposable Coveralls (Tyvek)	227.00	EA	6.04	0.00	0.00	$1,371	
Non Haz Drummed Site Waste - Load, Transp, & Landfill Disp (55-Gal Drums)	6.00	EA	277.55	0.00	0.00	$1,665	
DOT Steel Drum, 55 Gallon	6.00	EA	100.38	0.00	0.00	$602	
Senior Staff Engineer	16.00	HR	0.00	243.46	0.00	$3,895	
Staff Engineer	48.00	HR	0.00	143.89	0.00	$6,907	
Field Technician	96.00	HR	0.00	97.98	0.00	$9,406	
Startup Costs	1.00	LS	135709.21	165733.37	68455.09	$369,898	
Electrical Charge	2600058.00	KWH	0.09	0.00	0.00	$234,638	
Annual Maintenance Materials and Labor	1.00	LS	7376.48	9008.44	3720.88	$20,106	
SUBTOTAL						$678,419	
Groundwater Extraction Wells[a]							
Staff Engineer	84.00	HR	0.00	143.89	0.00	$12,087	
Field Technician	417.00	HR	0.00	97.98	0.00	$40,858	
Electrical Charge	5171.00	KWH	0.09	0.00	0.00	$467	
SUBTOTAL						$53,412	
Advanced Oxidation Processes[a]							
20 GPM Ozone System Consumables	142.00	WK	403.82	0.00	0.00	$57,342	
60 watt Ultraviolet Source Low Intensity Lamp	55.00	EA	153.45	0.00	0.00	$8,440	
Staff Engineer	63.00	HR	0.00	143.89	0.00	$9,065	
Field Technician	311.00	HR	0.00	97.98	0.00	$30,472	
Hydrogen Peroxide, 50% Solution, 500 Lb Drums	24.00	EA	1232.25	0.00	0.00	$29,574	
Electrical Charge	36028.00	KWH	0.09	0.00	0.00	$3,251	
SUBTOTAL						$138,145	
Discharge to Publicly Owned Treatment Works[a]							
Wastewater Disposal Fee	23652.00	KGAL	25.75	0.00	0.00	$608,969	
Staff Engineer	5.00	HR	0.00	143.89	0.00	$719	
Field Technician	25.00	HR	0.00	97.98	0.00	$2,450	
Electrical Charge	7380.00	KWH	0.09	0.00	0.00	$666	
SUBTOTAL						$612,804	
SUBTOTAL ($2003)						$1,482,779	
Runtime Percent Cost Adjustment	97%					$1,438,296	
Contingency	25%					$370,695	10% scope + 15% bid
SUBTOTAL ($2003)						$1,808,991	
SUBTOTAL ($2004)	1.0398					$1,881,059	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						$1,881,059	

TABLE C-6T2: ALTERNATIVE 3 - SITE 16 GROUNDWATER PUMP AND TREAT BY ADVANCED OXIDATION PROCESSES
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Pump and treat of contaminated groundwater by advanced oxidation processes at CERCLA Site 16. Capital costs occur in year 0.

PERIODIC COSTS[a]:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Five Year review Report	5	1	EA		$47,141		$47,141	End of year 5
Five Year review Report	10	1	EA		$47,929		$47,929	End of year 10
Five Year review Report	15	1	EA		$47,929		$47,929	End of year 15
Five Year review Report	16	1	EA		$47,929		$47,929	Close out report
SUBTOTAL							$190,927	
Contingency		25%					$47,732	10% scope + 15% bid
SUBTOTAL							$238,659	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[b]	Present Value	Notes
Capital Cost	0	$2,295,518	$2,295,518	1.0000	$2,295,518	
Annual O&M	1-15	$28,215,878	$1,881,059	10.7837	$20,284,733	
Monitoring	2-15	$380,146	$27,153	9.8175	$266,577	Groundwater
Monitoring	2-15	$120,611	$ 8,615	9.8175	$84,578	Surface water
Periodic Cost	5	$47,141	$47,141	0.8420	$39,691	5-year review
Periodic Cost	10	$47,929	$47,929	0.7089	$33,978	5-year review
Periodic Cost	15	$47,929	$47,929	0.5969	$28,608	5-year review
Periodic Cost	16	$47,929	$47,929	0.5767	$27,641	Close out report
		$31,203,080			$23,061,325	

TOTAL PRESENT VALUE OF P&T WITH ADVANCED OXIDATION PROCESSES $23,061,325

Notes:

[a] RACER 2003 outputs are in 2003 dollars. The average ENR Construction Cost Index for 2003 was 6694.5, the ENR Construction Cost Index for March 2004 was 6957. The inflation rate from 2003 to March 2004 was 3.92% or a multiplier of 1.0392, which was used to bring RACER 2003 outputs forward to 2004 dollars.

[b] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

TABLE C-6T3A SITE 16 IN SITU CHEMICAL OXIDATION SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In-situ chemical oxidation of contaminated groundwater followed by monitored natural attenuation and land-use controls at the underground storage tank area at CERCLA Site 16. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Pretreatment Costs[a]							
Work Plan						$10,000	
SUBTOTAL						$10,000	
Treatment Costs[a]							
Pilot Test							
Mobilization						$5,000	
Materials costs (reagent)							
Injector Fabrication/Installation and Injection						$70,000	
Other							
SUBTOTAL ($2004)						$75,000	
Pilot Test Groundwater Monitoring [b]							3 wells sampled quarterly
RSK175 analysis for dissolved gases	15.00	EA	97.83	0.00	0.00	$1,467	
Disposable Materials per Sample	15.00	EA	10.76	0.00	0.00	$161	
Decontamination Materials per Sample	15.00	EA	9.68	0.00	0.00	$145	
Nylon Tubing, 1/4" Outside Diameter	350.00	LF	0.56	0.00	0.00	$196	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	15.00	EA	55.69	0.00	0.00	$835	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	15.00	EA	38.58	0.00	0.00	$579	
Volatile Organic Analysis (EPA 624), Water Analysis	15.00	EA	276.27	0.00	0.00	$4,144	
Chloride (EPA 300), Water Analysis	15.00	EA	28.41	0.00	0.00	$426	
Sulfate (EPA 300.0), Water Analysis	15.00	EA	28.94	0.00	0.00	$434	
Sulfide (EPA 376.1), Water Analysis	15.00	EA	49.10	0.00	0.00	$737	
Ferrous Iron (S.M. 3500 Fe - D)	15.00	EA	146.31	0.00	0.00	$2,195	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	3.00	DAY	103.31	0.00	0.00	$310	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Manager	8.00	HR	0.00	243.91	0.00	$1,951	
Project Engineer	40.00	HR	0.00	180.58	0.00	$7,223	
Project Scientist	202.00	HR	0.00	146.81	0.00	$29,656	
Staff Scientist	120.00	HR	0.00	140.14	0.00	$16,817	
Field Technician	78.00	HR	0.00	97.98	0.00	$7,642	
Word Processing/Clerical	46.00	HR	0.00	81.20	0.00	$3,735	
Draftsman/CADD	30.00	HR	0.00	125.83	0.00	$3,775	
SUBTOTAL ($2003)						$85,775	
SUBTOTAL ($2004)[c]	1.0398					$89,192	
Primary Treatment							
Mobilization						$11,500	
Materials costs (reagent)							
Injector Fabrication/Installation and Injection						$602,000	
Other							
SUBTOTAL ($2004)						$613,500	
Follow up Treatment (if necessary)							
Mobilization						$11,500	
Materials costs (reagent)							
Injector Fabrication/Installation and Injection						$301,000	
Other							
SUBTOTAL ($2004)						$1,950,241	
Contingency	15%					$409,190	
SUBTOTAL ($2004) all Treatment costs						$3,137,123	

TABLE C-6T3A SITE 16 IN SITU CHEMICAL OXIDATION SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In-situ chemical oxidation of contaminated groundwater followed by monitored natural attenuation and land-use controls at the underground storage tank area at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Installation of Groundwater Monitoring Wells[b]							6 groundwater wells
Organic Vapor Analyzer Rental, per Day	2.00	DAY	154.46	0.00	0.00	$309	
Decontaminate Rig, Augers, Screen (Rental Equipment)	2.00	DAY	146.04	0.00	0.00	$292	
Field Technician	32.00	HR	0.00	97.98	0.00	$3,135	
2" PVC, Schedule 40, Well Casing	90.00	LF	1.54	7.41	9.42	$1,653	
2" PVC, Schedule 40, Well Screen	60.00	LF	3.55	9.55	12.15	$1,515	
2" PVC, Well Plug	6.00	EA	7.48	11.11	14.13	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	156.00	LF	0.00	20.31	25.83	$7,198	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	8.00	EA	101.71	0.00	0.00	$814	
2" Screen, Filter Pack	72.00	LF	3.99	6.30	8.01	$1,317	
2" Well, Portland Cement Grout	72.00	LF	1.49	0.00	0.00	$107	
2" Well, Bentonite Seal	6.00	EA	11.85	25.00	31.79	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2221.97	2825.78	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	51.93	231.57	5.33	$1,733	
SUBTOTAL ($2003)						$23,729	
SUBTOTAL ($2004)[c]	1.0398					$24,674	
Groundwater Monitoring[b]							years
RSK175 analysis for dissolved gases	106.00	EA	97.83	0.00	0.00	$10,370	
Disposable Materials per Sample	106.00	EA	10.76	0.00	0.00	$1,141	
Decontamination Materials per Sample	106.00	EA	9.68	0.00	0.00	$1,026	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	106.00	EA	55.69	0.00	0.00	$5,903	
	0.00						
Volatile Organic Analysis (EPA 624), Water Analysis	106.00	EA	276.27	0.00	0.00	$29,285	
Chloride (EPA 300), Water Analysis	106.00	EA	28.41	0.00	0.00	$3,011	
Sulfate (EPA 300.0), Water Analysis	106.00	EA	28.94	0.00	0.00	$3,068	
Sulfide (EPA 376.1), Water Analysis	106.00	EA	49.10	0.00	0.00	$5,205	
Total Organic Carbon, TOC (EPA 415.1/415.2), Water Analysis	106.00	EA	41.21	0.00	0.00	$4,368	
	0.00						
Ferrous Iron (S.M. 3500 Fe - D)	106.00	EA	146.31	0.00	0.00	$15,509	
55 Gallon 17C Closed Head Steel Drum	16.00	EA	91.19	0.00	0.00	$1,459	
Disposable Bailer, Polyethylene, 1.5" Outside Diameter x 36"	96.00	EA	12.56	0.00	0.00	$1,206	
Car or Van Mileage Charge	1600.00	MI	0.48	0.00	0.00	$768	
Project Manager	40.00	HR	0.00	243.91	0.00	$9,756	
Project Engineer	200.00	HR	0.00	180.58	0.00	$36,116	
Project Scientist	878.00	HR	0.00	146.81	0.00	$128,899	
Staff Scientist	600.00	HR	0.00	140.14	0.00	$84,084	
Field Technician	310.00	HR	0.00	97.98	0.00	$30,374	
Word Processing/Clerical	214.00	HR	0.00	81.20	0.00	$17,377	
Draftsman/CADD	134.00	HR	0.00	125.83	0.00	$16,861	
SUBTOTAL ($2003)						$408,574	
SUBTOTAL ($2004)[c]	1.0398					$424,851	
SUBTOTAL ($2004)						$3,596,649	
Contingency		25%				$899,162	10% scope + 15% bid
SUBTOTAL ($2004)						$4,495,811	
Project Management Labor Cost		5.00%				$224,791	
Planning Documents Labor Cost		5.00%				$224,791	
Construction Oversight Labor Cost		6.25%				$280,988	
Reporting Labor Cost		0.63%				$28,324	
As-Built Drawings Labor Cost		0.63%				$28,324	
Public Notice Labor Cost		0.09%				$4,046	
Site Closure Activities Labor Cost		2.00%				$89,916	
Permitting Labor Cost		6.25%				$280,988	
SUBTOTAL ($2004)						$1,162,167	
TOTAL CAPITAL COST IN 2004 DOLLARS						$5,657,978	

TABLE C-6T3A SITE 16 IN SITU CHEMICAL OXIDATION SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In-situ chemical oxidation of contaminated groundwater followed by monitored natural attenuation and land-use controls at the underground storage tank area at CERCLA Site 16. Capital costs occur in year 0.

OPERATIONS AND MAINTENANCE COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Treatment Train Miscellaneous							
Per Diem (per person)	0.00	DAY	160.00	0.00	0.00	$0	No O&M associated
Mobilize Crew, 50 Miles, per Person	0.00	EA	94.81	0.00	0.00	$0	with this technology
Staff Engineer	0.00	HR	0.00	143.89	0.00	$0	
Field Technician	0.00	HR	0.00	97.98	0.00	$0	
SUBTOTAL						$0	
SUBTOTAL ($2003)						$0	
Runtime Percent Cost Adjustment	97%					$0	
Contingency	25%					$0	10% scope + 15% bid
SUBTOTAL ($2003)						$0	
SUBTOTAL ($2004)	1.0398					$0	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$0**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	2	1	EA		$47,929		$47,929	Cost supplied by ISOTEC
SUBTOTAL ($2003)							$47,929	
Contingency		25%					$11,982	10% scope + 15% bid
SUBTOTAL ($2004)[c]		1.0398					$62,298	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[d]	Present Value	Notes
Capital Cost	0	$5,657,978	$5,657,978	1.0000	$5,657,978	
Annual O&M	1-2	$0	$0	1.8997	$0	
Periodic Cost	2	$62,298	$62,298	0.9335	$58,156	Cost supplied by ISOTEC
		$5,720,276			$5,716,134	
TOTAL PRESENT VALUE OF ISCO AT SITE 16 UST AREA					**$5,716,134**	

Notes:

[a] Vendor quote from ISOTEC, date, Chris Nelson, phone number. Quote includes labor, materials, equipment and reports.

[b] Cost generated in RACER 2003

[c] RACER 2003 outputs are in 2003 dollars. The average ENR Construction Cost Index for 2003 was 6690.5, the ENR Construction Cost Index for March 2004 was 6957. The inflation rate from 2003 to March 2004 was 3.98% or a multiplier of 1.0398, which was used to bring RACER 2003 outputs forward to 2004 dollars.

[d] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 for a 30 year technology and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

TABLE C-6T3B SITE 16 IN SITU CHEMICAL OXIDATION SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In-situ chemical oxidation of contaminated groundwater followed by monitored natural attenuation and land-use controls at the scrap yard at CERCLA Site 16. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Pretreatment Costs[a]							
Work Plan						$15,000	
SUBTOTAL						$15,000	
Treatment Costs[a]							
Pilot Test							
Mobilization						$5,000	
Materials costs (reagent)							
Injector Fabrication/Installation and Injection						$70,000	
Other							
SUBTOTAL ($2004)						$75,000	
Pilot Test Groundwater Monitoring[b]							3 wells sampled quarterly
RSK175 analysis for dissolved gases methan	15.00	EA	97.83	0.00	0.00	$1,467	
Disposable Materials per Sample	15.00	EA	10.76	0.00	0.00	$161	
Decontamination Materials per Sample	15.00	EA	9.68	0.00	0.00	$145	
Nylon Tubing, 1/4" Outside Diameter	350.00	LF	0.56	0.00	0.00	$196	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	15.00	EA	55.69	0.00	0.00	$835	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	15.00	EA	38.58	0.00	0.00	$579	
Volatile Organic Analysis (EPA 624), Water Analysis	15.00	EA	276.27	0.00	0.00	$4,144	
Chloride (EPA 300), Water Analysis	15.00	EA	28.41	0.00	0.00	$426	
Sulfate (EPA 300.0), Water Analysis	15.00	EA	28.94	0.00	0.00	$434	
Sulfide (EPA 376.1), Water Analysis	15.00	EA	49.10	0.00	0.00	$737	
Ferrous Iron (S.M. 3500 Fe - D)	15.00	EA	146.31	0.00	0.00	$2,195	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	3.00	DAY	103.31	0.00	0.00	$310	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Manager	8.00	HR	0.00	243.91	0.00	$1,951	
Project Engineer	40.00	HR	0.00	180.58	0.00	$7,223	
Project Scientist	202.00	HR	0.00	146.81	0.00	$29,656	
Staff Scientist	120.00	HR	0.00	140.14	0.00	$16,817	
Field Technician	78.00	HR	0.00	97.98	0.00	$7,642	
Word Processing/Clerical	46.00	HR	0.00	81.20	0.00	$3,735	
Draftsman/CADD	30.00	HR	0.00	125.83	0.00	$3,775	
SUBTOTAL ($2003)						$85,775	
SUBTOTAL ($2004)[c]	1.0398					$89,192	
Primary Treatment							
Mobilization						$11,500	
Materials costs (reagent)							
Injector Fabrication/Installation and Injection						$1,903,500	
Other							
SUBTOTAL ($2004)						$1,915,000	
Follow up Treatment (if necessary)							
Mobilization						$11,500	
Materials costs (reagent)							
Injector Fabrication/Installation and Injection						$951,750	
Other							
SUBTOTAL ($2004)	15%					$963,250	
Contingency						$456,366	
SUBTOTAL ($2004) all Treatment costs						$3,498,808	

TABLE C-6T3B SITE 16 IN SITU CHEMICAL OXIDATION SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In-situ chemical oxidation of contaminated groundwater followed by monitored natural attenuation and land-use controls at the scrap yard at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Installation of Groundwater Monitoring Wells[b]							6 groundwater monitoring wells
Organic Vapor Analyzer Rental, per Day	2.00	DAY	154.46	0.00	0.00	$309	
Decontaminate Rig, Augers, Screen (Rental Equipment)	2.00	DAY	146.04	0.00	0.00	$292	
Field Technician	32.00	HR	0.00	97.98	0.00	$3,135	
2" PVC, Schedule 40, Well Casing	90.00	LF	1.54	7.41	9.42	$1,653	
2" PVC, Schedule 40, Well Screen	60.00	LF	3.55	9.55	12.15	$1,515	
2" PVC, Well Plug	6.00	EA	7.48	11.11	14.13	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	156.00	LF	0.00	20.31	25.83	$7,198	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	8.00	EA	101.71	0.00	0.00	$814	
2" Screen, Filter Pack	72.00	LF	3.99	6.30	8.01	$1,317	
2" Well, Portland Cement Grout	72.00	LF	1.49	0.00	0.00	$107	
2" Well, Bentonite Seal	6.00	EA	11.85	25.00	31.79	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2221.97	2825.78	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	51.93	231.57	5.33	$1,733	
SUBTOTAL ($2003)						$23,728.63	
SUBTOTAL ($2004)[c]	1.0398					$24,673.94	
Groundwater Monitoring[b]							12 wells sampled quarterly for 2 years
RSK175 analysis for dissolved gases	106.00	EA	97.83	0.00	0.00	$10,370	
Disposable Materials per Sample	106.00	EA	10.76	0.00	0.00	$1,141	
Decontamination Materials per Sample	106.00	EA	9.68	0.00	0.00	$1,026	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	106.00	EA	55.69	0.00	0.00	$5,903	
	0.00						
Volatile Organic Analysis (EPA 624), Water Analysis	106.00	EA	276.27	0.00	0.00	$29,285	
						$0	
Chloride (EPA 300), Water Analysis	106.00	EA	28.41	0.00	0.00	$3,011	
Sulfate (EPA 300.0), Water Analysis	106.00	EA	28.94	0.00	0.00	$3,068	
Sulfide (EPA 376.1), Water Analysis	106.00	EA	49.10	0.00	0.00	$5,205	
Total Organic Carbon, TOC (EPA 415.1/415.2), Water Analysis	106.00	EA	41.21	0.00	0.00	$4,368	
	0.00						
Ferrous Iron (S.M. 3500 Fe - D)	106.00	EA	146.31	0.00	0.00	$15,509	
55 Gallon 17C Closed Head Steel Drum	16.00	EA	91.19	0.00	0.00	$1,459	
Disposable Bailer, Polyethylene, 1.5" Outside Diameter x 36"	96.00	EA	12.56	0.00	0.00	$1,206	
Car or Van Mileage Charge	1600.00	MI	0.48	0.00	0.00	$768	
Project Manager	40.00	HR	0.00	243.91	0.00	$9,756	
Project Engineer	200.00	HR	0.00	180.58	0.00	$36,116	
Project Scientist	878.00	HR	0.00	146.81	0.00	$128,899	
Staff Scientist	600.00	HR	0.00	140.14	0.00	$84,084	
Field Technician	310.00	HR	0.00	97.98	0.00	$30,374	
Word Processing/Clerical	214.00	HR	0.00	81.20	0.00	$17,377	
Draftsman/CADD	134.00	HR	0.00	125.83	0.00	$16,861	
SUBTOTAL ($2003)						$408,574	
SUBTOTAL ($2004)[c]	1.0398					$424,851	
SUBTOTAL ($2004)						$3,963,334	
Contingency		25%				$990,833	10% scope + 15% bid
SUBTOTAL ($2004)						$4,954,167	
Project Management Labor Cost		5.00%				$247,708.35	
Planning Documents Labor Cost		5.00%				$247,708.35	
Construction Oversight Labor Cost		6.25%				$309,635.43	
Reporting Labor Cost		0.63%				$31,211.25	
As-Built Drawings Labor Cost		0.63%				$31,211.25	
Public Notice Labor Cost		0.09%				$ 4,458.75	
Site Closure Activities Labor Cost		2.00%				$99,083.34	
Permitting Labor Cost		6.25%				$309,635.43	
SUBTOTAL ($2004)						$1,280,652.15	
TOTAL CAPITAL COST IN 2004 DOLLARS						$6,234,819	

TABLE C-6T3B SITE 16 IN SITU CHEMICAL OXIDATION SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: In-situ chemical oxidation of contaminated groundwater followed by monitored natural attenuation and land-use controls at the scrap yard at CERCLA Site 16. Capital costs occur in year 0.

OPERATIONS AND MAINTENANCE COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Treatment Train Miscellaneous							
Per Diem (per person)	0.00	DAY	160.00	0.00	0.00	$0	No O&M associated
Mobilize Crew, 50 Miles, per Person	0.00	EA	94.81	0.00	0.00	$0	with this technology
Staff Engineer	0.00	HR	0.00	143.89	0.00	$0	
Field Technician	0.00	HR	0.00	97.98	0.00	$0	
SUBTOTAL						$0	
SUBTOTAL ($2003)						$0	
Runtime Percent Cost Adjustment	97%					$0	
Contingency	25%					$0	10% scope + 15% bid
SUBTOTAL ($2003)						$0	
SUBTOTAL ($2004)	1.0398					$0	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$0**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
End of Project Report	2	1	EA		$47,929		$47,929	Cost supplied by ISOTEC
SUBTOTAL ($2003)							$47,929	
Contingency		25%					$11,982	10% scope + 15% bid
SUBTOTAL ($2004)[c]		1.0398					$62,298	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[d]	Present Value	Notes
Capital Cost	0	$6,234,819	$6,234,819	1.0000	$6,234,819	
Annual O&M	1-2	$0	$0	1.8997	$0	
Periodic Cost	2	$62,298	$62,298	0.9335	$58,156	Cost supplied by ISOTEC
		$6,297,117			$6,292,975	
TOTAL PRESENT VALUE OF ISCO AT SITE 16 SCRAP YARD					**$6,292,975**	

Notes:

[a] Vendor quote from ISOTEC, date, Chris Nelson, phone number. Quote includes labor, materials, equipment and reports.

[b] Cost generated in RACER 2003

[c] RACER 2003 outputs are in 2003 dollars. The average ENR Construction Cost Index for 2003 was 6690.5, the ENR Construction Cost Index for March 2004 was 6957. The inflation rate from 2003 to March 2004 was 3.98% or a multiplier of 1.0398, which was used to bring RACER 2003 outputs forward to 2004 dollars.

[d] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 for a 30 year technology and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

TABLE C-6T4A: SITE 16 HYDROGEN RELEASE COMPOUNDS SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Addition of hydrogen release compounds to contaminated groundwater followed by monitored natural attenuation and land-use controls at the underground storage tank area at CERCLA Site 16. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
HRC Injection and Materials[a]							
Pilot Test							
Work Plan						$10,000	
HRC material	800.00	LB	5.00			$4,000	
shipping	800.00	LB	0.40			$320	
Mobilization						$325	
Mobilization[c]	1.00	DAY			1650.00	$1,650	
Drill Rig[c]	1.00	DAY		150.00		$150	
Local Travel for Rig[c]	1.00	DAY		450.00		$450	
Additional Crew Member for Injection[c]	1.00	DAY			300.00	$300	
Injection Pump[c]	40.00	LF			1.00	$40	Upper 5 feet will be abandoned
Borehole Abandonment[c]	1.00	DAY			95.00	$95	
Steam Cleaner[c]						$8,800	
Staff Scientist[b]	78.00	HR	0.00	140.14	0.00	$10,931	
Install Monitoring Wells[b]	3.00					$7,500	
SUBTOTAL ($2004)						$44,561	
Pilot Test Groundwater Monitoring[b]							3 wells sampled quarterly
RSK175 analysis for dissolved gases methane, ethane, ethene	15.00	EA	97.83	0.00	0.00	$2,641	
Disposable Materials per Sample	15.00	EA	10.76	0.00	0.00	$291	
Decontamination Materials per Sample	15.00	EA	9.68	0.00	0.00	$261	
Nylon Tubing, 1/4" Outside Diameter	350.00	LF	0.56	0.00	0.00	$351	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	15.00	EA	55.69	0.00	0.00	$1,504	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	15.00	EA	38.58	0.00	0.00	$1,042	
Volatile Organic Analysis (EPA 624), Water Analysis	15.00	EA	276.27	0.00	0.00	$7,459	
Chloride (EPA 300), Water Analysis	15.00	EA	28.41	0.00	0.00	$767	
Sulfate (EPA 300.0), Water Analysis	15.00	EA	28.94	0.00	0.00	$781	
Sulfide (EPA 376.1), Water Analysis	15.00	EA	49.10	0.00	0.00	$1,326	
Ferrous Iron (S.M. 3500 Fe - D)	15.00	EA	146.31	0.00	0.00	$3,950	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$730	
4" Submersible Pump Rental, Day	3.00	DAY	103.31	0.00	0.00	$310	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$193	
Project Manager	8.00	HR	0.00	243.91	0.00	$1,951	
Project Engineer	40.00	HR	0.00	180.58	0.00	$7,223	
Project Scientist	202.00	HR	0.00	146.81	0.00	$29,656	
Staff Scientist	120.00	HR	0.00	140.14	0.00	$16,816	
Field Technician	78.00	HR	0.00	97.98	0.00	$7,643	
Word Processing/Clerical	46.00	HR	0.00	81.20	0.00	$3,735	
Draftsman/CADD	30.00	HR	0.00	125.83	0.00	$3,775	
SUBTOTAL ($2003)						$95,194	
SUBTOTAL ($2004)[c]	0.97					$91,975	
Primary Treatment							
HRC material	31680.00	LB	5.50			$174,240	
Shipping	31680.00	LB	0.20			$6,336	
Mobilization[c]						$1,000	
Drill Rig[c]	49.50	DAY			1650.00	$81,675	Drilling 200 holes per day
Local Travel for Rig[c]	50.00	DAY		150.00		$7,500	
Additional Crew Member for Injection[c]	49.50	DAY		450.00		$22,275	
Injection Pump[c]	50.00	DAY			300.00	$15,000	
Borehole Abandonment[c]	1980.00	LF			1.00	$1,980	Only upper 5 feet will be abandoned
Steam Cleaner[c]	50.00	DAY			95.00	$4,750	
Hand Auger[c]	6.60	DAY			750.00	$4,950	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	7.00	DAY		150.00		$1,050	
Concrete Coring[c]	5.00	DAY			1100.00	$5,500	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	5.00	DAY		150.00		$750	
Car or Van Mileage Charge[b]	10000.00	MI	0.48	0.00	0.00	$4,800	
SUBTOTAL ($2004)						$331,806	

TABLE C-6T4A: SITE 16 HYDROGEN RELEASE COMPOUNDS SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Addition of hydrogen release compounds to contaminated groundwater followed by monitored natural attenuation and land-use controls at the underground storage tank area at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Follow up Treatment							
HRC material	15840.00	LB	5.50			$87,120	
Shipping	15840.00	LB	0.20			$3,168	
Mobilization[c]						$1,000	
Drill Rig[c]	25.00	DAY			1250.00	$31,250	Drilling 200 holes per day
Local Travel for Rig[c]	25.00	DAY		150.00		$3,750	
Additional Crew Member for Injection[c]	25.00	DAY		450.00		$11,250	
Injection Pump[c]	25.00	DAY			300.00	$7,500	
Borehole Abandonment[c]	990.00	LF			1.00	$990	Only upper 5 feet will be abandoned
Steam Cleaner[c]	25.00	DAY			95.00	$2,375	
Hand Auger[c]	3.50	DAY			750.00	$2,625	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	4.00	DAY		150.00		$600	
Concrete Coring[c]	2.50	DAY			1100.00	$2,750	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	3.00	DAY		150.00		$450	
Car or Van Mileage Charge[b]	5000.00	MI	0.48	0.00	0.00	$2,400	
SUBTOTAL ($2004)						$157,228	
Contingency	15%					$93,835	
SUBTOTAL ($2004) all HRC material and injections						$719,405	
Installation of Groundwater Monitoring Wells [b]							6 groundwater monitoring wells
Organic Vapor Analyzer Rental, per Day	2.00	DAY	154.46	0.00	0.00	308.92	
Decontaminate Rig, Augers, Screen (Rental Equipment)	2.00	DAY	146.04	0.00	0.00	292.09	
Field Technician	32.00	HR	0.00	97.98	0.00	3135.42	
2" PVC, Schedule 40, Well Casing	90.00	LF	1.54	7.41	9.42	1652.64	
2" PVC, Schedule 40, Well Screen	60.00	LF	3.55	9.55	12.15	1515.23	
2" PVC, Well Plug	6.00	EA	7.48	11.11	14.13	196.29	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	156.00	LF	0.00	20.31	25.83	7197.89	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	8.00	EA	101.71	0.00	0.00	813.7	
2" Screen, Filter Pack	72.00	LF	3.99	6.30	8.01	1316.92	
2" Well, Portland Cement Grout	72.00	LF	1.49	0.00	0.00	106.95	
2" Well, Bentonite Seal	6.00	EA	11.85	25.00	31.79	411.85	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2221.97	2825.78	5047.75	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	51.93	231.57	5.33	$1,733	
SUBTOTAL ($2003)						$23,729	
SUBTOTAL ($2004)[c]	1.0398					$24,674	
Groundwater Monitoring[b]							12 wells sampled quarterly for 3 years
RSK175 analysis for dissolved gases	159.00	EA	97.83	0.00	0.00	$15,555	
Disposable Materials per Sample	159.00	EA	10.76	0.00	0.00	$1,711	
Decontamination Materials per Sample	159.00	EA	9.68	0.00	0.00	$1,539	
Water Level Indicator, Manual,	6.00	WK	88.82	0.00	0.00	$533	
Polyethylene Tape, 100' Cable, Weekly						$0	
Rental						$0	
Flow Through Monitor, Weekly Rental	6.00	WK	301.20	0.00	0.00	$1,807	
Water Quality Parameter Testing Device	6.00	WK	307.24	0.00	0.00	$1,843	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	159.00	EA	55.69	0.00	0.00	$8,855	
						$0	
Volatile Organic Analysis (EPA 624), Water Analysis	159.00	EA	276.27	0.00	0.00	$43,927	
						$0	
Chloride (EPA 300), Water Analysis	159.00	EA	28.41	0.00	0.00	$4,517	
Sulfate (EPA 300.0), Water Analysis	159.00	EA	28.94	0.00	0.00	$4,601	
Sulfide (EPA 376.1), Water Analysis	159.00	EA	49.10	0.00	0.00	$7,807	
Total Organic Carbon, TOC (EPA 415.1/415.2), Water Analysis	159.00	EA	41.21	0.00	0.00	$6,552	
						$0	
Ferrous Iron (S.M. 3500 Fe - D)	159.00	EA	146.31	0.00	0.00	$23,263	
55 Gallon 17C Closed Head Steel Drum	24.00	EA	91.19	0.00	0.00	$2,189	
Disposable Bailer, Polyethylene, 1.5" Outside Diameter x 36"	144.00	EA	12.56	0.00	0.00	$1,809	
						$0	
Car or Van Mileage Charge	2400.00	MI	0.48	0.00	0.00	$1,152	
Project Manager	60.00	HR	0.00	243.91	0.00	$14,635	
Project Engineer	300.00	HR	0.00	180.58	0.00	$54,174	
Project Scientist	1317.00	HR	0.00	146.81	0.00	$193,349	
Staff Scientist	900.00	HR	0.00	140.14	0.00	$126,126	
Field Technician	465.00	HR	0.00	97.98	0.00	$45,561	
Word Processing/Clerical	321.00	HR	0.00	81.20	0.00	$26,065	
Draftsman/CADD	201.00	HR	0.00	125.83	0.00	$25,292	
SUBTOTAL ($2003)						$612,862	
SUBTOTAL ($2004)[c]	1.0398					$637,277	

TABLE C-6T4A: SITE 16 HYDROGEN RELEASE COMPOUNDS SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Addition of hydrogen release compounds to contaminated groundwater followed by monitored natural attenuation and land-use controls at the underground storage tank area at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
SUBTOTAL ($2004)						$1,381,356	
Contingency		25%				$345,339	10% scope + 15% bid
SUBTOTAL ($2004)						$1,726,696	
Design (Regenesis)		9.00%				$155,403	
Project Management Labor Cost		5.00%				$86,335	
Planning Documents Labor Cost		5.00%				$86,335	
Construction Oversight Labor Cost		6.25%				$107,918	
Reporting Labor Cost		0.63%				$10,878	
As-Built Drawings Labor Cost		0.63%				$10,878	
Public Notice Labor Cost		0.09%				$1,554	
Site Closure Activities Labor Cost		2.00%				$34,534	
Permitting Labor Cost		6.25%				$107,918	
SUBTOTAL (2004)						$601,753	
TOTAL CAPITAL COST IN 2004 DOLLARS						$2,328,449	

OPERATIONS AND MAINTENANCE COSTS:

Treatment Train Miscellaneous							
Per Diem (per person)	0.00	DAY	160.00	0.00	0.00	$0	No O&M associated
Mobilize Crew, 50 Miles, per Person	0.00	EA	94.81	0.00	0.00	$0	with this technology
Staff Engineer	0.00	HR	0.00	143.89	0.00	$0	
Field Technician	0.00	HR	0.00	97.98	0.00	$0	
SUBTOTAL						$0	
SUBTOTAL ($2003)						$0	
Runtime Percent Cost Adjustment	97%					$0	
Contingency	25%					$0	10% scope + 15% bid
SUBTOTAL ($2003)						$0	
SUBTOTAL ($2004)	1.0398					$0	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						$0	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	2	1	EA		$47,929		$47,929	(RACER)
SUBTOTAL (2004)							$47,929	
Contingency		25%					$11,982	10% scope + 15% bid
SUBTOTAL ($2004)[c]		1.0398					$62,298	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[d]	Present Value	Notes
Capital Cost	0	$2,328,449	$2,328,449	1.0000	$2,328,449	
Annual O&M	1-2	$0	$0	1.8681	$0	
Periodic Cost	3	$62,298	$62,298	0.9019	$56,189	
		$2,390,747			$2,384,638	
TOTAL PRESENT VALUE OF HRC AT SITE 16 UST AREA					$2,384,638	

Notes:

[a] Vendor quote from Dave Reilly at Regenesis, (949) 366-8001 x 125 on March 17, 2004

[b] Costs provided by RACER 2003

[c] RACER 2003 outputs are in 2003 dollars. The average ENR Construction Cost Index for 2003 was 6690.5, the ENR Construction Cost Index for March 2004 was 6957. The inflation rate from 2003 to March 2004 was 3.98% or a multiplier of 1.0398, which was used to bring RACER 2003 outputs forward to 2004 dollars.

[d] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 for a 30 year technology and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

[e] Vendor quote from Derrik M. Sandberg at ResonantSonic International on March 17, 2004, (530) 668-2424

TABLE C-6T4B: SITE 16 HYDROGEN RELEASE COMPOUNDS SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Addition of hydrogen release compounds to contaminated groundwater followed by monitored natural attenuation and land-use controls at the scrap yard at CERCLA Site 16. Capital costs occur in year 0.

