Final

Feasibility Study for Installation Restoration Site 17 and Building 503 Area, Investigation Area A1

Mare Island
Vallejo, California

January 27, 2006

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

Prepared under:
Naval Facilities Engineering Command
Contract Number N68711-03-D-5104
Contract Task Order 090

DS.B090.20508

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PREPARED FOR:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

Project Manager: _____ Date: January 27, 2006
Kevin Bricknell, SulTech

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or relevant and appropriate requirement
AST	Aboveground storage tank
bgs	Below ground surface
BAAQMD	Bay Area Air Quality Management District
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CCR	*California Code of Regulations*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
cm^3/g	Cubic centimeters per gram
cm/sec	Centimeters per second
DoD	U.S. Department of Defense
EPA	U.S. Environmental Protection Agency
ERA	Ecological risk assessment
FRTR	Federal Remediation Technologies Roundtable
FS	Feasibility study
GAC	Granular activated carbon
GRA	General response action
HDPE	High-density polyethylene
HHRA	Human health risk assessment
HI	Hazard index
IA	Investigation Area
IR17	Installation Restoration Site 17
IRP	Installation Restoration Program
ISCO	In-situ chemical oxidation
ISTD	In-situ thermal desorption
LDR	Land disposal restriction
LNAPL	Light nonaqueous-phase liquid
LUC	Land use control
MINS	Mare Island Naval Shipyard
MNA	Monitored natural attenuation
MPE	Multiphase extraction
mg/kg	Milligrams per kilogram

mg/L	Milligrams per liter
msl	Mean sea level
NAPL	Nonaqueous-phase liquid
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NFESC	Naval Facility Engineering Service Center
OWS	Oil-water separator
O&M	Operation and maintenance
PC	Propriety control
PCB	Polychlorinated biphenyl
POTW	Publicly owned treatment works
PPE	Personal protective equipment
ppm	Parts per million
PRC	PRC Environmental Management, Inc.
PRG	Preliminary remediation goal
psi	Pounds per square inch
RA	Remedial alternative
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation
RME	Reasonable maximum exposure
ROI	Radius of influence
ROD	Record of decision
RWQCB	California Regional Water Quality Control Board, San Francisco Bay Region
SARA	Superfund Amendments and Reauthorization Act
SSPORTS	Supervisor of Shipbuilding, Conversion, and Repair, Portsmouth, Virginia, Environmental Detachment, Vallejo
TBC	To be considered
TerraTherm	TerraTherm Environmental Services, Inc.
Tetra Tech	Tetra Tech EM Inc.
USC	*United States Code*
UST	Underground storage tank
VOC	Volatile organic compound

EXECUTIVE SUMMARY

Under the direction of the U.S. Department of the Navy (Navy), Southwest Division, Naval Facilities Engineering Command, Tetra Tech EM Inc. (Tetra Tech) has conducted a feasibility study (FS) for the Installation Restoration Site 17 (IR17) and Building 503 Area, located within Investigation Area (IA) A1 at the former Mare Island Naval Shipyard at Mare Island in Vallejo, California. This FS report fulfills specific objectives of the scope of work under Delivery Order No. 034 of Contract No. N68711-00-D-0005, the Indefinite Quantity Contract for Architectural-Engineering Services to Provide CERCLA/RCRA/UST Studies. This FS is based primarily on a remedial investigation (RI) previously completed at the site (Tetra Tech 2003); it was prepared in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the Installation Restoration Program, and the U.S. Environmental Protection Agency (EPA) "Guidance for Conducting Remedial Investigations and Feasibility Studies Under the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]" (EPA 1988).

BACKGROUND

The Mare Island peninsula is located in Solano County, California, about 25 miles northeast of San Francisco. In support of ship construction and maintenance activities, paints and varnishes were manufactured at the facility from the 1940s to the mid-1950s. Materials used in the paint manufacturing process, which included oils, solvents, and resins, were stored at two tank farms. The northern tank farm is comprised of 21 aboveground storage tanks (AST) and is located between Building 503 and Cedar Avenue. The southern tank farm is made up of six ASTs southwest of Cedar Avenue. The paint manufacturing facility was closed in the mid-1950s. In the 1960s, Buildings 519 and 519-A and both tank farms were removed except for the Building 519 elevated concrete foundation and the concrete containment dike beneath the northern tank farm battery.

In accordance with the Defense Base Closure and Realignment Act of 1993, the property will eventually be transferred to the City of Vallejo. To ensure that base reuse priorities were considered in determining the focus and schedule for environmental cleanup efforts, Mare Island was divided into investigation areas by the Navy in consultation with regulatory agencies. The 14 IAs established at Mare Island were intended to generally coincide with reuse zones identified in the city's reuse plan (City of Vallejo 1994). IA A1 is designated for reuse as a light industrial area. This FS addresses the combined IR17 and Building 503 Area, located within IA A1. These properties are addressed together because of their proximity and their similar past uses.

Facility-wide and site-specific investigations were conducted at the IR17 and Building 503 Area between 1983 and 2000. Results of previous investigations indicated the presence of metals, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls in surface soil as well as solvents and oil in subsurface soil and groundwater. The oil and solvents appear to have been released from the tank farm ASTs or associated piping, or during the handling of materials at the facility. Metals, used as pigments and antifouling agents in paints, may have been released during handling of materials. In 2003, the RI of the IR17 and Building 503 Area was completed

(Tetra Tech 2003). The RI characterized the nature and extent of contaminants and subsurface conditions at the IR17 and Building 503 Area.

HUMAN HEALTH AND ECOLOGICAL RISKS

A human health risk assessment (HHRA) and ecological risk assessment (ERA) were conducted for the IR17 and Building 503 Area as part of the RI (Tetra Tech 2003). The objective of the HHRA was to provide a basis for risk management decisions regarding cancer risks and the risk of adverse noncancer health effects associated with potential human exposure to contaminants in soil and groundwater. Based on the intended reuse of most of the site as a light industrial area, the HHRA identified potential receptors as the commercial/industrial worker under an unchanged site configuration and the commercial/industrial worker and construction worker under a modified site configuration. For the unchanged site configuration (0- to 2- and 0- to 5-foot-below ground surface (bgs) soil depth horizons and groundwater), the reasonable maximum exposure (RME) commercial/ industrial worker scenario total excess cancer risk estimate was 6×10^{-6}. For the modified site configuration (0- to 10-foot-bgs soil horizon and groundwater), the RME commercial/industrial worker scenario total excess cancer risk estimate was 8×10^{-6}, while the RME construction worker scenario total cancer risk estimate was 1×10^{-6}. For each scenario, the hazard index did not exceed a value of 1. Excess cancer risk estimates were attributed primarily to the presence of benzo(a)pyrene in soil. Risk to human receptors (commercial/industrial worker and construction worker) is within the risk management range for industrial use. Based on the HHRA, the RI recommended no further action for the IR17 and Building 503 Area. However, the RI also recommended the consideration of remedial alternatives to address free product (that is, free-phase nonaqueous-phase liquids) as a potential continuous source of soil and groundwater contamination. Furthermore, due to the limitations of the inhalation model used in the HHRA to estimate vapor concentrations at the site, the RI recommended a post-remediation HHRA. The post-remediation site conditions should be designed to make the vapor model suitable for the site so that post-remediation concentrations can be estimated.

Ecological studies have identified the seasonal wetland as the only viable habitat at the IR17 and Building 503 Area. Potential risks to ecological receptors in the wetland area were evaluated during an onshore ERA. Wetland sediment sample data were evaluated, and food-chain modeling was conducted. Results of the food-chain modeling indicate no immediate or significant risk to ecological receptors from exposure to sediments in the wetland. Furthermore, fate and transport analysis concluded that no significant contaminant migration pathways exist from the upland area to surface water or sediment in the wetland. Because of this, no action was recommended for the site to address ecological risks.

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND REMEDIAL ACTION OBJECTIVES

Tetra Tech reviewed the available information about the IR17 and Building 503 Area to identify applicable or relevant and appropriate requirements (ARAR). Based on CERCLA requirements, the results of the HHRA and ERA in the three previous studies, and ARARs, the following remedial action objective (RAO) was proposed for soils at the IR17 and Building 503 Area:

Reduce the apparent occurrence of free product to the maximum extent practicable. Areas where free product may occur shall be remediated in a manner that minimizes the spread of contamination into previously uncontaminated zones, and abatement of free product migration shall be the predominant objective in the design of these activities.

SCREENING OF REMEDIAL ACTION ALTERNATIVES

Potential remedial measures were screened using effectiveness, implementability, and cost criteria. The effectiveness evaluation considered the ability of a remedial measure to protect human health and the environment, to comply with ARARs, and to meet the RAO. After screening, the following six remedial action alternatives were evaluated:

- Alternative 1: No Further Action
- Alternative 2: Construction of Extraction Trenches, Use of Skimmer Pumps, and Institutional Controls
- Alternative 3: Installation of Extraction Wells, Periodic Vacuum Extraction, and Institutional Controls
- Alternative 4: Soil Excavation, Bioremediation, Backfilling with Treated Soil, and Institutional Controls
- Alternative 5: Soil Excavation, Off-Site Disposal, Backfilling with Clean Soil, and Institutional Controls
- Alternative 6: Multiphase Extraction, In-Situ Thermal Desorption, and Institutional Controls

These alternatives were then evaluated based on the nine criteria required by the NCP in Title 40 of the *Code of Federal Regulations* (CFR) under Section 300.430(e) as follows:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, or volume of contaminants
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

The first seven criteria were used in the selection process. Input will be collected for the eighth and ninth criteria after the alternatives are presented to the public. A final decision will be made after review of state and community input, the final two criteria.

FEASIBILITY STUDY RECOMMENDATIONS

Because the results of the RI, HHRA, and ERA indicate that the risks under current conditions at the site are within the risk management range (Tetra Tech 2003), any of the alternatives would be protective of human health and the environment. Federal ARARs (40 CFR 280.64), however, require reduction of the apparent occurrence of free product to the maximum extent practicable. Because of site conditions that limit movement of free product, Alternatives 2 and 3 may not remove free product to the "maximum extent practicable," especially when compared to Alternatives 4, 5, and 6, each of which will remove free product and are practicable.

Although the costs of Alternatives 4 and 5 are almost the same, Alternative 4 reduces the volume of contaminants, and Alternative 5 does not. Alternative 6 also reduces the volume of contaminants but has increased costs compared to Alternatives 4 and 5. In addition, because Alternative 6 uses an innovative technology (in-situ thermal desorption), there are additional uncertainties regarding its potential overall performance, which may result in increased operational and maintenance costs. Compared to Alternative 5, Alternative 4 poses a greater degree of uncertainty in its success. In many cases, bioremediation requires extended treatment periods, thereby increasing labor, equipment, and especially laboratory costs. Because of the uncertainty of remedial success associated with Alternatives 2, 3, and 6 and the similarity in cost between Alternatives 4 and 5, Alternative 5 was recommended for the IR17 and Building 503 Area.