CAPITAL COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
HRC Injection and Materials[a]							
Pilot Test							
Work Plan						$10,000	
HRC material	752.00	LB	5.00	0.00	0.00	$3,760	
shipping	752.00	LB	0.20	0.00	0.00	$150	
Mobilization[a]			0.00	0.00	0.00	$325	
Drill Rig[a]	1.00	DAY	0.00	0.00	1650.00	$1,650	
Local Travel[a]	1.00	DAY	0.00	150.00	0.00	$150	
Additional Crew Member for Injection[a]	1.00	DAY	0.00	450.00	0.00	$450	
Injection Pump[a]	1.00	DAY	0.00	0.00	300.00	$300	
Borehole Abandonment[a]	40.00	LF	0.00	0.00	1.00	$40	Upper 5 feet will be abandoned
Steam Cleaner[a]	1.00	DAY	0.00	0.00	95.00	$95	
Analytical[b]						$8,800	
Staff Scientist[b]	78.00	HR	0.00	140.14	0.00	$10,931	
Install Monitoring Wells[b]	3.00					$7,500	3 monitoring wells
SUBTOTAL ($2004)						$44,151	
Pilot Test Groundwater Monitoring[b]							3 wells sampled quarterly
RSK175 analysis for dissolved gases methane, ethane, ethene	15.00	EA	97.83	0.00	0.00	$2,641	
Disposable Materials per Sample	15.00	EA	10.76	0.00	0.00	$291	
Decontamination Materials per Sample	15.00	EA	9.68	0.00	0.00	$261	
Nylon Tubing, 1/4" Outside Diameter	350.00	LF	0.56	0.00	0.00	$351	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	15.00	EA	55.69	0.00	0.00	$1,504	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	15.00	EA	38.58	0.00	0.00	$1,042	
Volatile Organic Analysis (EPA 624), Water Analysis	15.00	EA	276.27	0.00	0.00	$7,459	
Chloride (EPA 300), Water Analysis	15.00	EA	28.41	0.00	0.00	$767	
Sulfate (EPA 300.0), Water Analysis	15.00	EA	28.94	0.00	0.00	$781	
Sulfide (EPA 376.1), Water Analysis	15.00	EA	49.10	0.00	0.00	$1,326	
Ferrous Iron (S.M. 3500 Fe - D)	15.00	EA	146.31	0.00	0.00	$3,950	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$730	
4" Submersible Pump Rental, Day	3.00	DAY	103.31	0.00	0.00	$310	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$193	
Project Manager	8.00	HR	0.00	243.91	0.00	$1,951	
Project Engineer	40.00	HR	0.00	180.58	0.00	$7,223	
Project Scientist	202.00	HR	0.00	146.81	0.00	$29,656	
Staff Scientist	120.00	HR	0.00	140.14	0.00	$16,816	
Field Technician	78.00	HR	0.00	97.98	0.00	$7,643	
Word Processing/Clerical	46.00	HR	0.00	81.20	0.00	$3,735	
Draftsman/CADD	30.00	HR	0.00	125.83	0.00	$3,775	
SUBTOTAL ($2003)						$95,194	
SUBTOTAL ($2004)[c]	1.04					$98,986	
Primary Treatment							
HRC material	154950.00	LB	5.00	0.00	0.00	$774,750	
Shipping	154950.00	LB	0.20	0.00	0.00	$30,990	
Mobilization[a]						$1,000	
Drill Rig[a]	207.00	DAY			1650.00	$341,550	Drilling 200 feet per day
Local Travel[a]	207.00	DAY	0.00	150.00	0.00	$31,050	
Additional Crew Member for Injection[a]	207.00	DAY	0.00	450.00	0.00	$93,150	
Injection Pump[a]	207.00	DAY	0.00	0.00	300.00	$62,100	
Borehole Abandonment[a]	8250.00	LF	0.00	0.00	1.00	$8,250	Only upper 5 feet will be abandoned
Steam Cleaner[a]	207.00	DAY	0.00	0.00	95.00	$19,665	
Hand Auger[a]	27.50	DAY	0.00	0.00	750.00	$20,625	Assumes 15 cores per day
Local Travel for Hang Auger Crew[a]	28.00	DAY	0.00	150.00	0.00	$4,200	
Concrete Coring[a]	20.50	DAY	0.00	0.00	1100.00	$22,550	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[a]	21.00	DAY	0.00	150.00	0.00	$3,150	
Car or Van Mileage Charge[b]	7500.00	MI	0.48	0.00	0.00	$3,600	
SUBTOTAL ($2004)						$1,416,630	

TABLE C-6T4B: SITE 16 HYDROGEN RELEASE COMPOUNDS SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Addition of hydrogen release compounds to contaminated groundwater followed by monitored natural attenuation and land-use controls at the scrap yard at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Follow up Treatment							
HRC material	77475.00	LB	5.50	0.00	0.00	$426,113	
Shipping	77475.00	LB	0.20	0.00	0.00	$15,495	
Mobilization[a]						$1,000	
Drill Rig[a]	25.00	DAY			1250.00	$31,250	Drilling 200 feet per day
Local Travel[a]	103.50	DAY	0.00	150.00	0.00	$15,525	
Additional Crew Member for Injection[a]	25.00	DAY	0.00	450.00	0.00	$11,250	
Injection Pump[a]	103.50	DAY	0.00	0.00	0.00	$0	
Borehole Abandonment[a]	4125.00	LF	0.00	0.00	1.00	$4,125	Only upper 5 feet will be abandoned
Steam Cleaner[a]	103.50	DAY	0.00	0.00	95.00	$9,833	
Hand Auger[a]	3.50	DAY	0.00	0.00	750.00	$2,625	Assumes 15 cores per day
Local Travel for Hang Auger Crew[a]	4.00	DAY	0.00	150.00	0.00	$600	
Concrete Coring[a]	10.25	DAY	0.00	0.00	1100.00	$11,275	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[a]	3.00	DAY	0.00	150.00	0.00	$450	
Car or Van Mileage Charge[b]	51.75	MI	0.48	0.00	0.00	$25	
SUBTOTAL ($2004)						$529,565	
Contingency	15%					$313,400	
SUBTOTAL ($2004) all HRC material and injections						$2,402,732	
Installation of Groundwater Monitoring Wells[b]							6 groundwater monitoring wells
Organic Vapor Analyzer Rental, per Day	2.00	DAY	154.46	0.00	0.00	$309	
Decontaminate Rig, Augers, Screen (Rental Equipment)	2.00	DAY	146.04	0.00	0.00	$292	
Field Technician	32.00	HR	0.00	97.98	0.00	$3,135	
2" PVC, Schedule 40, Well Casing	90.00	LF	1.54	7.41	9.42	$1,653	
2" PVC, Schedule 40, Well Screen	60.00	LF	3.55	9.55	12.15	$1,515	
2" PVC, Well Plug	6.00	EA	7.48	11.11	14.13	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	156.00	LF	0.00	20.31	25.83	$7,198	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	8.00	EA	101.71	0.00	0.00	$814	
2" Screen, Filter Pack	72.00	LF	3.99	6.30	8.01	$1,317	
2" Well, Portland Cement Grout	72.00	LF	1.49	0.00	0.00	$107	
2" Well, Bentonite Seal	6.00	EA	11.85	25.00	31.79	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2221.97	2825.78	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	6.00	EA	51.93	231.57	5.33	$1,733	
SUBTOTAL ($2003)						$23,729	
SUBTOTAL ($2004)[c]	1.0398					$24,674	
Groundwater Monitoring[b]							12 wells sampled quarterly for 3 years
RSK175 analysis for dissolved gases methan	159.00	EA	97.83	0.00	0.00	$15,555	
Disposable Materials per Sample	159.00	EA	10.76	0.00	0.00	$1,711	
Decontamination Materials per Sample	159.00	EA	9.68	0.00	0.00	$1,539	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	6.00	WK	88.82	0.00	0.00	$533	
Flow Through Monitor, Weekly Rental	6.00	WK	301.20	0.00	0.00	$1,807	
Water Quality Parameter Testing Device	6.00	WK	307.24	0.00	0.00	$1,843	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	159.00	EA	55.69	0.00	0.00	$8,855	
Volatile Organic Analysis (EPA 624), Water Analysis	159.00	EA	276.27	0.00	0.00	$43,927	
Chloride (EPA 300), Water Analysis	159.00	EA	28.41	0.00	0.00	$4,517	
Sulfate (EPA 300.0), Water Analysis	159.00	EA	28.94	0.00	0.00	$4,601	
Sulfide (EPA 376.1), Water Analysis	159.00	EA	49.10	0.00	0.00	$7,807	
Total Organic Carbon, TOC (EPA 415.1/415.2), Water Analysis	159.00	EA	41.21	0.00	0.00	$6,552	
Ferrous Iron (S.M. 3500 Fe - D)	159.00	EA	146.31	0.00	0.00	$23,263	
55 Gallon 17C Closed Head Steel Drum	24.00	EA	91.19	0.00	0.00	$2,189	
Disposable Bailer, Polyethylene, 1.5" Outside Diameter x 36"	144.00	EA	12.56	0.00	0.00	$1,809	
Car or Van Mileage Charge	2400.00	MI	0.48	0.00	0.00	$1,152	
Project Manager	60.00	HR	0.00	243.91	0.00	$14,635	
Project Engineer	300.00	HR	0.00	180.58	0.00	$54,174	
Project Scientist	1317.00	HR	0.00	146.81	0.00	$193,349	
Staff Scientist	900.00	HR	0.00	140.14	0.00	$126,126	
Field Technician	465.00	HR	0.00	97.98	0.00	$45,561	
Word Processing/Clerical	321.00	HR	0.00	81.20	0.00	$26,065	
Draftsman/CADD	201.00	HR	0.00	125.83	0.00	$25,292	
SUBTOTAL ($2003)						$612,862	
SUBTOTAL ($2004)[c]	1.0398					$637,277	

TABLE C-6T4B: SITE 16 HYDROGEN RELEASE COMPOUNDS SOURCE AREA REDUCTION, TOTAL REMEDIAL COST SUMMARY
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: March 11, 2004

Description: Addition of hydrogen release compounds to contaminated groundwater followed by monitored natural attenuation and land-use controls at the scrap yard at CERCLA Site 16. Capital costs occur in year 0.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
SUBTOTAL ($2004)						$3,064,684	
Contingency		25%				$766,171	10% scope + 15% bid
SUBTOTAL ($2004)						$3,830,854	
Design and Work Plan		9.00%				$344,777	
Project Management Labor Cost		5.00%				$191,543	
Planning Documents Labor Cost		5.00%				$191,543	
Construction Oversight Labor Cost		6.25%				$239,428	
Reporting Labor Cost		0.63%				$24,134	
As-Built Drawings Labor Cost		0.63%				$24,134	
Public Notice Labor Cost		0.09%				$3,448	
Site Closure Activities Labor Cost		2.00%				$76,617	
Permitting Labor Cost		6.25%				$239,428	
SUBTOTAL ($2004)						$1,335,053	
TOTAL CAPITAL COST IN 2004 DOLLARS						$5,165,907	

OPERATIONS AND MAINTENANCE COSTS:

Treatment Train Miscellaneous							
Per Diem (per person)	0.00	DAY	160.00	0.00	0.00	$0	No O&M associated
Mobilize Crew, 50 Miles, per Person	0.00	EA	94.81	0.00	0.00	$0	with this technology
Staff Engineer	0.00	HR	0.00	143.89	0.00	$0	
Field Technician	0.00	HR	0.00	97.98	0.00	$0	
SUBTOTAL						$0	
SUBTOTAL ($2003)						$0	
Runtime Percent Cost Adjustment	97%					$0	
Contingency	25%					$0	10% scope + 15% bid
SUBTOTAL ($2003)						$0	
SUBTOTAL ($2004)	1.0398					$0	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$0**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	3	1	EA		$47,929		$47,929	
SUBTOTAL ($2003)							$47,929	
Contingency		25%					$11,982	10% scope + 15% bid
SUBTOTAL ($2004)[c]		1.0398					$62,298	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[d]	Present Value	Notes
Capital Cost	0	$5,165,907	$5,165,907	1.0000	$5,165,907	
Annual O&M	1-2	$0	$0	1.8997	$0	
Periodic Cost	3	$62,298	$62,298	0.9019	$56,189	
		$5,228,205			$5,222,096	
TOTAL PRESENT VALUE OF HRC AT SITE 16 SCRAP YARD					**$5,222,096**	

Notes:

[a] Vendor quote from Dave Reilly at Regenesis, (949) 366-8001 x 125 on March 17, 2004

[b] Costs provided by RACER 2003

[c] RACER 2003 outputs are in 2003 dollars. The average ENR Construction Cost Index for 2003 was 6690.5, the ENR Construction Cost Index for March 2004 was 6957. The inflation rate from 2003 to where i = 0.016 for a 3 year technology and t = year (i.e., the present value of the dollar paid in year t at 1.6%)

[d] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 for a 30 year technology and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

[e] Vendor quote from Derrik M Sandberg at ResonantSonic International on March 17, 2004, (530) 668-2424

TABLE C-6: SITE 16 COST SUMMARY FOR GROUNDWATER REMEDIAL ALTERNATIVES

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

TOTAL REMEDIAL COST SUMMARY FOR SITE 16 GROUNDWATER

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description	Alternative 2	Alternative 3A	Alternative 3B	Alternative 4A	Alternative 4B
	Plume Delineation, MNA, LUCs	Plume Delineation, In Situ Chemical Oxidation to Commercial/ Industrial Reuse Criteria, MNA, LUCs	Plume Delineation, Hydrogen Release Compounds to Commercial/ Industrial Reuse Criteria, MNA, LUCs	Plume Delineation, In Situ Chemical Oxidation to Unrestricted Reuse Criteria, MNA, LUCs	Plume Delineation, Hydrogen Release Compounds to Unrestricted Reuse Criteria, MNA, LUCs
Total Project Duration (Years)	30	33	34	34	35
Capital Cost	$743,319	$1,279,804	$1,038,436	$11,187,098	$7,589,636
Annual O & M Cost	$986,913	$1,088,523	$1,105,953	$1,105,953	$1,122,793
Total Periodic Cost	$98,401	$162,827	$162,339	$271,261	$343,592
Total Present Value of Alternative	**$1,828,633**	**$2,531,154**	**$2,306,728**	**$12,564,312**	**$9,056,021**

TABLE C-6A: ALTERNATIVE 2 SITE 16, PLUME BOUNDARY DELINEATION, MNA, AND LUCS, TOTAL REMEDIAL COST
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, monitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
CAPITAL COSTS:							
Sampling to Further Delineate the VOC Plume							68 water samples (plus 7 QC)
Disposable Materials per Sample	75.00	EA	12.68	0.00	0.00	$951	34 soil samples (plus 3 QC)
Decontamination Materials per Sample	75.00	EA	11.32	0.00	0.00	$849	
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	7.00	DAY	260.00	0.00	0.00	$1,820	
Mobilize Direct Push Rig and Crew	7.00	DAY	866.68	0.00	0.00	$6,067	
Demobilize Direct Push Rig and Crew	7.00	DAY	866.68	0.00	0.00	$6,067	
Water Quality Parameter Testing Device	2.00	WK	359.56	0.00	0.00	$719	
Peristaltic Pump, Weekly Rental	2.00	WK	173.34	0.00	0.00	$347	
Volatile Organic Analysis (EPA 624), Water Analysis	75.00	EA	310.03	0.00	0.00	$23,252	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	37.00	EA	394.11	0.00	0.00	$14,582	
Car or Van Mileage Charge	700.00	MI	0.54	0.00	0.00	$378	
Project Scientist	243.00	HR	0.00	146.81	0.00	$35,675	
Field Technician	140.00	HR	0.00	97.98	0.00	$13,717	
Word Processing/Clerical	26.00	HR	0.00	81.20	0.00	$2,111	
Draftsman/CADD	26.00	HR	0.00	125.83	0.00	$3,272	
SUBTOTAL ($2004)						**$109,806**	
Install Deep (25 ft) Groundwater Monitoring Wells							12 wells to be installed
Organic Vapor Analyzer Rental, per Day	4.00	DAY	173.34	0.00	0.00	$309	
Decontaminate Rig, Augers, Screen (Rental Equipment)	4.00	DAY	170.60	0.00	0.00	$292	
Field Technician	64.00	HR	0.00	97.98	0.00	$3,135	
2" PVC, Schedule 40, Well Casing	180.00	LF	1.70	8.34	10.69	$1,653	
2" PVC, Schedule 40, Well Screen	120.00	LF	3.93	10.76	13.80	$1,515	
2" PVC, Well Plug	12.00	EA	8.29	12.51	16.04	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	312.00	LF	0.00	22.86	29.33	$7,198	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	16.00	EA	101.71	0.00	0.00	$814	
2" Screen, Filter Pack	144.00	LF	4.42	7.09	9.09	$1,317	
2" Well, Portland Cement Grout	144.00	LF	1.65	0.00	0.00	$107	
2" Well, Bentonite Seal	12.00	EA	13.14	28.14	36.09	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2501.28	3208.23	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	12.00	EA	57.58	259.94	9.04	$1,733	
SUBTOTAL ($2004)						**$23,729**	
Install Shallow (10 ft) Groundwater Monitoring Wells							12 wells to be installed
Organic Vapor Analyzer Rental, per Day	2.00	DAY	173.34	0.00	0.00	$154	
Decontaminate Rig, Augers, Screen (Rental Equipment)	2.00	DAY	170.60	0.00	0.00	$146	
Field Technician	32.00	HR	0.00	97.98	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	60.00	LF	1.70	8.34	10.69	$551	
2" PVC, Schedule 40, Well Screen	60.00	LF	3.93	10.76	13.80	$758	
2" PVC, Well Plug	12.00	EA	8.29	12.51	16.04	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	132.00	LF	0.00	22.86	29.33	$3,045	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	12.00	EA	101.71	0.00	0.00	$610	
2" Screen, Filter Pack	84.00	LF	4.42	7.09	9.09	$768	
2" Well, Portland Cement Grout	24.00	LF	1.65	0.00	0.00	$18	
2" Well, Bentonite Seal	12.00	EA	13.14	28.14	36.09	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2501.28	3208.23	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	12.00	EA	57.58	259.94	9.04	$1,733	
SUBTOTAL ($2004)						**$15,007**	

TABLE C-6A: ALTERNATIVE 2 SITE 16, PLUME BOUNDARY DELINEATION, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, monitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Groundwater Monitoring[a]							24 wells monitored
Disposable Materials per Sample	104.00	EA	12.90	0.00	0.00	$1,342	quarterly
Decontamination Materials per Sample	104.00	EA	11.51	0.00	0.00	$1,197	
Nylon Tubing, 1/4" Outside Diameter	1820.00	LF	0.67	0.00	0.00	$1,219	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	16.00	DAY	39.66	0.00	0.00	$635	
Flow Through Monitor, Weekly Rental	4.00	WK	343.74	0.00	0.00	$1,375	
Water Quality Parameter Testing Device	4.00	WK	365.66	0.00	0.00	$1,463	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	104.00	EA	50.84	0.00	0.00	$5,287	
RSK175 analysis for dissolved gases	104.00	EA	97.83	0.00	0.00	$10,174	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	104.00	EA	39.41	0.00	0.00	$4,099	
Volatile Organic Analysis (EPA 624), Water Analysis	104.00	EA	315.29	0.00	0.00	$32,790	
Chloride (EPA 300), Water Analysis	104.00	EA	29.67	0.00	0.00	$3,086	
Sulfate (EPA 300.0), Water Analysis	104.00	EA	29.67	0.00	0.00	$3,086	
Sulfide (EPA 376.1), Water Analysis	104.00	EA	43.42	0.00	0.00	$4,516	
Ferrous Iron (S.M. 3500 Fe - D)	104.00	EA	137.58	0.00	0.00	$14,308	
4" Submersible Pump Rental, Day	16.00	DAY	116.50	0.00	0.00	$1,864	
Well Development Equipment Rental (weekly)	4.00	WK	365.66	0.00	0.00	$1,463	
Furnish 55 Gallon Drum for Development/Purge Water	16.00	EA	121.17	0.00	0.00	$1,939	
Car or Van Mileage Charge	1600.00	MI	0.55	0.00	0.00	$880	
Project Scientist	307.00	HR	0.00	146.81	0.00	$45,071	
Field Technician	214.00	HR	0.00	97.98	0.00	$20,968	
Word Processing/Clerical	27.00	HR	0.00	81.20	0.00	$2,192	
Draftsman/CADD	27.00	HR	0.00	125.83	0.00	$3,397	
SUBTOTAL ($2004)						**$162,350**	
Land Use Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Resrtrictions in Deed						$31,470	
Register and File Deed						$133	
Navy Oversight		25%				$17,807	
SUBTOTAL ($2004)						**$89,035**	
Vapor Removal System[b]							
Design - Building 608 Vapor Removal System						$7,500	
Installation of Soil Depressurization System						$50,000	
SUBTOTAL ($2004)						**$57,500**	
SUBTOTAL ($2004)						$457,427	
Contingency		25%				$114,357	10% scope + 15% bid
SUBTOTAL ($2004)						**$571,784**	
Professional Labor							
Design and Work Plan		9.00%				$51,460.52	
Project Management Labor Cost		5.00%				$28,589.18	
Planning Documents Labor Cost		4.00%				$22,871.34	
Construction Oversight Labor Cost		3.25%				$18,582.97	
Reporting Labor Cost		0.75%				$ 4,288.38	
As-Built Drawings Labor Cost		0.75%				$ 4,288.38	
Public Notice Labor Cost		0.25%				$ 1,429.46	
Site Closure Activities Labor Cost		2.00%				$11,435.67	
Permitting Labor Cost		5.00%				$28,589.18	
SUBTOTAL ($2004)						**$171,535.07**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$743,319**	

TABLE C-6A: ALTERNATIVE 2 SITE 16, PLUME BOUNDARY DELINEATION, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, monitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
OPERATIONS AND MAINTENANCE COSTS:							
Groundwater Monitoring[a]							24 wells monitored
Disposable Materials per Sample	26.00	EA	12.90	0.00	0.00	$335	annually
Decontamination Materials per Sample	26.00	EA	11.51	0.00	0.00	$299	
Nylon Tubing, 1/4" Outside Diameter	440.00	LF	0.67	0.00	0.00	$295	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	4.00	DAY	39.66	0.00	0.00	$159	
Flow Through Monitor, Weekly Rental	1.00	WK	343.74	0.00	0.00	$344	
Water Quality Parameter Testing Device	1.00	WK	365.66	0.00	0.00	$366	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	26.00	EA	50.84	0.00	0.00	$1,322	
RSK175 analysis for dissolved gases	26.00	EA	97.83	0.00	0.00	$2,544	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	26.00	EA	39.41	0.00	0.00	$1,025	
Volatile Organic Analysis (EPA 624), Water Analysis	26.00	EA	315.29	0.00	0.00	$8,198	
Chloride (EPA 300), Water Analysis	26.00	EA	29.67	0.00	0.00	$771	
Sulfate (EPA 300.0), Water Analysis	26.00	EA	29.67	0.00	0.00	$771	
Sulfide (EPA 376.1), Water Analysis	26.00	EA	43.42	0.00	0.00	$1,129	
Ferrous Iron (S.M. 3500 Fe - D)	26.00	EA	137.58	0.00	0.00	$3,577	
4" Submersible Pump Rental, Day	4.00	DAY	116.50	0.00	0.00	$466	
Well Development Equipment Rental (weekly)	1.00	WK	365.66	0.00	0.00	$366	
Furnish 55 Gallon Drum for Development/Purge Water	16.00	EA	121.17	0.00	0.00	$1,939	
Car or Van Mileage Charge	400.00	MI	0.55	0.00	0.00	$220	
Project Scientist	73.00	HR	0.00	146.81	0.00	$10,717	
Field Technician	52.00	HR	0.00	97.98	0.00	$5,095	
Word Processing/Clerical	12.00	HR	0.00	81.20	0.00	$974	
Draftsman/CADD	12.00	HR	0.00	125.83	0.00	$1,510	
SUBTOTAL ($2004)						**$42,421**	
Vapor Removal System[b]							
Annual O&M						$10,000	
SUBTOTAL ($2004)						**$10,000**	
Land Use Controls							
Annual Drive-by Inspection						$2,478	
Contingency		25%				$620	
Navy Oversight		25%				$620	
SUBTOTAL ($2004)						**$1,239**	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$53,660**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Five Year Reviews	5-30	6	EA		$20,163		$120,978	One every five years
SUBTOTAL							**$120,978**	
Well Abandonment	30	24	EA		$ 837		$20,088	
Close-out Report	30	1	EA		$47,929		$47,929	
SUBTOTAL							**$68,017**	

TABLE C-6A: ALTERNATIVE 2 SITE 16, PLUME BOUNDARY DELINEATION, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, monitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[c,d]	Present Value	Notes
Capital Cost	0	$743,319	$743,319	1.0000	$743,319	
Annual O&M	1-30	$3,380,567	$53,660	18.3920	$986,913	
Periodic Cost	5-30	$120,978	$20,163	3.6784	$74,168	One every five years
Periodic Cost	30	$68,017	$68,017	0.3563	$24,233	
		$4,312,880			$1,828,633	

TOTAL PRESENT VALUE OF ALTERNATIVE $1,828,633

Notes:
[a] Costs provided by RACER 2004
[b] Vender quote from Colorado Vintage Companies Doug Kladder, (719) 632-1215, March 22, 2004.
[c] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 and t = year (i.e., the present value of the dollar paid in year t at 3.5%)
[d] Multi-year discount factor = $\frac{(1+i)n - 1}{i(1+i)^n}$ where i = 0.035 for a 30+ year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-6B: ALTERNATIVE 3A SITE 16, PLUME BOUNDARY DELINEATION, ISCO TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (ISCO) to commercial/industrial reuse criteria based on inhalation, moitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
CAPITAL COSTS:							
Sampling to Further Delineate the VOC Plume[a]							68 water samples (plus 7 QC)
Disposable Materials per Sample	75.00	EA	12.68	0.00	0.00	$951	34 soil samples (plus 3 QC)
Decontamination Materials per Sample	75.00	EA	11.32	0.00	0.00	$849	
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	7.00	DAY	260.00	0.00	0.00	$1,820	
Mobilize Direct Push Rig and Crew	7.00	DAY	866.68	0.00	0.00	$6,067	
Demobilize Direct Push Rig and Crew	7.00	DAY	866.68	0.00	0.00	$6,067	
Water Quality Parameter Testing Device	2.00	WK	359.56	0.00	0.00	$719	
Peristaltic Pump, Weekly Rental	2.00	WK	173.34	0.00	0.00	$347	
Volatile Organic Analysis (EPA 624), Water Analysis	75.00	EA	310.03	0.00	0.00	$23,252	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	37.00	EA	394.11	0.00	0.00	$14,582	
Car or Van Mileage Charge	700.00	MI	0.54	0.00	0.00	$378	
Project Scientist	243.00	HR	0.00	146.81	0.00	$35,675	
Field Technician	140.00	HR	0.00	97.98	0.00	$13,717	
Word Processing/Clerical	26.00	HR	0.00	81.20	0.00	$2,111	
Draftsman/CADD	26.00	HR	0.00	125.83	0.00	$3,272	
SUBTOTAL ($2004)						**$109,806**	
Pretreatment Costs[b]							
Work Plan						$15,000	
SUBTOTAL						**$15,000**	
Treatment Costs[b]							
Pilot Test							
Mobilization	1.00	LS	0.00	0.00	0.00	$5,000	
Materials Costs (reagent), Injector Fabrication/Installation and Injection	1.00	LS	0.00	0.00	0.00	$70,000	
Pilot Test Groundwater Monitoring[a]							3 wells sampled quarterly
RSK175 analysis for dissolved gases	14.00	EA	97.83	0.00	0.00	$1,370	
Disposable Materials per Sample	14.00	EA	10.76	0.00	0.00	$151	
Decontamination Materials per Sample	14.00	EA	9.68	0.00	0.00	$136	
Nylon Tubing, 1/4" Outside Diameter	325.00	LF	0.56	0.00	0.00	$182	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis,	14.00	EA	55.69	0.00	0.00	$780	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	14.00	EA	38.58	0.00	0.00	$540	
Volatile Organic Analysis (EPA 624), Water Analysis	14.00	EA	276.27	0.00	0.00	$3,868	
Chloride (EPA 300), Water Analysis	14.00	EA	28.41	0.00	0.00	$398	
Sulfate (EPA 300.0), Water Analysis	14.00	EA	28.94	0.00	0.00	$405	
Sulfide (EPA 376.1), Water Analysis	14.00	EA	49.10	0.00	0.00	$687	
Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	146.31	0.00	0.00	$2,048	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	4.00	DAY	103.31	0.00	0.00	$413	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Scientist	63.00	HR	0.00	146.81	0.00	$9,249	
Field Technician	71.00	HR	0.00	97.98	0.00	$6,957	
Word Processing/Clerical	7.00	HR	0.00	81.20	0.00	$568	
Draftsman/CADD	7.00	HR	0.00	125.83	0.00	$881	
Primary Treatment							
Mobilization	1.00	LS	0.00	0.00	0.00	$11,500	
Materials Costs (reagent), Injector Fabrication/Installation and Injection	1.00	LS	0.00	0.00	0.00	$130,000	
Follow up Treatment (50% Retreat, If Necessary)							
Mobilization	1.00	LS	0.00	0.00	0.00	$11,500	
Materials Costs (reagent), Injector Fabrication/Installation and Injection	1.00	LS	0.00	0.00	0.00	$65,000	
Contigency (percent of treatment cost)	15%					$48,746.68	Scope
SUBTOTAL ($2004) all treatment						**$373,725**	

TABLE C-6B: ALTERNATIVE 3A SITE 16, PLUME BOUNDARY DELINEATION, ISCO TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (ISCO) to commercial/industrial reuse criteria based on inhalation, moitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Install Deep (25 ft) Groundwater Monitoring Wells[a]							12 wells to be installed
Organic Vapor Analyzer Rental, per Day	4.00	DAY	173.34	0.00	0.00	$309	
Decontaminate Rig, Augers, Screen (Rental Equipment)	4.00	DAY	170.60	0.00	0.00	$292	
Field Technician	64.00	HR	0.00	97.98	0.00	$3,135	
2" PVC, Schedule 40, Well Casing	180.00	LF	1.70	8.34	10.69	$1,653	
2" PVC, Schedule 40, Well Screen	120.00	LF	3.93	10.76	13.80	$1,515	
2" PVC, Well Plug	12.00	EA	8.29	12.51	16.04	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	312.00	LF	0.00	22.86	29.33	$7,198	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	16.00	EA	101.71	0.00	0.00	$814	
2" Screen, Filter Pack	144.00	LF	4.42	7.09	9.09	$1,317	
2" Well, Portland Cement Grout	144.00	LF	1.65	0.00	0.00	$107	
2" Well, Bentonite Seal	12.00	EA	13.14	28.14	36.09	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2501.28	3208.23	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	12.00	EA	57.58	259.94	9.04	$1,733	
SUBTOTAL ($2004)						**$23,729**	
Install Shallow (10 ft) Groundwater Monitoring Wells[a]							12 wells to be installed
Organic Vapor Analyzer Rental, per Day	2.00	DAY	173.34	0.00	0.00	$154	
Decontaminate Rig, Augers, Screen (Rental Equipment)	2.00	DAY	170.60	0.00	0.00	$146	
Field Technician	32.00	HR	0.00	97.98	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	60.00	LF	1.70	8.34	10.69	$551	
2" PVC, Schedule 40, Well Screen	60.00	LF	3.93	10.76	13.80	$758	
2" PVC, Well Plug	12.00	EA	8.29	12.51	16.04	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	132.00	LF	0.00	22.86	29.33	$3,045	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	12.00	EA	101.71	0.00	0.00	$610	
2" Screen, Filter Pack	84.00	LF	4.42	7.09	9.09	$768	
2" Well, Portland Cement Grout	24.00	LF	1.65	0.00	0.00	$18	
2" Well, Bentonite Seal	12.00	EA	13.14	28.14	36.09	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2501.28	3208.23	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	12.00	EA	57.58	259.94	9.04	$1,733	
SUBTOTAL ($2004)						**$15,007**	
Groundwater Monitoring[a]							24 wells monitored quarterly
Disposable Materials per Sample	104.00	EA	12.90	0.00	0.00	$1,342	
Decontamination Materials per Sample	104.00	EA	11.51	0.00	0.00	$1,197	
Nylon Tubing, 1/4" Outside Diameter	1820.00	LF	0.67	0.00	0.00	$1,219	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	16.00	DAY	39.66	0.00	0.00	$635	
Flow Through Monitor, Weekly Rental	4.00	WK	343.74	0.00	0.00	$1,375	
Water Quality Parameter Testing Device	4.00	WK	365.66	0.00	0.00	$1,463	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	104.00	EA	50.84	0.00	0.00	$5,287	
RSK175 analysis for dissolved gases	104.00	EA	97.83	0.00	0.00	$10,174	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	104.00	EA	39.41	0.00	0.00	$4,099	
Volatile Organic Analysis (EPA 624), Water Analysis	104.00	EA	315.29	0.00	0.00	$32,790	
Chloride (EPA 300), Water Analysis	104.00	EA	29.67	0.00	0.00	$3,086	
Sulfate (EPA 300.0), Water Analysis	104.00	EA	29.67	0.00	0.00	$3,086	
Sulfide (EPA 376.1), Water Analysis	104.00	EA	43.42	0.00	0.00	$4,516	
Ferrous Iron (S.M. 3500 Fe - D)	104.00	EA	137.58	0.00	0.00	$14,308	
4" Submersible Pump Rental, Day	16.00	DAY	116.50	0.00	0.00	$1,864	
Well Development Equipment Rental (weekly)	4.00	WK	365.66	0.00	0.00	$1,463	
Furnish 55 Gallon Drum for Development/Purge Water	16.00	EA	121.17	0.00	0.00	$1,939	
Car or Van Mileage Charge	1600.00	MI	0.55	0.00	0.00	$880	
Project Scientist	307.00	HR	0.00	146.81	0.00	$45,071	
Field Technician	214.00	HR	0.00	97.98	0.00	$20,968	
Word Processing/Clerical	27.00	HR	0.00	81.20	0.00	$2,192	
Draftsman/CADD	27.00	HR	0.00	125.83	0.00	$3,397	
SUBTOTAL ($2004)						**$162,350**	

TABLE C-6B: ALTERNATIVE 3A SITE 16, PLUME BOUNDARY DELINEATION, ISCO TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (ISCO) to commercial/industrial reuse criteria based on inhalation, moitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Land Use Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Resrtrictions in Deed						$31,470	
Register and File Deed						$133	
Navy Oversight		25%				$17,807	
SUBTOTAL ($2004)						**$89,035**	
Vapor Removal System[c]							
Design - Building 608 Vapor Removal System						$7,500	
Installation of Soil Depressurization System						$50,000	
SUBTOTAL ($2004)						**$57,500**	
SUBTOTAL ($2004)						$846,151	
Contingency		25%				$211,538	10% scope + 15% bid
SUBTOTAL ($2004)						**$1,057,689**	
Professional Labor[a]							
(No design cost is needed; it is incorporated in the vendor quote)							
Project Management Labor Cost		5.00%				$52,884	
Planning Documents Labor Cost		4.00%				$42,308	
Construction Oversight Labor Cost		3.25%				$34,375	
Reporting Labor Cost		0.75%				$7,933	
As-Built Drawings Labor Cost		0.75%				$7,933	
Public Notice Labor Cost		0.25%				$2,644	
Site Closure Activities Labor Cost		2.00%				$21,154	
Permitting Labor Cost		5.00%				$52,884	
SUBTOTAL						**$222,115**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$1,279,804**	
OPERATIONS AND MAINTENANCE COSTS:							
Groundwater Monitoring[a]							24 wells monitored annually
Disposable Materials per Sample	26.00	EA	12.90	0.00	0.00	$335	
Decontamination Materials per Sample	26.00	EA	11.51	0.00	0.00	$299	
Nylon Tubing, 1/4" Outside Diameter	440.00	LF	0.67	0.00	0.00	$295	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	4.00	DAY	39.66	0.00	0.00	$159	
Flow Through Monitor, Weekly Rental	1.00	WK	343.74	0.00	0.00	$344	
Water Quality Parameter Testing Device	1.00	WK	365.66	0.00	0.00	$366	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	26.00	EA	50.84	0.00	0.00	$1,322	
RSK175 analysis for dissolved gases	26.00	EA	97.83	0.00	0.00	$2,544	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	26.00	EA	39.41	0.00	0.00	$1,025	
Volatile Organic Analysis (EPA 624), Water Analysis	26.00	EA	315.29	0.00	0.00	$8,198	
Chloride (EPA 300), Water Analysis	26.00	EA	29.67	0.00	0.00	$771	
Sulfate (EPA 300.0), Water Analysis	26.00	EA	29.67	0.00	0.00	$771	
Sulfide (EPA 376.1), Water Analysis	26.00	EA	43.42	0.00	0.00	$1,129	
Ferrous Iron (S.M. 3500 Fe - D)	26.00	EA	137.58	0.00	0.00	$3,577	
4" Submersible Pump Rental, Day	4.00	DAY	116.50	0.00	0.00	$466	
Well Development Equipment Rental (weekly)	1.00	WK	365.66	0.00	0.00	$366	
Furnish 55 Gallon Drum for Development/Purge Water	16.00	EA	121.17	0.00	0.00	$1,939	
Car or Van Mileage Charge	400.00	MI	0.55	0.00	0.00	$220	
Project Scientist	73.00	HR	0.00	146.81	0.00	$10,717	
Field Technician	52.00	HR	0.00	97.98	0.00	$5,095	
Word Processing/Clerical	12.00	HR	0.00	81.20	0.00	$974	
Draftsman/CADD	12.00	HR	0.00	125.83	0.00	$1,510	
SUBTOTAL ($2004)						**$42,421**	
Vapor Removal System[c]							
Annual O&M						$10,000	
SUBTOTAL ($2004)						**$10,000**	

TABLE C-6B: ALTERNATIVE 3A SITE 16, PLUME BOUNDARY DELINEATION, ISCO TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (ISCO) to commercial/industrial reuse criteria based on inhalation, moitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Land Use Controls							
Annual Drive-by Inspection						$2,478	
Contingency		25%				$620	
Navy Oversight		25%				$620	
SUBTOTAL ($2004)						**$3,717**	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$56,138**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	3	1	EA		47928.91		$47,929	
SUBTOTAL							**$47,929**	
Five Year Reviews	5-30	6	EA		20163.00		$120,978	One every five years
Navy Oversight		25%					$30,245	
SUBTOTAL							**$151,223**	
Well Abandonment	33	24	EA		837.00		$20,088	
Close-out Report	33	1	EA		47928.91		$47,929	
SUBTOTAL							**$68,017**	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[d,e]	Present Value	Notes
Capital Cost	0	$1,279,804	$1,279,804	1.0000	$1,279,804	
Annual O&M	1-32	$1,796,409	$56,138	19.3902	$1,088,523	
Periodic Cost	3	$47,929	$47,929	0.9019	$43,229	
Periodic Cost	5-30	$151,223	$25,204	3.8780	$97,741	One every five years
Periodic Cost	33	$68,017	$68,017	0.3213	$21,857	
		$3,343,382			$2,531,154	
TOTAL PRESENT VALUE OF ALTERNATIVE						**$2,531,154**

Notes:
[a] Cost generated in RACER 2004
[b] Vendor quote from ISOTEC, Chris Nelson, (303) 843-9079, March 11, 2004. Second vendor quote requested from GeoCleanse. Costs will be averaged.
[c] Vender quote from Colorado Vintage Companies Doug Kladder, (719) 632-1215, March 22, 2004.
[d] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 for a 30 year technology and t = year (i.e., the present value of the dollar paid in year t at 3.5%)
[e] Multi-year discount factor = $\frac{(1+i)n - 1}{i(1+i)^n}$ where i = 0.035 for a 30+ year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-6C: ALTERNATIVE 3B SITE 16, PLUME BOUNDARY DELINEATION, HRC TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (HRC) to commercial/industrial reuse criteria based on inhalation, monitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
CAPITAL COSTS:							
Sampling to Further Delineate the VOC Plume[a]							68 water samples (plus 7 QC)
Disposable Materials per Sample	75.00	EA	12.68	0.00	0.00	$951	34 soil samples (plus 3 QC)
Decontamination Materials per Sample	75.00	EA	11.32	0.00	0.00	$849	
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	7.00	DAY	260.00	0.00	0.00	$1,820	
Mobilize Direct Push Rig and Crew	7.00	DAY	866.68	0.00	0.00	$6,067	
Demobilize Direct Push Rig and Crew	7.00	DAY	866.68	0.00	0.00	$6,067	
Water Quality Parameter Testing Device	2.00	WK	359.56	0.00	0.00	$719	
Peristaltic Pump, Weekly Rental	2.00	WK	173.34	0.00	0.00	$347	
Volatile Organic Analysis (EPA 624), Water Analysis	75.00	EA	310.03	0.00	0.00	$23,252	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	37.00	EA	394.11	0.00	0.00	$14,582	
Car or Van Mileage Charge	700.00	MI	0.54	0.00	0.00	$378	
Project Scientist	243.00	HR	0.00	146.81	0.00	$35,675	
Field Technician	140.00	HR	0.00	97.98	0.00	$13,717	
Word Processing/Clerical	26.00	HR	0.00	81.20	0.00	$2,111	
Draftsman/CADD	26.00	HR	0.00	125.83	0.00	$3,272	
SUBTOTAL ($2004)						**$109,806**	
HRC Injection and Materials[b]							
Pilot Test							
Work Plan	1.00	LS	0.00	0.00	0.00	$10,000	
HRC material	752.00	LB	5.00	0.00	0.00	$3,760	
Shipping	752.00	LB	0.20	0.00	0.00	$150	
Mobilization[c]	1.00	LS	0.00	0.00	0.00	$325	
Drill Rig[c]	1.00	DAY	0.00	0.00	1650.00	$1,650	
Local Travel[c]	1.00	DAY	0.00	150.00	0.00	$150	
Additional Crew Member for Injection[c]	1.00	DAY	0.00	450.00	0.00	$450	
Injection Pump[c]	1.00	DAY	0.00	0.00	300.00	$300	
Borehole Abandonment[c]	40.00	LF	0.00	0.00	1.00	$40	Upper 5 feet will be abandoned
Steam Cleaner[c]	1.00	DAY	0.00	0.00	95.00	$95	
Staff Scientist[a]	78.00	HR	0.00	140.14	0.00	$10,931	
Install Monitoring Wells[a]	1.00	LS	0.00	0.00	0.00	$7,500	
Pilot Test Groundwater Monitoring a							3 wells sampled quarterly
RSK175 analysis for dissolved gases	14.00	EA	97.83	0.00	0.00	$1,370	
Disposable Materials per Sample	14.00	EA	10.76	0.00	0.00	$151	
Decontamination Materials per Sample	14.00	EA	9.68	0.00	0.00	$136	
Nylon Tubing, 1/4" Outside Diameter	325.00	LF	0.56	0.00	0.00	$182	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	14.00	EA	55.69	0.00	0.00	$780	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	14.00	EA	38.58	0.00	0.00	$540	
Volatile Organic Analysis (EPA 624), Water Analysis	14.00	EA	276.27	0.00	0.00	$3,868	
Chloride (EPA 300), Water Analysis	14.00	EA	28.41	0.00	0.00	$398	
Sulfate (EPA 300.0), Water Analysis	14.00	EA	28.94	0.00	0.00	$405	
Sulfide (EPA 376.1), Water Analysis	14.00	EA	49.10	0.00	0.00	$687	
Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	146.31	0.00	0.00	$2,048	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	4.00	DAY	103.31	0.00	0.00	$413	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Scientist	63.00	HR	0.00	146.81	0.00	$9,249	
Field Technician	71.00	HR	0.00	97.98	0.00	$6,957	
Word Processing/Clerical	7.00	HR	0.00	81.20	0.00	$568	
Draftsman/CADD	7.00	HR	0.00	125.83	0.00	$881	