The Navy believes that state and community input is essential to select a remedial alternative. Input will be collected after the alternatives are presented to the public, and a final decision will be made after review of state and community input. The Navy will use this FS to prepare a proposed plan for public comment, which will recommend the selected alternative. After considering regulatory and community acceptance, the Navy will issue a record of decision containing the selected final remedy.

1.0 INTRODUCTION

Under the direction of the U.S. Department of the Navy (Navy), Southwest Division, Naval Facilities Engineering Command, Tetra Tech EM Inc. (Tetra Tech) has conducted a feasibility study (FS) for the Installation Restoration Site 17 (IR17) and Building 503 Area at the former naval shipyard at Mare Island (Mare Island) in Vallejo, California. This FS report fulfills specific objectives of the scope of work under Delivery Order No. 034 of Contract No. N68711-00-D-0005, the Indefinite Quantity Contract for Architectural-Engineering Services to Provide CERCLA/RCRA/UST Studies. This report is based primarily on a remedial investigation (RI) previously completed at the site (Tetra Tech 2003).

The Navy has been conducting environmental studies at the IR17 and Building 503 Area as part of the Installation Restoration Program (IRP) at Mare Island. The IRP, a program to identify, assess, and clean up or control contamination from past hazardous waste disposal operations and hazardous materials management practices, follows the steps and requirements provided under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Navy is conducting the IRP at Mare Island in accordance with the *Department of the Navy Installation Restoration Manual* (Navy 2001).

In accordance with the Defense Base Closure and Realignment Act of 1993, the property will eventually be transferred to the City of Vallejo. To ensure that base reuse priorities were considered in determining the focus and schedule for environmental cleanup efforts, Mare Island was divided into Investigation Areas (IA) by the Navy in consultation with regulatory agencies. The 14 IAs established at Mare Island were intended to coincide generally with reuse zones identified in the City of Vallejo's reuse plan (City of Vallejo 1994). IA A1 is designated for reuse as a light industrial area. This FS addresses the combined IR17 and Building 503 Area, located within IA A1. These properties are addressed together because of their proximity and because the past uses were similar.

The Navy, with state regulatory oversight, is the lead agency for the FS. As the lead agency, the Navy, with state concurrence, has final approval authority for the selected remedial alternative. The Navy is working with the California Environmental Protection Agency, Department of Toxic Substances Control; the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB); the California Department of Fish and Game; and the local community to select and implement a proposed remedial action.

This FS was prepared in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the U.S. Environmental Protection Agency (EPA) "Guidance for "Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response, Compensation, and Liability Act" (EPA 1988). The purpose of this FS is to develop and perform a comparative analysis of alternative remedial actions to address free product (that is, free-phase nonaqueous-phase liquid [NAPL]) as a potential continuing source of soil and groundwater contamination.

1.1 PURPOSE AND SCOPE OF WORK

The CERCLA RI/FS process is an iterative process that (1) characterizes threats to human health and the environment posed by hazardous substances released at a site and (2) evaluates potential remedial alternatives (RA) to mitigate those threats. The NCP states that appropriate remediation is defined as a cost-effective RA that effectively mitigates and minimizes threats to and provides adequate protection of public health, welfare, and the environment. RAs evaluated in this FS vary in cost and level of protection afforded to human health and the environment. The FS process of developing and evaluating RAs consists of the following steps:

- Develop remedial action objectives (RAO) that specify contaminants and media of concern, volume of each affected medium, and remediation goals. RAOs are developed based on applicable or relevant and appropriate requirements (ARAR), human health risk assessment (HHRA) results, and ecological risk assessment (ERA) results (Tetra Tech 2003).

- Develop general response actions (GRA) for each medium that can be conducted to satisfy RAOs. Consider containment, treatment, removal, or other actions singly or in combination in developing GRAs.

- Identify and screen technologies for each GRA 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 analysis of the remaining alternatives based on the criteria identified in the NCP at Title 40 of the *Code of Federal Regulations* (40 CFR) 300.430(e)(9).

This FS develops and evaluates potential response actions to address the environmental concerns identified at the IR17 and Building 503 Area during the RI (Tetra Tech 2003). This document presents the results of the FS conducted specifically at the combined IR17 and Building 503 Area. These properties have been addressed together because of their proximity and their similar past uses. It further selects and evaluates RAs to facilitate closure of the IR17 and Building 503 Area in accordance with the CERCLA process, as shown on Figure 1-1. The FS will be used as the basis for proposed remedial actions, if any are needed, at the IR17 and Building 503 Area.

1.2 REPORT ORGANIZATION

The remainder of Section 1.0 provides background information, including a summary of the HHRA and ERA conducted for the IR17 and Building 503 Area (Tetra Tech 2003). In addition, Section 1.0 provides information regarding the apparent extent of free product present at the site. Section 2.0 presents the RAOs and ARARs and identifies GRAs. Section 3.0 identifies and

describes alternative RAs, analyzes each of the six alternatives based on NCP evaluation criteria, and identifies and compares the advantages and disadvantages of each alternative. The text is followed by a list of cited references, figures, tables, and Appendices A, B, C, D, and E. Appendix A presents an evaluation of the ARARs for this FS; Appendix B presents the remedial alternative cost summary sheets; Appendix C presents the remedial evaluation of the preferred alternative for the unrestricted use scenario; and Appendix D and Appendix E presents responses to regulatory agency comments received on the draft FS.

1.3 BACKGROUND INFORMATION

The Mare Island peninsula is located in Solano County, California, about 25 miles northeast of San Francisco (Figure 1-2). The Napa River (Mare Island Strait) lies to the east and separates the peninsula from the City of Vallejo; the remainder of the peninsula is surrounded by the Carquinez Strait to the south, San Pablo Bay to the west, and Highway 37 to the north. A bridge crosses the Napa River and connects the island to the city of Vallejo at Tennessee Street. A second access point is located at the northern end of Mare Island, where Railroad and Walnut Avenues connect to Highway 37. Mare Island is within the incorporated boundaries of the city of Vallejo. IA A1 is located on the northern portion of Mare Island (Figure 1-3).

Mare Island Naval Shipyard (MINS) was the first naval station established on the Pacific coast. The Navy purchased 956 acres of Mare Island in 1853 and commenced ship repair on September 16, 1854; shipbuilding operations began in the 1870s. The primary ship construction and maintenance area of MINS was established along the northeastern shore of the original island, southeast of IA A1, adjacent to Mare Island Strait. As shipbuilding technologies advanced from wooden to steel construction and wind power to nuclear propulsion, the entire facility saw vast transformations during its years of operation. In the early 1920s, the Navy initiated construction and maintenance of submarines at MINS. Originally, the land occupied by IA A1 was either part of San Pablo Bay or part of a tidal marshland area, northwest of the Mare Island upland area. Between 1911 and 1938, land occupied by IA A1 was created when dredge spoil fill material was placed in areas bounded by a network of levees (Navy 1911, 1938; PRC Environmental Management, Inc. [PRC] 1995b).

During World War II, MINS reached peak capacity for shipbuilding, repair, overhaul, and maintenance. Following the war, MINS was considered to be one of the primary stations for construction and maintenance of the Navy's Pacific fleet of submarines. Because of decreasing Navy needs in a post-Cold War environment, however, shipyard activity declined. MINS was closed on April 1, 1996, after 142 years of operation.

1.3.1 Site Description

The IR17 and Building 503 Area was used to manufacture paints and varnishes from the 1940s to the mid-1950s. With the exception of Building 503, the buildings and structures used to manufacture paints and varnishes have been removed. Currently, the site primarily consists of 26 acres of uplands area, including four complete or partial buildings and an adjacent wetland. The site is not currently in use, and the majority is designated for reuse as a light industrial area.

A small portion of the site extends into IA I, which is designated for reuse as recreational/open space.

The IR17 and Building 503 Area is at the northern end of Mare Island in IA A1 (Figure 1-3). The former paint manufacturing facility includes Buildings 503 and 517; former Buildings 519, 519-A, and 567; two former aboveground storage tank (AST) farms and associated pipeline; and a 4,000-gallon heating oil AST adjacent to Building 503. The facility also includes a former underground oil-water separator (OWS) north of former Building 519 and a former electrical substation northeast of former Building 567 (Figure 1-4). Building 499, an adjacent tin canopy, and most of Building 601 are also within the facility boundary. Most of the facility, including existing buildings, is currently not in use. Most of the IR17 and Building 503 Area is within IA A1, which is designated for reuse as a light industrial area; however, the former AST farm area southwest of Cedar Avenue, is within IA I, which is designated for reuse as recreational/open space.

Building 503 is a three-story, 33,800-square-foot structure, which was built in 1940 and is not currently in use (MINS 1996). The building foundation consists of an elevated concrete slab supported by approximately 5-foot-high concrete piers; exposed soil is present between the piers. Most of the first floor of Building 503 contains open areas, offices, training rooms, and classrooms. A large room at the southwestern end of the building contains a 2-inch-diameter floor drain clogged with sediment or debris. The second and third floors of the building contain additional classrooms, offices, and conference rooms. On the southwestern side of Building 503, a buried concrete foundation (about 1,600 square feet) is present about 3 feet below ground surface (bgs); the concrete foundation represents a portion of the former tank farm containment structure.

Building 517 is an electrical substation. Buildings 499 and 601, both of which were warehouses used to store paint products, are currently not in use. Numerous utilities surround and underlie the site, including sanitary sewer, storm water, electrical, compressed air, freshwater, and steam lines. The site is relatively flat, and ground surface elevations generally slope from the south to the northeast and northwest, with surface elevations generally ranging from 7 to 9 feet above mean sea level (msl). Mare Island Strait is located about 1,500 feet northeast of the IR17 and Building 503 Area (Figure 1-2).

1.3.2 Site History

Originally, land occupied by the IR17 and Building 503 Area was part of a tidal marshlands area near the shoreline of Mare Island Strait, northwest of the Mare Island upland area. Between 1911 and 1938, land occupied by the IR17 and Building 503 Area was created when dredge spoil fill material (primarily clay and silt) was placed in an area bounded by a network of levees constructed to the northeast, south, and southwest of the site in 1914 (Navy 1911, 1938; PRC 1995a). The land apparently remained vacant until the paint manufacturing facility, which included Buildings 503, 519, 519-A, and 567, was constructed at the site between 1938 and 1944 (Navy 1938, 1941, 1944). Additionally, coarser-grained fill presumably was imported to the site

before its development, resulting in the site's current ground surface elevation of 7 to 9 feet above msl.