TABLE C-6C: ALTERNATIVE 3B SITE 16, PLUME BOUNDARY DELINEATION, HRC TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (HRC) to commercial/industrial reuse criteria based on inhalation, monitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Primary Treatment							
HRC material	10575.00	LB	8.00	0.00	0.00	$84,600	
shipping	1.00	LS	0.00	0.00	0.00	$795	
Mobilization[c]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	2.00	DAY	0.00	0.00	1650.00	$3,300	Drilling 200 feet per day
Local Travel[c]	2.00	DAY	0.00	150.00	0.00	$300	
Additional Crew Member for Injection[c]	2.00	DAY	0.00	450.00	0.00	$900	
Injection Pump[c]	2.00	DAY	0.00	0.00	300.00	$600	
Borehole Abandonment[c]	350.00	LF	0.00	0.00	1.00	$350	Only upper 5 feet will be abandoned
Steam Cleanerc	2.00	DAY	0.00	0.00	95.00	$190	
Hand Auger[c]	2.00	DAY	0.00	0.00	750.00	$1,500	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	2.00	DAY	0.00	150.00	0.00	$300	
Concrete Coring[c]	2.00	DAY	0.00	0.00	1100.00	$2,200	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	2.00	DAY	0.00	150.00	0.00	$300	
Car or Van Mileage Charge[a]	200.00	MI	0.48	0.00	0.00	$96	
Follow up Treatment (50% Retreat, If Necessary)							
HRC material	5287.50	LB	5.50	0.00	0.00	$29,081	
Shipping	1.00	LS	0.00	0.00	0.00	$795	
Mobilization[c]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	1.00	DAY	0.00	0.00	1250.00	$1,250	Drilling 200 feet per day
Local Travel[c]	1.00	DAY	0.00	150.00	0.00	$150	
Additional Crew Member for Injection[c]	1.00	DAY	0.00	450.00	0.00	$450	
Injection Pump[c]	1.00	DAY	0.00	0.00	300.00	$300	
Borehole Abandonment[c]	175.00	LF	0.00	0.00	1.00	$175	Only upper 5 feet will be abandoned
Steam Cleanerc	1.00	DAY	0.00	0.00	95.00	$95	
Hand Auger[c]	1.00	DAY	0.00	0.00	750.00	$750	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	1.00	DAY	0.00	150.00	0.00	$150	
Concrete Coring[c]	1.00	DAY	0.00	0.00	1100.00	$1,100	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	1.00	DAY	0.00	150.00	0.00	$150	
Car or Van Mileage Charge[a]	100.00	MI	0.48	0.00	0.00	$48	
Contigency (percent of treatment cost)	15%					$29,888.16	Scope
SUBTOTAL ($2004) all HRC Material and Injections						**$229,143**	
Install Deep (25 ft) Groundwater Monitoring Wells[a]							12 wells to be installed
Organic Vapor Analyzer Rental, per Day	4.00	DAY	173.34	0.00	0.00	$309	
Decontaminate Rig, Augers, Screen (Rental Equipment)	4.00	DAY	170.60	0.00	0.00	$292	
Field Technician	64.00	HR	0.00	97.98	0.00	$3,135	
2" PVC, Schedule 40, Well Casing	180.00	LF	1.70	8.34	10.69	$1,653	
2" PVC, Schedule 40, Well Screen	120.00	LF	3.93	10.76	13.80	$1,515	
2" PVC, Well Plug	12.00	EA	8.29	12.51	16.04	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	312.00	LF	0.00	22.86	29.33	$7,198	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	16.00	EA	101.71	0.00	0.00	$814	
2" Screen, Filter Pack	144.00	LF	4.42	7.09	9.09	$1,317	
2" Well, Portland Cement Grout	144.00	LF	1.65	0.00	0.00	$107	
2" Well, Bentonite Seal	12.00	EA	13.14	28.14	36.09	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2501.28	3208.23	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	12.00	EA	57.58	259.94	9.04	$1,733	
SUBTOTAL ($2004)						**$23,729**	
Install Shallow (10 ft) Groundwater Monitoring Wells[a]							12 wells to be installed
Organic Vapor Analyzer Rental, per Day	2.00	DAY	173.34	0.00	0.00	$154	
Decontaminate Rig, Augers, Screen (Rental Equipment)	2.00	DAY	170.60	0.00	0.00	$146	
Field Technician	32.00	HR	0.00	97.98	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	60.00	LF	1.70	8.34	10.69	$551	
2" PVC, Schedule 40, Well Screen	60.00	LF	3.93	10.76	13.80	$758	
2" PVC, Well Plug	12.00	EA	8.29	12.51	16.04	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	132.00	LF	0.00	22.86	29.33	$3,045	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	12.00	EA	101.71	0.00	0.00	$610	
2" Screen, Filter Pack	84.00	LF	4.42	7.09	9.09	$768	
2" Well, Portland Cement Grout	24.00	LF	1.65	0.00	0.00	$18	
2" Well, Bentonite Seal	12.00	EA	13.14	28.14	36.09	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2501.28	3208.23	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	12.00	EA	57.58	259.94	9.04	$1,733	
SUBTOTAL ($2004)						**$15,007**	

TABLE C-6C: ALTERNATIVE 3B SITE 16, PLUME BOUNDARY DELINEATION, HRC TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (HRC) to commercial/industrial reuse criteria based on inhalation, monitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Groundwater Monitoring[a]							24 wells monitored
Disposable Materials per Sample	104.00	EA	12.90	0.00	0.00	$1,342	quarterly
Decontamination Materials per Sample	104.00	EA	11.51	0.00	0.00	$1,197	
Nylon Tubing, 1/4" Outside Diameter	1820.00	LF	0.67	0.00	0.00	$1,219	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	16.00	DAY	39.66	0.00	0.00	$635	
Flow Through Monitor, Weekly Rental	4.00	WK	343.74	0.00	0.00	$1,375	
Water Quality Parameter Testing Device	4.00	WK	365.66	0.00	0.00	$1,463	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	104.00	EA	50.84	0.00	0.00	$5,287	
RSK175 analysis for dissolved gases	104.00	EA	97.83	0.00	0.00	$10,174	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	104.00	EA	39.41	0.00	0.00	$4,099	
Volatile Organic Analysis (EPA 624), Water Analysis	104.00	EA	315.29	0.00	0.00	$32,790	
Chloride (EPA 300), Water Analysis	104.00	EA	29.67	0.00	0.00	$3,086	
Sulfate (EPA 300.0), Water Analysis	104.00	EA	29.67	0.00	0.00	$3,086	
Sulfide (EPA 376.1), Water Analysis	104.00	EA	43.42	0.00	0.00	$4,516	
Ferrous Iron (S.M. 3500 Fe - D)	104.00	EA	137.58	0.00	0.00	$14,308	
4" Submersible Pump Rental, Day	16.00	DAY	116.50	0.00	0.00	$1,864	
Well Development Equipment Rental (weekly)	4.00	WK	365.66	0.00	0.00	$1,463	
Furnish 55 Gallon Drum for Development/Purge Water	16.00	EA	121.17	0.00	0.00	$1,939	
Car or Van Mileage Charge	1600.00	MI	0.55	0.00	0.00	$880	
Project Scientist	307.00	HR	0.00	146.81	0.00	$45,071	
Field Technician	214.00	HR	0.00	97.98	0.00	$20,968	
Word Processing/Clerical	27.00	HR	0.00	81.20	0.00	$2,192	
Draftsman/CADD	27.00	HR	0.00	125.83	0.00	$3,397	
SUBTOTAL ($2004)						**$162,350**	
Land Use Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Resrtrictions in Deed						$31,470	
Register and File Deed						$133	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$89,035**	
Vapor Removal System[d]							
Design - Building 608 Vapor Removal System						$7,500	
Installation of Soil Depressurization System						$50,000	
SUBTOTAL ($2004)						**$57,500**	
SUBTOTAL ($2004)						$686,569	
Contingency	25%					$171,642	10% scope + 15% bid
SUBTOTAL ($2004)						**$858,212**	
Professional Labor							
Design and Work Plan	9.00%					$77,239	
Project Management Labor Cost	5.00%					$42,911	
Planning Documents Labor Cost	4.00%					$34,328	
Construction Oversight Labor Cost	3.25%					$27,892	
Reporting Labor Cost	0.75%					$6,437	
As-Built Drawings Labor Cost	0.75%					$6,437	
Public Notice Labor Cost	0.25%					$2,146	
Site Closure Activities Labor Cost	2.00%					$17,164	
Permitting Labor Cost	5.00%					$42,911	
SUBTOTAL						**$180,224**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$1,038,436**	

OPERATIONS AND MAINTENANCE COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Groundwater Monitoring[a]							24 wells monitored
Disposable Materials per Sample	26.00	EA	12.90	0.00	0.00	$335	annually
Decontamination Materials per Sample	26.00	EA	11.51	0.00	0.00	$299	
Nylon Tubing, 1/4" Outside Diameter	440.00	LF	0.67	0.00	0.00	$295	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	4.00	DAY	39.66	0.00	0.00	$159	

TABLE C-6C: ALTERNATIVE 3B SITE 16, PLUME BOUNDARY DELINEATION, HRC TREATMENT, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate the VOC plumes, active groundwater treatment (HRC) to commercial/industrial reuse criteria based on inhalation, monitoring, LUCs to restrict residential reuse of the property and/or require vapor barrier/removal technology and restrict domestic use of groundwater for 30 years.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Flow Through Monitor, Weekly Rental	1.00	WK	343.74	0.00	0.00	$344	
Water Quality Parameter Testing Device	1.00	WK	365.66	0.00	0.00	$366	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	26.00	EA	50.84	0.00	0.00	$1,322	
RSK175 analysis for dissolved gases	26.00	EA	97.83	0.00	0.00	$2,544	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	26.00	EA	39.41	0.00	0.00	$1,025	
Volatile Organic Analysis (EPA 624), Water Analysis	26.00	EA	315.29	0.00	0.00	$8,198	
Chloride (EPA 300), Water Analysis	26.00	EA	29.67	0.00	0.00	$771	
Sulfate (EPA 300.0), Water Analysis	26.00	EA	29.67	0.00	0.00	$771	
Sulfide (EPA 376.1), Water Analysis	26.00	EA	43.42	0.00	0.00	$1,129	
Ferrous Iron (S.M. 3500 Fe - D)	26.00	EA	137.58	0.00	0.00	$3,577	
4" Submersible Pump Rental, Day	4.00	DAY	116.50	0.00	0.00	$466	
Well Development Equipment Rental (weekly)	1.00	WK	365.66	0.00	0.00	$366	
Furnish 55 Gallon Drum for Development/Purge Water	16.00	EA	121.17	0.00	0.00	$1,939	
Car or Van Mileage Charge	400.00	MI	0.55	0.00	0.00	$220	
Project Scientist	73.00	HR	0.00	146.81	0.00	$10,717	
Field Technician	52.00	HR	0.00	97.98	0.00	$5,095	
Word Processing/Clerical	12.00	HR	0.00	81.20	0.00	$974	
Draftsman/CADD	12.00	HR	0.00	125.83	0.00	$1,510	
SUBTOTAL ($2004)						**$42,421**	
Vapor Removal System[d]							
Annual O&M						$10,000	
SUBTOTAL ($2004)						**$10,000**	
Land Use Controls							
Annual Drive-by Inspection						$2,478	
Contingency	25%					$620	
Navy Oversight	25%					$620	
SUBTOTAL ($2004)						**$3,717**	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						**$56,138**	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	4	1	EA		47928.91		$47,929	
SUBTOTAL							**$47,929**	
Five Year Reviews	5-30	6	EA		20193.00		$121,158	One every five years
Navy Oversight		25%					$30,290	
SUBTOTAL							**$151,448**	
Well Abandonment	34	24	EA		837.00		$20,088	
Close-out Report	34	1	EA		47928.91		$47,929	
SUBTOTAL							**$68,017**	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[e,f]	Present Value	Notes
Capital Cost	0	$1,038,436	$1,038,436	1.0000	$1,038,436	
Annual O&M	1-33	$1,852,547	$56,138	19.7007	$1,105,953	
Periodic Cost	4	$47,929	$47,929	0.8714	$41,767	
Periodic Cost	5-30	$151,448	$25,241	3.9401	$99,454	One every five years
Periodic Cost	34	$68,017	$68,017	0.3105	$21,118	
		$2,890,983			$2,306,728	
TOTAL PRESENT VALUE OF ALTERNATIVE						**$2,306,728**

Notes:
[a] Costs provided by RACER 2004
[b] Vendor quote from Dave Reilly at Regenesis, (949) 366-8001 x 125 on March 17, 2004
[c] Vendor quote from Derrik M Sandberg at ResonantSonic International on March 17, 2004, (530) 668-2424
[d] Vender quote from Colorado Vintage Companies Doug Kladder, (719) 632-1215, March 22, 2004.
[e] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 and t = year (i.e., the present value of the dollar paid in year t at 3.5%)
[f] Multi-year discount factor = $\frac{(1+i)n - 1}{i(1+i)^n}$ where i = 0.035 for a 30+ year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-6D: ALTERNATIVE 4A SITE 16, PLUME BOUNDARY DELINEATION, ISCO TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (in situ chemical oxidation) to residential reuse, monitoring, and LUCs including vapor barriers until residential criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
CAPITAL COSTS:							
Sampling to Further Delineate the VOC Plume[a]							68 water samples (plus 7 QC)
Disposable Materials per Sample	75.00	EA	12.68	0.00	0.00	$951	34 soil samples (plus 3 QC)
Decontamination Materials per Sample	75.00	EA	11.32	0.00	0.00	$849	
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	7.00	DAY	260.00	0.00	0.00	$1,820	
Mobilize Direct Push Rig and Crew	7.00	DAY	866.68	0.00	0.00	$6,067	
Demobilize Direct Push Rig and Crew	7.00	DAY	866.68	0.00	0.00	$6,067	
Water Quality Parameter Testing Device	2.00	WK	359.56	0.00	0.00	$719	
Peristaltic Pump, Weekly Rental	2.00	WK	173.34	0.00	0.00	$347	
Volatile Organic Analysis (EPA 624), Water Analysis	75.00	EA	310.03	0.00	0.00	$23,252	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	37.00	EA	394.11	0.00	0.00	$14,582	
Car or Van Mileage Charge	700.00	MI	0.54	0.00	0.00	$378	
Project Scientist	243.00	HR	0.00	146.81	0.00	$35,675	
Field Technician	140.00	HR	0.00	97.98	0.00	$13,717	
Word Processing/Clerical	26.00	HR	0.00	81.20	0.00	$2,111	
Draftsman/CADD	26.00	HR	0.00	125.83	0.00	$3,272	
SUBTOTAL ($2004)						**$109,806**	
Pretreatment Costs[b]							
Work Plan						$15,000	
SUBTOTAL						**$15,000**	
ISCO Treatment Costs(Scrayard Area)[b]							
Pilot Test							
Mobilization	1.00					$5,000	
Materials Costs (reagent), Injector	1.00					$70,000	
Fabrication/Installation and Injection	1.00						
Pilot Test Groundwater Monitoring [a]							3 wells sampled quarterly
RSK175 analysis for dissolved gases	14.00	EA	97.83	0.00	0.00	$1,370	
Disposable Materials per Sample	14.00	EA	10.76	0.00	0.00	$151	
Decontamination Materials per Sample	14.00	EA	9.68	0.00	0.00	$136	
Nylon Tubing, 1/4" Outside Diameter	325.00	LF	0.56	0.00	0.00	$182	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	14.00	EA	55.69	0.00	0.00	$780	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	14.00	EA	38.58	0.00	0.00	$540	
Volatile Organic Analysis (EPA 624), Water Analysis	14.00	EA	276.27	0.00	0.00	$3,868	
Chloride (EPA 300), Water Analysis	14.00	EA	28.41	0.00	0.00	$398	
Sulfate (EPA 300.0), Water Analysis	14.00	EA	28.94	0.00	0.00	$405	
Sulfide (EPA 376.1), Water Analysis	14.00	EA	49.10	0.00	0.00	$687	
Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	146.31	0.00	0.00	$2,048	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	4.00	DAY	103.31	0.00	0.00	$413	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Scientist	63.00	HR	0.00	146.81	0.00	$9,249	
Field Technician	71.00	HR	0.00	97.98	0.00	$6,957	
Word Processing/Clerical	7.00	HR	0.00	81.20	0.00	$568	
Draftsman/CADD	7.00	HR	0.00	125.83	0.00	$881	
Primary Treatment							
Mobilization						$11,500	
Materials Costs (reagent), Injector						$1,903,500	
Fabrication/Installation and Injection							
Follow up Treatment (1) (100% Retreat, If Necessary)							
Mobilization						$11,500	
Materials Costs (reagent), Injector						$1,903,500	
Fabrication/Installation and Injection							
Follow up Treatment (2) (50% Retreat, If Necessary)							
Mobilization						$11,500	
Materials Costs (reagent), Injector						$951,750	
Fabrication/Installation and Injection							
Contigency (percent of treatment cost)	15%					$735,034	Scope
SUBTOTAL ($2004) all Treatment costs						**$5,635,262**	

TABLE C-6D: ALTERNATIVE 4A SITE 16, PLUME BOUNDARY DELINEATION, ISCO TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (in situ chemical oxidation) to residential reuse, monitoring, and LUCs including vapor barriers until residential criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
ISCO Treatment Costs (UST Area)[b]							
Pilot Test							
Mobilization						$5,000	
Materials Costs (reagent), Injector Fabrication/Installation and Injection						$70,000	
Pilot Test Groundwater Monitoring [b]							3 wells sampled quarterly
RSK175 analysis for dissolved gases	14.00	EA	97.83	0.00	0.00	$1,370	
Disposable Materials per Sample	14.00	EA	10.76	0.00	0.00	$151	
Decontamination Materials per Sample	14.00	EA	9.68	0.00	0.00	$136	
Nylon Tubing, 1/4" Outside Diameter	325.00	LF	0.56	0.00	0.00	$182	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	14.00	WK	88.82	0.00	0.00	$1,243	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	14.00	EA	55.69	0.00	0.00	$780	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	14.00	EA	38.58	0.00	0.00	$540	
Volatile Organic Analysis (EPA 624), Water Analysis	14.00	EA	276.27	0.00	0.00	$3,868	
Chloride (EPA 300), Water Analysis	14.00	EA	28.41	0.00	0.00	$398	
Sulfate (EPA 300.0), Water Analysis	14.00	EA	28.94	0.00	0.00	$405	
Sulfide (EPA 376.1), Water Analysis	14.00	EA	49.10	0.00	0.00	$687	
Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	146.31	0.00	0.00	$2,048	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	4.00	DAY	103.31	0.00	0.00	$413	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Scientist	63.00	HR	0.00	146.81	0.00	$9,249	
Field Technician	71.00	HR	0.00	97.98	0.00	$6,957	
Word Processing/Clerical	7.00	HR	0.00	81.20	0.00	$568	
Draftsman/CADD	7.00	HR	0.00	125.83	0.00	$881	
Primary Treatment							
Mobilization						$11,500	
Materials Costs (reagent), Injector Fabrication/Installation and Injection						$602,000	
Follow up Treatment (100% Retreat, If Necessary)							
Mobilization						$11,500	
Materials Costs (reagent), Injector Fabrication/Installation and Injection						$602,000	
Follow up Treatment (2) (50% Retreat, If Necessary)							
Mobilization						$11,500	
Materials Costs (reagent), Injector Fabrication/Installation and Injection						$301,000	
Contigency (percent of treatment cost)	15%					$247,104.91	Scope
SUBTOTAL ($2004) all Treatment costs						**$1,894,471**	
Install Deep (25 ft) Groundwater Monitoring Wells[a]							12 wells to be installed
Organic Vapor Analyzer Rental, per Day	4.00	DAY	173.34	0.00	0.00	$309	
Decontaminate Rig, Augers, Screen (Rental Equipment)	4.00	DAY	170.60	0.00	0.00	$292	
Field Technician	64.00	HR	0.00	125.60	0.00	$3,135	
2" PVC, Schedule 40, Well Casing	180.00	LF	1.70	8.34	10.69	$1,653	
2" PVC, Schedule 40, Well Screen	120.00	LF	3.93	10.76	13.80	$1,515	
2" PVC, Well Plug	12.00	EA	8.29	12.51	16.04	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	312.00	LF	0.00	22.86	29.33	$7,198	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	16.00	EA	101.71	0.00	0.00	$814	
2" Screen, Filter Pack	144.00	LF	4.42	7.09	9.09	$1,317	
2" Well, Portland Cement Grout	144.00	LF	1.65	0.00	0.00	$107	
2" Well, Bentonite Seal	12.00	EA	13.14	28.14	36.09	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2501.28	3208.23	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	12.00	EA	57.58	259.94	9.04	$1,733	
SUBTOTAL ($2004)						**$23,729**	

TABLE C-6D: ALTERNATIVE 4A SITE 16, PLUME BOUNDARY DELINEATION, ISCO TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (in situ chemical oxidation) to residential reuse, monitoring, and LUCs including vapor barriers until residential criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Install Shallow (10 ft) Groundwater Monitoring Wells[a]							12 wells to be installed
Organic Vapor Analyzer Rental, per Day	2.00	DAY	173.34	0.00	0.00	$154	
Decontaminate Rig, Augers, Screen (Rental Equipment)	2.00	DAY	170.60	0.00	0.00	$146	
Field Technician	32.00	HR	0.00	125.60	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	60.00	LF	1.70	8.34	10.69	$551	
2" PVC, Schedule 40, Well Screen	60.00	LF	3.93	10.76	13.80	$758	
2" PVC, Well Plug	12.00	EA	8.29	12.51	16.04	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	132.00	LF	0.00	22.86	29.33	$3,045	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	12.00	EA	101.71	0.00	0.00	$610	
2" Screen, Filter Pack	84.00	LF	4.42	7.09	9.09	$768	
2" Well, Portland Cement Grout	24.00	LF	1.65	0.00	0.00	$18	
2" Well, Bentonite Seal	12.00	EA	13.14	28.14	36.09	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2501.28	3208.23	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	12.00	EA	57.58	259.94	9.04	$1,733	
SUBTOTAL ($2004)						**$15,007**	
Groundwater Monitoring[a]							24 wells monitored quarterly
Disposable Materials per Sample	104.00	EA	12.90	0.00	0.00	$1,342	
Decontamination Materials per Sample	104.00	EA	11.51	0.00	0.00	$1,197	
Nylon Tubing, 1/4" Outside Diameter	1820.00	LF	0.67	0.00	0.00	$1,219	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	16.00	DAY	39.66	0.00	0.00	$635	
Flow Through Monitor, Weekly Rental	4.00	WK	343.74	0.00	0.00	$1,375	
Water Quality Parameter Testing Device	4.00	WK	365.66	0.00	0.00	$1,463	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	104.00	EA	50.84	0.00	0.00	$5,287	
RSK175 analysis for dissolved gases	104.00	EA	97.83	0.00	0.00	$10,174	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	104.00	EA	39.41	0.00	0.00	$4,099	
Volatile Organic Analysis (EPA 624), Water Analysis	104.00	EA	315.29	0.00	0.00	$32,790	
Chloride (EPA 300), Water Analysis	104.00	EA	29.67	0.00	0.00	$3,086	
Sulfate (EPA 300.0), Water Analysis	104.00	EA	29.67	0.00	0.00	$3,086	
Sulfide (EPA 376.1), Water Analysis	104.00	EA	43.42	0.00	0.00	$4,516	
Ferrous Iron (S.M. 3500 Fe - D)	104.00	EA	137.58	0.00	0.00	$14,308	
4" Submersible Pump Rental, Day	16.00	DAY	116.50	0.00	0.00	$1,864	
Well Development Equipment Rental (weekly)	4.00	WK	365.66	0.00	0.00	$1,463	
Furnish 55 Gallon Drum for Development/Purge Water	16.00	EA	121.17	0.00	0.00	$1,939	
Car or Van Mileage Charge	1600.00	MI	0.55	0.00	0.00	$880	
Project Scientist	307.00	HR	0.00	193.93	0.00	$59,537	
Field Technician	214.00	HR	0.00	127.93	0.00	$27,377	
Word Processing/Clerical	27.00	HR	0.00	100.85	0.00	$2,723	
Draftsman/CADD	27.00	HR	0.00	132.24	0.00	$3,570	
SUBTOTAL ($2004)						**$183,928**	
Land Use Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Resrtrictions in Deed						$31,470	
Register and File Deed						$133	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$89,035**	
Vapor Removal System[d]							
Design - Building 608 Vapor Removal System						$7,500	
Installation of Soil Depressurization System						$50,000	
SUBTOTAL ($2004)						**$57,500**	
SUBTOTAL ($2004)						$8,023,739	
Contingency	25%					$2,005,935	10% scope + 15% bid
SUBTOTAL ($2004)						**$10,029,673**	
Professional Labor[e]							
(No design cost is needed; it is incorporated in the vendor quote)							
Project Management Labor Cost	2.00%					$200,593	
Planning Documents Labor Cost	2.00%					$200,593	
Construction Oversight Labor Cost	2.50%					$250,742	
Reporting Labor Cost	0.25%					$25,074	
As-Built Drawings Labor Cost	0.25%					$25,074	
Public Notice Labor Cost	0.04%					$4,012	
Site Closure Activities Labor Cost	2.00%					$200,593	
Permitting Labor Cost	2.50%					$250,742	
SUBTOTAL						**$1,157,424**	
TOTAL CAPITAL COST IN 2004 DOLLARS						**$11,187,098**	

TABLE C-6D: ALTERNATIVE 4A SITE 16, PLUME BOUNDARY DELINEATION, ISCO TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (in situ chemical oxidation) to residential reuse, monitoring, and LUCs including vapor barriers until residential criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
OPERATIONS AND MAINTENANCE COSTS:							
Groundwater Monitoring[a]							24 wells monitored
Disposable Materials per Sample	26.00	EA	12.90	0.00	0.00	$335	annually
Decontamination Materials per Sample	26.00	EA	11.51	0.00	0.00	$299	
Nylon Tubing, 1/4" Outside Diameter	440.00	LF	0.67	0.00	0.00	$295	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	4.00	DAY	39.66	0.00	0.00	$159	
Flow Through Monitor, Weekly Rental	1.00	WK	343.74	0.00	0.00	$344	
Water Quality Parameter Testing Device	1.00	WK	365.66	0.00	0.00	$366	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	26.00	EA	50.84	0.00	0.00	$1,322	
RSK175 analysis for dissolved gases	26.00	EA	97.83	0.00	0.00	$2,544	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	26.00	EA	39.41	0.00	0.00	$1,025	
Volatile Organic Analysis (EPA 624), Water Analysis	26.00	EA	315.29	0.00	0.00	$8,198	
Chloride (EPA 300), Water Analysis	26.00	EA	29.67	0.00	0.00	$771	
Sulfate (EPA 300.0), Water Analysis	26.00	EA	29.67	0.00	0.00	$771	
Sulfide (EPA 376.1), Water Analysis	26.00	EA	43.42	0.00	0.00	$1,129	
Ferrous Iron (S.M. 3500 Fe - D)	26.00	EA	137.58	0.00	0.00	$3,577	
4" Submersible Pump Rental, Day	4.00	DAY	116.50	0.00	0.00	$466	
Well Development Equipment Rental (weekly)	1.00	WK	365.66	0.00	0.00	$366	
Furnish 55 Gallon Drum for Development/Purge Water	16.00	EA	121.17	0.00	0.00	$1,939	
Car or Van Mileage Charge	400.00	MI	0.55	0.00	0.00	$220	
Project Scientist	73.00	HR	0.00	146.81	0.00	$10,717	
Field Technician	52.00	HR	0.00	97.98	0.00	$5,095	
Word Processing/Clerical	12.00	HR	0.00	81.20	0.00	$974	
Draftsman/CADD	12.00	HR	0.00	125.83	0.00	$1,510	
SUBTOTAL ($2004)						**$42,421**	
Vapor Removal System[d]							
Annual O&M						$10,000	
SUBTOTAL ($2004)						**$10,000**	
Land Use Controls							
Annual Drive-by Inspection						$2,478	
Contingency	25%					$620	
Navy Oversight	25%					$620	
SUBTOTAL ($2004)						**$3,717**	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						$56,138	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	4	1	EA		$47,929		$47,929	One every five years
Five Year Reviews	5-30	6	EA		20193.00		$121,158	One every five years
Navy Oversight		25%					$30,290	
SUBTOTAL							**$151,448**	
Well Abandonment	34	24	EA		$ 837		$20,088	
Close-out Report	34	1	EA		$47,929		$47,929	
SUBTOTAL							**$418,841**	

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[c,d]	Present Value	Notes
Capital Cost	0	$11,187,098	$11,187,098	1.0000	$11,187,098	
Annual O&M	1-33	$168,413	$56,138	19.7007	$1,105,953	
Periodic Cost	4	$47,929	$47,929	0.8714	$41,767	
Periodic Cost	5-30	$151,448	$25,241	3.9401	$99,454	One every five years
Periodic Cost	34	$418,841	$418,841	0.3105	$130,040	
		$11,973,728			$12,564,312	
TOTAL PRESENT VALUE OF ALTERNATIVE					$12,564,312	

Notes:

[a] Cost generated in RACER 2004

[b] Vendor quote from ISOTEC, Chris Nelson, (303) 843-9079, March 11, 2004. Second vendor quote requested from GeoCleanse. Costs will be averaged.

[c] Discount factor = $\frac{1}{(1+i)^t}$ where $i = 0.035$ for a 30+ year technology and t = year (i.e., the present value of the dollar paid in year t at 3.5%)

[d] Multi-year discount factor = $\frac{(1+i)n - 1}{i(1+i)^n}$ where i = 0.035 for a 30+ year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

TABLE C-6E: ALTERNATIVE 4B SITE 16, PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (hydrogen release compunds) to residential reuse, monitoring, and LUCs including vapor barriers until residentil criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
CAPITAL COSTS:							
Sampling to Further Delineate the VOC Plume[a]							68 water samples (plus 7 QC)
Disposable Materials per Sample	75.00	EA	12.68	0.00	0.00	$951	34 soil samples (plus 3 QC)
Decontamination Materials per Sample	75.00	EA	11.32	0.00	0.00	$849	
Direct Push Rig, Truck Mounted, Non Hydraulic, Includes Labor, Sampling, Decontamination	7.00	DAY	260.00	0.00	0.00	$1,820	
Mobilize Direct Push Rig and Crew	7.00	DAY	866.68	0.00	0.00	$6,067	
Demobilize Direct Push Rig and Crew	7.00	DAY	866.68	0.00	0.00	$6,067	
Water Quality Parameter Testing Device	2.00	WK	359.56	0.00	0.00	$719	
Peristaltic Pump, Weekly Rental	2.00	WK	173.34	0.00	0.00	$347	
Volatile Organic Analysis (EPA 624), Water Analysis	75.00	EA	310.03	0.00	0.00	$23,252	
Volatile Organic Analysis (SW 5035/SW 8260B), Soil Analysis	37.00	EA	394.11	0.00	0.00	$14,582	
Car or Van Mileage Charge	700.00	MI	0.54	0.00	0.00	$378	
Project Scientist	243.00	HR	0.00	146.81	0.00	$35,675	
Field Technician	140.00	HR	0.00	97.98	0.00	$13,717	
Word Processing/Clerical	26.00	HR	0.00	81.20	0.00	$2,111	
Draftsman/CADD	26.00	HR	0.00	125.83	0.00	$3,272	
SUBTOTAL ($2004)						**$109,806**	
HRC Treatment Costs (Scrapyard Area)[b]							
Pilot Test							
Work Plan						$10,000	
HRC material	780.00	LB	5.00	0.00	0.00	$3,900	
Shipping	780.00	LB	0.20	0.00	0.00	$156	
Mobilization[b]						$325	
Drill Rig[b]	1.00	DAY	0.00	0.00	1650.00	$1,650	8 holes to 25 ft
Local Travel[b]	1.00	DAY	0.00	150.00	0.00	$150	
Additional Crew Member for Injection[b]	1.00	DAY	0.00	450.00	0.00	$450	
Injection Pump[b]	1.00	DAY	0.00	0.00	300.00	$300	
Borehole Abandonment[b]	40.00	LF	0.00	0.00	1.00	$40	Upper 5 feet will be abandoned
Steam Cleaner[b]	1.00	DAY	0.00	0.00	95.00	$95	
Staff Scientist[a]	78.00	HR	0.00	140.14	0.00	$10,931	
Install Monitoring Wells[a]	3.00	EA	0.00	0.00	0.00	$7,500	
Pilot Test Groundwater Monitoring a							3 wells sampled quarterly
RSK175 analysis for dissolved gases methane, ethane, ethene	14.00	EA	97.83	0.00	0.00	$1,370	
Disposable Materials per Sample	14.00	EA	10.76	0.00	0.00	$151	
Decontamination Materials per Sample	14.00	EA	9.68	0.00	0.00	$136	
Nylon Tubing, 1/4" Outside Diameter	325.00	LF	0.56	0.00	0.00	$182	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	4.00	WK	88.82	0.00	0.00	$355	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	14.00	EA	55.69	0.00	0.00	$780	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	14.00	EA	38.58	0.00	0.00	$540	
Volatile Organic Analysis (EPA 624), Water Analysis	14.00	EA	276.27	0.00	0.00	$3,868	
Chloride (EPA 300), Water Analysis	14.00	EA	28.41	0.00	0.00	$398	
Sulfate (EPA 300.0), Water Analysis	14.00	EA	28.94	0.00	0.00	$405	
Sulfide (EPA 376.1), Water Analysis	14.00	EA	49.10	0.00	0.00	$687	
Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	146.31	0.00	0.00	$2,048	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	4.00	DAY	103.31	0.00	0.00	$413	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Scientist	63.00	HR	0.00	146.81	0.00	$9,249	
Field Technician	71.00	HR	0.00	97.98	0.00	$6,957	
Word Processing/Clerical	7.00	HR	0.00	81.20	0.00	$568	
Draftsman/CADD	7.00	HR	0.00	125.83	0.00	$881	

TABLE C-6E: ALTERNATIVE 4B SITE 16, PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (hydrogen release compunds) to residential reuse, monitoring, and LUCs including vapor barriers until residentil criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Primary Treatment							
HRC material	154950.00	LB	5.00	0.00	0.00	$774,750	3.1 containers per injection point
Shipping	154950.00	LB	0.20	0.00	0.00	$30,990	
Mobilization[a]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	207.00	DAY	0.00	0.00	1650.00	$341,550	8 holes to 25 ft
Local Travel[c]	207.00	DAY	0.00	150.00	0.00	$31,050	
Additional Crew Member for Injection[c]	207.00	DAY	0.00	450.00	0.00	$93,150	
Injection Pump[c]	207.00	DAY	0.00	0.00	300.00	$62,100	
Borehole Abandonment[c]	8250.00	LF	0.00	0.00	1.00	$8,250	Only upper 5 feet will be abandoned
Steam Cleaner[c]	207.00	DAY	0.00	0.00	95.00	$19,665	
Hand Auger[c]	27.50	DAY	0.00	0.00	750.00	$20,625	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	28.00	DAY	0.00	150.00	0.00	$4,200	
Concrete Coring[c]	20.50	DAY	0.00	0.00	1100.00	$22,550	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	21.00	DAY	0.00	150.00	0.00	$3,150	
Car or Van Mileage Charge[a]	7500.00	MI	0.48	0.00	0.00	$3,600	
Follow up Treatment (1) (100% Retreat, If Necessary)							
HRC material	154950.00	LB	5.00	0.00	0.00	$774,750	3.1 containers per injection point
Shipping	154950.00	LB	0.20		0.00	$30,990	
Mobilization[a]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	207.00	DAY	0.00	0.00	1650.00	$341,550	8 holes to 25 ft
Local Travel[c]	207.00	DAY	0.00	150.00	0.00	$31,050	
Additional Crew Member for Injection[c]	207.00	DAY	0.00	450.00	0.00	$93,150	
Injection Pump[c]	207.00	DAY	0.00	0.00	300.00	$62,100	
Borehole Abandonment[c]	8250.00	LF	0.00	0.00	1.00	$8,250	Only upper 5 feet will be abandoned
Steam Cleaner[c]	207.00	DAY	0.00	0.00	95.00	$19,665	
Hand Auger[c]	27.50	DAY	0.00	0.00	750.00	$20,625	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	28.00	DAY	0.00	150.00	0.00	$4,200	
Concrete Coring[c]	20.50	DAY	0.00	0.00	1100.00	$22,550	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	21.00	DAY	0.00	150.00	0.00	$3,150	
Car or Van Mileage Charge[a]	7500.00	MI	0.48	0.00	0.00	$3,600	
Follow up Treatment (2) (50% Retreat, If Necessary)							
HRC material	77475.00	LB	5.50	0.00	0.00	$426,113	3.1 containers per injection point
Shipping	77475.00	LB	0.20	0.00	0.00	$15,495	
Mobilization[a]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	25.00	DAY	0.00	0.00	1250.00	$31,250	8 holes to 25 ft
Local Travel[c]	103.50	DAY	0.00	150.00	0.00	$15,525	
Additional Crew Member for Injection[c]	25.00	DAY	0.00	450.00	0.00	$11,250	
Injection Pump[c]	103.50	DAY	0.00	0.00	300.00	$31,050	
Borehole Abandonment[c]	4125.00	LF	0.00	0.00	1.00	$4,125	Only upper 5 feet will be abandoned
Steam Cleaner[c]	103.50	DAY	0.00	0.00	95.00	$9,833	
Hand Auger[c]	3.50	DAY	0.00	0.00	750.00	$2,625	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	4.00	DAY	0.00	150.00	0.00	$600	
Concrete Coring[c]	10.25	DAY	0.00	0.00	1100.00	$11,275	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	3.00	DAY	0.00	150.00	0.00	$450	
Car or Van Mileage Charge[a]	51.75	MI	0.48	0.00	0.00	$25	
Contigency (percent of treatment cost)	15%					$519,202	Scope
SUBTOTAL ($2004) all HRC Material and Injections						**$3,980,552**	
HRC Treatment Costs (UST Area)[b]							
Pilot Test							
Work Plan	1.00	LS	0.00	0.00	0.00	$10,000	
HRC Material	660.00	LB	7.50	0.00	0.00	$4,950	
shipping	660.00	LB	0.20	0.00	0.00	$132	
Mobilization[a]	1.00	LS	0.00	0.00	0.00	$325	
Drill Rig[c]	1.00	DAY	0.00	0.00	1650.00	$1,650	Drilling 200 feet per day
Local Travel[c]	1.00	DAY	0.00	150.00	0.00	$150	
Additional Crew Member for Injection[c]	1.00	DAY	0.00	450.00	0.00	$450	
Injection Pump[c]	1.00	DAY	0.00	0.00	300.00	$300	
Borehole Abandonment[c]	40.00	LF	0.00	0.00	1.00	$40	upper 5 feet will be abandoned
Steam Cleaner[c]	1.00	DAY	0.00	0.00	95.00	$95	
Staff Scientist[a]	78.00	HR	0.00	140.14	0.00	$10,931	
Install Monitoring Wells[a]	3.00	EA	0.00	0.00		$7,500	