In support of ship construction and maintenance activities, paints and varnishes were manufactured at the facility from the 1940s to the mid-1950s. Paints and varnishes were apparently produced in Buildings 503 and 519, respectively, while the drums used to store the paints were manufactured in Building 567 (Figure 1-4) (Navy 1946). The foundations of these buildings consisted of a structural concrete slab supported by approximately 4- to 5-foot-high concrete piers. Building 519-A was used as a covered loading dock (Navy 1946). Railroad cars were used in the area to transport raw materials and manufactured paints and varnishes on and off site. Railroad tracks extended from Cedar Avenue to Buildings 503 and 567 (MINS 1942). Raw materials and finished paints and varnishes were apparently stored in Buildings 499 and 601, two adjacent warehouses east and north, respectively, of the paint manufacturing facility.

Materials used in the paint manufacturing process, which included oils, solvents, and resins, were stored at two tank farms. The northern tank farm, comprising 21 ASTs, was between Building 503 and Cedar Avenue. The southern tank farm, comprising six ASTs, was southwest of Cedar Avenue. The content and capacity of each AST is shown on Figure 1-4. The 21 ASTs in the northern tank farm included a battery of 16 horizontal ASTs enclosed in a concrete secondary containment adjacent to Building 503, and five larger ASTs east of Cedar Avenue and enclosed in soil berms. Three of these ASTs (ASTs 546, 548, and 550) were apparently moved to the paint manufacturing facility from an on-base area south of 10th Street, at the juncture of 10th Street and Walnut Avenue (Navy 1940). The six ASTs in the southern tank farm (south of "J" Street) stood on individual concrete pads in unpaved areas, surrounded by soil berms. A set of product distribution pipelines connected the two tank farms with Building 503 (Figure 1-4).

When the paint manufacturing facility was active, two common anticorrosive paints were applied to Navy vessels: a zinc-chromate formulation and a lead-based formulation. Antifoulant paints, like most other marine paints, consisted of a film-forming material (matrix, binder, resin, and medium), a pigment, and a biocide that kills or repels fouling organisms. The biocide that may have been used was cuprous oxide. Former shipyard workers stated that polychlorinated biphenyls (PCB), organotins, and other biocide agents were added to paints only on an experimental basis. They specifically recalled a 400-gallon batch of PCB-containing paint and a 100-gallon batch of organotin-containing paint (Tetra Tech 1999b).

1.3.3 Site Closure Activities and Removal Action

The paint manufacturing facility was closed in the mid-1950s. In the 1960s, Buildings 519 and 519A and both tank farms were removed except for the Building 519 elevated concrete foundation and the concrete containment dike beneath the northern tank farm battery (Navy 1960, 1963, 1966). The containment dike was subsequently covered with about 3 feet of soil. Building 503 was converted to a training center for the naval reserve in 1962 (PRC 1995a), and the area where Building 519-A was located was paved for use as a parking lot for the Naval Reserve Center. Building 567 (except for the elevated concrete foundation) was removed in the 1980s (Navy 1978, 1989); the use of Building 567 between the time of facility closure and its

demolition is unknown. The elevated concrete foundation of Building 519 was removed in the spring of 1998 (Tetra Tech 1998.) The elevated concrete foundation of Building 567 and a portion of an aboveground sanitary sewer pipeline located beneath the slab were removed in March 1996 (PRC 1996). The electrical substation adjacent to former Building 567 was removed in 1991 (Supervisor of Shipbuilding, Conversion, and Repair, Portsmouth, Virginia, Environmental Detachment, Vallejo [SSPORTS] 1999b). Navy records indicate that the substation transformer had leaked but do not provide information about the quantity of the release or subsequent corrective actions (SSPORTS 1999b). The product distribution pipeline (except for a portion beneath Cedar Avenue) and OWS were removed in late 1998 and early 1999 (Tetra Tech 1999a). In addition, surface soil containing elevated concentrations of metals, polycyclic aromatic hydrocarbons, and PCBs was removed in the vicinity of the Building 519 foundation and former electrical substation. SSPORTS also removed abandoned product distribution pipelines that extended between the two tank farms.

A 150-gallon gasoline underground storage tank (UST) was reportedly installed at the IR17 and Building 503 Area in 1962 (SSPORTS 1999a); however, the location of this UST has not been documented. It may have been associated with a gasoline pump shown on the 1942 historical plan of the site, off the western corner of Building 503. In 1981, a heating oil AST was installed adjacent to the northern corner of Building 503 (Figure 1-4). This 4,000-gallon AST is still active but not currently in use (MINS 1994)

1.3.4 Treatability Study Results

Based on an initial human health risk evaluation, which indicated that remedial action would be required at the site, a treatability study was conducted in a phased approach at IR17. The treatability study evaluated whether chemical oxidation injection could be used to remediate benzene, toluene, ethylbenzene, and xylenes (BTEX) and phenols in groundwater to below target concentrations. Approximately 9,789 gallons of 10 percent hydrogen peroxide solution was injected under pressures of up to 3,000 pounds per square inch at 144 injection locations during five injection events, all of which occurred within a 900-square-foot test plot area. The conclusions of the study were that site-specific soil conditions including the high clay and the heterogeneity of the soil prevented the injection solution from contacting target contaminants. Furthermore, distinct tubular intrusions in the soil and observations of fluid backing up into the injection borings indicated that the radius of influence (ROI) of the injection solution was limited to approximately 6 inches. The study concluded that chemical oxidation, or any other in situ technology that relies on uniform distribution of fluid or gas in the subsurface, would likely not work effectively at the site without subsurface modification such as hydraulic or pneumatic fracturing. This technology may, however, be more applicable to site soil with increased permeability, such as reworked backfill.

1.3.5 Remedial Investigation

In 2003, an RI of the IR17 and Building 503 Area was completed (Tetra Tech 2003). The primary objectives of the RI were to identify potential contaminants resulting from past activities at the site, characterize the nature and extent of identified contaminants, assess baseline risks to

both human and ecological receptors, and provide recommendations for conducting an FS. The following sections provide information included in the RI regarding the hydrogeologic setting, presence of free product, HHRA, ERA, and the RI conclusions and recommendations regarding further action.

1.3.5.1 Hydrogeologic Setting

Two geologic units have been identified at the site and consist of, from top to bottom stratigraphically: (1) artificial fill to a depth of approximately 7 to 9 feet bgs and (2) silty clay with organic material, extending to greater than 50 feet bgs. Based on lithologic data collected during previous investigations and this study, fill material is heterogeneous and consists primarily of clayey silt, sandy silt, and silty sand. Debris encountered within the fill unit includes wood, brick, paint flakes, and concrete.

Based on the site lithology, two hydrogeologic units have been identified at the IR17 and Building 503 Area, including (1) the coarse-grained unconsolidated heterogeneous material and (2) the fine-grained, unconsolidated heterogeneous material and underlying silty clay unit. The coarse-grained, unconsolidated heterogeneous material is composed of materials such as silty sand and gravel. These materials, which were encountered at the site between the ground surface and 14 feet bgs, are expected to be relatively permeable and may act as preferential flow pathways. The second unit is the clayey and silty portion of the unconsolidated heterogeneous material and the underlying silty clay unit (including peat). These materials exhibit lower hydraulic conductivity than the coarse-grained, unconsolidated heterogeneous material.

Groundwater at the IR17 and Building 503 Area was encountered within the fill material at depths of approximately 3 to 8 feet bgs. The average aquifer thickness is about 4 feet. Water level data collected since 1992 indicate that the wells exhibit a moderate seasonal variation. In general, water levels in the wells were highest during the wet season (November to April), lowest during the dry season (May to October), and varied by 0.11 to 3.35 feet over the annual hydrologic cycle in any one well. General similarities in water level fluctuations among the wells during the various monitoring periods suggest that the zones in which the wells are screened are in hydrologic communication and respond to seasonal recharge.

Although flow directions vary significantly across the site, the primary flow direction over most of the IR17 and Building 503 Area is to the north. In the southern portion of the site, in the vicinity of the former southern tank farm, groundwater flows towards the wetland, to the west and south. Groundwater flow at the IR17 and Building 503 Area appears to be significantly influenced by variations in fill material lithology and by other manmade conduits such as underground utility pipeline corridors. Significant portions of the sanitary sewer and storm water pipeline at the IR17 and Building 503 Area are at or below the groundwater table, at least during the wet season. Although data are not available to evaluate the influence of the utility pipelines on shallow groundwater flow, it is apparent by the groundwater flow patterns and the distribution of contamination that the coarse-grained base material beneath and around many of the pipes and possibly the pipes themselves act as preferential groundwater flow pathways. Variations in

groundwater flow direction in the vicinity of Cedar Avenue and Building 503 appear to correlate with the presence and orientation of nearby utility pipelines.

The estimated hydraulic gradient in the direction of groundwater flow varied from as low as 0.002 and 0.006 in the southern tank farm area and the northern portion of the site (near former Building 567), respectively, to as high as 0.035 in the southern portion of the site (in the vicinity of well 17W17).

1.3.5.2 Presence of Free Product

In general, free product (free-phase NAPL) has not been observed during site assessment activities at the IR17 and Building 503 Area. During the June 2002 groundwater sampling event, however, thin lenses of free product (less than 0.01 foot) were observed in monitoring wells 17W12 and 17W15 using an oil/water interface probe. Based on direct observation of NAPL, it appears that the extent of free product is limited to the areas surrounding monitoring well 17W12 and 17W15. Based on analysis of the groundwater sample collected from well 17W15, the light nonaqueous-phase liquid (LNAPL) primarily consists of ethylbenzene and xylenes, consistent with volatile organic compounds (VOC) detected at the IR17 and Building 503 Area.

Based on groundwater flow in the area of well 17W15, any free product would potentially migrate in a north-northwest direction, through the subsurface utility corridors along Cedar Avenue.

1.3.5.3 Human Health Risk Assessment

An HHRA was conducted for the IR17 and Building 503 Area (Tetra Tech 2003). The objective of the HHRA was to provide a basis for risk management decisions regarding cancer risks and risks of adverse noncancer health effects associated with potential human exposure to contaminants in soil and groundwater. Based on the intended reuse of a majority of the site as a light industrial area, the HHRA identified potential receptors as the commercial/industrial worker under an unchanged site configuration and the commercial/industrial worker and construction worker under a modified site configuration. For the unchanged site configuration (0- to 2- and 0- to 5-foot-bgs soil depth horizons and groundwater), the reasonable maximum exposure (RME) commercial/industrial worker scenario total excess cancer risk estimate was 6×10^{-6}. For the modified site configuration (0- to 10-foot-bgs soil horizon and groundwater), the RME commercial/industrial worker scenario total excess cancer risk estimate was 8×10^{-6}, while the RME construction worker scenario total cancer risk estimate was 1×10^{-6}. For each scenario, the hazard index (HI) did not exceed a value of 1. Excess cancer risk estimates were attributed primarily to the presence of benzo(a)pyrene in soil. The risk to human receptors (commercial/industrial worker and construction worker) is within the risk management range for industrial use.