TABLE C-6E: ALTERNATIVE 4B SITE 16, PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)

Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (hydrogen release compunds) to residential reuse, monitoring, and LUCs including vapor barriers until residentil criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Pilot Test Groundwater Monitoringc							3 wells sampled quarterly
RSK175 analysis for dissolved gases	14.00	EA	97.83	0.00	0.00	$1,370	
Disposable Materials per Sample	14.00	EA	10.76	0.00	0.00	$151	
Decontamination Materials per Sample	14.00	EA	9.68	0.00	0.00	$136	
Nylon Tubing, 1/4" Outside Diameter	325.00	LF	0.56	0.00	0.00	$182	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Weekly Rental	14.00	WK	88.82	0.00	0.00	$1,243	
Flow Through Monitor, Weekly Rental	4.00	WK	301.20	0.00	0.00	$1,205	
Water Quality Parameter Testing Device	4.00	WK	307.24	0.00	0.00	$1,229	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	14.00	EA	55.69	0.00	0.00	$780	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	14.00	EA	38.58	0.00	0.00	$540	
Volatile Organic Analysis (EPA 624), Water Analysis	14.00	EA	276.27	0.00	0.00	$3,868	
Chloride (EPA 300), Water Analysis	14.00	EA	28.41	0.00	0.00	$398	
Sulfate (EPA 300.0), Water Analysis	14.00	EA	28.94	0.00	0.00	$405	
Sulfide (EPA 376.1), Water Analysis	14.00	EA	49.10	0.00	0.00	$687	
Ferrous Iron (S.M. 3500 Fe - D)	14.00	EA	146.31	0.00	0.00	$2,048	
55 Gallon 17C Closed Head Steel Drum	4.00	EA	91.19	0.00	0.00	$365	
4" Submersible Pump Rental, Day	4.00	DAY	103.31	0.00	0.00	$413	
Car or Van Mileage Charge	400.00	MI	0.48	0.00	0.00	$192	
Project Scientist	63.00	HR	0.00	146.81	0.00	$9,249	
Field Technician	71.00	HR	0.00	97.98	0.00	$6,957	
Word Processing/Clerical	7.00	HR	0.00	81.20	0.00	$568	
Draftsman/CADD	7.00	HR	0.00	125.83	0.00	$881	
Primary Treatment							
HRC material	31680.00	LB	5.25	0.00	0.00	$166,320	
Shipping	31680.00	LB	0.20	0.00	0.00	$6,336	
Mobilization[a]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	49.50	DAY	0.00	0.00	1650.00	$81,675	Drilling 200 feet per day
Local Travel[c]	50.00	DAY	0.00	150.00	0.00	$7,500	
Additional Crew Member for Injection[c]	49.50	DAY	0.00	450.00	0.00	$22,275	
Injection Pump[c]	50.00	DAY	0.00	0.00	300.00	$15,000	
Borehole Abandonment[c]	1980.00	LF	0.00	0.00	1.00	$1,980	Only upper 5 feet will be abandoned
Steam Cleaner[c]	50.00	DAY	0.00	0.00	95.00	$4,750	
Hand Auger[c]	6.60	DAY	0.00	0.00	750.00	$4,950	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	7.00	DAY	0.00	150.00	0.00	$1,050	
Concrete Coring[c]	5.00	DAY	0.00	0.00	1100.00	$5,500	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	5.00	DAY	0.00	150.00	0.00	$750	
Car or Van Mileage Charge[a]	10000.00	MI	0.48	0.00	0.00	$4,800	
Follow up Treatment (1) (100% Retreat, If Necessary)							
HRC material	31680.00	LB	5.25	0.00	0.00	$166,320	
Shipping	31680.00	LB	0.20	0.00	0.00	$6,336	
Mobilization[a]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	49.50	DAY	0.00	0.00	1650.00	$81,675	Drilling 200 feet per day
Local Travel[c]	50.00	DAY	0.00	150.00	0.00	$7,500	
Additional Crew Member for Injection[c]	49.50	DAY	0.00	450.00	0.00	$22,275	
Injection Pump[c]	50.00	DAY	0.00	0.00	300.00	$15,000	
Borehole Abandonment[c]	1980.00	LF	0.00	0.00	1.00	$1,980	Only upper 5 feet will be abandoned
Steam Cleaner[c]	50.00	DAY	0.00	0.00	95.00	$4,750	
Hand Auger[c]	6.60	DAY	0.00	0.00	750.00	$4,950	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	7.00	DAY	0.00	150.00	0.00	$1,050	
Concrete Coring[c]	5.00	DAY	0.00	0.00	1100.00	$5,500	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	5.00	DAY	0.00	150.00	0.00	$750	
Car or Van Mileage Charge[a]	10000.00	MI	0.48	0.00	0.00	$4,800	
Follow up Treatment (2) (50% Retreat, If Necessary)							
HRC material	15840.00	LB	5.50	0.00	0.00	$87,120	
Shipping	15840.00	LB	0.20	0.00	0.00	$3,168	
Mobilization[a]	1.00	LS	0.00	0.00	0.00	$1,000	
Drill Rig[c]	25.00	DAY	0.00	0.00	1250.00	$31,250	Drilling 200 feet per day
Local Travel[c]	25.00	DAY	0.00	150.00	0.00	$3,750	
Additional Crew Member for Injection[c]	25.00	DAY	0.00	450.00	0.00	$11,250	
Injection Pump[c]	25.00	DAY	0.00	0.00	300.00	$7,500	
Borehole Abandonment[c]	990.00	LF	0.00	0.00	1.00	$990	Only upper 5 feet will be abandoned
Steam Cleaner[c]	25.00	DAY	0.00	0.00	95.00	$2,375	
Hand Auger[c]	3.50	DAY	0.00	0.00	750.00	$2,625	Assumes 15 cores per day
Local Travel for Hang Auger Crew[c]	4.00	DAY	0.00	150.00	0.00	$600	
Concrete Coring[c]	2.50	DAY	0.00	0.00	1100.00	$2,750	Assumes 20 cores per day
Local Travel for Concrete Coring Crew[c]	3.00	DAY	0.00	150.00	0.00	$450	
Car or Van Mileage Charge[a]	5000.00	MI	0.48	0.00	0.00	$2,400	
Contigency (percent of treatment cost)	15%					$131,158	Scope
SUBTOTAL ($2004) all HRC Material and Injections						**$1,005,547**	

TABLE C-6E: ALTERNATIVE 4B SITE 16, PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (hydrogen release compunds) to residential reuse, monitoring, and LUCs including vapor barriers until residentil criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Install Deep (25 ft) Groundwater Monitoring Wells[c]							12 wells to be installed
Organic Vapor Analyzer Rental, per Day	4.00	DAY	173.34	0.00	0.00	$309	
Decontaminate Rig, Augers, Screen (Rental Equipment)	4.00	DAY	170.60	0.00	0.00	$292	
Field Technician	64.00	HR	0.00	125.60	0.00	$3,135	
2" PVC, Schedule 40, Well Casing	180.00	LF	1.70	8.34	10.69	$1,653	
2" PVC, Schedule 40, Well Screen	120.00	LF	3.93	10.76	13.80	$1,515	
2" PVC, Well Plug	12.00	EA	8.29	12.51	16.04	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	312.00	LF	0.00	22.86	29.33	$7,198	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	16.00	EA	101.71	0.00	0.00	$814	
2" Screen, Filter Pack	144.00	LF	4.42	7.09	9.09	$1,317	
2" Well, Portland Cement Grout	144.00	LF	1.65	0.00	0.00	$107	
2" Well, Bentonite Seal	12.00	EA	13.14	28.14	36.09	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2501.28	3208.23	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	12.00	EA	57.58	259.94	9.04	$1,733	
SUBTOTAL ($2004)						**$23,729**	
Install Shallow (10 ft) Groundwater Monitoring Wells[c]							12 wells to be installed
Organic Vapor Analyzer Rental, per Day	2.00	DAY	173.34	0.00	0.00	$154	
Decontaminate Rig, Augers, Screen (Rental Equipment)	2.00	DAY	170.60	0.00	0.00	$146	
Field Technician	32.00	HR	0.00	125.60	0.00	$1,568	
2" PVC, Schedule 40, Well Casing	60.00	LF	1.70	8.34	10.69	$551	
2" PVC, Schedule 40, Well Screen	60.00	LF	3.93	10.76	13.80	$758	
2" PVC, Well Plug	12.00	EA	8.29	12.51	16.04	$196	
Hollow Stem Auger, 8" Dia Borehole, Depth <= 100 ft	132.00	LF	0.00	22.86	29.33	$3,045	
Furnish 55 Gallon Drum for Drill Cuttings & Development Water	12.00	EA	101.71	0.00	0.00	$610	
2" Screen, Filter Pack	84.00	LF	4.42	7.09	9.09	$768	
2" Well, Portland Cement Grout	24.00	LF	1.65	0.00	0.00	$18	
2" Well, Bentonite Seal	12.00	EA	13.14	28.14	36.09	$412	
Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	2501.28	3208.23	$5,048	
Surface Pad, Concrete, 2' x 2' x 4"	12.00	EA	57.58	259.94	9.04	$1,733	
SUBTOTAL ($2004)						**$15,007**	
Groundwater Monitoring[g]							24 wells monitored quarterly
Disposable Materials per Sample	104.00	EA	12.90	0.00	0.00	$1,342	
Decontamination Materials per Sample	104.00	EA	11.51	0.00	0.00	$1,197	
Nylon Tubing, 1/4" Outside Diameter	1820.00	LF	0.67	0.00	0.00	$1,219	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	16.00	DAY	39.66	0.00	0.00	$635	
Flow Through Monitor, Weekly Rental	4.00	WK	343.74	0.00	0.00	$1,375	
Water Quality Parameter Testing Device	4.00	WK	365.66	0.00	0.00	$1,463	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	104.00	EA	50.84	0.00	0.00	$5,287	
RSK175 analysis for dissolved gases	104.00	EA	97.83	0.00	0.00	$10,174	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	104.00	EA	39.41	0.00	0.00	$4,099	
Volatile Organic Analysis (EPA 624), Water Analysis	104.00	EA	315.29	0.00	0.00	$32,790	
Chloride (EPA 300), Water Analysis	104.00	EA	29.67	0.00	0.00	$3,086	
Sulfate (EPA 300.0), Water Analysis	104.00	EA	29.67	0.00	0.00	$3,086	
Sulfide (EPA 376.1), Water Analysis	104.00	EA	43.42	0.00	0.00	$4,516	
Ferrous Iron (S.M. 3500 Fe - D)	104.00	EA	137.58	0.00	0.00	$14,308	
4" Submersible Pump Rental, Day	16.00	DAY	116.50	0.00	0.00	$1,864	
Well Development Equipment Rental (weekly)	4.00	WK	365.66	0.00	0.00	$1,463	
Furnish 55 Gallon Drum for Development/Purge Water	16.00	EA	121.17	0.00	0.00	$1,939	
Car or Van Mileage Charge	1600.00	MI	0.55	0.00	0.00	$880	
Project Scientist	307.00	HR	0.00	146.81	0.00	$45,071	
Field Technician	214.00	HR	0.00	97.98	0.00	$20,968	
Word Processing/Clerical	27.00	HR	0.00	81.20	0.00	$2,192	
Draftsman/CADD	27.00	HR	0.00	125.83	0.00	$3,397	
SUBTOTAL ($2004)						**$162,350**	
Land Use Controls							
Land Use Control Implementation Plan						$39,625	
Environmental Resrtrictions in Deed						$31,470	
Register and File Deed						$133	
Navy Oversight	25%					$17,807	
SUBTOTAL ($2004)						**$89,035**	
Vapor Removal System[d]							
Design - Building 608 Vapor Removal System						$7,500	
Installation of Soil Depressurization System						$50,000	
SUBTOTAL ($2004)						**$57,500**	
SUBTOTAL ($2004)						$5,443,526	
Contingency	25%					$1,360,882	10% scope + 15% bid
SUBTOTAL ($2004)						**$6,804,408**	

TABLE C-6E: ALTERNATIVE 4B SITE 16, PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (hydrogen release compunds) to residential reuse, monitoring, and LUCs including vapor barriers until residentil criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Professional Labor							
Design and Work Plan	8.00%					$544,353	
Project Management Labor Cost	2.00%					$136,088	
Planning Documents Labor Cost	2.00%					$136,088	
Construction Oversight Labor Cost	2.50%					$170,110	
Reporting Labor Cost	0.25%					$17,011	
As-Built Drawings Labor Cost	0.25%					$17,011	
Public Notice Labor Cost	0.04%					$2,722	
Site Closure Activities Labor Cost	2.00%					$136,088	
Permitting Labor Cost	2.50%					$170,110	
SUBTOTAL						$785,229	
TOTAL CAPITAL COST IN 2004 DOLLARS						$7,589,636	

OPERATIONS AND MAINTENANCE COSTS:

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Groundwater Monitoring[a]							24 wells monitored annually
Disposable Materials per Sample	26.00	EA	12.90	0.00	0.00	$335	
Decontamination Materials per Sample	26.00	EA	11.51	0.00	0.00	$299	
Nylon Tubing, 1/4" Outside Diameter	440.00	LF	0.67	0.00	0.00	$295	
Water Level Indicator, Manual, Polyethylene Tape, 100' Cable, Daily Rental	4.00	DAY	39.66	0.00	0.00	$159	
Flow Through Monitor, Weekly Rental	1.00	WK	343.74	0.00	0.00	$344	
Water Quality Parameter Testing Device	1.00	WK	365.66	0.00	0.00	$366	
Nitrogen/Nitrite/Nitrate (EPA 300.0/SM 4110B, Water Analysis	26.00	EA	50.84	0.00	0.00	$1,322	
RSK175 analysis for dissolved gases	26.00	EA	97.83	0.00	0.00	$2,544	
Acidity/Alkalinity (EPA 305.1/310.1), Water Analysis	26.00	EA	39.41	0.00	0.00	$1,025	
Volatile Organic Analysis (EPA 624), Water Analysis	26.00	EA	315.29	0.00	0.00	$8,198	
Chloride (EPA 300), Water Analysis	26.00	EA	29.67	0.00	0.00	$771	
Sulfate (EPA 300.0), Water Analysis	26.00	EA	29.67	0.00	0.00	$771	
Sulfide (EPA 376.1), Water Analysis	26.00	EA	43.42	0.00	0.00	$1,129	
Ferrous Iron (S.M. 3500 Fe - D)	26.00	EA	137.58	0.00	0.00	$3,577	
4" Submersible Pump Rental, Day	4.00	DAY	116.50	0.00	0.00	$466	
Well Development Equipment Rental (weekly)	1.00	WK	365.66	0.00	0.00	$366	
Furnish 55 Gallon Drum for Development/Purge Water	16.00	EA	121.17	0.00	0.00	$1,939	
Car or Van Mileage Charge	400.00	MI	0.55	0.00	0.00	$220	
Project Scientist	73.00	HR	0.00	146.81	0.00	$10,717	
Field Technician	52.00	HR	0.00	97.98	0.00	$5,095	
Word Processing/Clerical	12.00	HR	0.00	81.20	0.00	$974	
Draftsman/CADD	12.00	HR	0.00	125.83	0.00	$1,510	
SUBTOTAL ($2004)						**$42,421**	
Vapor Removal System[d]							
Annual O&M						$10,000	
SUBTOTAL ($2004)						**$10,000**	
Land Use Controls							
Annual Drive-by Inspection						$2,478	
Contingency	25%					$620	
Navy Oversight	25%					$620	
SUBTOTAL ($2004)						**$3,717**	
TOTAL ANNUAL O&M COST IN 2004 DOLLARS						$56,138	

PERIODIC COSTS:

DESCRIPTION	Year	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes
Remedial Action Report	5	1	EA		$47,929		$47,929	
Five Year Reviews	5-30	6	EA		20193.00		$121,158	One every five years
Navy Oversight		25%					$30,290	
SUBTOTAL							**$151,448**	
Well Abandonment	35	24	EA		$837		$20,088	
Close-out Report	35	1	EA		$47,929		$47,929	
SUBTOTAL							**$418,841**	

TABLE C-6E: ALTERNATIVE 4B SITE 16, PLUME BOUNDARY DELINEATION, HRC TREATMENT TO UNRESTRICTED REUSE, MNA, AND LUCS, TOTAL REMEDIAL COST (CONTINUED)
Feasibility Study Report for Operable Unit 1, Site 6, 7, 8, and 16, Alameda Point, Alameda, California

COST ESTIMATE SUMMARY

Site: Operable Unit 1, CERCLA Site 16
Location: Alameda Point, Alameda, California
Phase: Feasibility Study
Base Year: 2004
Date: October 18, 2004

Description: One-time sampling to further delineate VOC plume, active groundwater treatment (hydrogen release compunds) to residential reuse, monitoring, and LUCs including vapor barriers until residentil criteria is met.

DESCRIPTION	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Notes

PRESENT VALUE ANALYSES:

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor[d]	Present Value	Notes
Capital Cost	0	$7,589,636	$7,589,636	1.0000	$7,589,636	
Annual O&M	1-35	$252,620	$56,138	20.0007	$1,122,793	
Periodic Cost	4	$47,929	$47,929	0.8714	$41,767	
Periodic Cost	5-30	$151,448	$25,241	3.9401	$99,454	One every five years
Periodic Cost	35	$418,841	$418,841	0.4832	$202,371	
		$8,460,474			$9,056,021	

TOTAL PRESENT VALUE OF ALTERNATIVE $9,056,021

Notes:
[c] Costs provided by RACER 2004
[a] Vendor quote from Dave Reilly at Regenesis, (949) 366-8001 x 125 on March 17, 2004
[b] Vendor quote from Derrik M Sandberg at ResonantSonic International on March 17, 2004, (530) 668-2424
[c] Discount factor = $\frac{1}{(1+i)^t}$ where i = 0.035 for a 30+ year technology and t = year (i.e., the present value of the dollar paid in year t at 3.5)
[d] Multi-year discount factor = $\frac{(1+i)n - 1}{i(1+i)^n}$ where i = 0.035 for a 30+ year technology, t = year, and n = total number of years (i.e., the present value of the dollar paid per year from year 1 to year n at 3.5%)

ATTACHMENT C1
MODELING TO EVALUATE MONITORED NATURAL ATTENUATION AS REMEDIAL ACTION ALTERNATIVES FOR SITES 6 AND 16

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C1.1 MODELING OBJECTIVES

The objective of groundwater modeling was to evaluate and compare two remedial action scenarios at Alameda Point Sites 6 and 16. The remedial action scenarios were considered for one plume of chlorinated ethenes at Site 6 and three plumes at Site 16, including two separate plumes of chlorinated ethenes and one intermingled plume of 1,3-dichlorobenzene (DCB) and 1,4-DCB.

The first scenario assessed monitored natural attenuation (MNA) of the entire plume without active remediation (that is, without using any in situ treatment technologies). The second scenario assessed cleanup of a portion of the aquifer to a predetermined concentration using active treatment. Modeling results were used to evaluate whether or not California maximum contaminant levels (MCL).

The modeling was conducted using Natural Attenuation Software (NAS). NAS was designed as a screening tool to estimate timeframes required for natural attenuation processes, such as dispersion, sorption, and biodegradation, to lower contaminant concentrations and mass to predetermined regulatory goals in groundwater systems (Chapelle and others 2003). The NAS software is in public domain and may be downloaded from the website http://www.cee.vt.edu/NAS/.

NAS was used to simulate remediation by natural attenuation of the compounds detected in groundwater at Sites 6 and 16 at concentrations above the MCL. Specifically, NAS estimated the time of remediation (TOR) or number of years needed to naturally attenuate concentrations of chlorinated ethenes and DCBs to below the California MCLs.

C1.2 MODEL DESCRIPTION

The TOR problem is formulated as three interactive components (Chapelle and others 2003): (1) estimating the length of a contaminant plume once it has achieved a steady-state configuration from a source area of constant contaminant concentration; (2) estimating the time required for a plume to shrink to a smaller, regulatory acceptable configuration when source-area contaminant concentrations are lowered by engineered methods; and (3) estimating the time needed for nonaqueous phase liquid (NAPL) contaminants to dissolve, disperse, and biodegrade below predetermined levels in contaminant source areas. All these three components were realized in the NAS.

The NAS was designed specifically for petroleum hydrocarbon and chlorinated ethene contaminants. The NAS requires the input of detailed site information about hydrogeology, redox conditions, and the distribution of contaminants. Because NAS is based on numerous simplifications of hydrologic, microbial, and geochemical processes, the program may introduce unacceptable errors for highly heterogeneous hydrologic systems. In such cases, application of the TOR framework may require more detailed, site-specific digital modeling (Chapelle and others 2003).

The NAS uses SEAM3D (Waddill and Widdowson 2000), a reactive transport model, for simulation of complex biodegradation problems involving multiple substrates and electron acceptors. SEAM3D is based on the MT3DMS code (Zheng and Wang 1999). In addition to the regular MT3DMS modules, SEAM3D includes a biodegradation module and NAPL dissolution module. The user may choose to evaluate the effects of source reduction or complete removal in terms of meeting a user-specified contaminant concentration at a specific point of compliance (Chapelle and others 2003).

Examples of NAS application at various sites indicated a general agreement of estimated decreases in chlorinated ethene concentrations with observed decreases during monitoring. The comparisons showed, however, that observed patterns of contaminant concentration changes are much more complex than indicated by NAS. This, in turn, illustrates the general principle that hydrologic complexities of groundwater systems are not fully accounted for in simulation tools like NAS and that TOR estimates made with such tools are inherently uncertain. Although TOR estimates can be useful for evaluating different remediation strategies and goals for particular sites, these estimates should always be verified with site monitoring (Chapelle and others 2003).

C1.3 MODEL SETUP AND INPUT PARAMETERS

The source area for each plume at Sites 6 and 16 was considered to be near the well with the highest measured concentrations in the core of the plume. The simulated plumes are shown on Figures 6-5 and 6-13.

Site geology and hydrogeology are discussed in detail in Sections 4.1.4 and 7.1.4 of the remedial investigation (RI) report (Tetra Tech EM Inc. [Tetra Tech] 2004). Site-specific hydrogeologic parameters are based on field data and are listed by site in Table C1-1. Average hydraulic conductivities and gradients (Tetra Tech 2004) were selected for modeling. Chemical concentrations measured in monitoring wells and Hydropunch™ borings along the plume centerline were used as inputs into the model.

TABLE C1-1: MODEL SETUP DATA
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Parameter	Value	
	Site 6	Site 16
Saturated thickness of aquifer in source zone (feet)	5	20
Hydraulic conductivity (feet/day)	2.4	2.8
Hydraulic gradient (feet/feet)	0.0036	0.0013
Effective aquifer porosity (unitless)	0.25	0.25
Groundwater seepage velocity (feet/year)	12.6	5.3
Fraction organic carbon (unitless)[a]	0.004	0.004

Note:
a An assumed value was used.

The following assumptions were used in modeling for both Sites 6 and 16.

Assumptions Required by the Model

- The aquifer is homogeneous and isotropic.
- Groundwater flow is horizontal, unidirectional, and at steady state.

Chemical-Specific Assumptions

- Initial concentrations of chemicals of concern (COC) are based on the most recent sampling data collected in December 2002 from monitoring wells or Hydropunch™ data collected between the mid-1990s through 2002. If earlier than 2002 concentrations were used as inputs, their likely reduction by 2002 was not accounted for in the model.
- Decay coefficients for COCs were calculated after adjusting the redox parameters to fit the model curve to the observed COC concentrations along the plume centerline.
- Tests for trends in VOC concentrations in monitoring wells at Sites 6 and 16 over time indicate that the concentrations of VOCs either decreased or remained similar to those detected since 1991. The VOC plumes at both sites, therefore, appear to be either shrinking or stable. The exceptions can be the daughter products of tetrachloroethene and trichloroethene, such as 1,2-dichloroethene (DCE) and vinyl chloride (VC). It is possible for daughter products to increase in concentration before they decrease through reductive dechlorination under anaerobic conditions or cometabolic oxidation under aerobic conditions. The review of groundwater data for 1,2-DCE and VC at both Sites 6 and 16 suggests that their concentrations continue to decrease or vary insignificantly over time.
- For the purpose of conservative modeling, it was assumed that the mass of a contaminant in the plume resulted from NAPL assumed to be present at residual saturation throughout the aquifer thickness. Although the low concentrations of VOCs detected in groundwater do not suggest NAPL presence, it was assumed, however, that a NAPL source with a mass of 0.1 kilogram is present.

Assumptions Based on Field Data Collected during the RI (Tetra Tech 2004)

- The plume length and width is based on concentration isocontours generated using most recent data from monitoring wells and historic data from grab groundwater samples.

Simulations considered two main scenarios: (1) MNA of the entire plume without active remediation and (2) cleanup of a portion of the aquifer to a predetermined concentration. The NAS modeling for the first scenario determines the time required for natural attenuation processes to lower contaminant concentrations to levels protective of human health and the environment.

If the estimated TOR by MNA is unacceptably long, then the NAS modeling determines what level of source zone treatment is adequate to meet the site-specific remediation goals for MNA timeframes of 10, 20, or 30 years. In other words, simulations for the second scenario assume an active remediation of source zone to reduce current groundwater concentrations to levels that will be further lowered by natural attenuation only in acceptable timeframes.

C1.4 RESULTS OF THE MODELING

The NAS model simulation results for Sites 6 and 16 are summarized in Table C1-2. The model outputs for each of the plumes at Sites 6 and 16 are presented as Attachment C1-1.

The TORs for different chlorinated ethenes plumes at Sites 6 and 16 vary significantly, which suggests that conditions at sites can be favorable for reductive dechlorination to a different degree. Because for each plume a model was calibrated to the observed concentrations, the resulting estimated decay coefficients for parent and daughter compounds have a greatest effect on predicted TORs. Other sensitive parameters of the model are groundwater seepage velocity and organic carbon content. The TORs are predicted to be fastest for site conditions with the highest decay coefficients for chlorinated ethenes, highest groundwater seepage velocities, and lowest organic carbon content.

SITE 6

Model simulations for the scenario of MNA without active remediation of the source suggest that 36.7 years are required to achieve the MCL of 0.5 microgram per liter (µg/L) for VC. During this time, all ethenes are expected to attenuate.

The model was also run for an active remediation scenario. To achieve the TORs by natural attenuation of 30 years, the present maximum concentrations of total chlorinated ethenes should be reduced to 12 µg/L by active remediation (for example, chemical oxidation). To achieve a 20- and 10-year TOR by natural attenuation, the present total ethene concentrations should be treated to 4 and 1.5 µg/L, respectively.

Based on currently observed concentrations and estimates of the efficacy of natural attenuation, the model predicted that the plume would extend up to 926 feet versus the currently measured length of 425 feet. The predicted length is likely significantly exaggerated. The model appears to treat a highest measured sum of chlorinated ethene concentrations as representative of a source, while the main contributor to the sum is 1,2-DCE, the concentration of which generally increases downgradient from the source location of the parent compound. The source area in the model is predicted to extend farther than observed, which makes the predicted length of the plume longer. The model estimate may still not be realistic.

TABLE C1-2: PREDICTED TIMES OF GROUNDWATER REMEDIATION BY NATURAL ATTENUATION
Feasibility Study Report for Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

OU-1 Site	Contaminant(s)	Max Concentration in the Plume[a] (µg/L)	Plume Length[b] Measured/ Model Estimated (feet)	Plume Width[b] (feet)	Aquifer Thickness (feet)	Remediation Goal for Compound(s)[c] (µg/L)	Time of Remediation by Natural Attenuation Only (years)
Site 6	PCE, TCE, 1,2-DCE, VC	89 (50)	425	305	5	5	13.5
			(926)			**0.5**	**36.7**
						0.1	54.3
						0.01	76
Site 16 Former UST	PCE, TCE, 1,2-DCE, VC	186 (59)	390	180	20	5	29.5
			(223)			**0.5**	**64.2**
						0.1	90.8
						0.01	124
Site 16 Scrap Yard	TCE, 1,2-DCE, VC	195 (7.1)	650	450	20	5	9.4
			(515)			**0.5**	**63**
						0.1	94
						0.01	140
	1,3-DCB	1,000	425	175	20	100	32.7
			(233)			10	88.0
						5.5	**100.5**
	1,4-DCB	3,100	425	175	25	310	4.9
			(355)			10	13.8
						5.0	**15.9**

TABLE C1-2: PREDICTED TIMES OF GROUNDWATER REMEDIATION BY NATURAL ATTENUATION (CONTINUED)

Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Notes:

a For chlorinated ethenes, the maximum concentration is a largest sum of concentrations of both parent and daughter compounds; the highest concentration of the parent compound is shown in parentheses.

b Plume length and width are defined by the MCL contour in the plan view. The model predicts the plume length (shown in parentheses) based estimated time of its stabilization.

c The remediation goal is defined as an MCL (bolded) at the point of compliance (POC). For chlorinated ethenes, this goal is specified for their total concentration at the POC. The Natural Attenuation Software does not allow to set the goal as low as 0.01 μg/L, so for this goal the TORs were estimated using regression analysis.

DCB Dichlorobenzene
DCE Dichloroethene
MCL Maximum contaminant level
PCE Tetrachloroethene
TCE Trichloroethene
TOR Time of remediation
VC Vinyl Chloride

TABLE C1-3: TARGET CHLORINATED ETHENES CONCENTRATIONS FOR REMEDIATED SOURCE SCENARIO TO ACHIEVE 30-, 20-, AND 10-YEAR TIMEFRAMES FOR NATURAL A

Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California

Site	Total Chlorinated Ethenes Concentrations (µg/L)			
	Most Recent Concentration	Target Concentrations for Natural Attenuation to Meet 0.5 µg/L Goal in:		
		30 years	20 years	10 years
Site 6	89	12	4.0	1.5
Site 16 Former UST	186	3.8	2.0	1.1
Site 16 Scrap Yard	195	1.9	1.2	0.7

Note:

µg/L Micrograms per liter

SITE 16

For chlorinated ethene plumes at Site 16, model simulations for the scenario of MNA without active remediation of the source suggest that 64 years (plume near former UST) and 63 years (plume near scrap yard) will be required to achieve the MCL of 0.5 μg/L for VC.

The model predicts that it will take more than 127 years for the plume near scrap yard to stabilize, as opposed to the predicted 5-year stabilization timeframe for the plume near former UST. The model prediction for the plume near the scrap yard to stabilize after very long time is likely exaggerated because the model appears to assume that the source zone is expanding in longitudinal direction. This assumption is not supported by the data, so the time of plume stabilization is likely much shorter.

The model was also run for an active remediation scenario. To achieve the TORs by natural attenuation of 30 years, the present maximum concentrations of total chlorinated ethenes should be reduced to 2 to 4 μg/L by active remediation (for example, chemical oxidation).

Based on simulations for two plumes of 1,3-DCB and 1,4-DCB near the scrap yard, it takes nearly 6 times longer for natural attenuation to bring currently observed concentrations of 1,3-DCB to below the MCL (5.5 μg/L) than 1,4-DCB. The plume concentration distributions simulated by a calibrated model appear to indicate a potential for 1,4-DCB to attenuate quicker.

C1.5 LIMITATIONS AND UNCERTAINTIES OF THE MODELING

Development of NAS model for each plume involved incorporating numerous assumptions and simplifications that could possibly overestimate or underestimate actual chemical concentrations and cleanup times.

For the remediated source scenarios, the model assumed that the location of the continuing contribution of VOCs in the subsurface at Sites 6 and 16 can be identified and that the sources can be remediated to the extent practical. If the sources cannot be located and remediated, then TORs predicted by natural attenuation would increase.

The results of current modeling activities are adequate to satisfy the primary objectives of the main feasibility study report. Specifically, modeling results provide a useful comparison for cleanup times among various remedial alternatives. Because of the simplifications and numerous assumptions needed to model aquifer systems in NAS (as in any other model), using the NAS-generated TOR estimates as precise predictions of systems behavior is inappropriate.

C1.6 CONCLUSIONS

Results of modeling using natural attenuation software for Alameda Sites 6 and 16 suggest the following.

- Under the unremediated source scenario for chlorinated ethenes, 37 to 64 years will be required to naturally attenuate currently observed concentrations to below the MCL of 0.5 μg/L for VC. For DCB plumes, the predicted times of remediation by natural attenuation range from 16 to 101 years.
- To achieve a remediation by natural attenuation within 30 years, the currently observed maximum concentrations of total chlorinated ethenes should be reduced to between 2 to 4 μg/L at Site 16 and 12 μg/L at Site 6.

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APPENDIX C – REMEDIAL ACTION ALTERNATIVE COST SUMMARY SHEETS

ATTACHMENT C1 – MODELING TO EVALUATE MONITORED NATURAL ATTENUATION AS REMEDIAL ACTION ALTERNATIVES FOR SITES 6 AND 16

REFERENCES
PAGE C1-10

FINAL
FEASIBILITY STUDY REPORT FOR
OPERABLE UNIT 1, SITES 6, 7, 8, AND 16

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NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

ATTACHMENT C-C1
MODEL OUTPUTS

This attachment contains model output files in the following order:

Operable Unit 1 Site	Contaminant(s)	Page
Site 6	PCE, TCE, 1,2-DCE, VC	D1-2
Site 16 Former UST	PCE, TCE, 1,2-DCE, VC	D1-5
Site 16 Scrap Yard	TCE, 1,2-DCE, VC	D1-8
	1,3-DCB	D1-11
	1,4-DCB	D1-14

Notes:

DCB Dichlorobenzene
DCE Dichloroethene
PCE Tetrachloroethene
TCE Trichloroethene
VC Vinyl Chloride

MODEL OUTPUT FOR TETRACHLOROETHANE, TRICHLOROETHENE, 1,2-DICHLOROETHENE, AND VINYL CHLORIDE, SITE 6

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Facility Name:	Alameda Point	***Length:***	feet
Site Name:	Site 6, OU-1	***Time:***	days
Additional Description:	solvents plume	***Mass:***	kilograms

Hydrogeologic Data and Contaminant Transport Calculations

	Maximum	*Average*	*Minimum*		*Value*
Hydr. Conductivity [ft/d]	2.4	2.4	2.4	*Estimated Plume Length [ft]*	925.9
Hydraulic Gradient [ft/ft]	0.0036	0.0036	0.0036	*Longitudinal Dispersivity [ft]*	23.70
Total Porosity [-]		0.4		*Dispersivity Ratio [-]*	20.0
Effective Porosity [-]		0.25		*Contaminated Aquifer*	
Groundwater Vel. [ft/d]	0.035	0.035	0.035	*Thickness [ft]*	5.0

Contaminant Data (December 2002)

Well Name	*Distance [ft]*	*PCE [µg/L]*	*TCE [µg/L]*	*cis-DCE [µg/L]*	*Vinyl Chl. [µg/L]*	*Total Chl. Eth. [µg/L]*
1	0.0	25	31	NS	BD	56
DP02	45.0	38	50	NS	1	89
M06-06	110.0	4.2	2.5	14	1.5	22.2
HP-06	210.0	2.3	2	13	21	38.3
M06-01	240.0	0.4	4	16	2.5	22.9

Redox Data (December 2002)

Well Name	*Distance [ft]*	*Oxygen [mg/L]*	*Nitrate [mg/L]*	*Iron(II) [mg/L]*	*Sulfate [mg/L]*	*Methane [mg/L]*	*Redox Condition*
DP01	0.0	NS	NS	NS	NS	NS	SO4/CO2-red.
DP02	45.0	NS	NS	NS	NS	NS	SO4/CO2-red.
M06-06	110.0	0.1	0.18	0.04	31	0.82	SO4/CO2-red.
HP-06	210.0	NS	NS	NS	NS	NS	Ferrogenic
M06-01	240.0	NS	NS	NS	NS	NS	Ferrogenic

MODEL OUTPUT FOR TETRACHLOROETHANE, TRICHLOROETHENE, 1,2-DICHLOROETHENE, AND VINYL CHLORIDE, SITE 6

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Sorption Parameters					
Fraction Org. Carbon [-]					
	Maximum	0.004			
	Average	0.004			
	Minimum	0.004			
		PCE	*TCE*	*cis-DCE*	*Vinyl Chl.*
Koc [L/kg]		364	126	24	57
Retardation Factor [-]					
	Maximum	10.26	4.21	1.61	2.45
	Average	10.26	4.21	1.61	2.45
	Minimum	10.26	4.21	1.61	2.45

Attenuation Rates						
		Total Chl. Eth.	*PCE*	*TCE*	*cis-DCE*	*Vinyl Chl.*
NAC (Single Zone) [1/ft]		0.0046	0.0197	0.0119	Insuff. Data	0.0709
Decay Rate [1/d]						
	Maximum	0.0002	0.0008	0.0005		0.0046
	Average	0.0002	0.0008	0.0005		0.0046
	Minimum	0.0002	0.0008	0.0005		0.0046
NAC (Zone 1) [1/ft]		0.0214	0.0339	0.0461		0.0709 (Est.)
Decay Rate [1/d]						
	Maximum	0.0011	0.0016	0.0026		0.0046
	Average	0.0011	0.0016	0.0026		0.0046
	Minimum	0.0011	0.0016	0.0026		0.0046
NAC (Zone 2) [1/ft]		0.0171	0.0583	0.0461 (Est.)		0.0709
Decay Rate [1/d]						
	Maximum	0.0008	0.0034	0.0026		0.0046
	Average	0.0008	0.0034	0.0026		0.0046
	Minimum	0.0008	0.0034	0.0026		0.0046

MODEL OUTPUT FOR TETRACHLOROETHANE, TRICHLOROETHENE, 1,2-DICHLOROETHENE, AND VINYL CHLORIDE, SITE 6

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Time of Stabilization(TOS) and Max Source Conc. Calculations

	Distance to POC [1/ft]	50.0					
	Estimated Source Width [ft]	100.0					
		Source Concentration [µg/L]				*TOS [years]*	
	RCC [µg/L]	*Well*	*Current*	*Target*	*Maximum*	*Average*	*Minimum*
Total Chl. Eth.	0.5	2	89	1	13.7	13.7	13.7

Time of Remediation(TOR) Calculations

	NAPL Source Width [ft]	10.0			
	NAPL Source Length [ft]	10.0			
	Contaminated Aquifer Thickness [ft]	5.0			
NAPL Component	*% of NAPL*				
PCE	0.01				
TCE	0.01				
cis-DCE	0.00				
	Oxygen [mg/L]	*Nitrate [mg/L]*	*Mn(IV) [mg/kg]*	*Iron(III) [mg/kg]*	*Sulfate [mg/L]*
Background EA Conc.	0.0	0.0	NS	100.0	0.0
	Average				
NAPL Mass [kg]	0.1				
	Plan 1				
% NAPL Removed	None				
	Maximum Time of Analysis [yr]	100			
	SCC [µg/L]				
Total Chl. Eth.	0.5				
	NAPL Mass (PCE) [kg]	*Source Removal Plan Plan 1 0% Rem'd*			
PCE	0.1	36.7			

MODEL OUTPUT FOR TETRACHLOROETHANE, TRICHLOROETHENE, 1,2-DICHLOROETHENE, AND VINYL CHLORIDE, SITE 16, FORMER UST

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Facility Name:	Alameda Point	***Length:***	feet
Site Name:	Site 16, OU-1	***Time:***	days
Additional Description:	Chl. eth. plume near former UST	***Mass:***	kilograms

Hydrogeologic Data and Contaminant Transport Calculations

	Maximum	*Average*	*Minimum*		*Value*
Hydr. Conductivity [ft/d]	2.8	2.8	2.8	*Estimated Plume Length [ft]*	222.7
Hydraulic Gradient [ft/ft]	0.0013	0.0013	0.0013	*Longitudinal Dispersivity [ft]*	11.74
Total Porosity [-]		0.4		*Dispersivity Ratio [-]*	20.0
Effective Porosity [-]		0.25		*Contaminated Aquifer*	
Groundwater Vel. [ft/d]	0.015	0.015	0.015	*Thickness [ft]*	20.0

Contaminant Data (December 2002)

Well Name	*Distance [ft]*	*PCE [µg/L]*	*TCE [µg/L]*	*cis-DCE [µg/L]*	*Vinyl Chl. [µg/L]*	*Total Chl. Eth. [µg/L]*
MW2	0.0	59	34	92	0.5	185.5
CA09-03	32.0	9.8	5.4	95	21	131.2
MW3	55.0	4	4	100	4	112
DP12	180.0	1.6	0.4	0.5	BD	2.5

Redox Data (June 2002)

Well Name	*Distance [ft]*	*Oxygen [mg/L]*	*Nitrate [mg/L]*	*Iron(II) [mg/L]*	*Sulfate [mg/L]*	*Methane [mg/L]*
MW2	0.0	BD	BD	0.03	12	0.04
CA09-03	32.0	NS	NS	NS	NS	NS
MW3	55.0	NS	NS	NS	NS	NS
DP12	180.0	NS	NS	NS	NS	NS

MODEL OUTPUT FOR TETRACHLOROETHANE, TRICHLOROETHENE, 1,2-DICHLOROETHENE, AND VINYL CHLORIDE, SITE 16, FORMER UST

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Sorption Parameters					
Fraction Org. Carbon [-]					
	Maximum	0.004			
	Average	0.004			
	Minimum	0.004			
		PCE	*TCE*	*cis-DCE*	*Vinyl Chl.*
Koc [L/kg]		364	126	24	57
Retardation Factor [-]					
	Maximum	10.26	4.21	1.61	2.45
	Average	10.26	4.21	1.61	2.45
	Minimum	10.26	4.21	1.61	2.45

Attenuation Rates						
		Total Chl. Eth.	*PCE*	*TCE*	*cis-DCE*	*Vinyl Chl.*
NAC (Single Zone) [1/ft]		0.0252	0.0169	0.0222	0.0424	0.0721
Decay Rate [1/d]						
	Maximum	0.0005	0.0003	0.0004	0.0009	0.0015
	Average	0.0005	0.0003	0.0004	0.0009	0.0015
	Minimum	0.0005	0.0003	0.0004	0.0009	0.0015
NAC (Zone 1) [1/ft]		0.0108	0.0561	0.0575	0.0424 (Est.)	0.0721 (Est.)
Decay Rate [1/d]						
	Maximum	0.0002	0.0013	0.0012	0.0009	0.0015
	Average	0.0002	0.0013	0.0012	0.0009	0.0015
	Minimum	0.0002	0.0013	0.0012	0.0009	0.0015
NAC (Zone 2) [1/ft]		0.0304	0.0073	0.0184	0.0424	0.0721 (Est.)
Decay Rate [1/d]						
	Maximum	0.0006	0.0001	0.0003	0.0009	0.0015
	Average	0.0006	0.0001	0.0003	0.0009	0.0015
	Minimum	0.0006	0.0001	0.0003	0.0009	0.0015

MODEL OUTPUT FOR TETRACHLOROETHANE, TRICHLOROETHENE, 1,2-DICHLOROETHENE, AND VINYL CHLORIDE, SITE 16, FORMER UST

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Time of Stabilization(TOS) and Max Source Conc. Calculations

	Distance to POC [1/ft]	10.0				
	Estimated Source Width [ft]	10.0				
		Source Concentration [µg/L]				*TOS [years]*
	RCC [µg/L]	*Well*	*Current*	*Target*	*Maximum*	*Average*
Total Chl. Eth.	0.5	1	186	1	5.0	5.0

Time of Remediation(TOR) Calculations

	NAPL Source Width [ft]	10.0			
	NAPL Source Length [ft]	10.0			
	Contaminated Aquifer Thickness [ft]	20.0			
NAPL Component	*% of NAPL*				
PCE	0.01				
TCE	0.00				
cis-DCE	0.00				
	Oxygen [mg/L]	*Nitrate [mg/L]*	*Mn(IV) [mg/kg]*	*Iron(III) [mg/kg]*	*Sulfate [mg/L]*
Background EA Conc.	0.0	0.0	NS	100.0	0.0
	Average				
NAPL Mass [kg]	0.1				
	Plan 1				
% NAPL Removed	None				
	Maximum Time of Analysis [yr]	100			
	SCC [µg/L]				
Total Chl. Eth.	0.5				
	NAPL Mass (PCE) [kg]	*Source Removal Plan Plan 1 0% Rem'd*			
PCE	0.1	64.2			

MODEL OUTPUT FOR TRICHLOROETHENE, 1,2-DICHLOROETHENE, AND VINYL CHLORIDE, SITE 16, SCRAP YARD

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Facility Name:	Alameda Point	***Length:***	feet
Site Name:	Site 16, OU-1	***Time:***	days
Additional Description:	Solvent Plume, near Scrap Yard	***Mass:***	kilograms

Hydrogeologic Data and Contaminant Transport Calculations

	Maximum	*Average*	*Minimum*		*Value*
Hydr. Conductivity [ft/d]	2.8	2.8	2.8	*Estimated Plume Length [ft]*	514.7
Hydraulic Gradient [ft/ft]	0.0013	0.0013	0.0013	*Longitudinal Dispersivity [ft]*	18.18
Total Porosity [-]		0.4		*Dispersivity Ratio [-]*	20.0
Effective Porosity [-]		0.25		*Contaminated Aquifer*	
Groundwater Vel. [ft/d]	0.015	0.015	0.015	*Thickness [ft]*	200.0

Contaminant Data (April 2002)

Well Name	*Distance [ft]*	*TCE [µg/L]*	*cis-DCE [µg/L]*	*Vinyl Chl. [µg/L]*	*Total Chl. Eth. [µg/L]*
DP17	0.0	7.1	18	0.3	25.4
DP30	220.0	6	49	1	56
DP37	380.0	3	190	2	195
DP41	510.0	0.1	1	0.1	1.2

Redox Data (April 2002)

Well Name	*Distance [ft]*	*Oxygen [mg/L]*	*Nitrate [mg/L]*	*Iron(II) [mg/L]*	*Sulfate [mg/L]*	*Methane [mg/L]*	*Redox Condition*
DP17	0.0	NS	NS	NS	NS	NS	SO4/CO2-red.
DP30	220.0	NS	NS	NS	NS	NS	SO4/CO2-red.
DP37	380.0	NS	NS	NS	NS	NS	Ferrogenic
DP41	510.0	NS	NS	NS	NS	NS	Ferrogenic

Sorption Parameters

Fraction Org. Carbon [-]	
Maximum	0.004
Average	0.004
Minimum	0.004

MODEL OUTPUT FOR TRICHLOROETHENE, 1,2-DICHLOROETHENE, AND VINYL CHLORIDE, SITE 16, SCRAP YARD

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

		TCE	cis-DCE	Vinyl Chl.
Koc [L/kg]		126	24	57
Retardation Factor [-]				
	Maximum	4.21	1.61	2.45
	Average	4.21	1.61	2.45
	Minimum	4.21	1.61	2.45

Attenuation Rates

		Total Chl. Eth.	TCE	cis-DCE	Vinyl Chl.
NAC (Single Zone) [1/ft]		0.0392	0.0074	0.0404	0.023
Decay Rate [1/d]					
	Maximum	0.001	0.0001	0.001	0.0005
	Average	0.001	0.0001	0.001	0.0005
	Minimum	0.001	0.0001	0.001	0.0005
NAC (Zone 1) [1/ft]		0.0392 (Est.)	0.0008	0.0404 (Est.)	0.023 (Est.)
Decay Rate [1/d]					
	Maximum	0.001	0.000	0.001	0.0005
	Average	0.001	0.000	0.001	0.0005
	Minimum	0.001	0.000	0.001	0.0005
NAC (Zone 2) [1/ft]		0.0392	0.0262	0.0404	0.023
Decay Rate [1/d]					
	Maximum	0.001	0.0005	0.001	0.0005
	Average	0.001	0.0005	0.001	0.0005
	Minimum	0.001	0.0005	0.001	0.0005

Time of Stabilization(TOS) and Max Source Conc. Calculations

Distance to POC [1/ft]	390.0
Estimated Source Width [ft]	200.0

		Source Concentration [µg/L]			TOS [years]		
	RCC [µg/L]	*Well*	*Current*	*Target*	*Maximum*	*Average*	*Minimum*
Total Chl. Eth.	0.5	3	195	17	127.3	127.3	127.3

MODEL OUTPUT FOR TRICHLOROETHENE, 1,2-DICHLOROETHENE, AND VINYL CHLORIDE, SITE 16, SCRAP YARD

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Time of Remediation(TOR) Calculations

	NAPL Source Width [ft]	10.0
	NAPL Source Length [ft]	10.0
	Contaminated Aquifer Thickness [ft]	20.0

NAPL Component	*% of NAPL*
TCE	0.01
cis-DCE	0.00

	Oxygen [mg/L]	*Nitrate [mg/L]*	*Mn(IV) [mg/kg]*	*Iron(III) [mg/kg]*	*Sulfate [mg/L]*
Background EA Conc.	0.0	0.0	NS	100.0	0.0

	Average
NAPL Mass [kg]	0.1

	Plan 1
% NAPL Removed	None

	Maximum Time of Analysis [yr]	100

	SCC [µg/L]
Total Chl. Eth.	0.5

	NAPL Mass (TCE) [kg]	*Source Removal Plan Plan 1 0% Rem'd*
TCE	0.1	63.0

MODEL OUTPUT FOR 1,3-DICHLOROBENZENE, SITE 16, SCRAP YARD

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Facility Name:	Alameda Point	***Length:***	feet
Site Name:	Site 16, OU-1	***Time:***	days
Additional Description:	1,3-DCB	***Mass:***	kilograms

Hydrogeologic Data and Contaminant Transport Calculations

	Maximum	*Average*	*Minimum*		*Value*
Hydr. Conductivity [ft/d]	2.8	2.8	2.8	*Estimated Plume Length [ft]*	232.8
Hydraulic Gradient [ft/ft]	0.0013	0.0013	0.0013	*Longitudinal Dispersivity [ft]*	12.04
Total Porosity [-]		0.4		*Dispersivity Ratio [-]*	20.0
Effective Porosity [-]		0.25		*Contaminated Aquifer*	
Groundwater Vel. [ft/d]	0.015	0.015	0.015	*Thickness [ft]*	20.0

Contaminant Data (December 2002)

Well Name	*Distance [ft]*	1,3-DCB *[µg/L]*
DP34	0.0	1000
DP01	138.0	700
MWC2-2	163.0	55
DP19	178.0	0.1

Redox Data (December 2002)

Well Name	*Distance [ft]*	*Oxygen [mg/L]*	*Nitrate [mg/L]*	*Iron(II) [mg/L]*	*Sulfate [mg/L]*	*Methane [mg/L]*	*Redox Condition*
DP34	0.0	NS	NS	NS	NS	NS	SO4/CO2-red.
DP01	138.0	NS	NS	NS	NS	NS	SO4/CO2-red.
MWC2-2	163.0	1.09	0.12	1.01	350	0.014	Oxic
DP19	178.0	NS	NS	NS	NS	NS	Oxic

MODEL OUTPUT FOR 1,3-DICHLOROBENZENE, SITE 16, SCRAP YARD

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Sorption Parameters		
Fraction Org. Carbon [-]		
	Maximum	0.004
	Average	0.004
	Minimum	0.004
		1,3-DCB
Koc [L/kg]		126
Retardation Factor [-]		
	Maximum	4.21
	Average	4.21
	Minimum	4.21

Attenuation Rates		
		1,3-DCB
NAC (Single Zone) [1/ft]		0.0335
Decay Rate [1/d]		
	Maximum	0.0007
	Average	0.0007
	Minimum	0.0007
NAC (Zone 1) [1/ft]		0.0026
Decay Rate [1/d]		
	Maximum	0.000
	Average	0.000
	Minimum	0.000
NAC (Zone 2) [1/ft]		0.4207
Decay Rate [1/d]		
	Maximum	0.0371
	Average	0.0371
	Minimum	0.0371

Time of Stabilization(TOS) and Max Source Conc. Calculations

Distance to POC [1/ft]	170.0
Estimated Source Width [ft]	100.0

		Source Concentration [µg/L]				*TOS [years]*	
	RCC [µg/L]	*Well*	*Current*	*Target*	*Maximum*	*Average*	*Minimum*
1,3-DCB	5.5	1	1000	None Req'd	N/A	N/A	N/A

MODEL OUTPUT FOR 1,3-DICHLOROBENZENE, SITE 16, SCRAP YARD

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Time of Remediation(TOR) Calculations

	NAPL Source Width [ft]	10.0
	NAPL Source Length [ft]	10.0
	Contaminated Aquifer Thickness [ft]	20.0

NAPL Component	*% of NAPL*
1,3-DCB	0.01

	Oxygen [mg/L]	*Nitrate [mg/L]*	*Mn(IV) [mg/kg]*	*Iron(III) [mg/kg]*	*Sulfate [mg/L]*
Background EA Conc.	0.0	0.0	NS	100.0	0.0

	Average
NAPL Mass [kg]	0.1

	Plan 1
% NAPL Removed	None

	Maximum Time of Analysis [yr]	100

	SCC [µg/L]
1,3-DCB	5.5

	NAPL Mass (1,3-DCB) [kg]	*Source Removal Plan Plan 1 0% Rem'd*
1,3-DCB	0.1	100+

MODEL OUTPUT FOR 1,4-DICHLOROBENZENE, SITE 16, SCRAP YARD

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Facility Name:	Alameda Point	***Length:***	feet
Site Name:	Site 16, OU-1	***Time:***	days
Additional Description:	1,4-DCB	***Mass:***	kilograms

Hydrogeologic Data and Contaminant Transport Calculations

	Maximum	*Average*	*Minimum*		*Value*
Hydr. Conductivity [ft/d]	2.8	2.8	2.8	*Estimated Plume Length [ft]*	355.1
Hydraulic Gradient [ft/ft]	0.0013	0.0013	0.0013	*Longitudinal Dispersivity [ft]*	15.12
Total Porosity [-]		0.4		*Dispersivity Ratio [-]*	20.0
Effective Porosity [-]		0.25		*Contaminated Aquifer*	
Groundwater Vel. [ft/d]	0.015	0.015	0.015	*Thickness [ft]*	20.0

Contaminant Data (December 2002)

Well Name	*Distance [ft]*	*1,4-DCB [µg/L]*
DP34	0.0	2700
DP01	138.0	3100
MWC2-2	163.0	280
DP15	195.0	170
DP19	252.0	96
DP22	302.0	13
DP28	402.0	0.1

Redox Data (December 2002)

Well Name	*Distance [ft]*	*Oxygen [mg/L]*	*Nitrate [mg/L]*	*Iron(II) [mg/L]*	*Sulfate [mg/L]*	*Methane [mg/L]*	*Redox Condition*
DP34	0.0	0.4	NS	NS	NS	NS	Oxic
DP01	138.0	0.4	NS	NS	NS	NS	Oxic
MWC2-2	163.0	1.09	0.12	1.01	350	0.014	Oxic
DP15	195.0	0.4	NS	NS	NS	NS	SO4/CO2-red.
DP19	252.0	0.4	NS	NS	NS	NS	SO4/CO2-red.
DP22	302.0	0.4	NS	NS	NS	NS	SO4/CO2-red.
DP28	402.0	0.4	NS	NS	NS	NS	SO4/CO2-red.

MODEL OUTPUT FOR TRICHLOROETHENE, 1,2-DICHLOROETHENE, AND VINYL CHLORIDE, SITE 16, SCRAP YARD

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Facility Name:	Alameda Point	***Length:***	feet
Site Name:	Site 16, OU-1	***Time:***	days
Additional Description:	Solvent Plume, near Scrap Yard	***Mass:***	kilograms

Hydrogeologic Data and Contaminant Transport Calculations

	Maximum	*Average*	*Minimum*		*Value*
Hydr. Conductivity [ft/d]	2.8	2.8	2.8	*Estimated Plume Length [ft]*	514.7
Hydraulic Gradient [ft/ft]	0.0013	0.0013	0.0013	*Longitudinal Dispersivity [ft]*	18.18
Total Porosity [-]		0.4		*Dispersivity Ratio [-]*	20.0
Effective Porosity [-]		0.25		*Contaminated Aquifer*	
Groundwater Vel. [ft/d]	0.015	0.015	0.015	*Thickness [ft]*	200.0

Contaminant Data (April 2002)

Well Name	*Distance [ft]*	*TCE [µg/L]*	*cis-DCE [µg/L]*	*Vinyl Chl. [µg/L]*	*Total Chl. Eth. [µg/L]*
DP17	0.0	7.1	18	0.3	25.4
DP30	220.0	6	49	1	56
DP37	380.0	3	190	2	195
DP41	510.0	0.1	1	0.1	1.2

Redox Data (April 2002)

Well Name	*Distance [ft]*	*Oxygen [mg/L]*	*Nitrate [mg/L]*	*Iron(II) [mg/L]*	*Sulfate [mg/L]*	*Methane [mg/L]*	*Redox Condition*
DP17	0.0	NS	NS	NS	NS	NS	SO4/CO2-red.
DP30	220.0	NS	NS	NS	NS	NS	SO4/CO2-red.
DP37	380.0	NS	NS	NS	NS	NS	Ferrogenic
DP41	510.0	NS	NS	NS	NS	NS	Ferrogenic

Sorption Parameters

Fraction Org. Carbon [-]	
Maximum	0.004
Average	0.004
Minimum	0.004

MODEL OUTPUT FOR 1,4-DICHLOROBENZENE, SITE 16, SCRAP YARD

Draft Final Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8 and 16, Alameda Point, Alameda, California

Time of Stabilization(TOS) and Max Source Conc. Calculations

	Distance to POC [1/ft]	140.0					
	Estimated Source Width [ft]	150.0					
		Source Concentration [µg/L]				*TOS [years]*	
	RCC [µg/L]	*Well*	*Current*	*Target*	*Maximum*	*Average*	*Minimum*
1,4-DCB	5.5	2	3100	7	54.0	54.0	54.0

Time of Remediation(TOR) Calculations

	NAPL Source Width [ft]	10.0				
	NAPL Source Length [ft]	10.0				
	Contaminated Aquifer Thickness [ft	20.0				
NAPL Component	*% of NAPL*					
1,4-DCB	0.01					
cis-DCE	0.00					
	Oxygen [mg/L]	*Nitrate [mg/L]*	*Mn(IV) [mg/kg]*	*Iron(III) [mg/kg]*	*Sulfate [mg/L]*	
Background EA Conc.	0.0	0.0	NS	100.0	0.0	
	Average					
NAPL Mass [kg]	0.1					
	Plan 1					
% NAPL Removed	None					
	Maximum Time of Analysis [yr]	100				
	SCC [µg/L]					
1,4-DCB	5.0					
	NAPL Mass (1,4-DCB) [kg]	*Source Removal Plan Plan 1 0% Rem'd*				
1,4-DCB	0.1	15.9				

APPENDIX D
RESPONSES TO COMMENTS ON THE DRAFT FEASIBILITY STUDY REPORT

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RESPONSES TO REGULATORY AGENCY COMMENTS ON THE DRAFT FEASIBILITY STUDY REPORT, OPERABLE UNIT 1 SITES 6, 7, 8, AND 16, ALAMEDA POINT, ALAMEDA, CALIFORNIA

This document presents the U.S. Department of the Navy's (Navy) responses to xx comments from the regulatory agencies on the "Draft Feasibility Study Report, Operable Unit 1, Sites 6, 7, 8, and 16, Alameda Point, Alameda, California" [Draft FS Report], dated December 1, 2004. The Navy received 121 comments from the U.S. Environmental Protection Agency (EPA) and 46 comments from EPA's Office of Regional Counsel (ORC) on March 17, 2005; and 53 comments from the Department of Toxic Substances Control (DTSC) on March 18, 2005.

RESPONSES TO COMMENTS FROM EPA

General Comments

1. **Comment:** **The executive summary of an FS should give the reader a snap shot of what to expect in the document. This is especially crucial in a complicated document like this one that involves 4 sites, 2 media, and multiple contaminants. It would be helpful to have in the executive summary a short paragraph on each site summarizing the nature of the site, the anticipated reuse, and what COCs the Navy intends to address at the site. EPA recommends explaining at the beginning that even though the soil near the OWSs has not been characterized, the FS evaluates remedies to address contamination that may be found during the characterization of these areas.**

   Response: The Executive Summary was revised to include a short paragraph on each site summarizing the nature of the site, the anticipated reuse, and what chemicals of concern (COC) the Navy intends to address at the site. A revision was also made to address the characterization of soil located adjacent to each relevant oil-water separator (OWS).

2. **Comment:** **Please remove the phrase "groundwater contaminant examination" from this document. This phrase appears synonymous with monitored natural attenuation, and the accepted "monitored natural attenuation" should be used instead. Regardless of what it is called, MNA still requires that certain conditions be met, i.e. lines of evidence be shown, before it can be selected as a remedial alternative.**

   Response: The phrase "groundwater contaminant examination" was replaced with "monitored natural attenuation" or "groundwater monitoring," as appropriate, throughout the document.

3. **Comment:** **The discussion regarding PAHs is often incorrectly presented in the document. PAHs in deep soil, i.e below 8 ft bgs, are attributed to the Marsh Crust which currently has an ordinance in place to restrict exposure to this layer of PAHs. PAHs in soil from 0 - 8 feet are attributed to dredged sediment used to create most of Alameda Point and there is no ordinance or other form of remedy in place to protect exposure to receptors from PAHs at these depths. Therefore, PAHs from 0 - 8 feet bgs at all sites need to be evaluated for potential risk. If the average exposure concentration across a site is 0.62 mg/kg BaP eq in the 0-8 foot range, and if no single sample point in the 0- 8 foot range is above 1.0 mg/kg, then the PAHs pass the screening criteria. If the average is above 0.62 mg/kg BaP eq. or if there is a hit above 1.0 mg/kg, then PAHs at the specific site need to be evaluated for risk and potential remedial action. Please correct to reflect this approach throughout the document.**

Response: The risk from exposure to polynuclear aromatic hydrocarbons (PAH) in the entire 0 to 8-foot soil column was evaluated for potential risk at all sites in the remedial investigation (RI) report (Tetra Tech EM Inc. [Tetra Tech] 2004). The purpose of the discussions in the Draft FS Report is to consider the need for remedial action at each site. These discussions were revised to restrict the application of the Marsh Crust Ordinance to Site 7 because the ordinance addresses PAH contamination to depths as shallow as 5 feet below ground surface (bgs) at Site 7. The ordinance will not be applied at the other Alameda sites since it is applicable to PAH contamination only at depths greater than 8 feet bgs at these sites where some PAH was found at shallower depths.

4. **Comment:** **EPA requests that the inhalation concentrations used for remediation goals be those presented by the State of California in their January 2005 document "Use of California Human Health Screening Levels in Evaluation of Contaminated Properties", specifically the information contained in Table 2. (see enclosure)**

Response: The Navy does not believe that the direct use of screening levels is an appropriate method for deriving cleanup goals. In the Draft FS Report, site-specific cleanup goals based on Johnson and Ettinger model calculations were developed for the indoor vapor intrusion pathway. EPA toxicity criteria and site-specific parameters were used as inputs to the model. The Navy used the model parameters in the referenced State of California document as default parameters in the Draft FS report, as appropriate, to derive goals for the inhalation pathway (EPA 2003).

5. **Comment:** **The FS uses a duration of 100 years for LUCs for soil alternatives; however, the basis for this period is unclear. The duration selected for comparative analysis of alternatives should be the time to achieve**

remedial goals. It is unclear if the Navy anticipates that soil contaminants will reach remedial goals in 100 years. An explanation should be provided whenever the period of analysis is less than the time to achieve remedial goals. Please revise the FS to clarify the basis for the 100-year duration of LUCs for soil remedies.

Response: Section 5.3.1.2. of the FS Report was revised to clarify the basis for the time period of 100 years for institutional controls (IC). ICs would be in place indefinitely; however, for the purpose of cost comparison, ICs are assumed to last 100 years.

6. **Comment:** **Appendix C includes costs for groundwater alternatives 3A, 3B, 4A, and 4B, but the text does not include these designations and only presents Alternative 3 and Alternative 4. Since the components of these subalternatives, the timeframes to achieve cleanup, and the costs are different, the alternatives should be presented separately in the text as Alternative 3A, Alternative 3B, Alternative 4A, and Alternative 4B and then evaluated separately. Please make this change.**

Response: Appendix C was revised as requested.

7. **Comment:** **EPA greatly appreciates the focused ARARs discussion in this FS.**

Response: Comment noted.

Specific Comments

1. **Comment:** **<u>ES-1, Soil bullets</u>: Please note that Site 7 will include further characterization of the soil debris area in addition to remediation of the soil debris area.**

Response: The Executive Summary was revised include further characterization of the soil debris area.

2. **Comment:** **<u>ES-1, Groundwater bullets</u>: Add two more bullets explaining that groundwater beneath the OWSs at Sites 7 and 8 will be sampled for VOCs, SVOCs, metals and pesticides. If the sampling results show groundwater contamination, remediation of groundwater will be evaluated.**

Response: The Executive Summary was revised to explain that groundwater beneath the OWSs at Sites 7 and 8 will be sampled for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), metals, and pesticides. The revisions state that remediation of groundwater will be evaluated if sampling results indicate groundwater contamination.

3. **Comment:** **<u>Page ES-3</u>: Site 16 RAOs need to be MCLs because the groundwater in this location is a potential and possibly current source of drinking water. MCLs will be ARARs regardless of the potential future reuse of the property in this location.**

Response: The Executive Summary was revised to include maximum contaminant levels (MCL) as the cleanup goal for the Site 16 remedial action objectives (RAO). MCLs will be addressed as an applicable or relevant and appropriate requirement (ARAR).

4. **Comment:** **<u>ES-3, last paragraph</u>: Please explain why California MCLs were selected as remediation goals. In addition, please explain why vinyl chloride is not included with PCE and TCE as an inhalation threat, given its presence at Site 6 and 16. EPA requests that the inhalation concentrations used for remediation goals be those presented by the State of California in their January 2005 document "Use of California Human Health Screening Levels in Evaluation of Contaminated Properties", specifically the information contained in Table 2. (see enclosure)**

Response: The Executive Summary was revised to state that the most conservative of either federal or State of California MCLs were used as cleanup goals for drinking water. As stated previously, the Navy does not agree that the direct use of screening levels is an appropriate method for deriving remediation goals.

5. **Comment:** **<u>Executive Summary, Page ES-6</u>: In the Executive Summary, the durations of groundwater remedial alternatives are reported as 40 years, 30 years and up to 5 years for Alternatives 2, 3, and 4 respectively, to attain domestic use remedial goals; however, in the text of the FS and in the cost estimates, 30 years is used as the duration for Alternative 2. Furthermore, the Executive Summary concludes that the 30 and 5 year time-frames for Alternatives 3 and 4 are shorter than the time-frame for Alternative 2, but the time frame used for Alternative 2 in the body of the FS is the same as that for Alternative 3: 30 years. Please revise the FS to correct this discrepancy.**

Response: The FS Report was revised to resolve these discrepancies.

6. **Comment:** **<u>Page 1-1, second paragraph</u>: It would be more accurate to say that the RI/FS work for Site 14 and 15 was put on a faster track than Sites 6, 7, 8 and 16. Site 15 has a completed RI and FS, but the Site 14 FS is not yet complete.**

Response: The RI Report was revised to reflect the current status of sites in Operable Unit (OU)-1.

7. **Comment:** **<u>Section 2.1, Installation History, Page 2-1</u>: The text in the first paragraph states that the first documented filling of the subtidal lands "began some time during the 1890s" but the text of the first full paragraph on page 2-2 and the text of the second bullet on page 2-3 indicate that this filling began in 1887. Please resolve this discrepancy and revise the text as necessary.**

Response: The discrepancy was resolved, and Section 2.1 was revised to indicate that filling began in 1887.

8. **Comment:** **<u>Section 2.1, Installation History, Pages 2-1 and 2-2</u>: The installation history does not include the date Alameda Point was placed on the National Priorities List (NPL). Please include this date in the text.**

Response: Section 2.1 was revised to include the date.

9. **Comment:** **<u>Section 2.3, Geology, Page 2-3</u>: The text of the first bullet indicates that the Marsh Crust layer "was formed by petroleum wastes," but EPA comments on the OU-1 Remedial Investigation (RI) Report indicated that EPA would prefer that the text state that the Marsh Crust is associated with refinery and coal gasification wastes so that readers will not assume that the polynuclear aromatic hydrocarbon (PAH) problem is related to the total petroleum hydrocarbon (TPH) program rather than to CERCLA. Please revise the text to state that the Marsh Crust is associated with refinery and coal gasification wastes.**

Response: Section 2.3 was revised to reflect that the Marsh Crust is associated with refinery and coal gasification wastes.

10. **Comment:** **<u>Section 2.3.3, Site 8 Geology, Page 2-5</u>: The text does not include a description of the artificial fill between the surface and 6 feet below ground surface (ft bgs), but does include a description of the fill between 6 and 10 feet bgs. Please include a description of the artificial fill materials between the surface and 6 ft bgs at Site 8.**

Response: Section 2.3.3 was revised to describe the artificial fill between the surface and 6 to 10 feet bgs.

11. **Comment:** **<u>Page 2-9, first paragraph</u>: The statements in this paragraph are incorrect. Groundwater beneath Sites 6 and 8 meets the federal definition of a Class II aquifer which means it is a potential drinking**

water source. However, due to the many factors described in the "Beneficial Uses of Groundwater" document for Alameda Point (Navy, 2000), the water is unlikely to be used as a drinking water source in the future which means that there is some flexibility in applying MCLs as ARARs for CERCLA cleanup purposes.

Response: The text was revised to state the regulatory agencies view on the potential beneficial use of groundwater at Alameda Point.

12. **Comment:** **<u>Page 2-9, second paragraph</u>: Please note that the groundwater beneath Site 16 is correctly stated as being a Class II aquifer that is possibly a current drinking water source (due to the existence of close off-base wells). In this instance MCLs do apply as ARARs, regardless of future property use.**

Response: The Navy agrees that MCLs do apply as ARARs at Site 16, and the FS Report was revised accordingly (see Section 8.1.3.1).

13. **Comment:** **<u>Page 2-11, last bullet</u>: Please confirm that the stated reuses for Site 6, 8 and 16 are as stated in this bullet. EPA is under the impression that Site 16 is slated for residential and that Site 6 and 8 are also likely targeted for residential (or mixed use, which includes residential).**

Response: The stated reuses are correct.

14. **Comment:** **<u>Table 2-1, Site History, Planned Reuse, and Beneficial Groundwater Uses</u>: This table indicates that the potential future land reuse for Site 6 is recreational and commercial/industrial, and for Site 16 it is recreational. However, both Site 6 and 16 are shown in areas identified as "housing opportunities" on Figure 2–6, Planned Reuse Areas. Please clarify if residential use is possible in the future at Site 6 and 16 and add residential use to Table 2-1 as appropriate.**

Response: The stated reuses are correct.

15. **Comment:** **<u>Section 3.0, Remedial Investigation Summary and Recommendations</u>: It appears that the words "contaminant" and "contaminate" have been used interchangeably. For example, "contaminate" was used where "contaminant" should have been used in the second to the last sentence in Section 3.2, and in the last paragraph of the subsection titled "Soil" on page 3-7. Please revise the text to use the correct terminology.**

Response: Section 3.0 was revised so that the word "contaminant" is consistently used.

16. **Comment:** **<u>Page 3-2, sentence that reads</u> "For metals, screening levels were based on the maximum concentration detected in ambient soil or groundwater." EPA strongly disagrees with this method of screening and asks that the Navy perform a comparison of the distribution of each metal contaminant in the background data set with the distribution of each contaminant in the site data set. The distributions for each data set should be close in value in order to claim that a site metal concentration level is due to background. In addition, outlier tests should be performed on the site data to ensure that potential hot spots are not being overlooked by "averaging" them in with the rest of the data.**

Response: The text cited was not intended to describe the method used to determine if a chemical was part of background or not. Rather, the text describes the numerical value used in screen levels for comparison purposes on the figures. The determination of background chemicals was fully described in the RI report and included a two-population comparison test, as described in the comment above (Tetra Tech 2004). The text was revised to remove any confusion.

17. **Comment:** **<u>Page 3-2, second paragraph</u>: Please note that the regulatory agencies did not agree with the risk assessment results for the RI and believe that the risk is probably underestimated at each site.**

Response: Section 3.1.2 was revised to include the regulatory agencies' concerns.

18. **Comment:** **<u>Page 3-3, Section 3.1.2, second paragraph</u>: Even though the groundwater beneath Site 7 is a Class III aquifer according to federal guidelines and therefore not subject to MCLs as ARARs, protection of this groundwater may be required under Regional Board regulations. Further, it is incorrect to state that there is no contamination in groundwater beneath Site 7. Arsenic levels are an order of magnitude above the background level, and therefore appear attributable to site activities. In addition, arsenic is a COC in the soil, further indication that the groundwater contamination is due to site activities. EPA requests that the Navy acknowledge that arsenic is a contaminant above background range in groundwater at Site 7 and correct all references in the FS document that state otherwise. Further, TPH is a problem at Site 7 and that fact, even though outside of the CERCLA cleanup, should be mentioned.**

Response: Section 3.1.2 was revised to indicate arsenic is being considered Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) contamination is present in groundwater at Site 7. Arsenic in groundwater at Site 7 does not appear to be related to arsenic in the soil debris area. There is no correlation between arsenic in

groundwater and arsenic in the soil debris area. The FS Report was revised to clarify this point. Section 3.1.2 also was revised to acknowledge TPH contamination is present at Site 7 and that cleanup is ongoing.

19. **Comment:** **<u>Page 3-3, Residential Scenario</u>: Ingestion of homegrown produce should be included as an exposure pathway for the residential scenario to be consistent with evaluation of other sites on the base.**

Response: The text was revised to indicate the ingestion of homegrown produce was included as an exposure pathway in the HHRA.

20. **Comment:** **<u>Page 3-4, first paragraph</u>: A brief discussion of the limitations of the data set used in the risk assessment would be helpful either here or in the beginning of the risk assessment portions. The useability of the data was limited by many of the sample analyses having detection limits set above the PRGs, in some cases substantially above the PRGs. This problem means that the data set falls short of doing an adequate job characterizing the sites and results in data gaps which the Navy has agreed to investigate as part of the RD/RA. It also explains why the regulators believe the risks may be underestimated.**

Response: The limitations of the data set are discussed in Section 3.1.2, as described in EPA Specific Comment 17.

21. **Comment:** **<u>Page 3-4, Section 3.1.3</u>: Please explain why storm sewer lines and associated bedding material were not considered preferential pathways for contaminants in groundwater to the Seaplane Lagoon and the Bay, or alternatively, rephrase this section to state that the clean up of groundwater will eliminate any concerns regarding potential migration of contaminated groundwater to an aquatic receptor.**

Response: Section 3.1.3 was revised to explain that storm sewer lines and surrounding soil (bedding material) have been investigated during numerous prior investigations. There is no indication that a separate bedding material (other than native soil material) was used in the construction of these storm sewer lines. Consequently, the Navy does not believe that these lines represent a preferential pathway, unless a segment of storm sewer line below the groundwater table breaks.

22. **Comment:** **<u>Page 3-5, Section 3.1.4, last sentence</u>: Please clarify this sentence to explain that the only site with a comingled TPH and CERCLA plume is Site 16, and the plumes will be handled under the CERCLA cleanup.**

Response: Section 3.1.4 was revised to explain that Site 16 is the only site with a commingled TPH and CERCLA plume and that the plume at Site 16 will be addressed by the CERCLA cleanup.

23. **Comment:** **<u>Section 3.1.5, Approach to Risk Management Decisions, Page 3-5</u>: Sites are evaluated in this FS if the total site risk is greater than 1E-06 or the Hazard Index (HI) is greater than 1, but lead does not appear to fit either of these categories. Please revise this section to clarify the approach to risk management decisions for lead contamination at OU 1 sites.**

Response: Section 3.1.5 was revised to state that LeadSpread model was used to evaluate potential exposures to lead at the OU-1 sites. Additionally, text was added to clarify the approach used for risk management decisions for lead.

24. **Comment:** **<u>Page 3-8, second paragraph</u>: Please confirm that the detection limits for Bis(2-chloroethyl)ether in all 35 samples were below the PRGs, or if this is not the case, the sentence should be qualified to explain why this contaminant is not a concern.**

Response: The text was revised to indicate that the maximum detection limit for this chemical is in accordance with Contract Laboratory Program methods and that this detection limit exceeds the preliminary remediation goals (PRG).

25. **Comment:** **<u>Page 3-8, third paragraph</u>: Please clarify what is meant by the phrase "do not appear to be migrating off site...". Does this refer to Site 6 or to Alameda Point?**

Response: This text was revised to clarify that this phrase refers only to Site 6.

26. **Comment:** **<u>Page 3-10, Section 3.2.2.2</u>: The potential for bedding material around the storm sewer lines to act as a preferential pathway should be evaluated here, or alternatively, an explanation given that groundwater will be remediated to levels that no longer pose a threat to aquatic receptors even if the bedding material presents a preferential pathway out to the Bay.**

Response: Section 3.2.2.2 was revised to reflect that bedding material around the storm sewer lines has been evaluated, and there is no indication that the bedding material has significantly different hydraulic properties than surrounding soil material.

27. **Comment:** **<u>Section 3.2.2.2, Ecological Risk Assessment Results, Page 3-10 and Section 3.2.3, Risk Management Decisions, Page 3-10</u>: The text in these two sections contains a contradiction. In Section 3.2.2.2, the text states that "the ERA results indicated that none of the chemicals in soil or groundwater pose significant risk to ecological receptors," but the text in Section 3.2.3 states that, "No action is recommended for chemicals that pose a risk only to ecological receptors," which implies that there are chemicals that pose a risk to ecological receptors. Please resolve this discrepancy.**

Response: Section 3.2.2.2 is correct in stating that "the ERA results indicated that none of the chemicals in soil or groundwater pose significant risk to ecological receptors." Section 3.2.3 was revised to be consistent with Section 3.2.2.2.