1.3.5.4 Ecological Risk Assessment

Ecological studies have identified the seasonal wetland as the only viable habitat at the IR17 and Building 503 Area. Potential risks to ecological receptors in the wetland area were evaluated during an onshore ERA. Wetland sediment sample data were evaluated, and food-chain modeling was conducted. Results of the food-chain modeling indicate that no immediate or significant risk exists to ecological receptors from exposure to sediments in the wetland. Furthermore, fate and transport analysis concluded that no significant contaminant migration pathways exist from the upland area to surface sediment and water in the wetland.

1.3.5.5 Conclusions and Recommendations

The nature and extent of contaminants and subsurface conditions at the IR17 and Building 503 Area have been adequately characterized such that no further investigation is recommended. Cumulative cancer risks fall within the risk management range (10^{-6} to 10^{-4}); therefore, no remedial action is recommended for this site based on the planned reuse.

Contaminants remaining in soil and groundwater at the site are expected to continue to naturally attenuate; contaminants in groundwater are not expected to migrate off site at concentrations exceeding ecological criteria. Potential risks to human receptors, primarily from exposure to soil contaminants, are within the risk management range (10^{-6} to 10^{-4}); therefore, no remedial action is recommended for this site based on excess risk to human health.

The results of the screening-level ERA for the IR17 and Building 503 Area indicate the site does not pose unacceptable risk to ecological receptors. Based on the ERA, no action is recommended for risk management to address ecological risk at the IR17 and Building 503 Area. Ecological receptors are not at immediate or significant risk from chemicals present in wetland sediments.

Although the risk to human health is within the risk management range and current site conditions do not pose significant ecological risks, the apparent presence of free product in the IR17 and Building 503 Area may continue to represent a long-term source of soil and groundwater contamination. In accordance with 40 CFR 280.64, RAs should be evaluated to reduce the apparent occurrence of free product to the maximum extent practicable.

1.4 POTENTIAL OCCURRENCE OF FREE PRODUCT

Based on the RI recommendation to reduce the quantity of free product, additional assessment of the potential occurrence of free product was conducted. In general, this assessment was conducted using NAPL characterization techniques consistent with EPA guidance (EPA 1992, 1995).

NAPLs are hydrocarbons that exist as a separate, immiscible phase when in contact with water or air. Based on the data and the site history presented in the RI (Tetra Tech 2003), observed NAPL at the IR17 and Building 503 Area is considered to be weathered mineral spirits. Mineral spirits, also known as petroleum spirits, consist of a mixture of paraffinic hydrocarbons, naphthenic hydrocarbons, and aromatic and olefinic hydrocarbons within the heavier end of gasoline and the lighter end of diesel. Mineral spirits have a density less than water and are therefore light NAPLs or LNAPLs. At sites where LNAPL has reached the groundwater, the greatest mass of the contamination commonly exists as "free product" on the groundwater.

In general, LNAPLs represent potential long-term sources for continued groundwater contamination. LNAPLs in the subsurface tend to migrate downward and float on the groundwater, where they can flow into a well. The apparent occurrence of LNAPL can be estimated using visual observation (that is, using a hand bailer), oil/water interface probes, groundwater concentrations, and soil concentrations (EPA 1992). These techniques and the estimated extent of potential LNAPLs are presented in the following sections.

1.4.1 Direct Observation of Free Product in Groundwater Wells

In general, NAPL has not been observed during site assessment activities at the IR17 and Building 503 Area. During the June 2002 groundwater sampling event, however, a thin lens of NAPL (less than 0.01 foot) was observed in monitoring wells 17W12 and 17W15 using an oil/water interface probe. Based on direct observation of the NAPL, it appears that the extent of free-phase NAPL is limited to the areas surrounding monitoring wells 17W12 and 17W15.

1.4.2 Estimated Free Product Subsurface Thickness

At sites where LNAPL has reached the groundwater, the greatest mass of the contamination commonly exists as "free product" on the groundwater; however, the measurement of the amount of free product above the water table is not straightforward. Typically, a monitoring well will act as a hydraulic conduit, allowing free product to drain and accumulate. The weight of the collected free product will then depress the surface of the water in the monitoring well below that of the water table. As a result, the thickness of free product measured in a monitoring well is frequently greater than the actual thickness of the free product in the vadose zone (Fetter 1999). The free product thickness measured in a monitoring well has reportedly typically exceeded the LNAPL-saturated formation thickness by a factor ranging from 2 to 10 (EPA 1995). Because only trace NAPL (less than 0.01 foot) has been detected in wells 17W12 and 17W15, it is unlikely that a measurable subsurface (that is, formation) thickness of free product exists at the IR17 and Building 503 Area.

1.4.3 Estimated Smear Zone Thickness

Accumulation of free product at or near the water table is susceptible to "smearing" from changes in water table elevation such as those that occur as a result of seasonal changes in recharge/discharge or tidal influence in coastal environments. Free product floating above the water-saturated zone will move vertically as the groundwater elevation fluctuates. As the water

table rises or falls, free product will be retained in the soil pores, leaving behind a residual product "smear zone." If smearing occurs during a decline in groundwater elevations, residual product may be trapped below the water table when groundwater elevations rise.

A comparison of water level data collected since 1992 at the IR17 and Building 503 Area indicates that water levels generally fluctuate 0.11 to 3.35 feet over the annual hydrologic cycle in any one well. For example, groundwater level measurements in wells 17W12 and 17W15 ranged from 0.58 to 2.94 feet bgs (a fluctuation of 2.36 feet) and 4.12 to 6.83 feet bgs (a fluctuation of 2.71 feet), respectively. Based upon the observed water level variation, the residual product smear zone is estimated to be less than 4 feet thick.