28. **Comment:** **<u>Page 3-10. Section 3.2.3, PAHs</u>: Here and in other sections, the discussion regarding PAHs is incorrectly presented. PAHs in deep soil, i.e below 8 ft bgs, are attributed to the Marsh Crust which currently has an ordinance in place to restrict exposure to this layer of PAHs. PAHs in soil from 0 - 8 feet are attributed to dredged sediment used to create most of Alameda Point and there is no ordinance or other form of remedy in place to protect exposure to receptors from PAHs at these depths. Therefore, PAHs from 0 - 8 feet bgs at all sites need to be evaluated for potential risk. If the average exposure concentration across a site is 0.62 mg/kg BaP eq in the 0-8 foot range, and if no single sample point in the 0- 8 foot range is above 1.0 mg/kg, then the PAHs pass the screening criteria. If the average is above 0.62 mg/kg BaP eq. or if there is a hit above 1.0 mg/kg, then PAHs at the specific site need to be evaluated for remedial action. Please correct to reflect this approach throughout the document.**

Response: Please see response to EPA General Comment 3.

29. **Comment:** **<u>Page 3-12, third paragraph</u>: Please be clear that soil AND groundwater samples will be taken around and beneath the OWS at each site. The OWSs represent not only soil data gaps but also groundwater data gaps.**

Response: This text was revised to state that soil and groundwater samples will be collected around and beneath the OWS at each site.

30. **Comment:** **<u>Page 3-12, sixth paragraph</u>: EPA does not agree with attributing metal contaminant concentrations in groundwater above background to other factors (in this case the presence of solvents) as a reason to discount the metal as a COPC. Since the presence of solvents is due to site related activities, it can be argued that the elevated manganese is also due to site related activities and therefore needs to be evaluated for risk and possible remediation. Please revise and address this potential risk.**

Response: The Navy has acknowledged that the presence of metals such as arsenic and manganese may be attributed to solvent or TPH releases. The Navy did not intend to discount the metal as a chemical of potential concern (COPC); however, the Navy believes that remediation of the solvent will correct the biogeochemical conditions that led to the solubilization of these metals. These metals were evaluated for risk in the RI report (Tetra Tech 2004) and will be evaluated in the post remediation risk assessment. If they continue to demonstrate significant risk, then further remedial action may be required.

31. **Comment:** **<u>Page 3-14, third paragraph</u>: Please provide the range of concentrations of PAH hits and also the maximum hit concentration, as is done for other contaminants.**

Response: The text was revised to provide the range of concentrations for PAHs, including the maximum concentration.

32. **Comment:** **<u>Page 3-15, first paragraph, last sentence</u>: This statement raises the concern that the source of the VOCs may not yet have been identified.**

Response: The text was revised to indicate that Site 7 has been sampled thoroughly for other VOCs, besides those associated with the TPH release. The revised text states that most of these other VOC compounds are associated with 135 samples collected from sampling locations throughout Site 7. Data from these samples indicated only a few detected concentrations of VOCs at the site. In addition, the revised text states that a continual source of VOCs is not likely because analytical results for the 135 samples show that VOCs were not detected more than once at the same location at Site 7.

33. **Comment:** **<u>Section 3.3.1, Groundwater, Page 3-15</u>: The second paragraph of this subsection appears to be out of place since it includes a discussion of risk from soil. Please move this paragraph to one of the subsections on risk.**

Response: Comment noted. The text in Section 3.3.1 was moved to Section 3.3.2.1.

34. **Comment:** **<u>Page 3-15, third paragraph, last sentence</u>: It is premature to state that the PAH plume has been defined since there has only been one round of sampling that has included PAHs at Site 7. It is not possible to know yet whether the plume has been defined or whether PAHs are really a problem here.**

Response: The text was revised to indicate it is premature to state that the PAH plume has been identified, even though several groundwater samples from Site 7 have been analyzed for PAHs.

35. **Comment:** **<u>Section 3.3.2, Risk Assessment Results, Page 3-16</u>: There are several discrepancies between the information presented in this section and the data listed in the table on Page 3-18. For example, for subsurface soil in the non soil debris area, the total RME carcinogenic risk is given as 2E-04 but the sum of residential cancer risk values in the table appears to be 3E-04. Similarly, the HI is given as 4, but the numbers in the table add to 5.44. Benzene is listed as a risk driver, but the contribution from benzene is not listed in the table. Furthermore, since the table includes only those chemicals exceeding screening levels, it appears that the total RME carcinogenic risk should be higher than 3E-04 and the total HI should be higher than 5.44. Please revise this section to correct these discrepancies.**

Response: Section 3.3.2, including the table, was revised to correct discrepancies in the data.

36. **Comment:** ***Page 3-16, fourth paragraph, last sentence*: What is the risk driver in subsurface soils that is resulting in a risk level of 2 x 10^{-4} and that would seem to imply that remediation is necessary.**

Response: Arsenic and benzo(a)pyrene are the risk drivers in subsurface soils. Section 3.3.2.1 was revised to include this information.

37. **Comment:** **<u>Page 3-17, second and third paragraph</u>: EPA reiterates our opinion stated in our comments on the Remedial Investigation Report that we do not accept that the explanation given in the text here that levels of arsenic found in the groundwater are at background levels. The incremental risk level is, in fact, an order of magnitude higher, as stated in the third paragraph, and therefore arsenic levels do no seem attributable to background. In addition, arsenic is a risk driver in the soil, which further supports the speculation that its presence in groundwater is due not to background, but to site related activities. Even though the water beneath Site 7 is considered a Class III aquifer under federal guidelines, it still falls under the area covered in the Regional Board's Basin Plan as warranting protection. Therefore, it is likely that remediation of the groundwater for arsenic and possibly**

PAHs will be necessary. Please acknowledge the presence of arsenic at Site 7 may be due to site related activities, and include a remediation component for this contaminant that will meet the Regional Board's requirements.

Response: As noted in EPA Specific Comment 16, background should be determined using comparisons of the statistical distributions from sample results collected on site and from samples collected in a background location. This is the process that the Navy used during the RI report (Tetra Tech 2004). Using this process, the distribution of arsenic in groundwater at Site 7 was similar to the distribution of arsenic in the background locations. However, the variability in arsenic concentrations in groundwater at Site 7, resulted in the use of the maximum detected arsenic value as the exposure point concentration, rather than the value of the 95 percent upper confidence limit of all site data. Because the latter typically was lower than the maximum value, the use of the maximum value for arsenic is more conservative. However, it also results in a site risk estimate that is an order of magnitude higher than the background risk estimate. The FS Report will note that the incremental site risk is unexpectedly elevated because of excessive variability in the data used to calculate the exposure point concentration for arsenic.

Section 3.3.2.1 was revised to clearly state that because of the presence of arsenic contamination in the soil debris area, Navy will consider arsenic in groundwater at Site 7 potential contaminant of concern. During preparation of the remedial investigation report, it was postulated that arsenic in groundwater may be attributed to releases of TPH. The release of TPH causes increased microbial activity that increases oxygen consumption and results in reducing conditions. Arsenic solubility increases under reducing conditions. An examination of groundwater monitoring data presented in the Remedial investigation report showed that the maximum arsenic concentrations was present in samples collected in the 1990s from wells located near the former gas station where the TPH release occurred and not from a well located in the soil debris area.. Recent groundwater monitoring data (2003 and 2004) show that arsenic concentrations in these area have largely decreased to nondetect levels that are similar to the MCL of 10 μg/L.

38. **Comment:** **<u>Section 3.3.2, Lead, Page 3-17</u>: Text appears to be missing from the sentence that reads, "The model predicts that the 95th percentile estimate of blood lead is 24.6 micrograms per deciliter (ug/dL) for a child ingesting groundwater and the soil debris area." Please provide the missing text.**

Response: Section 3.3.2 was revised as requested.

39. **Comment:** **<u>Table, Chemicals Exceeding Screening Levels at Site 7, Page 3-18</u>: Lead is listed as a COC in the soil debris area, but the criterion for lead is not provided. For clarity, please list the exposure point concentration and the lead screening criterion in this table.**

Response: The text was revised to include exposure point concentrations and screening criteria.

40. **Comment:** **<u>Section 3.3.2.2, Site 7 Soil Debris Area, Pages 3-19 and 3-20</u>: The fact that the extent of contamination in the Soil Debris Area has not been delineated is not discussed in this section. The extent of aluminum, arsenic, copper, and lead, has not been delineated, so it is unclear whether the risk associated with these areas has been defined. Therefore, the conclusion that "risk is within the risk management range" is premature. Please revise the text to state that the extent of contamination in the Soil Debris Area has not been delineated and that this will be addressed in the RD/RA. In addition, please recommend further action to delineate the extent of contamination.**

Response: The Navy intends to excavate and remove the soil debris area as discussed in the Draft FS Report. Following excavation, confirmation sampling will be conducted to evaluate if contamination remains. The removal action will not be considered complete until the RAOs are satisfied, as discussed in the Draft FS Report. No separate further action is required to delineate the extent of contamination and achieve the RAOs.

41. **Comment:** **<u>Section 3.3, Risk Management Decisions, Page 3-20</u>: The first sentence in this section states that for the residential scenario, carcinogenic risk from Site 7 soil is within the risk management range; however, on Page 3-16 the FS gives the total RME carcinogenic risk as which exceeds the risk management range. Please correct this discrepancy. Also, cadmium is accepted as a COC for Site 7 soil and exceeds the HI of 1, but is not discussed in this section. Please revise this section to provide further justification for eliminating Site 7 soil from consideration in this FS.**

Response: The text is correct. The total residential RME cancer risk for surface soil (0 to 2 feet bgs) is 8E-05, which is within the risk management range of 1E-04 to 1E-06.

Cadmium is only a COC for the soil debris area, not soil. The text and tables have been corrected. This revision provides further justification for eliminating soil from consideration in the FS .

42. **Comment:** **<u>Page 3-20, fourth paragraph</u>: The Marsh Crust does not address PAH contamination found at 4 to 8 feet bgs and PAH contamination found at this depth interval is due to PAHs from sediment used to fill Alameda Point rather than trapped PAH contamination in the marshes and sloughs. A remedy to control exposure to any PAHs above the RAOs of 0.62 mg/kg BaP eq average concentration and any single point over 1.0 mg/kg BaP eq. must be evaluated at this site.**

Response: The text was revised to discuss potential exposures to PAHs at Site 7 and to indicate that the Marsh Crust Ordinance at Site 7 addresses PAH contamination to depths as shallow as 5 feet bgs. Risk for soil from depths less than 5 feet was found to be within the risk management range and required no further action.

43. **Comment:** **<u>Page 3-20, sixth paragraph</u>: The logic for disregarding risks from PAHs in soil is wrong. The PAHs between 0 and 8 feet bgs are NOT attributed to the Marsh Crust and the Marsh Crust ordinance does not address them. Also, cadmium is listed as a COC for this soil area on page 3-18, but seems to have been dropped from discussion from this section. Please explain what happened to the cadmium hits.**

Response: Please see response to EPA General Comment 3 and Specific Comment 42 for additional information on PAHs. Please see response to EPA Specific Comment 41 for information on cadmium.

44. **Comment:** **<u>Section 3.3, Risk Management Decisions, Page 3-21</u>: This section presents a justification for not considering Site 7 groundwater in this FS by discussing each COC; however, lead apparently exceeds the screening criterion but is not discussed in this section. Further, methyl tert butyl ether (MTBE) was detected in groundwater east of Site 7, but this chemical was not included in the HHRA. For clarify and completeness, please revise this section to discuss why lead and MTBE in groundwater are not a concern at Site 7.**

Response: Section 3.3 was revised to clarify that lead in groundwater and methyl tert butyl ether (MTBE) in groundwater at Site 7 are attributed to the TPH release and thus, are not subject to remedial action under the CERCLA process. TPH groundwater plume is currently being remediated through a removal action for TPH free product and MTBE. The table within Section 3.3.3 was revised to indicate that lead was not accepted as a COC, since. risk is primarily attributed to lead in soil at Site 7. In addition, groundwater is an unlikely source for a drinking water supply as it does not meet TDS criteria

45. **Comment:** **<u>Page 3-21, Groundwater Section</u>: EPA disagrees with the logic for removing arsenic and PAHs from being risks in groundwater at this site. Arsenic is an order of magnitude higher than background and PAHs are probably due to elevated levels of PAHs in soil.**

Response: Comment noted. The Navy believes PAHs in soil are attributed to the Marsh Crust and both PAHs and arsenic have been mobilized as a consequence of the TPH (gasoline) release at Site 7. The Navy has begun remediation under the TPH program. Recent groundwater monitoring for arsenic in Site 7 groundwater has shown that arsenic concentrations in groundwater monitoring wells are decreasing. There may be a need to include additional wells to the monitoring program and include PAHs to ensure there are no unforeseen risks.

46. **Comment:** **<u>Section 3.4.1, Groundwater, Page 3-23</u>: Although the text states that "there are no detectable concentrations of TCE," it is possible that trichloroethene (TCE) is present in Site 8 groundwater, since the well in which TCE was detected has not been sampled since quarterly monitoring began in 2002. Since the well that historically had TCE has not been sampled, it is not known if TCE is still present in Site 8 groundwater. Similarly, the same well (M08-06) had the highest concentrations of benzene; since this well has not been sampled recently, the current maximum concentration of benzene is unknown. Please revise the text to state that it is not known if TCE or benzene is present in Site 8 groundwater and also state that groundwater samples will be taken beneath the OWSs to ascertain if they are the source of the past hit of TCE.**

Response: Text will be revised to state that it is not know if TCE or benzene are still present in groundwater at Site 8. Soil and groundwater samples will be collected beneath the OWSs at Site 8 as stated in Section 4.0 of the FS Report.

47. **Comment:** **<u>Chemicals Exceeding Screening Levels at Site 8</u>: Lead is listed as a COC in soil, but the criterion for lead is not provided. For clarity, please list the exposure point concentration and the lead screening criterion in this table.**

Response: The table was revised to include exposure point concentrations and screening criteria.

48. **Comment:** **<u>Section 3.4.3, Risk Management Decisions, Page 3-26</u>: The second sentence at the top of this page states that no further action is recommended at Site 8. Please clarify this statement (e.g., no further action is recommended for TPH at Site 8).**

Response: Section 3.4.3 was revised to clarify this statement.

49. **Comment:** **<u>Page 3-26, Site 8 Soil Section</u>: The Marsh Crust does not address PAH contamination found from 0 to 8 feet bgs and PAH contamination found at this depth interval is due to PAHs from sediment used to fill Alameda Point rather than trapped PAH contamination in the marshes and sloughs. A remedy to control exposure to any PAHs above the RAOs of 0.62 mg/kg BaP eq average concentration and any single point over 1.0 mg/kg BaP eq. needs to be evaluated at this site.**

Response: At Site 8, the Navy agrees that the Marsh Crust Ordinance may not address PAH contamination found from 0 to 8 feet bgs. However, the criteria cited do not indicate that remediation needs to be evaluated, only that the risk needs to be evaluated. The Navy does not believe risk at Site 8 warrants remedial action for PAHs.

50. **Comment:** **<u>Page 3-27, Site 8 Groundwater</u>: Note that groundwater sampling beneath the OWS needs to be performed as part of the RD/RA data gap sampling. Based on those results, a determination can be made whether the groundwater at this site needs further investigation or remediation, or whether no action is appropriate.**

Response: The text was revised to indicate samples will be collected beneath the OWSs and whether further investigation is required.

51. **Comment:** **<u>Page 3-28, 3-29, Groundwater Section</u>: Note that chlordane was found at very high concentrations in soil near UST 608-1 and may show a source for the chlordane hits in groundwater. It is possible that the contamination has migrated away from the source over the last 10 years and may still be present in the groundwater.**

Response: The Navy is aware that chlordane was found in soil near underground storage tank (UST) 608-1 and acknowledges that the UST was the likely source of chlordane in groundwater. However, subsequent sampling results have not exhibited chlordane concentrations in soil near the former location of UST 608-1. Because chlordane is considered to be immobile in groundwater, it is likely the leaking UST 608-1 is responsible for mobilizing the chlordane. Through the Basewide Groundwater Monitoring Program, groundwater will be analyzed for chlordane to determine if additional action is warranted. This recommendation will be included as part of the remedial design for Site 16.

52. **Comment:** **<u>Section 3.5.1, Nature and Extent, Pages 3-28 and 3-29</u>: Some text is in the wrong subsections. For example, the second paragraph (under Soil) on Page 3-28 discusses the extent of contamination in groundwater and should be moved to the groundwater subsection. The fourth paragraph (under Soil) discusses risk from soil and groundwater and should be moved to Section 3.5.2. The first two sentences of the last paragraph of the groundwater subsection (page 3-29) discuss the risk associated with lead, but the remainder of the paragraph discusses the pilot study for in situ chemical oxidation, so it appears that the first two sentences should be moved to Section 3.5.2. Please reorganize the text in this section so that the Soil subsection only contains information about the extent of soil contamination and the groundwater subsection only contains information about the extent of groundwater contamination.**

Response: Comment noted. Section 3.5.1 was reorganized to improve its readability.

53. **Comment:** **<u>Section 3.5.2.1, Human Health Risk Assessment, Page 3-30</u>: The discussion of groundwater risk states that risk from background groundwater is 2.2E-04, but the next sentence says that incremental risk from "background" metals is 4.6E-04. This appears to be in error, since the risk from background groundwater cited in the RI Report is lower. Please clarify if the incremental risk, less the risk from background metals is 4.6E-04 and if not, revise the text to cite the correct incremental risk.**

Response: The first sentence is correct in stating that the reasonable maximum exposure (RME) is 2.2E-04. The RI text says the incremental risk is 5E-04. The FS text will be corrected to include this value which is consistent within 1 significant digit.

54. **Comment:** **<u>Section 3.5.3, Risk Management Decisions, Page 3-31</u>: This section states that COCs identified for soil are lead and PCBs; however, lead is not listed as a soil COC in the table on Page 3-32 and the text of Section 3.5.2.1 states that there is a minimal risk to human health from ingestion of lead in Site 16 soil. Please resolve this discrepancy.**

Response: Section 3.5.3 was revised to indicate lead is not a COC.

55. **Comment:** **<u>Page 3-32, last paragraph</u>: Storm sewer bedding material may still provide a preferential pathway for contaminated groundwater to flow to the Bay, even in areas where the storm sewers are in good condition. If groundwater is remediated to MCLs, any ecological concern regarding aquatic receptors will be addressed and the bedding migration pathway will no longer be a concern.**

Response: The storm sewer bedding material has been evaluated, and results show the bedding material is unlikely to be a preferential pathway for contaminant migration. Section 3.1.3 was revised.

56. **Comment:** **<u>Page 4-1, first paragraph</u>: Please mention that not only will soil samples be taken beneath and adjacent to the OWSs at the sites, but that groundwater will also be sampled beneath the OWSs.**

Response: Section 4.0 was revised to state that groundwater samples will be collected beneath the OWSs.

57. **Comment:** **<u>Page 5-1, Soil Section</u>: Please note that soil samples need to be taken beneath the OWSs as well as adjacent to them. The final sampling locations can be decided in the Remedial Design Workplan.**

Response: Section 5.0 was revised to state, "Therefore, the general response objectives for soil at Site 6 are to determine whether soil beneath and adjacent to OWS-040A and OWS-040B contain..."

58. **Comment:** **<u>Section 5.1.3.1, Chemical, Page 5-5</u>: The discussion of groundwater ARARs refers to Site 16; however, this section discusses Site 6 ARARs. For clarity, please remove the reference to Site 16 from this section. Please note that Site 6 groundwater qualifies as a potential, although unlikely drinking water source. EPA will not require that MCLs be used as ARARs if there is a prohibition use of the groundwater and on residential use of the property. However, Site 6 groundwater does fall under the area delineated by the Regional Board as requiring protection, and therefore any Regional Board requirements for clean up must be addressed by the remedial action chosen for this site.**

Response: The reference discussing Site 16 was moved to Section 8.1.3.1. For Site 6, the text was reworded as follows "Although groundwater at Site 6 is Class II, both the Water Board and EPA have determined that groundwater beneath Site 6 is not likely to be a potential source of drinking water. The point of compliance for MCLGs and MCLs under SDWA is at the tap; therefore, the MCLs and MCLGs are not "applicable" ARARs for this Navy site."

59. **Comment:** **<u>Page 5-7, Table at the top of the page</u>: The inhalation criteria for restricted use for vinyl chloride have been entered incorrectly in this table. When revising the table, EPA requests that the Navy use the CalEPA's January 2005 guidance "Use of California Human Health Screening Levels in Evaluation of Contaminated Property" to derive the corresponding groundwater concentrations for the contaminants of concern.**

Response: The inhalation criterion for vinyl chloride is correct. Site specific parameters were used in risk assessment calculations, and toxicity values were selected in accordance with OSWER Directive 9285.7-53. The Navy is using California EPA guidance only as a source of default parameters to calculate inhalation cleanup goals. The Navy will continue to use site-specific parameters, where available, with toxicity criteria selected in accordance with OSWER Directive 9285.7-53 (EPA 2003).

60. **Comment:** **<u>Page 5-10, Section 5.2.2.2, second paragraph</u>: While LUCs may be necessary during the time it takes for a remedy to meet the RAOs, EPA does not agree with the statement that "attainment of the vapor intrusion goal may not be possible, verifiable or practical." EPA expects that this goal will be met by the remedy that is chosen.**

Response: The referenced sentence was removed from FS Report. Section 5.2.2.2 was revised to state, "For vapor intrusion, ICs should include a component that requires all future buildings located above VOC plumes to have a vapor barrier or vapor removal system."

61. **Comment:** **<u>Page 5-11, second paragraph</u>: The statement "The effectiveness of the groundwater use restrictions depends on the willingness and ability of local governments to monitor compliance and take enforcement action" is disturbing. Firstly, the Navy, at least in part, is responsible for ensuring that restrictions as part of LUCs are enforced. Second, we have evidence to show that groundwater restrictions in the City of Alameda are not strictly monitored or enforced, which means that further layers of restrictions will be necessary to ensure that the LUCs work, i.e. prohibition on residential use in areas where groundwater use is prohibited.**

Response: The Navy acknowledges its role in ensuring LUCs are enforced. LUCs are comprised of ICs and ECs. The LUCs were modified in Section 5.2.2.2 to include a prohibition on the installation of drinking water wells without regulatory approval.

62. **Comment:** **<u>Page 5-15, Oxygen Releasing Compounds</u>: Is it worth evaluating use of oxygen releasing compounds in tandem with other technologies? Reducing vinyl chloride is often the most difficult part of the remedy process and oxygen releasing compounds are known to be effective in this regard.**

Response: The text in Section 5.2.2.4 was revised to indicate that "Oxygen releasing compounds should be evaluated in tandem with other technologies when such technologies are needed for addressing other contaminants at a site."

63. **Comment:** **<u>Page 5-15</u>: Please remove the phrase "groundwater contaminant examination" from this document. This phrase appears synonymous with monitored natural attenuation, and the accepted "monitored natural attenuation" should be used instead. Regardless of what it is called, MNA still requires that certain conditions be met, i.e. lines of evidence shown, before it can be selected as a remedial alternative.**

Response: The phrase was replaced with monitored natural attenuation (MNA) or groundwater monitoring, as appropriate in the document. The Navy understands that MNA requires additional information before it is selected.

64. **Comment:** **<u>Section 5.3.2.4, Alternative 4 - Plume boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, Groundwater Contaminant Examination, and LUCs, Page 5-22</u>: Under this alternative, groundwater contaminant examination would be conducted for a period of 30 years after active groundwater treatment to MCLs. It is not clear why groundwater contaminant examination for 30 years would be required if MCLs are achieved within 3 to 5 years. Please revise the FS to include a reasonable timeframe for monitoring to confirm that MCLs have been attained and provide justification for the monitoring period included in Alternative 4.**

Response: Section 5.3.2.4 was revised to state, "Active groundwater treatment would use either ISCO (Alternative 4A) or hydrogen release compounds (Alternative 4B) and monitored natural attenuation to establish trends and to assess if COC concentrations continue to meet criteria that allow unrestricted reuse of Site 6."

65. **Comment:** **<u>Page 5.23, second paragraph</u>: Confirmation of decrease in residual contamination due to remedial actions is simply monitoring, and is a required component of any groundwater remedy. Please revise the text to reflect this fact.**

Response: Second paragraph of Section 5.2.3 was revised to include MNA as an effective component of groundwater remedy.

66. **Comment:** **<u>Section 5.4.2.1, Overall Protection of Human Health and the Environment, Page 5-24 and Section 8.4.2.1, Overall Protection of Human Health and the Environment, Page 8-2</u> : The first sentence in Section 5.4.2.1 states that Alternative 2 "protects human health by identifying the nature and extent of contamination present in soil at OWS-040A and OWS-040B ..." but delineation of the nature and extent of contamination is not protective of human health because it does nothing to break the exposure pathway or to reduce the toxicity,**

mobility, or volume of contaminants. The same problem occurs in Section 8.4.2.1., where the text states that Alternative 2 protects human health by identifying the nature and extent of contamination present in soil at OWS-608A and OWS-608B ..." Please revise the quoted phrase from these sections and from any other section (e.g., 8.4.3.1, for Alternative 3) in which "identifying the nature and extent of contamination" is said to be protective.

Response: The text was revised to state, "Alternative 2 protects human health by identifying the nature and extent of contamination present in soil at OWS-040A and OWS-040B and prevents further contact by instituting an IC on potential exposure areas that contain at COC concentrations below risk-based concentrations.

67. **Comment:** **<u>Section 5.4.2.2, Compliance with Applicable or Relevant and Appropriate Requirements, Page 5-25</u>: Under "Potential Action" the Navy lists action-specific ARARs for excavation and off-site disposal; however, this section addresses Alternative 2: One Time Soil Sampling and LUCs. Please revise the FS to provide the list of ARARs applicable to Alternative 2 in this section.**

Response: These ARARs refer to the excavated waste rather than soil sampling. No specific ARARs are available for soil sampling and ICs. As a result, the text was revised to state, "The following RCRA requirements are ARARs for any waste generated from soil sampling activities...".

68. **Comment:** **<u>Section 5.4.3.4, Reduction of Toxicity, Mobility, or Volume through Treatment, Page 5-29</u>: This section states that Alternative 3 would reduce the toxicity, mobility, or volume of potentially contaminated soil adjacent to OWS-040A and OWS-040B by excavating and disposing of contaminated materials at an off-site facility. According to the National Contingency Plan, this criterion is intended to evaluate alternatives with respect to reduction of toxicity, mobility, or volume *through treatment.* Disposal at an offsite facility does not meet this criterion unless treatment is conducted at the facility, in which case the volume may actually increase depending on treatment method. Please revise this section to clarify that Alternative 3 would not reduce the toxicity, mobility or volume through treatment unless treatment is conducted at the off-site facility.**

Response: The text was revised to state, "Alternative 3 would reduce the toxicity, mobility, or volume of potentially contaminated soil adjacent to OWS-040A and OWS-040B by excavating, disposing, and treating contaminated materials".

69. **Comment:** **<u>Section 5.5.2.2, Reduction in Toxicity, Mobility, and Volume, Page 5-31</u>: This criterion is intended to evaluate alternatives with respect reduction of toxicity, mobility, or volume *through treatment.* Since Alternative 2 includes no treatment, please delete the statement that it "does reduce the toxicity of contaminated soil, although not through treatment...."**

Response: The text was revised to state, "The IC for Alternative 2 prohibits excavation and therefore will reduce the mobility of contaminated soil at the site."

70. **Comment:** **<u>Section 5.6.1.2, Compliance with Applicable or Relevant and Appropriate Requirements, Page 5-32 and Section 8.6.1.2, Compliance with Applicable or Relevant and Appropriate Requirements, Page 8-30</u>: The text states that Alternative 1 "will eventually meet chemical-specific ARARs," but since there is no treatment and no mechanism to measure a reduction in contaminant concentrations in Alternative 1, this assumption cannot be made. Please delete the quoted statement.**

Response: The text was revised to state, "Alternative 1 may eventually meet chemical-specific ARARs at Site 6, although this may not occur...".

71. **Comment:** **Section 5.6.3.7, Cost, Page 5-38: The cost of hydrogen release compound under Alternative 3 is give as $1.7 million, but in Appendix C, the cost is $1.4 million. Please resolve this discrepancy.**

Response: Section 5.6.4.7 was revised to indicate the cost for Alternative 3 is $1.4 million.

72. **Comment:** **<u>Page 5-38, Section 5.6.4.3</u>: EPA believes the long term effectiveness and permanence would be greater for Alternative 4 than Alternative 3 because there would be no long term LUCs to be kept in place.**

Response: The text was revised to state, "The evaluation of the long-term effectiveness and permanence of Alternatives 4A and 4B is better than Alternatives 3A and 3B due to the shorter time."

73. **Comment:** **<u>Page 5-39, Section 5.6.4.4</u>: Reduction of mobility, toxicity and volume would all be greater with Alternative 4 than Alternative 3.**

Response: The text was revised to state, "Evaluation of this criterion for Alternatives 4A and 4B is greater than Alternatives 3A and 3B."

74. **Comment:** **<u>Section 5.7.1.1, Overall Protection of Human Health and the Environment, Page 5-40</u>: The second paragraph appears to discuss Alternatives 2 through 4, but only the specific elements of Alternative 2 are discussed. Please revise this section to clarify how Alternatives 3 and 4 compare in achieving this criterion.**

Response: Section 5.7.1.1 was revised to clarify the evaluation and remove any discrepancies.

75. **Comment:** **<u>Section 5.7.1.2, Compliance with Applicable or Relevant and Appropriate Requirements, Page 5-40, and Table 5-8: Summary of Comparative Analysis of Groundwater Alternatives for Site 6</u>: The text states that "all alternatives are expected to meet the chemical-specific, location-specific, and action-specific ARARs identified in this FS report" and Table 5-8 indicates that Alternative 1 will meet ARARs, but since Alternative 1 does not include treatment or mechanism to measure a reduction in contaminant concentrations it cannot be assumed that Alternative 1 will meet ARARs. Further, the fact that Alternative 1 will not provide long-term-effectiveness and permanence at Site 6 is acknowledged in Section 5.7.2.1. Please revise the text to state that Alternative 1 will not meet ARARs.**

Response: Section 5.7.1.2 was revised to state, "Alternative 1 would not trigger ARARs for groundwater. Alternatives 2 through 4B meet or have the potential to meet the chemical-, location-, and action-specific ARARs identified in this FS report."

76. **Comment:** **<u>Section 5.7.2.2, Reduction of Mobility, Toxicity, or Volume through Treatment, Page 5-41</u>: The text states that all of the alternatives "would eventually reduce the mobility, toxicity and volume of contamination through natural degradation processes, but there is no mechanism to measure any reduction in Alternative 1, so this assumption cannot be made. Please revise the text to state that Alternative 1 will not reduce the mobility, toxicity, and volume of contamination.**

Response: Section 5.7.2.2 was revised to say "Alternative 1 will not reduce the mobility, toxicity, and volume of contamination. Alternatives 2 through 4B would eventually reduce the mobility, toxicity, and volume of contamination through natural degradation processes; however, only Alternatives 3A, 3B, 4A, and 4B would reduce the mobility, toxicity, and volume of contamination through active treatment."

77. **Comment:** **<u>Page 5-42, Section 5.7.3, third paragraph</u>: Alternatives 3 and 4 provide protection against indoor vapor intrusion through treatment which is more effective and permanent that Alternative 2 LUCs.**

Response: Section 5.7.3 was revised to state, "Alternatives 2 through 4B all provide protection against indoor vapor intrusion through deed restrictions; however, Alternatives 3A through 4B provide better protection against indoor vapor intrusion through treatment, which is more effective and permanent than Alternative 2 LUCs."

78. **Comment:** **<u>Figure 5-1, Proposed Excavation Areas for Site 6 Soil and OWS-040A and OWS-040B</u>: It is not clear how the excavation areas for the OWSs were estimated. Please clarify the basis for the assumed excavation areas (e.g., previous sampling locations, experience removing similar size OWSs, etc.).**

Response: The text was revised to state, "The boundary is based on the estimated size of the OWS, allowing for some over excavation of soil."

79. **Comment:** **<u>Page 6-1, first paragraph</u>: While EPA agrees that the high TDS in groundwater beneath Site 7 disqualifies it for protection as a Class II potential drinking water source, the area still falls under the protection of the Regional Board. Any RB requirements for protection of the groundwater must be met at this site, notwithstanding the federal designation of the groundwater.**

Response: Comment noted.

80. **Comment:** **<u>Section 6.1.1, Chemicals of Concern, Page 6-1</u>: The text states that arsenic, cadmium, and lead are the only COCs in Site 7 soil, but the extent of aluminum and copper contamination in the Soil Debris Area has not been delineated so it is unclear if these metals should also be considered COCs. Please revise the text to state that the extent of aluminum and copper has not been delineated so it is not known if these metals should also be considered COCs.**

Response: The text was revised to state, "Based on the results of the RI, arsenic, cadmium, and lead are the only COCs in soil at Site 7 (soil debris area only). In addition, soil concentrations of VOCs, SVOCs, metals (such as aluminum and copper), pesticides, and PCBs adjacent to OWS-459 are unknown and are recommended for further evaluation in this FS."

81. **Comment:** **Page 6-1, last sentence: EPA requests that the Navy perform a comparison of the distribution of each metal contaminant in the background data set with the distribution of each contaminant in the site data set rather than a comparison to maximum background concentration levels. The average value for arsenic at Alameda is around 8 - 9 mk/kg and so screening against a value of 15.6 mg/kg is not sufficiently conservative. The distributions for each data set should be close in value in order to claim that a site metal concentration level is**

due to background. In addition, outlier tests should be performed on the site data to ensure that potential hot spots are not being overlooked by "averaging" them in with the rest of the data.

Response: Section 6.1.1 was revised to refer to the statistical population testing conducted during the RI report (Tetra Tech 2004).

82. **Comment:** **<u>Page 6-2, third paragraph</u>: Please note that groundwater samples must be taken beneath the OWS in addition to the soil samples beneath and adjacent to it.**

Response: The text was revised to state, "Potential soil contamination adjacent to OWS-459 will be investigated by collecting soil and groundwater samples beneath and adjacent to the OWS. Soil and groundwater samples will be analyzed for VOCs, SVOCs...".

83. **Comment:** **<u>Section 6.2, General Response Actions and Remedial Alternatives, Page 6-5</u>: This section states that three general response actions (GRAs) were identified for the contaminated soils at Site 7; however, only two GRAs are listed and evaluated: no action and excavation. Since the no action alternative is only retained for comparison purposes, effectively only one alternative is developed for Site 7 soil. This is insufficient. In order to ensure that the best possible alternative is developed for Site 7 soil, please revise the FS to include additional alternatives for Site 7 soil. If other alternatives do not meet the threshold criteria, they can be eliminated during the screening of alternatives.**

Response: The text in Section 6.2 was revised as follows: "Three general response actions (GRA) were identified for contaminated soils at Site 7: (1) no action, (2) one-time sampling at OWS-459 and excavation with off-site disposal, and (3) treatment, such as soil washing or thermal treatment. The three GRAs for soil were assembled into two practicable remedial alternatives: (1) no action and (2) one-time soil sampling, excavation, and off-site disposal. The third GRA, treatment, was considered impracticable at Site 7 with the presence of a debris area posing unacceptable risk to human health, and the remediation surface area and volume (about 40 cy) at OW-459 being extremely small and impracticable for any active remedy."

84. **Comment:** **<u>Section 6.2.2, Alternative 2: One-Time Soil Sampling, Excavation, and Off-site Disposal, Page 6-6 and Figure 6-1</u>: It is unclear how the extent of the excavation can be shown with any accuracy since the extent of aluminum, arsenic, cadmium, copper, and lead has not been delineated in the Soil Debris Area and sampling to determine the extent of contamination is apparently not included in this alternative.**

It is possible that contamination extends beyond the boundaries shown on Figure 6-1. For example, the concentration of lead in the 4.0 to 4.5 foot interval below ground surface (bgs) at S07-SSI-SS13 is 2,550 milligrams per kilogram (mg/kg) and cadmium was detected at 125 mg/kg, but here are no locations to the southwest, south, or southeast to delineate the extent of this contamination. In the 2.0 to 3.0 foot bgs interval of the next sample to the west (S07-SSI-SS14), lead was detected at 1,200 mg/kg and cadmium was detected at 44.2 mg/kg, but there are no locations to the southwest, south, or southeast to delineate the extent of this contamination. Please revise this alternative to include sampling to delineate the extent of contamination in the Soil Debris Area.

Response: The Navy acknowledges that the borders of the soil debris area may not encompass all contamination associated with the soil debris area, as discussed in Section 3.3.1 of the Draft FS Report. However, the alternative includes confirmation sampling that will evaluate if contamination remains following excavation. The alternative was not revised to include a separate delineation phase.

85. **Comment:** **<u>Page 7-1, first paragraph</u>: Groundwater beneath Site 8 does qualify as a potential drinking water source under federal criteria. However, it is an unlikely, although still potential, drinking water source. Due to the reasons given in the Beneficial Uses of Groundwater document, EPA will not require that MCLs apply as ARARs provided there is a prohibition on groundwater use at this site and a prohibition on use of the site as residential property. However, the Regional Board does require that groundwater beneath Site 8 be protected, and so all State requirements pertaining to the protection of this resource must be addressed.**

Response: The text was revised to state the regulatory agencies position on potential groundwater use and the protection requirements of the San Francisco Bay Regional Water Quality Control Board.

86. **Comment:** **<u>Section 7.1.1, Chemicals of Concern, Page 7-1 and Figure 7-1, Proposed Excavation Areas, Site 8 Soil</u>: The FS states that Aroclor-1260 was detected along the storm sewer line at Site 8 at concentrations slightly above residential PRGs, but Figure 7-1 shows Aroclor concentrations along the sewer line on the order of 270 mg/kg, which is more than 1000 times the PRG. A comparison of this figure with the information presented in the RI, suggests that the units on Figure 7-1 are in error. Please revise Figure 7-1 to present data in the appropriate units.**

Response: Figure 7-1 was revised as requested.

87. **Comment:** **<u>Page 7-5, Section 7.2.2, first paragraph</u>: Please explain why the prohibition on residential use is in effect for 100 years and not indefinitely. Also, please state that if groundwater contamination is found beneath the OWS, remediation of the groundwater may be necessary.**

Response: Section 7.2.2 was revised to state that the timeframe for prohibition of residential use will extend indefinitely and that remediation of groundwater may be necessary, depending on the results of sampling being conducted at the OWSs.

88. **Comment:** **<u>Section 7.5.4, Reduction of Toxicity, Mobility, or Volume, Page 7-12</u>: This section states that Alternative 3 would reduce the toxicity, mobility, or volume contaminated soil at Site 8 by excavating and disposing of contaminated materials at an off-site facility. According to the National Contingency Plan, this criterion is intended to evaluate alternatives with respect to reduction of toxicity, mobility, or volume *through treatment.* Disposal at an offsite facility does not meet this criterion unless treatment is conducted at the facility, in which case the volume may actually increase depending on treatment method. Please revise this section to clarify that Alternative 3 would not reduce the toxicity, mobility or volume through treatment unless treatment is conducted at the off-site facility.**

Response: Section 7.5.4 was revised as requested.

89. **Comment:** **<u>Section 7.6.2.2, Reduction in Toxicity, Mobility, and Volume, Page 7-14</u>: This criterion is intended to evaluate alternatives with respect reduction of toxicity, mobility, or volume *through treatment.* Since Alternative 2 includes no treatment, please delete the statement that it "does reduce the toxicity of contaminated soil, although not through treatment ...."**

Response: The sentence in Section 7.6.2.2 was deleted.

90. **Comment:** **<u>Page 8-2, Section 8.1.1, Soil</u>: The first sentence states that arsenic, lead and PCBs will not be evaluated further in this FS. However, the previous page states data gaps for PCBs will be addressed, per BCT agreement, as part of the RD activities. Please clarify Section 8.1.1.**

Response: Section 8.1.1 was revised to address the potential data gap associated with polychlorinated biphenyls (PCB) that was described in Section 3.5.2.1. Soil samples in the PCB area have been included in the costs.

91. **Comment:** **<u>Page 8-4, first paragraph</u>: Please include additional PCB sampling with that being proposed for the OWSs.**

Response: Section 8.1.4 was revised to include PCBs as part of the OWSs sampling program.

92. **Comment:** **<u>Page 8-4, Section 8.1.4, Groundwater RAOs</u>: Since the groundwater beneath Site 16 is a potential and possibly current drinking water source, and the likelihood of groundwater use is high, the only RAOs that can be used for groundwater clean up are MCLs. Please revise this section by removing the non-MCL RAO options, since they would not comply with ARARs.**

Response: Section 8.1.4 was revised to remove the non-MCL portion of the RAOs.

93. **Comment:** **<u>Page 8-5, first bullet on page</u>: Please add "and any PCB contaminated soil in the storage area" to the sentence.**

Response: The text was revised as requested.

94. **Comment:** **<u>Section 8.2.2.4, Active Remediation, Page 8-10</u>: Air sparging is listed as one of the technologies evaluated, but it is not discussed in this section. For clarity and completeness, please include a discussion of air sparging in the screening of technologies for Site 16.**

Response: Section 8.2.2.4 was revised to discuss air sparging in the screening of technologies.

95. **Comment:** **<u>Page 8-12, Groundwater Contaminant Examinations</u>: This term appears to be Monitored Natural Attenuation. Please be aware that the requirements for MNA specifically state that, among other things, the plume must be stable in order to consider MNA as a remedy. Therefore, in a situation where "the plume is still expanding and migrating", MNA would immediately fail as one of the alternatives under consideration.**

Response: Comment noted.

96. **Comment:** **<u>Page 8-13, Section 8.2.3, second paragraph</u>: The activity described in this paragraph is actually monitoring, not MNA, and is not a stand alone remedy, but a component of every active groundwater remedy.**

Response: The term "groundwater contaminant examination" was revised as either groundwater monitoring or MNA, and related text throughout the FS Report was revised accordingly. Also, the text was revised to indicate that groundwater monitoring is not considered a stand-alone remedy for Site 16.

97. **Comment:** **<u>8.4.2.4, Reduction of Toxicity, Mobility, or Volume through Treatment, Page 8-27</u>: This section states that Alternative 3 would reduce the toxicity, mobility, or volume of potentially contaminated soil adjacent to OWS-608A and OWS-608B by excavating and disposing of contaminated materials at an off-site facility. According to the National Contingency Plan, this criterion is intended to evaluate alternatives with respect to reduction of toxicity, mobility, or volume *through treatment.* Disposal at an offsite facility does not meet this criterion unless treatment is conducted at the facility, in which case the volume may actually increase depending on treatment method. Please revise this section to clarify that Alternative 3 would not reduce the toxicity, mobility or volume through treatment unless treatment is conducted at the off-site facility.**

Response: Section 8.4.3.4 was revised to properly reflect the intent of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) criterion.

98. **Comment:** **<u>Page 8-32, Page 8.6.2.2</u>: EPA disagrees that Alternative 2 would eventually meet RAOs in the absence of any active remedial implementation. Rather, all evidence to date shows that PCE and TCE would eventually degrade to vinyl chloride and stall at that state unless aquifer conditions were changed through active remediation.**

Response: EPA's concern is noted, and all of the alternatives were reevaluated to examine the likelihood of achieving RAOs. Based on recent monitoring data, the more oxidizing groundwater state shows a favorable degradation trend for vinyl chloride. As a result, MNA will eventually meet the RAOs.

99. **Comment:** **<u>Page 8-37, Sections 8.6.4.5</u>: The Short-term Effectiveness is much better for Alternative 4 which takes 1/7 of the time to reach RAOs as that for Alternative 3.**

Response: Comment noted. The time to achieve RAOs is only one of the elements for evaluating short-term effectiveness. The FS Report reevaluated the criteria as RAOs, and the report was modified as appropriate.

100. **Comment:** **<u>Page 8-38, Section 8.7.1</u>: There would need to be a prohibition on residential use of the property for Alternatives 2 and 3, and a prohibition on residential use until MCLs are met under Alternative 4.**

Response: Section 8.7.1 was revised to indicate that the LUC on the property will include a prohibition on detached residential homes. However, the LUC may allow some types of connected residential structures (such as apartments, lofts, and condominiums), provided acceptable inhalation risks are demonstrated. Groundwater ingestion is not expected to occur in connected residential structures because residents would not be allowed to install wells.

101. **Comment:** **<u>Section 8.7.1.2, Compliance with Applicable or Relevant and Appropriate Requirements, Page 8-38, and Table 8-8</u>: Summary of Comparative Analysis of Groundwater Alternatives For Site 16: The text states that "all alternatives are expected to meet the chemical-specific, location-specific, and action-specific ARARs identified in this FS report" and Table 8-8 indicates that Alternative 1 will meet ARARs, but since Alternative 1 does not include treatment or mechanism to measure a reduction in contaminant concentrations it cannot be assumed that Alternative 1 will meet ARARs. Further, the fact that Alternative 1 will not provide long-term-effectiveness and permanence at Site 16 is acknowledged in Section 8.7.3. Please revise the text to state that Alternative 1 will not meet ARARs.**

Response: Section 8.7.2 was revised as requested. The detailed analysis for each no-action alternative states "Alternative 1 may eventually meet chemical-specific ARARs at Site 16; however, there is no mechanism to measure and verify contaminant reduction occurs." The comparative analysis for each site indicates that the no-action alternative will not meet ARARs.

102. **Comment:** **<u>Page 8-38, Section 8.7.3, second paragraph</u>: Alternative 2 would also require a prohibition on residential use of the property.**

Response: Section 8.7.3 was revised as requested.

103. **Comment:** **<u>Page 8-40, first paragraph, last sentence</u>: EPA does not agree with the 37 year timeframe for Alternative 2 to reach domestic use remediation goals. It would be extremely difficult to remove the vinyl chloride in groundwater without any active remediation.**

Response: Groundwater modeling presented in Attachment C1 of Appendix C concludes that it will take 37 years for Alternative 2 to reach the remediation goals set for Site 16.

104. **Comment:** **<u>Page 8-40, fifth paragraph</u>: Please revise this paragraph. There are many domestic wells located in neighboring residences within a ¼ mile of this site and it is downplaying a potential exposure pathway to say that use of the groundwater beneath Site 16 is "highly unlikely". It is also possible that use of the off-base wells could draw contamination from Site 16 across the base boundary and into these home wells. Regardless, the water qualifies as a potential, possibly current, drinking water source, both under federal and State criteria and MCLs need to be used as the RAOs to comply with ARARs.**

Response: The FS Report was revised to use MCLs as RAOs, and alternatives were reevaluated to ensure they achieve the RAOs.

105. **Comment:** **<u>Appendix A, Section 3.2, Trichloroethene, Pages A-4 and A-5</u>: The last sentence of the first paragraph in this section and the first full sentence on page A-5 appear to be incomplete. Please review and revise these sentences to clarify their meaning.**

Response: Section 3.2 of Appendix A was revised to clarify the meaning of these sentences.

106. **Comment:** **<u>Appendix C, Section 6.1.2.2, Assumptions for Technology Screen at Site 6, Page C-10</u>: The second bullet on this page addresses follow-up treatment, but gives the duration and sampling requirements for primary treatment. Please revise this bullet to provide the duration and sampling requirements for follow-up treatment.**

Response: As a conservative estimate for estimating costs, Section 6.1.2.2 of Appendix C was revised to indicate that follow-up treatment would require the same effort as the primary treatment. (Please note that follow-up treatment will depend on the success of the primary treatment.)

107. **Comment:** **<u>Appendix C, Section 6.1.3.3, Alternative 4: Plume Boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, Groundwater Contaminant Examination, and LUCs, Page C-15</u>: This section addresses remediation to unrestricted reuse criteria, but the first bullet under "Active Groundwater Treatment (ISCO or HRC) discusses assumptions for the commercial/industrial reuse levels. Please revise the FS to make sure the assumptions for the unrestricted reuse criteria are listed in this section and incorporated into the cost estimates.**

Response: Section 6.1.3.3 of Appendix C was revised to ensure the assumptions for the unrestricted reuse criteria are correctly listed.

108. **Comment:** **<u>Appendix C, Section 6.4.2.2, Assumptions for Technology Screen at Site 16, Page C-27</u>: The third bullet in this section indicates that effluent water will be discharged to the storm sewer. Please clarify if this is correct, or if discharge to the sanitary sewer is intended.**

Response: The assumptions were reviewed to ensure effluent water is discharged to the sanitary sewer system.

109. **Comment:** **<u>Appendix C, Section 6.4.2.2, Assumptions for Technology Screen at Site 16, Page C-28</u>: Under Site 16-Modified Fenton's Reagent, the fourth bullet discusses follow-up treatment, but the same paragraph presents assumptions for primary treatment rather than for follow-up treatment. Please revise this bullet to clarify the assumptions for follow-up treatment.**

Response: As a conservative estimate for estimating costs, Section 6.4.2.2 of Appendix C was revised to indicate that the follow-up treatment would require the same effort as the primary treatment.

110. Comment: **<u>Appendix C, Section 6.4.2.5, Alternative 4: Plume Boundary Delineation, Active Groundwater Treatment to Unrestricted Reuse Criteria, Groundwater Contaminant Examination, and LUCs, Page C-33</u>: The first bullet under Active Groundwater Treatment (ISCO or HRC) addresses treatment to commercial/industrial reuse levels; however, this section applies to unrestricted reuse criteria. Please revise this section to make sure the assumptions for the unrestricted reuse criteria are listed and incorporated into the cost estimates.**

Response: Section 6.4.2.5 of Appendix C was revised to ensure the assumptions for the unrestricted reuse criteria are correctly listed.

111. Comment: **<u>Appendix C, Remedial Action Alternative Cost Summary Sheets, Table C-2D</u>: The present value analysis includes a 34 year time frame for annual O&M costs; however, the annual O&M costs include LUCs. The LUCs under the unrestricted reuse scenario were assumed to apply only during the active remediation, or 4 years. Please revise the present value analysis to use the appropriate duration for LUCs.**

Response: The present value analysis in Appendix C was revised to use the appropriate duration for the LUCs.

112. Comment: **<u>Appendix C, Remedial Action Alternative Cost Summary Sheets, Table C-2E</u>: The present value analysis includes a 35 year time frame for annual O&M costs; however, the annual O&M costs include LUCs. The LUCs under the unrestricted reuse scenario were assumed to apply only during the active remediation, or 5 years. Please revise the present value analysis to use the appropriate duration for LUCs.**

Response: The present value analysis in Appendix C was revised to use the appropriate duration for the LUCs.

113. Comment: **<u>Appendix C, Remedial Action Alternative Cost Summary Sheets, Table C-4B</u>: The cost summary does not appear to include sampling and disposal of decontamination wastewater. Please revise the cost estimates to include this cost as appropriate.**

Response: The cost estimate in Appendix C was revised to include sampling and disposal costs, as appropriate.

114. Comment: **<u>Appendix C, Remedial Action Alternative Cost Summary Sheets, Table C-6A</u>: Under land use controls the total should be $3,718 rather than $1,239. Please correct this total and revise the corresponding present value annual O&M cost as appropriate.**

Response: The total in Table C-6A was revised, and the present value costs were recalculated.

RESPONSES TO COMMENTS FROM EPA ORC

EPA ORC General Comments

1. **Comment:** **Need for multiple copies. For future documents of this type, EPA requests that the Navy provide three copies of the document to EPA.**

   Response: Additional copies will be provided for future documents.

2. **Comment:** **Groundwater classification and ARARs. The discussion of groundwater for the various sites is insufficient. There needs to be more discussion either in the individual FS chapters or on p. 2-9. Additionally, EPA disagrees with some of the Navy's conclusions. We recognize that EPA's position on GW at Alameda may appear to have evolved as we have considered individual sites more in depth. Our analysis of the GW at OU1 can be summarized as follows:**

   Given the quality of the water at Site 16, all parties have agreed that it should be considered potential DW. Therefore, MCLs must be selected as ARARs. This is necessary for protection of the resource, regardless of the potential reuse of the site.

   At Sites 6 and 8, although actual use of this water for domestic consumption may be unlikely, MCLs are generally considered to be ARARs for Class II water. In determining whether MCLs are relevant and appropriate for sites such as these, the Navy and regulators need to weigh both the goal of preserving the resource, and risk factors such as the possibility of accidental ingestion by a child from a domestic well.

   At Site 7, the groundwater is Class III. For Class III GW, there is much less weight given to protecting the resource, and the preamble to the NCP indicates that MCLs are not ARARs. Thus, remediation goals for Class III water need to be based on risk.

   Site 6 groundwater: This GW is 5 feet bgs and is contaminated with VOCs. Site 6 is expected to be mixed use (Civic Core and Marina District). The FS includes two potential active remedies (both of which also include LUCs) as well as LUCs as a stand-alone remedy (that possibly includes MNA). There is some confusion on exactly what the substance of the GW LUCs would be. Specifically, for GW Alt. 3 (cleanup to commercial/industrial levels), Sec. 5.6.3 indicates that the remedy would include a LUC to prevent domestic use of the GW, while in 5.3.2.3. the FS indicates that this remedy includes a LUC to prevent residential use of the site. MCLs are included as ARARs in the Site 6 ARARs table, and the residential PRGs are calculated to include dermal, ingestion, and inhalation pathways and are set equivalent to the MCLs. On the other hand, the ARARs

discussion in the Site 6 chapter (Chapter 5) implies that only at Site 16 are MCLs being selected as ARARs

Site 7 groundwater: Here the GW is 3 to 3.5 feet bgs, and the reuse is residential (Main Street Neighborhoods). TDS exceeds 10,000 so it's Class III GW, so MCLs are not ARARs under federal law. But the Regional Board may consider MCLs to be ARARs under state law. Our main concern here is that the Navy appears to be not even considering the GW despite high cancer risk numbers (total 3E-03 with a background of 2E-04), and very high HI numbers (for a child, total of 33, background of 13, incremental of 20). Contaminants are arsenic, thallium, PAHs. The Navy is already doing a removal for TPH and MTBE – will that help with the other contaminants?

Site 8 groundwater: GW is 5 feet bgs and site is part of the Civic Core, intended for commercial and recreational reuse. The FS for Site 8 does not discuss GW ARARs because the Navy does not consider there to be any COCs

Site 16 groundwater: The Navy acknowledges that this is potential drinking water and that they are selecting MCLs as ARARs (although they discuss this in the chapter on Site 6 rather than the chapter on Site 16 – but they do state in the ARARs appendix that MCLs are ARARs for Site 16). The GW averages 5 feet bgs and the reuse is non residential – industrial and open space. They appear to be relying on MNA to eventually get to MCLs, although they don't present MNA as a remedy component. The LUCs under the LUC alternative and the industrial-cleanup alternative are for no residential use of the water, not of the property. They do include a residential cleanup remedy.

(a) If they are relying on MNA, they need to include MNA as a remedy and demonstrate that it meets EPA criteria for using MNA.

(b) The LUC should be no residential use of the property. This shouldn't be a problem as the reuse is nonresidential. There could be a two-stage remedy if there is a possibility for residential use.

Response: Section 2.4.3 was revised to clarify the discussion of groundwater. At Site 6, MCLs will be acknowledged as a potential ARAR; however, the Navy may exercise some flexibility in applying MCLs at Site 6 because domestic use of groundwater at the site is unlikely. If necessary, a LUC will be implemented to prevent residential use of the property.

At Site 7, groundwater does not meet EPA criteria for domestic use and cleanup criteria are primarily risk-based. Although risk from arsenic and manganese at Site 7 exceeds the risk management range, these risk drivers are attributed to the release of TPH. The cleanup of TPH will reduce risk attributed to arsenic and manganese at Site 7.

The Navy does not believe COCs are present in groundwater at Site 8. As a result, no remediation is necessary at this time. However, there is some uncertainty regarding certain features, such as OWSs, and the Navy has agreed to conduct limited sampling to evaluate if any COCs are present in groundwater.

For Site 16, the text was revised to indicate MCLs are ARARs. The text also was revised to acknowledge the limited use of MNA as part of the remediation strategy for Site 16. The Navy believes that the appropriate LUC is an IC prohibiting the use of groundwater for drinking water and prohibiting the installation of drinking water wells without regulatory approval.

EPA ORC Specific Comments

Executive Summary

1. **Comment:** **Lack of clarity: (a) The executive summary of an FS should give the reader a snap shot of what to expect in the document. This is especially crucial in a complicated document like this one that involves 4 sites, 2 media, and multiple contaminants. It would be helpful to have in the executive summary a short paragraph on each site summarizing the nature of the site, the anticipated reuse, and what COCs the Navy intends to address at the site. (b) It is confusing for the second paragraph to suggest that soil contamination is only being addressed for sites 7 and 8, when the bullets immediately following describe all four sites. This should be clarified in the document. (c) EPA recommends explaining at the beginning that even though the soil near the OWSs has not been characterized, the FS evaluates remedies to address contamination that may be found during the characterization of these areas.**

   Response: The Executive Summary was revised to improve its clarity, correct errors, and provide additional explanation about the characterization of OWSs.

2. **Comment:** **<u>P. 1-2</u>. The FS says that the Navy is not addressing PAHs because they are "attributable primarily to the Marsh Crust. Marsh Crust ICs will not protect against any risk from PAHs in soil 0-8 feet bgs.**

   Response: The text was revised to restrict the use of the Marsh Crust Ordinance to Site 7. For other sites, the reviewer is correct, and the text was revised accordingly.

3. **Comment:** **<u>P. 2-9, Sec. 2.4.3—GW Beneficial Uses</u>: The statement that GW at Sites 6 and 8 is not considered a DW source is an overstatement and is a mischaracterization of EPA's letters. The Navy should include a fuller analysis of the GW either here or in the separate FS chapters. See general comments on GW.**

Response: The Navy's position on groundwater is based on results of the 2000 beneficial use report and on Ms. Cook's letter. The Navy accurately quotes Ms. Cook's letter, and the Navy does not believe that it has overstated or mischaracterized EPA's letter. The FS states that domestic use of groundwater as a drinking water source at Site 6 is not likely. This is consistent with EPA's letter.

4. **Comment:** **<u>P. 5-4, discussion of chemical-specific soil ARARs</u>. In the discussion of RCRA, the FS should note that RCRA requirements, even if not applicable, are generally found to be appropriate and relevant at CERCLA sites. This should also be done in the discussions of RCRA in the chapters dealing with the other sites.**

Response: The RCRA requirements identified in Section 5.0 are applicable requirements. It is true that some RCRA requirements may be relevant and appropriate; however, the Navy has determined that all of the RCRA requirements identified for this FS are applicable. Section B2.1.2.1 of Appendix B explains that RCRA requirements may be relevant and appropriate even if they are not applicable.

5. **Comment:** **<u>p. 5-5. Groundwater chemical-specific ARARs for Site 6</u>. It is too facile to say that this is not a potential DW source. Rather, under EPA guidance, it is Class II groundwater and is considered to be potential drinking water, although we acknowledge that actual domestic consumption of this groundwater is not likely. In any event, Class II water generally requires MCLs as ARARs, and a fuller discussion is necessary. It appears from Table 5-2 that the Navy is including MCLs as ARARs for Site 6, although this is not apparent from the text. There should be a more complete discussion of whether MCLs are ARARs for the GW at site 6. See also General Comment**

Response: MCLs are not ARARs for Site 6 based on the 2000 groundwater beneficial use report and the 2000 letter from EPA. As a result, Section 5.0 will be revised to indicate MCLs are not ARARs for Site 6. In the letter, EPA concurs with the use of non-MCL cleanup levels if contaminated groundwater is remediated to levels where (1) threats posed by exposures such as inhalation, dermal contact, and those associated with irrigation use are eliminated, and (2) any significant ongoing degradation of groundwater from contaminant migration is prevented.

6. **Comment:** **<u>P. 5-21, Sec. 5.3.2.2, GW Alt. 2</u>. It is not clear whether "groundwater contaminant examination" is a longer phrase for "monitoring" as a remedy component, or whether it refers to MNA as a potential stand-alone remedy. This should be clarified, and the standard terms should be used.**

Response: Section 5.3.2.2 was revised to replace "groundwater contaminant examination" with "MNA".

7. **Comment:** **<u>P. 5-21, Sec. 5.3.2.3, GW Alt. 3</u>. This section indicates that the LUCs for this alternative would prevent both domestic use of GW and residential use of the site, while later, in Sec. 5.6.3, only a prohibition on domestic use of the GW is included. EPA recommends that the LUC include prevention of residential use of the site, as stated in this section.**

Response: The Navy has revised Section 5.3.2.3 to indicate that the appropriate IC is prohibiting the use of groundwater for drinking water use and the installation of drinking water wells without regulatory approval.

8. **Comment:** **<u>P. 5-21, Sec. 5.3.2.3., GW Alt. 3</u>. The FS discusses "GW contaminant examination" for 30 years. It is not clear whether this means that the Navy intends to monitor for 30 years, or that they expect that 30 years of natural attenuation will be necessary, or both. The suggestion is that the active remediation will not attain PRGs, but this is not clear. Their discussion of Alt. 4 is similarly confusing.**

Response: Section 5.3.2.3 was revised to state, "Active groundwater treatment would be followed by MNA for a period of 30 years...".

9. **Comment:** **<u>P. 5-24 and elsewhere, soil alt. 2 (LUCs)</u>. Although there is much discussion of the vehicles for implementing LUCs (land use covenant, etc.), there is not a clear discussion of what the substance of the LUCs would be. It is unclear whether the LUCs would be engineering controls (p. 5-10 & 5-12), or a restriction on residential use of the property (p. 5-30), or something else.**

Response: The text was revised to further explain the IC proposed.

10. **Comment:** **<u>P. 5-24, Sec. 5.4.2.1, soil alt. 2 (LUCs)</u>. Identifying the nature and extent of contamination does NOT protect human health. What is the LUC? This paragraph is not sufficient.**

Response: Section 5.4.2.1 was revised as requested. Please note that action cannot be predicted until the sampling results are available. If no COCs are identified, then no action is warranted and human health is protected. If

COCs are identified, then action (IC) may be warranted to protect human health. The IC will be a prohibition on excavation without regulatory approval. In either case, the information is necessary to make the determination and protect human health.

11. **Comment:** **<u>P. 5-25, soil alt. 2 (LUCs), long-term effectiveness</u>. It is difficult to see how this meets the overall protectiveness criterion if it is not considered a permanent alternative, as acknowledged in sec. 5.4.2.3.**

Response: The text was revised to state, "ICs will remain in effect as long as required to adequately protect human health and the environment."

12. **Comment:** **<u>P. 5-26, Sec. 5.4.3.1, discussion of soil alt. 3 (excavation)</u>. For the first time in this FS, there is mention of runoff and wind erosion. If that is a concern, it should also be discussed in relation to the previous alternative of LUCs.**

Response: Section 5.4.3.1 was revised to remove the reference to runoff and erosion for subsurface features that are surrounded by pavement. There is little likelihood for contamination to be transported by runoff or wind erosion in these situations.

13. **Comment:** **<u>P. 5-31, Sec. 5.5.2.2, Comparative Analysis for Soil Alternatives</u>. LUCs don't reduce toxicity.**

Response: Section 5.5.2.2 was revised to state, "The IC for Alternative 2 prohibits excavation and therefore will reduce the mobility of contaminated soil at the site.

14. **Comment:** **<u>P. 5-32, Sec. 5.6.1.2, GW Alt. 1 (no action), Compliance with ARARs</u>. It is not apparent how the no-action alternative will comply with ARARs, assuming that MCLs are ARARs. If the Navy is relying on natural attenuation to reach chemical-specific ARARs, that should be analyzed as an MNA remedy. Even if there is some evidence that natural attenuation is occurring, it cannot be assumed that the no-action alternative will comply with ARARs without a means of checking this, e.g. through a MNA remedy. This comment also applies to the comparative analysis on p. 5-40, Sec. 5.7.1.2.**

Response: Section 5.6.1.2 was revised to correct the comparative analysis for the no-action alternative, as follows: "Section 121(d)(2) of CERCLA indicates that ARARs apply to on-site response actions. If there is no response action, then there is no need to identify ARARs."

15. **Comment:** **<u>P. 5-33, GW Alt. 2 (LUCs), LUC bullets</u>: There should be a Navy deed <u>restriction</u>, not just a deed notice.**

Response: The text was revised to state "Recording of deed restrictions to restrict the public from using groundwater at Site 6."

16. **Comment:** **<u>P. 5-34, Sec. 5.6.2.2, GW Alt. 2 (LUCs)</u>. If the Navy is relying on natural attenuation to meet ARARs, the remedy should be analyzed as a MNA remedy. This again raises the issue of what does "groundwater contaminant examination" means.**

Response: Section 5.6.2.2 was revised to replace "groundwater contaminant examination" with "MNA."

17. **Comment:** **<u>P. 5-35, Sec. 5.6.3, GW Alt. 3 (treatment to commercial/industrial)</u>. This paragraph is confusing, as the remedy appears aimed at attaining commercial/industrial levels, while the first paragraph indicates that treatment will continue until concentrations are reduced to levels below domestic remediation goals, suggesting that treatment could continue for 30 years. Thus, there is confusion on how this alternative differs from Alt. 4 (treatment to unrestricted levels).**

Response: Section 5.6.3 was revised to correct and clarify the differences between the two alternatives.

18. **Comment:** **<u>Sec. 5.6.4, GW Alt. 4 (treatment to unrestricted)</u>. Are the target concentrations in fact lower for Alt. 4 than for Alt. 3, or is it the <u>short-</u>term target concentrations that are lower (or the concentrations to be achieved by the active treatment)?**

Response: The target concentrations for Alternative 4 are unrestricted reuse inhalation criteria, and the target concentrations for Alternative 3 are commercial/industrial inhalation criteria.

19. **Comment:** **<u>Sec. 5.6.4.1, GW Alt. 4 (treatment to unrestricted)</u>. If the remediation goals will be met within 3 to 4 ½ years, why is GCE (MNA?) necessary?**

Response: Groundwater contamination examination in this instance means monitoring to ensure the cleanup goals are met.

20. **Comment:** **<u>P. 6-4, Sec. 6.1.3.1., ARARs</u>. The FS states that there are no chemical-specific ARARs "because COCs exceeding risk criteria have not been identified at Site 7." This is not the correct analysis. Even subtracting out background, the cumulative HI is 20. Even if MCLs are not federal ARARs for Class III groundwater, they may be**

ARARs under State law if the Regional Board does not determine that the GW should not be protected. Additionally, even if MCLs are not ARARs, the Navy needs to determine whether the GW at Site 7 needs to be addressed due to the risk of accidental ingestion in a neighborhood of detached homes, with GW 3 feet bgs, on the east side of the base fairly close to wells.

Response: Section 6.1.3.1 was revised to state that no COCs in groundwater are attributed to CERCLA releases. The COCs present in groundwater are attributed to TPH, which will be addressed under a separate regulatory program. The Navy is assessing the next phase of TPH cleanup for groundwater at Site 7.

21. Comment: **P. 6-7, Sec. 6.3.5., analysis of no-action alternative, short-term effectiveness. This criterion is analyzed differently for the no action alternative for Site 7 than for Site 8, where it is concluded that no action is not effective in the short-term because there is no remedial action. EPA prefers the Site 8 analysis. This criterion is analyzed for Sites 6 and 16 the same way it is analyzed for Site 7, and our comment applies to those sites also.**

Response: Comment noted. Section 6.3.5 was revised to use the Site 8 analysis for short-term effectiveness.

22. Comment: **Sec. 8.1.3, ARARs. While the Site 16 ARARs table includes MCLs as relevant and appropriate, the text in Sec. 8.1.3 does not include them. MCLs should be included as a chemical-specific ARAR for all scenarios, not just as a remediation goal for a residential reuse scenario. The discussion of the Site 16 GW ARARs in Chapter 5 (for Site 6) should be moved to the Site 16 chapter.**

Response: Section 8.1.3 was revised to include MCLs as an ARAR, and the discussion for Site 6 was corrected.

23. Comment: **Sec. 8.2.2.2, LUCs. The Navy should discuss the substance of the LUCs (e.g. no excavation, no residential reuse).**

Response: The text has been revised to discuss the substance of the proposed IC.

24. Comment: **8.3.2.2, GW Alt. 2 (LUCs and "groundwater contaminant examination"). Again, the Navy needs to clarify whether GCE is a new term for monitoring, or if they are contemplating MNA as an aspect of this remedy. The same comment applies to the GCE portion of the active remedies.**

Response: Section 8.3.2.2 was clarified to distinguish between the use of monitoring and MNA.

25. **Comment:** **<u>Sec. 8.6.1.2, GW Alt 1 (no action), Compliance with ARARs</u>. It is not accurate to say that this remedy will comply with ARARs through natural attenuation because there will not be monitoring to confirm that. If the Navy is evaluating a MNA remedy, it should be presented separately from no action.**

Response: Section 8.6.1.2 was revised to identify MNA when it is a component of a remedial alternative. In addition, the alternative evaluation was revised to remove any suggestion that the "no-action alternative" complies with ARARs.

26. **Comment:** **<u>Sec. 8.6.2, GW Alt. 2 (LUCs)</u>. This is another place where it is unclear whether there is a MNA component. Without it, there is no evidence that this remedy will meet ARARs. If the Navy is including MNA as part of a remedy, they need to show that it will satisfy EPA policy on MNA. Also, they should indicate how long it will take this remedy to achieve ARARs.**

Response: Section 8.6.2 was revised to identify MNA when it is a component of a remedial alternative.

27. **Comment:** **<u>Sec. 8.7.5, GW Comparative analysis, short-term effectiveness</u>. Short-term effectiveness will vary greatly among the alternatives because Alt. 4 will achieve MCLs in the short-term but the others will not. This should be reflected in the analysis.**

Response: The text was revised to indicate that Alternative 4B would achieve the greatest short-term effectiveness since it would induce the quickest contamination degradation rate while minimizing impacts on to the workers and environment.

28. **Comment:** **<u>Sec. 8.7.6, GW comparative analysis, implementability</u>. Alt. 3 and 4 should not be considered the same in terms of LUCs, as Alt. 4 would require them for a much shorter time.**

Response: The comparative analysis was reevaluated. The text was revised to indicate that Alternatives 4A and 4B would require a shorter time since LUCs will remain only the duration of active treatment.

29. **Comment:** **<u>Sec. 8.7.7, GW comparative analysis, cost</u>. It is not clear how long LUCs will be necessary for the various alternatives. The Navy includes 30 years for Alt. 3. One would assume that Alt. 2 would**

require more than 30 years of LUCs and Alt. 4 less than 30 years. There is mention in section 8.7.8 that Alt. 2 will take 37 years; this should be explained earlier.

Response: Section 8.7.7 and the cost estimates were revised to establish the length of time LUCs will be required for each remedial alternative.

30. **Comment:** **Table 8-5, pages 1-2, LUCs. The discussion of the LUCs should include a deed restriction in Navy deed of the property.**

Response: Table 8-5 was revised to include a deed restriction.

Appendix B, ARARs

[Comments regarding ARARs also apply in many cases to the ARARs discussions in the separate FS chapters and generally are not made separately in those chapters.]

31. **Comment:** **General Comment: EPA greatly appreciates the focused ARARs discussion in this FS.**

Response: Comment noted.

32. **Comment:** **P. B-8, Sec. B1.2.3.2. Chronology of Efforts to Identify State ARARs. EPA urges the State to submit an up-to-date list of State ARARs as soon as possible to incorporate any changes in requirements or analysis since DTSC's 1996 submission.**

Response: Comment noted.

33. **Comment:** **P. B11-12. The FS appears to assume that some of the waste will be RCRA characteristic HW and that the soils will need to require stabilization prior to disposal. Are there ARARs for that process?**

Response: The Navy does not expect any on-site stabilization of soil; therefore, no additional ARARs are required for this FS. Any stabilization required would be conducted off site at the disposal facility.

34. **Comment:** **P. B-13 – B-14, B2.1.1, Groundwater ARARs. See general comments. Also,**

(a) The Navy should explain why California MCLs rather than federal MCLs are considered to be relevant and appropriate. A chart with the relevant numbers would be helpful.

(b) The Navy should ascertain the current status of the Regional Board's proposed de-designation of GW in this OU from the MUN designation.

(c) P. B-20, language concerning California's position on SWRCB Resolutions is copied from the ROD for another base and would need to be edited to have any meaning in this FS.

Response: (a) The Navy reviewed state and federal MCLs for Site 16 and chose the most stringent of either the California MCL or federal MCL. A table was included to show the comparison.

(b) The Navy has provided a brief write-up on the current status of the proposed de-designation of groundwater from the MUN designation. The most recent information is from August 2004, and the State Water Resources Control Board (Water Board) had not determined whether or when it would consider the proposed dedesignation (Water Board 2004).

(c) The text was revised to ensure it is relevant to the OU 1 FS Report.

35. **Comment:** **<u>P. B-22 third paragraph</u> says that as long as excavated material remains inside the AOC it is not newly generated and will not be subject to RCRA generator, treatment or other waste management requirements. This statement is somewhat misleading, as it implies that RCRA requirements will not be considered to be ARARs because the excavated material would remain in the AOC. However, while land disposal requirements do not apply within an AOC, other RCRA requirements area often found to be ARARs. It appears, however, that the Navy is identifying 22 CCR 66262.34 as applicable for the temporary storage of waste within the AOC.**

Response: The text was revised to clarify the discussion of the area of contamination.

36. **Comment:** **<u>P. B-25, B3.1.1. ESA</u>. Consultation requirements are generally not considered to be TBCs, although EPA encourages the Navy to follow such requirements.**

Response: Comment noted. It is not anticipated that any consultations will be required for any site in OU 1.

37. **Comment:** **<u>P. B-26, first line</u>, remove the second "is."**

Response: The text was revised as requested.

38. **Comment:** **<u>Sec B4.2.1. RCRA Requirements</u>. In the discussion of 22 CCR 66262.34, the FS should note that this ARAR in turn triggers other requirements depending on whether the waste is placed in containers, tanks, drip pads, or containment buildings.**

Response: Appendix B was revised to indicate that other requirements may be ARARs, depending on the placement of the waste.

39. **Comment:** **<u>P. B-27, B4.2.2.ICs</u>. The FS says that at Site 6, ICs "will" be implemented to prevent residential reuse of the property. Should "will" be "may"?**

Response: The text was revised to replace the word "may" with the word "will."

40. **Comment:** **<u>P. B-27, Federal Hazardous Materials Transportation Law</u>. EPA does not consider requirements based on the Federal Hazardous Materials Transportation Law to be ARARs because they are not based on an environmental law.**

Response: Comment noted. The text was reviewed and revised as appropriate.

41. **Comment:** **<u>P. B-28, ICs</u>. The paragraph that EPA does not agree that certain sections of the California codes are ARARs should be removed. EPA has reconsidered statements to that effect submitted in previous Alameda documents.**

Response: The text was revised to delete the referenced paragraph.

42. **Comment:** **<u>P. B-29, B4.2.2.3, Vapor Removal</u>. This paragraph is confusing because it states that there are no ARARs for this part of the remedy, but it also indicates that the system would be installed in accord with BAAQMD regulations, suggesting that there may be some BAAQMD ARARs that should be considered. This should be clarified.**

Response: The text was revised to explain that no specific state or federal ARARs are available for vapor removal; however, if a system is constructed, it will be constructed in accordance with all ARARs.

43. **Comment:** **<u>Sec. B4.3, Soil Alt. 3, Excavation, Action-Specific ARARs</u>. Would substantive NPDES requirements found in the general permit for stormwater runoff from construction sites apply to any of the excavation remedies in this FS?**

Response: The proposed excavations do not exceed the 1-acre size criterion for applicability of NPDES requirements.

44. **Comment:** **<u>GW ARARs</u>: EPA does not believe UIC requirements would be ARARs for ISCO or HRC.**

Response: The UIC requirements were retained as they can apply to a fluid.

RESPONSES TO COMMENTS FROM DTSC

General Comments

DTSC-1.Comment: **Several data gaps have been identified in OU-1 based on the results of the RI. The BCT has agreed to address data gaps at each of the sites as part of the FS and remedial design phases. Several data gaps are noted and discussed in the FS document. Additional data gaps have been identified in this memorandum by GSU. These additional data gaps have been identified based on GSU's review of the RI. However, as indicated in DTSC's comments presented in Attachment 2 of Appendix K of the Final RI Report, all data gaps cannot be fully identified without additional *evaluation* of the data collected during the RI.**

It may be demonstrated through rigorous analysis and presentation of the RI data that additional data gaps do not exist. The GSU appreciates the sample location maps by chemical group that were included in the Final RI Report. However, in order to demonstrate the presence or absence of additional data gaps, please consider preparing soil maps for each site which present detected concentrations that are greater than residential Preliminary Remediation Goals (PRGs) for the 0 to 2 foot, 2.5 to 8 foot, and greater than 8 foot depth intervals. Please indicate those sample locations where detection limits exceeded the residential PRGs. Please also prepare similar maps for groundwater data.

Because the data obtained from the additional site characterization activities (data gap sampling) may significantly affect remedial design considerations, the Executive Summary (ES) and Section 1.0 (Introduction) of the FS report should include a discussion/presentation of data gaps. It is important to lay this information out early in the document to ensure that all concerns regarding data gaps are addressed. It should be stated that the site characterization approach taken during the remedial design will be as rigorous as that which would be used for an RI, and that human health and ecological risk assessments will be performed which will include the new site data.

Please identify in narrative and tabular format the data gaps that were determined for each site based on the Final RI and state the agreement among the BCT that complete characterization of these data gaps will be addressed in the Remedial Design Workplan. Please be advised that all data gaps may not have been identified until rigorous analysis and presentation of the RI data as suggested above is completed.

Response: Section 4.0 was revised to discuss the data gaps identified during the RI.. The Navy believes that the information presented in the RI report is sufficient to identify data gaps and evaluate remedial alternatives (Tetra Tech 2004). The Navy agrees that additional information about contamination or plume extent is necessary to ensure the chosen remedial alternative can achieve the RAO; this information will be obtained from results of the sampling discussed in each alternative.

2. **Comment:** **There does not appear to be good hydraulic control at any of the sites. Groundwater flow directions and velocities presented on the various site-specific maps within the document are not consistent from figure to figure (see figures 3-2 through 3-6 and 5-2 through 5-7) and do not represent site-specific groundwater data. The Basewide Groundwater Monitoring Reports for Sites 6, 7, 8, and 16 present interpretations of site-specific flow directions and gradients that differ from those presented in this FS.**

Please use site-specific water level data on figures, and provide the source and date of water level data used for groundwater flow directions and velocities. Ensure that data presented for flow directions and velocities are consistent from figure to figure.

Response: The figures referenced in the comment above are intended only to show the groundwater plumes for contaminants. Flow direction is consistent from figure to figure.

Figures 2-3 and 2-4 show the potentiometric surface for each day sampled. Groundwater flow velocities were calculated on the basis of well tests in the RI. Potentiometric maps were constructed using well data from each site and adjacent sites to provide better hydraulic control than only using site wells.

3. **Comment:** **There has been no demonstrated connection between soil sources and volatile organic compounds (VOCs) in groundwater at Sites 6, 8, and 16. It is the opinion of the GSU that soil sources at these sites represent data gaps. Please provide more information to establish how and where VOCs were introduced to groundwater at each of these sites. Sanitary and storm sewers should be considered as potential historical sources and as preferred pathways for contaminant migration.**

Response: The Navy agrees that storm sewers are a potential source of VOCs in groundwater, which would readily explain the absence of VOCs in surface soil. The site history shows that all of these sites have been paved since the 1940s, making it unlikely that VOCs would be detected in surface soils. The Navy does not agree that this represents a data gap.

4. **Comment:** **It is the opinion of the GSU that the FS should specify the proposed scope of additional data gap investigations including sampling locations, methods, and rationale. Without this information, the reviewers cannot concur that all concerns regarding data gaps have been/will be addressed. Information should include number and locations of proposed borings and wells, as well as purpose of each sampling location and proposed analytical suite. Additional details regarding methods and procedures can be provided in the Remedial Design Workplan.**

Please include in the respective FS Evaluation sections for each site (Sections 5, 6, 7, and 8) a summary of proposed soil and groundwater sampling to be undertaken to address each of the data gaps identified. Include proposed locations and depths of borings and monitoring wells, as well as the rationale for each sampling location.

Response: The Draft FS Report provides alternatives that include collection of additional soil or groundwater to address identified data gaps. The FS Report was not revised to provide the requested sampling information. This information should be part of the remedial design plan and is premature at this time.

5. **Comment:** **The terms COC, COPC, and risk drivers are all used in this document but are not defined. It seems that "COC" and "risk drivers" are sometimes used interchangeably. This inconsistent use of terminology is confusing to the reviewer. For example, in Section 3.2.3 (Risk Management Decisions for Site 6) it is stated that no COCs were identified for soil, but in Section 5.1.1 (Chemicals of Concern at Site 6) it is stated that nine COCs were identified for soil (see Specific Comment #35).**

Please define the terms COPC, COC, and risk drivers and use them consistently throughout the FS document.

Response: COPCs are "chemicals of potential concern," which are any chemical detected.

COCs are "chemicals of concern," which pose significant risk (greater than 10^{-6} or a hazard index [HI] above 1.0), are greater than background (for metals), and are likely to require remedial action because they are prevalent at a site.

Risk driver are chemicals defined by the risk assessment as demonstrating significant risk to human health or the environment. They are further defined as chemicals that pose a cancer risk above 1E-06, an HI above 1.0, or pose potential risk to ecological receptors.

The text was revised to use consistent terminology.

6. **Comment:** **The embedded tables in Sections 3.2.3, 3.3.3, 3.4.3, and 3.5.3 entitled *Chemicals Exceeding Screening Levels at Sites 6, 7, 8, and 16*, respectively, are confusing. It appears that only a subset of the chemicals exceeding screeing levels are included on these tables (see Specific Comment # 35). Decisions to "not identify chemicals as COCs" based on risk being "within the risk management range" needs to be supported with site data. Where data gaps exist, chemicals detected above screening levels should not be excluded as COCs due to the likely underestimation of risk.**

Please revise the embedded tables in the above referenced sections. Please consider adding all constituents that exceeded screening levels based on the results of the RI, their respective risk contribution, and cumulative risk and hazard values by media. It is the opinion of the GSU that chemicals should not be excluded as COCs if data gaps exist.

Response: The tables were retitled as follows: "Risk Management Decisions for Chemicals Exceeding Screening Levels at Site 6, 7, 8, or 16." However, the Navy has not included all chemicals that exceeded screening levels. The Navy acknowledges the DTSC's concern that risks may be underestimated; however, a risk assessment has already been conducted to evaluate potential risks and associated COCs. Additionally, the data gaps are not associated with chemical identification but with the extent of contamination.

7. **Comment:** **In Sections 3.2.2.1, 3.3.2.1, 3.4.2.1, and 3.5.2.1, it is stated for each of the sites that the either recreational, commercial/industrial, and/or construction worker scenarios are considered the most likely exposure scenarios. The GSU questions the source of this information. The Reuse Plan Map presented in the report entitled *Determination of the Beneficial Uses of Groundwater* (Tetra Tech EM, Inc. July 2000) indicates that the planned future use at Sites 6, 8, and 16 is "mixed-use" which may include residential, recreational, industrial, office space, civic space, research and development space, or open space. Site 7 is designated as "housing." Groundwater at Site 16 has been designated as a potential drinking water source.**

Please clarify the basis for the determination of "most likely exposure scenarios." In addition, because each of the sites has residential or potential residential future uses, the risks determined for the residential scenario should be used as the basis for making risk management decisions and establishing remedial action goals.

Response: The "most likely exposure scenarios" were determined based on Site 6 as commercial, Site 7 and Site 8 as residential, and Site 16 as mixed residential.

8. **Comment:** **Please explain in the ES and in Sections 5.0, 6.0, 7.0, and 8.0 that the no action alternative is being evaluated as a requirement of the NCP to provide a baseline for comparison. It is not considered to be an alternative that meets the RAOs.**

Response: The FS Report was revised for each alternative to indicate that "The NCP requires evaluation of the no-action response as part of the FS process."

Specific Comments

1. **Comment:** **Executive Summary. The first sentence in the second full paragraph of the ES states that the RI report for Sites 6, 7, 8, and 16 recommended further evaluation to address potential human health risks from soil contamination at Sites 7 and 8, and groundwater contamination at Sites 6 and 16. This statement is not consistent with the Final RI Report recommendation that states that soil *and* groundwater at each of the sites are recommended for further evaluation in an FS. Please correct.**

   In addition, the Tetra Tech RI Report reference (Tetra Tech 2004) used in this paragraph and throughout the FS document should be referring to the Final RI dated November 18, 2004 and not the Draft RI dated February 13, 2004. Please correct this reference.

   Response: The Executive Summary was revised as requested. Additionally, the reference for the RI report was revised throughout the FS Report.

2. **Comment:** **Executive Summary. Please consider adding a table to the ES listing the RAOs, General Response Actions, and Remedial Alternatives that were developed for each media at each site.**

   Response: The Executive Summary was revised to clarify the RAOs, GRA, and remedial alternatives that were developed for each media at each site.

3. **Comment:** **Section 1.1 – Purpose and Objectives. Please state that it is the opinion of the regulatory agencies that the risks for each site have been consistently underestimated due to data gaps. However, it was agreed that the FS would proceed because it has been determined that remedial action is warranted at each of the sites. It should be noted that the results of additional characterization at each site may increase estimates of soil and groundwater volumes for remediation which may impact time frames for completion and cost.**

   Response: Data gaps are acknowledged in Section 4.0, and the Navy has agreed to remediate the sites, as necessary.

4. **Comment:** **<u>Section 2.3.1 – Site 6 Geology</u>. It is stated that the Bay Sediment Unit (BSU) occurs from approximately 9 to 15.5 feet below the ground surface (bgs) and is thought to be consistent throughout the site. What is the thickness of the BSU across the site, and what data were used to determine that the BSU is consistent throughout Site 6?**

Response: Section 2.3.1 was revised to provide the site geological history. Geological conditions beneath Site 6 were assessed by reviewing lithologic logs and cone penetrometer test logs of pressure differentials for 24 borings advanced at the site (Appendix A of the Final RI Report [Tetra Tech 2004]). On average, the Bay Sediment Unit is 6.5 feet thick.

5. **Comment:** **<u>Section 2.3.3 – Site 8 Geology</u>. It is stated that the BSU occurs from approximately 11 to 15.5 feet bgs and also that it was found discontiuously throughout the site at depths from 9.5 to 13 feet bgs. Please clarify the data interpretations regarding the presence and depth of the BSU at Site 8. What is the thickness of the BSU across the site, and what data were used to determine that the BSU is discontinuous?**

The last sentence in the same section states that the clay horizon (BSU?) contains 15 to 80 percent fines and fine sand. If this geologic unit contains only 15 percent fines and/or up to 80 percent fine sand, then it would not be defined as a clay. Please clarify or remove this statement.

Response: Section 2.3.3 was revised as requested.

6. **Comment:** **<u>Section 2.4.2.1 – Site 6 Hydrogeology</u>. It is stated that there is an "east-west groundwater divide north of Site 6." However, in looking at the site-specific data it appears that this "divide" may actually occur on the northern portion of Site 6. Water level elevations from M06-06 in the central portion of Site 6 have been consistently higher than those from M06-05 which is located on the north central perimeter of the site. If water levels in M06-06 are representative, the site-specific hydraulic gradient is steeper than that reported, and groundwater flow velocities are higher.**

Please use site-specific water level data on figures, and provide the source and date of water level data used for groundwater flow directions and velocities. Ensure that data presented for flow directions and velocities are consistent from figure to figure (see General Comment # 2).

Response: Site-specific groundwater data were used, as shown on Figures 2-3 and 2-4.

7. **Comment** **<u>Section 3.0 – Remedial Investigation Summary and Recommendations</u>. In the first paragraph, the reference to Section 3.6 (site-specific risk management decisions) should be removed and replaced with the appropriate references. Section 3.6 does not exist.**

Response: Section 3.0 was revised to reference the appropriate section.

8. **Comment:** **<u>Section 3.2.1 – Nature and Extent Results, Soil (Site 6)</u>. The statement that chemicals appear to have been released to soil in the following three areas: (1) near OWS-041 and the solvent dip tank associated with WD-041A, (2) between WD-040 and Building 41, and (3) near the probable location of avionics laboratories, is not substantiated with soil analytical data. Soil samples collected from these areas were mostly non-detect for VOCs, with only a few exceptions. Evidence for these potential source areas are more likely historical land use and groundwater data. However, groundwater plume definition at Site 6 is incomplete and groundwater flow directions, gradients, and velocities are not well established in the RI (see Specific Comment # 6).**

Please clarify what the determination of three principal source areas is based on. Because soil sources were not found at Site 6, it is the opinion of the GSU that the source of VOCs in groundwater is a data gap that should be addressed with additional investigation and discussed in this FS.

Response: Figures 3-3, 3-4, and 3-5 support the statement declaring the three main locations of chemicals. The Navy will further characterize the groundwater plume to support the remedial action, which is an existing component of the alternatives for evaluating groundwater remedial actions.

9. **Comment:** **<u>Section 3.2.1 – Nature and Extent Results, Soil (Site 6)</u>. The statement that no VOCs were detected in soil samples collected from depths greater than 10 feet bgs is incorrect. Based on data contained in Appendix D of the Final RI Report, the highest concentration for all VOCs detected in soil was from soil boring B06-21 at a depth of 13.5 to 14.5 feet bgs. Please correct this information.**

Response: Section 3.2.1 was revised to indicate VOCs were detected in soil samples from a depth of 13.5 to 14.5 feet bgs.

10. **Comment:** **<u>Section 3.2.1 – Nature and Extent Results, Soil (Site 6)</u>. In the last full paragraph of this section it is stated that OWS-40A and OWS-40B represent data gaps and will be addressed as part of Site 6 in this FS. Please consider adding a reference to the subsequent section in the FS report that provides information on how OWS-040A and OWS-040B are being addressed (See Specific Comment # 34).**

Response: The Navy acknowledges the OWSs present data gaps and will collect soil and groundwater samples from beneath every OWS. These data gaps are addressed in Section 4.0 of the Draft FS Report.

11. **Comment:** **<u>Section 3.2.1 – Nature and Extent Results, Groundwater (Site 6)</u>. In the last paragraph of this section it is stated that VOCs in groundwater at Site 6 appear to be confined to the upper FWBZ. This statement is not founded with sufficient data. The BCT has agreed that additional plume delineation in both the horizontal and vertical directions needs to be performed at Site 6. Please omit this statement.**

Response: This statement was deleted from the FS Report.

12. **Comment:** **In the same paragraph it is stated that all VOC concentrations are decreasing from historical maximums and there appears to be no continuing source of VOCs at Site 6. While concentrations of VOCs in monitoring wells may appear to have declined, the GSU does not believe that these trends are significant. Fluctuations observed are within expected fluctuations due to sampling and analytical variability. Trends observed are generally not order of magnitude changes. They may merely mean that the plume is shifting. In addition, monitoring wells at Site 6 have not been placed in areas of highest concentration (i.e. near the approximate location of the portable avionics laboratory).**

The statement that groundwater plumes are not migrating off-site is also not supported by the current data and monitoring well network. As discussed previously, it has been agreed by the BCT that the VOC plume at Site 6 has not been fully characterized (horizontally or vertically). Additional monitoring wells are needed.

Please add a discussion of data gaps in groundwater. Include OWS-040A and OWS-040B, as these oil water separators will likely require both soil and groundwater investigations. Please also refer the reader to the subsequent section of the FS that addresses groundwater data gaps at Site 6.

Response: Section 4.0, Feasibility Study Approach, was revised to indicate the OWSs are data gaps that require further investigation, including soil and groundwater sampling. As a result, Section 3.0 of the RI Report was not revised.

13. **Comment:** **<u>Section 3.2.2.1 – Human Health Risk Assessment Results, Soil (Site 6).</u> The first sentence of this section states that the recreational, commercial/industrial, and construction worker scenarios are considered the most likely exposure scenarios. The GSU questions the source of this information (see General Comment # 7). Please clarify the basis for determination of "most likely exposure scenarios."**

Response: Please see the response to DTSC General Comment 7.

14. **Comment:** **<u>Section 3.2.3 – Risk Management Decisions (Site 6)</u>. Please state in the introductory paragraph that Site 6 is designated as "mixed use" and therefore, that the risks determined for the residential scenario will be the basis for making risk management decisions (see General Comment # 7).**

Response: Please see the response to DTSC General Comment 7.

15. **Comment:** **<u>Section 3.2.3 – Risk Management Decisions, Groundwater (Site 6)</u>. It is stated in the second full paragraph on Page 3-13 that groundwater was recommended for further evaluation in this FS to address the risk from TCE in groundwater to the commercial/industrial worker through the vapor intrusion pathway. However, risk management decisions for Site 6 should be based on potential residential exposure to vapors in indoor air (see General Comment # 7). Please revise this discussion to reflect risk management decisions based on the residential exposure scenario.**

Response: Please see the response to DTSC General Comment 7.

16. **Comment:** **<u>Section 3.3.1 – Nature and Extent Results, Soil (Site 7)</u>. It is stated that aluminum and copper were detected above ambient levels across the site but that these metals are not associated with historical Navy activities. What is the explanation for their presence at elevated levels and how is it determined that they are not related to Navy activities?**

It is also stated that PAH concentrations in Site 7 soil are generally low. Please explain what "generally low" means.

Response: Natural variability that was not reflected in the background data set could readily explain the elevated concentrations of aluminum and copper. Both of these metals are natural components of soils and sediments. However,

the presence of elevated concentrations of metals in soils in the soil debris area will be considered separately from the rest of the site. The soil debris area clearly has elevated concentrations of metals that are related to site activities. The buildings away from the debris area did not historically perform activities that would have resulted in any type of aluminum or copper release. Therefore it is determined that elevated concentrations of aluminum and copper outside the soil debris area are not related to past Navy activities. Section 3.3.1 was revised to distinguish between metals concentrations in soil outside of the debris area and metals concentrations in the debris area.

Additionally, Section 3.3.1 was revised to clarify the term "generally low" means less than the PAH screening level of 0.62 milligrams per kilogram.

17. **Comment:** **<u>Section 3.3.1 – Nature and Extent Results, Soil (Site 7)</u>. It is stated that the vertical and horizontal boundaries of arsenic, lead, and cadmium in the soil debris area have not been fully defined. It is the opinion of the GSU that the extent of elevated levels of arsenic, copper, and lead outside the soil debris area has also not been fully defined. Please state that the extent of elevated levels of these metals in the soil represents a data gap that is addressed in this FS, and refer the reader to the subsequent section where it is addressed.**

Response: Data gaps are addressed in Section 4.0, Feasibility Study Approach, of the FS. It is unnecessary to add a reference to this section.

18. **Comment:** **<u>Section 3.3.1 – Nature and Extent Results, Soil (Site 7)</u>. In the last full paragraph of this section it is stated that OWS-459 represents a data gap and will be addressed in this FS. Please consider adding a reference to the subsequent section in the FS report that provides information of how OWS-459 is addressed (see Specific Comment # 37).**

Response: Section 4.0, Feasibility Study Approach, was revised to indicate the OWS areas are data gaps that require further investigation, including soil and groundwater sampling. As a result, Section 3.0 of the RI Report was not revised.

19. **Comment:** **<u>Section 3.3.1 – Nature and Extent Results, Groundwater (Site 7)</u>. The second paragraph on page 3-15 is a discussion of the risk assessment and seems out of place. Please either remove this paragraph or move it to *Section 3.3.2 - Risk Assessment Results*.**

In addition, the first sentence of the third paragraph on page 3-15 is meaningless. Please revise.

Response: Comment noted. This paragraph was incorporated into Section 3.3.2 of the FS Report. Additionally, the first sentence of the third paragraph was revised for clarification.

20. **Comment:** **<u>Section 3.3.1 – Nature and Extent Results, Groundwater (Site 7)</u>. The GSU disagrees that the extent of PAHs in groundwater at Site 7 has been defined. The Final RI Report states that PAHs were detected above the screening level in groundwater throughout Site 7. The extent of PAHs in groundwater is a data gap and should be addressed in this FS. In addition, the GSU disagrees that there are sufficient data to eliminate arsenic as a site-related groundwater contaminant. Arsenic is a COC for the soil debris area and a potential COC for soil outside the soil debris area.**

    Please add a discussion of data gaps in groundwater. Include OWS-459 as this oil water separator will likely require both soil and groundwater investigations. Please also refer the reader to the subsequent section of the FS report that addresses groundwater data gaps at Site 7.

    Response: Section 4.0 was revised to identify data gaps, including the OWS areas. In addition, PAHs will be recommended for further investigation in the Basewide monitoring program.

21. **Comment:** **<u>Section 3.3.2.1 – Human Health Risk Assessment Results, Soil (Site 7).</u> The first sentence of this section (on page 3-16) states that the commercial/industrial and the construction worker scenarios are considered the most likely exposure scenarios. The GSU questions the source of this information (see General Comment # 7). Please clarify the basis for determination of "most likely exposure scenarios."**

    Response: Please see the response to DTSC General Comment 7.

22. **Comment:** **<u>Section 3.3.3 – Risk Management Decisions (Site 7)</u>. Please state in the introductory paragraph that Site 7 is designated as residential housing and therefore, that the risks determined for the residential scenario will be the basis for making risk management decisions. (see General Comment # 6).**

    Response: Please see the response to DTSC General Comment 7.

23. **Comment:** **<u>Section 3.3.3 – Risk Management Decisions (Site 7)</u>. The following comments pertain to the embedded table entitled *"Chemicals Exceeding Screening Levels at Site 7"* on pages 3-18 and 3-19:**

- **The GSU disagrees that arsenic in soil outside the soil debris area can be eliminated as a COC due to lack of thorough characterization. In addition, the GSU believes that copper and lead should be included as COCs for soil outside the soil debris area due to lack of thorough characterization. The GSU recommends additional soil sampling for arsenic, copper, and lead at Site 7 be included as a data gap.**

- **Please include the risk assessment results for benzene. They appear to have been inadvertently left off of the table.**

- **The table indicates that the residential cancer risk due to arsenic in the soil debris area is 6E-05. The Final RI for OU-1 indicates that the carcinogenic risk from arsenic in soil is 9E-05. There appear to be other discrepancies in this table between the two documents. (For example, the groundwater HI for arsenic and thallium). Please revise the table to reflect the correct information.**

- **Please provide a footnote to the table or some other means to indicate why lead is accepted as a COPC for the soil debris area and groundwater.**

- **The GSU disagrees that there are sufficient data to eliminate arsenic as a site-related groundwater contaminant. The incremental cancer risk due to arsenic in groundwater is 2E-03 and the incremental noncancer risk is 8. Arsenic is a COC for the soil debris area and a potential COC for soil outside the soil debris area. Arsenic should be retained as a COC for Site 7 groundwater in the FS.**

- **The GSU disagrees that PAHs should not be accepted as COCs for Site 7 groundwater. See Specific Comment # 19.**

- **The GSU agrees that thallium concentrations in groundwater have been decreased during recent monitoring rounds. However, it should be noted that thallium will continue to be monitored through the Basewide Groundwater Monitoring Program to determine whether this trend continues.**

Response: All discrepancies in this table were corrected.

24. **Comment:** **<u>Section 3.3.3 – Risk Management Decisions, Site 7 Soil</u>. The GSU disagrees with the recommendation of no further action for soil at Site 7 (page 3-21). The extent of elevated levels of arsenic, copper, and lead outside the soil debris area has not been defined and represents a data gap. It is recommended that this FS include data gap sampling for metals in areas where elevated arsenic, copper and arsenic were found in soil outside the soil debris area.**

Response: Copper and lead are the only risk drivers for ecological receptors. The Navy does not intend to conduct remedial activities at Site 7 for ecological receptors. Arsenic is attributed to background and is not subject to remediation.

25. **Comment:** **<u>Section 3.3.3 – Risk Management Decisions, Site 7 Groundwater</u>. The GSU disagrees with the recommendation of no further action for groundwater at Site 7. At a minimum, continued monitoring for PAHs and metals should be performed to determine whether concentrations are increasing or decreasing over time, and whether these contaminants may be migrating off-site. In the second paragraph on page 3-21, it is hypothesized that PAHs will desolubilize from the groundwater once the TPH removal action is complete. This hypothesis needs to be supported with actual site data.**

Response: The Navy intends to continue monitoring for PAHs and metals as part of the Basewide Groundwater Monitoring Program. As a result, this monitoring was not included as a remedial alternative in the FS Report.

26. **Comment:** **<u>Section 3.4.1 – Nature and Extent Results, Soil (Site 8)</u>. In the last full paragraph of this section it is stated that OWS-114 represents a data gap and will be addressed as part of Site 8 in this FS. Please consider adding a reference to the subsequent section in the FS report that provides information on how OWS-114 is addressed (see Specific Comment #39).**

Response: Section 4.0, Feasibility Study Approach, was revised to indicate the OWSs are data gaps that require further investigation, including soil and groundwater sampling. As a result, Section 3.0 of the RI Report was not revised.

27. **Comment:** **<u>Section 3.4.1 – Nature and Extent, Groundwater (Site 8)</u>. The GSU does not agree that benzene concentrations in groundwater are decreasing from historical maximums. The most recent sample collected from east perimeter monitoring well M08-06 (November 1998) had the highest result for benzene (58.3 µg/l) indicating that concentrations in this well may be increasing. In addition, the sample collected from north perimeter monitoring well M08-03 in June 2004 indicated that the benzene concentration in this well is also increasing. Fluctuations observed in benzene concentrations are within expected fluctuations due to sampling and analytical variability. They may also represent changes due to plume migration. In addition, monitoring wells at Site 8 may not have been placed in areas of highest concentration.**

It is the opinion of the GSU that additional monitoring wells need to be installed at Site 8 to address data gaps with respect to benzene and possibly TCE and 1,4-dioxane in groundwater. Please also indicate in this section that OWS-114 represents a data gap and will require both soil and groundwater investigations.

Response: Section 4.0, Feasibility Study Approach, was revised to indicate the OWSs are data gaps that require further investigation. As a result, Section 3.0 of the RI Report was not revised. Soil samples will be collected near all OWSs, and groundwater samples will be collected from beneath all OWSs. Groundwater will be further investigated under the Basewide Groundwater Monitoring Program, but no additional monitoring wells will be installed. Samples will be analyzed for trichloroethene and 1,4-dioxane, and sampling results are included in the FS Report.

28. **Comment:** **Section 3.4.2.1 – Human Health Risk Assessment, Soil (Site 8). The first sentence of this section states that the recreational, commercial/industrial, and construction worker scenarios are considered the most likely exposure scenarios. The GSU questions the source of this information (see General Comment # 7). Please clarify the basis for determination of "most likely exposure scenarios."**

Response: Please see the response to DTSC General Comment 7.

29. **Comment:** **Section 3.4.3 – Risk Management Decisions (Site 8). Based on GSU's review of the RI, the data at Site 8 were not deemed suitable for risk assessment purposes due to elevated detection limits. The GSU recommended additional monitoring wells be installed in the heart of the benzene plume. This concern represents a data gap that should be addressed in this FS. Due to incomplete site characterization, the GSU does not concur with the risk management decision that benzene and TCE are not groundwater COCs. Please retain benzene and TCE as groundwater COCs.**

Response: The Navy believes that data from Site 8 are suitable for risk assessment. The detection limits did not affect the calculations of the exposure point concentration, and the RI report includes additional detail about the calculation methodology (Tetra Tech 2004). Because risk did not exceed the risk management range, the Navy recommends no further action for groundwater.

30. **Comment:** **Section 3.5.1 – Nature and Extent Results, Soil (Site 16). The second paragraph under the *Soil* subsection on page 3-28 discusses groundwater contamination. It is unclear why there is a discussion of groundwater in the subsection on soil. Please move this discussion to the subsection on groundwater. Also, in this paragraph, it is stated**

that "natural processes are slowly degrading the VOCs." This statement needs to be supported with scientific evidence.

The fourth paragraph under the *Soil* subsection discusses the results of the risk assessment and also seems out of place. Please move this discussion to the appropriate section.

There is insufficient discussion of soil contamination in this subsection of the FS report. It is stated that chemicals were released to soil in two principal areas but the chemicals present, extent, and levels are not discussed. It is not possible to evaluate the risk management decisions for soil in Section 3.5.3 without this information. Please provide a summary of the soil data for Site 16 so that the reviewer can understand the concerns with soil and the basis for risk management decisions.

Response: This second paragraph was moved to a more appropriate location. The statement declaring that "natural processes are slowly degrading the VOCs" was revised to provide further detail.

This fourth paragraph was moved to a more appropriate location.

Soil data, including its location, extent, and levels, are discussed in the Section 3.5.1, Nature and Extent, of the Draft FS Report; therefore, this information was not included in Section 3.5.3.

31. **Comment:** **<u>Section 3.5.1 – Nature and Extent Results, Soil (Site 16)</u>. In the last full paragraph of this section it is stated that OWS-608A and OWS-608B represent a data gap and will be addressed in this FS. Please consider providing a reference to the subsequent section in the FS report that provides information on how these oil water separators are addressed (see Specific Comment # 42).**

Response: Section 4.0, Feasibility Study Approach, was revised to indicate the OWSs are data gaps that require further investigation. As a result, Section 3.0 of the RI Report was not revised.

32. **Comment:** **<u>Section 3.5.2.1 – Human Health Risk Assessment Results, Soil (Site 16).</u> The first sentence of this section states that the commercial/industrial and the construction worker scenarios are considered the most likely exposure scenarios. The GSU questions the source of this information (see General Comment # 7). Please clarify the basis for the determination of "most likely exposure scenarios."**

Response: Please see the response to DTSC General Comment 7.

33. **Comment:** **<u>Section 3.5.3 – Risk Management Decisions (Site 16)</u>. Please state in the introductory paragraph that Site 16 is designated as "mixed use" and therefore, that the risks determined for the residential scenario will be the basis for making risk management decisions (see General Comment # 7).**

Response: Please see the response to DTSC General Comment 7.

34. **Comment:** **<u>Section 4.0 – Feasibility Study Approach</u>. The first paragraph of Section 4.0 is incomplete with respect to data gaps. Please expand this discussion to include a comprehensive list of data gaps identified by the regulatory agencies.**

Response: Section 4.0 was revised to list all data gaps.

35. **Comment:** **<u>Section 5.1 – Remedial Action Objective Development for Soil and Groundwater at Site 6</u>. It is stated that the general response objectives for soil at Site 6 are to determine whether soil adjacent to OWS-040A and OWS-040B contain contaminants at concentrations that exceed their respective residential PRGs, and to prevent human exposure to any such soils. Is it true that residential PRGs will be used for metals and TPH?**

Please add that another general response objective for soil is to prevent it from acting as a continuing source of contaminants to groundwater. Also include a discussion of data gaps for groundwater adjacent to OWS-040A and OWS-040B. State that 1,4-dioxane will be added to the list of analytes for the additional soil and groundwater characterization due to the presence of TCE.

Information on the proposed methods for evaluating these data gaps including approximate numbers, locations, and depths of borings and wells, as well as rationale for each sampling point should be provided in this section (see General Comment # 4).

Response: Section 4.0, Feasibility Study Approach, was revised to indicate the OWS areas are data gaps that require further investigation. Section 5.1 was revised to state that additional samples will be collected and analyzed for 1,4-dioxane. Additionally, another GRA was added stating that soil should be prevented from acting as a continuing source of contaminants to groundwater.

The FS provides alternatives that include additional soil or groundwater sampling needed to address identified data gaps; therefore, Section 5.1 was not revised to include the requested sampling information. This information should be part of the remedial design plan and is premature at this time.

36. **Comment:** **<u>Section 5.1.1 – Chemicals of Concern (Site 6)</u>. The term COCs should be defined and used consistently throughout the document. In this section, nine chemicals are identified as COCs for soil at Site 6. However, in Section 3.2.3 – *Risk Management Decisions*, it is stated that no COCs were identified for soil at Site 6. Further, it is stated in Section 5.1.1 that 2 of the 9 COCs identified for soil (arsenic and PAHs) are not evaluated further in this FS. However, these are the only two COCs that are listed in the table of *Chemicals Exceeding Screening Levels at Site 6* on pages 3-10 and 3-11.**

Similarly for groundwater, seven COCs are identified in Section 5.1.1 while four are identified in Section 3.2.3, and six are presented on the table of *Chemicals Exceeding Screening Levels at Site 6* on pages 3-10 and 3-11.

This inconsistent use of terminology and presentation of information is confusing and should be corrected (see General Comments # 5 and 6).

Response: Please see the response to DTSC General Comment 5.

37. **Comment:** **<u>Section 5.1.4 – Remediation Goals and Section 5.1.5 Remedial Action Objectives (Site 6)</u>. Based on the potential future use designation of Site 6 as potential residential, remediation goals should be based on unrestricted use (see General Comment # 7). It should be noted that a risk assessment will be performed using the additional data obtained from the site as a result of data gap sampling, and based on the results, remediation goals and remedial action objectives may be revised.**

Response: Please see the response to DTSC General Comment 7.

38. **Comment:** **<u>Section 6.1 – Remedial Action Objectives for Site 7</u>. It is stated that the general response objectives for soil at Site 7 are: 1) to prevent dermal contact and ingestion of the contaminated soil from the soil debris area that contains arsenic, cadmium, and lead at concentrations that pose risk to human health, and 2) to prevent human exposure to soil adjacent to OWS-459 that is found to exceed residential PRG concentrations for VOCs, SVOCs, metals, pesticides, PCBs, and TPH. Is it true that residential PRGs will be used for metals and TPH?**

Please add that soil outside the soil debris area will be sampled to determine the extent of arsenic, copper, and lead that was identified as a data gap (see Specific Comment # 16). Include that another general response objective for soil is to prevent it from acting as a

continuing source of contaminants to groundwater. Also include a discussion of data gaps for groundwater adjacent to OWS-459.

Information on the proposed methods for evaluating these data gaps including approximate numbers, locations, and depths of borings and wells, as well as rationale for each sampling point should be provided in this section (see General Comment # 4).

Response: Section 4.0, Feasibility Study Approach, was revised to indicate the OWSs are data gaps that require further investigation. Section 6.1 was revised to include a GRA for soil that states that soil should be prevented from acting as a continuing source of contaminants to groundwater.

The FS provides alternatives that include additional soil or groundwater sampling needed to address identified data gaps; therefore, Section 6.1 was not revised to include the requested sampling information. This information should be part of the remedial design plan and is premature at this time.

39. **Comment:** **<u>Section 6.1.1 – Chemicals of Concern (Site 7)</u>. It is stated that based on the results of the RI, arsenic, cadmium, and lead are the only COCs in soil at Site 7 (soil debris area only). The GSU disagrees with this statement. Elevated levels of arsenic, copper, and lead were found in soil outside the soil debris area. The extent of these metals in soil has not been delineated and represents a data gap (see Specific Comment # 16). In addition, it is the opinion of the GSU that arsenic and PAHs in groundwater should be considered COCs at Site 7 (see Specific Comment # 19).**

Please add text to inform the reader that elevated levels of metals and PAHs in groundwater at Site 7 will be monitored through the Basewide Groundwater Monitoring Program.

Response: Section 6.1.1 was revised to state that elevated concentrations of metals and PAHs in groundwater at Site 7 will be monitored under the Basewide Groundwater Monitoring Program.

40. **Comment:** **<u>Section 7.1 – Remedial Action Objective Development for Site 8</u>. It is stated that the general response objectives for soil at Site 8 are: 1) to prevent dermal contact and ingestion of Aroclor-1254, Aroclor-1260, dieldrin, and lead contaminated-soil that pose risk to human health, and 2) to prevent human exposure to soil adjacent to OWS-411 that is found to contain VOCs, SVOCs, metals, pesticides, PCBs, or TPH at concentrations that exceed their respective PRG concentrations. Is it true that PRGs will be used for metals and TPH?**

Based on data gaps identified for benzene, TCE, and 1,4-dioxane in groundwater, please include a discussion of general response

objectives for groundwater. Also include a discussion of data gaps for groundwater adjacent to OWS-411.

Information on the proposed methods for evaluating these data gaps including approximate numbers, locations, and depths of borings and wells, as well as rationale for each sampling point should also be provided in this section (see General Comment # 4).

Response: Section 4.0, Feasibility Study Approach, was revised to indicate the OWS areas are data gaps that require further investigation. Section 7.1 was revised to discuss the GRAs for groundwater. Metals attributed to be background levels will not be remediated. However, preliminary remediation goals are the initial decision criteria used to evaluate the need for additional action (EPA 2002). TPH was screened against the Alameda Point TPH criteria (Navy 2001).

The FS provides alternatives that include additional soil or groundwater sampling needed to address identified data gaps. Therefore, Section 6.1 was not revised to include the requested sampling information, since the Navy feels this information should be part of the remedial design plan and is premature at this time.

41. Comment: **<u>Section 7.1.1 – Chemicals of Concern (Site 8)</u>. It is stated that based on the results of the RI, Aroclor-1254, Aroclor-1260, dieldrin, and lead are the only COCs in soil requiring remedial action at Site 8. No COCs are identified for groundwater. The GSU disagrees that soil COCs are the only COCs at Site 8 due to incomplete characterization of VOC sources and groundwater contamination (see General Comment # 3 and Specific Comment #'s 26 and 28). Please include benzene, TCE and 1,4-dioxane as COCs for Site 8 groundwater.**

Response: Groundwater will be further investigated under the Basewide Groundwater Monitoring Program, but no additional monitoring wells will be installed. Samples will be analyzed for trichloroethene and 1,4-dioxane, and sampling results are included in the FS Report.

42. Comment: **<u>Section 7.1.4 – Remediation Goals and Section and 7.1.5 Remedial Action Objectives (Site 8)</u>. Based on the future use designation of Site 8 as potential residential, remediation goals should be based on unrestricted use (see General Comment # 7). It should be noted that a risk assessment will be performed using the additional data obtained from the site as a result of data gap sampling, and based on the results, remediation goals and remedial action objectives may be revised.**

Response: Please see the response to DTSC General Comment 7.

43. **Comment:** **<u>Section 8.1 – Remedial Action Objective Development for Soil and Groundwater at Site 16</u>. It is stated that the general response objectives for soil at Site 16 are to determine whether soil adjacent to OWS-608A and OWS-608B contain contaminants at concentrations that exceed their respective residential PRGs, and to prevent human exposure to any such soils. Please add that another general response objective for soil is to prevent it from acting as a continuing source of contaminants to groundwater. Also include a discussion of data gaps for groundwater adjacent to OWS-608A and OWS-608B. Please state that 1,4-dioxane will be added to the list of analytes for the additional soil and groundwater characterization.**

Information on the proposed methods for evaluating these data gaps including approximate numbers, locations, and depths of borings and wells, as well as rationale for each sampling point should be provided in this section (see General Comment # 4).

Response: Section 4.0, Feasibility Study Approach, was revised to indicate the OWS areas are data gaps that require further investigation. Section 8.1 was revised to include a GRA for soil stating soil should be prevented from acting as a continuing source of contaminants to groundwater. Additional groundwater investigation will be conducted under the Baseline Groundwater Monitoring Program, and additional samples will be collected for analysis of 1,4-dioxane.

The FS provides alternatives that include additional soil or groundwater sampling needed to address identified data gaps; therefore, Section 6.1 was not revised to include the requested sampling information. This information should be part of the remedial design plan and is premature at this time.

44. **Comment:** **<u>Section 8.1.4 – Remediation Goals and Section 8.1.5 Remedial Action Objectives (Site 16)</u>. Based on the future use designation of Site 16 as potential residential and the designation of groundwater at Site 16 as a potential drinking water source, remediation goals should be based on unrestricted use (see General Comment # 7). It should be noted that a risk assessment will be performed using the additional data obtained from the site as a result of data gap sampling, and based on the results, remediation goals and remedial action objectives may be revised.**

Response: Please see the response to DTSC General Comment 7.

Comments on Figures

1. **Comment:** **<u>Figures 2-3 and 2-4</u>. Please provide the groundwater elevation datum on Figures 2-3 and 2-4. Please note that groundwater flow direction should be perpendicular to potentiometric surface contours and revise as appropriate.**

   Response: The groundwater elevation datum was added to Figures 2-3 and 2-4. Please note that the groundwater flow direction is a general indication; groundwater flow is perpendicular to potentiometric surface contours, but there is no uniform gradient across the entire site.

2. **Comment:** **<u>Section 3 Figures</u>. Please use site-specific figures and data presentation that is consistent with the figures that have been provided in the Final RI Report.**

   Response: The figures were revised to be consistent with figures that were provided in the Final RI Report (Tetra Tech 2004).

REFERENCES

California State Water Resources Control Board. 2004. "Concurrence that Groundwater Meets the Exemption Criteria in the State Water Resources Control Board Source of Drinking Water Policy Resolution 88-63, and San Francisco Bay Regional Water Quality Control Board Resolution 89-39 for Groundwater West of Saratoga Street at Alameda Point, City of Alameda, Alameda County." Letter from Water Board's Groundwater Protection and Waste Containment Division to the Navy. July 21.

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U.S. Department of the Defense. 2003. "Principles and Procedures for Specifying, Monitoring, and Enforcement of Land Use Controls and Other Post-ROD Actions." Office of the Under Secretary of Defense, Washington, DC. October 2.

U.S. Department of the Navy. 2001. "Preliminary Remediation Criteria and Closure Strategy for Petroleum Contaminated Sites at Alameda Point, Alameda, California." May 16.

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EPA. 2003. "Human Health Toxicity Values in Superfund Risk Assessments." Memorandum from Michael B. Cook, Director, EPA Office of Superfund Remediation and Technology Innovation. To EPA Superfund National Policy Managers, Regions 1 – 10. OSWER Directive 9285.7-53. December 5.