1.4.4 Occurrence of Free Product Based on Groundwater Concentrations

Free product in physical contact with groundwater will dissolve gradually into the aqueous phase. The solubility limit of an organic compound in water is the concentration of that compound under equilibrium conditions. For all practical purposes, the solubility limit represents the maximum concentration of that compound in water. Organic compounds are only rarely found in groundwater at concentrations approaching their solubility limits, even when free product is known or suspected to be present. As such, the observed groundwater concentrations are usually less than one tenth of the solubility limit, presumably because of natural processes, such as diffusion and dispersion, which contribute to the dilution of the dissolved organic contaminants. This phenomenon has also been attributed to reduced solubility as a result of the presence of other soluble compounds (that is, effective solubility), the heterogeneous distribution of NAPL in the subsurface, and the potential for dilution during groundwater sampling (EPA 1991a). The effective solubility (S_i^e) of a multicomponent NAPL, such as mineral spirits, can be evaluated as the product of its pure phase solubility (S_i) and its mole fraction (X_i) in the NAPL mixture (EPA 1992).

Because organic contaminants solubilize from free product into groundwater, the potential occurrence of free product may be estimated using groundwater concentrations. In general, groundwater concentrations greater than 1 percent of the effective solubility (S_i^e) may indicate the presence of free product (EPA 1992) and:

$$S_i^e = X_i S_i$$

where

S_i^e	=	Effective solubility on contaminant (milligrams per liter [mg/L])
S_i	=	Pure-phase solubility of contaminant (mg/L)
X_i	=	Mole fraction of contaminant in product

Assuming mineral spirits to be the observed NAPL in the IR17 and Building 503 Area, groundwater concentrations of benzene, ethylbenzene, and xylenes were used to evaluate the apparent occurrence of free product. The following solubility values were used for this evaluation:

Compound	Pure-Phase Solubility (S_i) (mg/L)[a]	Approximate Mole Fraction (X_i)[b]	Effective Solubility (S_i^e)		
			S_i^e (mg/L)	$0.01xS_i^e$ (mg/L)	$0.01xS_i^e$ (µg/L)
Benzene	1,780	0.02	35.6	0.356	356
Ethylbenzene	173	0.25	43	0.43	430
Xylenes	186	0.35	65	0.65	650

Notes:

a Standard literature values (U.S. Army Corps of Engineers 1995)

b Mole fractions estimated from June 2002 groundwater data

µg/L Micrograms per liter

mg/L Milligrams per liter

In general, comparison of 1999 and 2000 groundwater concentrations to 1 percent of the effective solubility of these indicator compounds indicates that the extent of apparent free product occurrence generally corresponds to the interpreted ethylbenzene groundwater plume presented in the RI (Figure 1-5) and is limited to the following areas:

- North of Building 503
- Utility corridors to the east and west of Cedar Avenue
- Eastern portion of the Former Southern Tank Farm

1.4.5 Occurrence of Residual Product Based on Soil Concentrations

The chemical analysis of soil samples provides another measure to evaluate the apparent occurrence of residual product. Qualitatively, soil that contains high concentrations of organic compounds (greater than 10,000 milligrams per kilogram [mg/kg]) generally would be considered to indicate the presence of product (Feenstra and others 1991). Based on concentrations of total petroleum hydrocarbons as gasoline and diesel in soil, only a few soil samples exceed this criterion, including samples collected from soil borings 17GB017 and 17GB033 in the former northern tank area and soil boring B503FP025 in the former southern tank area. Additional site-specific assessment of the presence of residual product in soil samples is possible, however, using the results of chemical and physical analyses of the soil as well as the fundamental principles of chemical partitioning in unsaturated or saturated soil (Feenstra and others 1991):

$$C_t = \frac{C_w\left(K_d \rho_b + \varphi_w\right)}{\rho_b}; \text{ and } K_d = f_{oc} \times K_{oc}; \ \log K_{oc} = \log K_{ow} - 0.21$$

where

C_t	=	Total soil chemistry concentration (mg/kg)
C_w	=	Chemical concentration in pore water (mg/L)
ρ_b	=	Dry bulk density of soil (grams per cubic centimeter)
K_d	=	Partition coefficient between pore water and soil solids (cubic centimeters per gram [cm^3/g])
K_{oc}	=	Organic carbon-water partition coefficient (cm^3/g)
K_{ow}	=	Octanol-water partition coefficient (cm^3/g)
F_{oc}	=	Fraction organic carbon in soil
ϕ_w	=	Water-filled porosity (volume fraction)

With no NAPL present, a hypothetical maximum mass of chemical (for example, benzene) can be contained in a sample of soil. The corresponding hypothetical maximum total soil concentration (C_t) is defined by setting the effective solubility (S_i^e) of the chemical equal to the pore water concentration (C_w). Accordingly, if residual product were present in the soil sample, the hypothetical maximum total soil concentration would be exceeded. Given the limited site-specific partitioning data currently available, default values were used to establish the following maximum total soil concentrations indicating the apparent occurrence of residual product:

Constituent	Log K_{ow}[a]	K_{oc}	K_d	S_i^e (mg/L)	C_t (mg/kg)
		ϕ_w = 0.2; ρ_b = 2.11; F_{oc} = 0.001[b]			
Benzene	2.13	83	0.08	36	317
Ethylbenzene	3.34	1,349	1.35	43	250
Xylenes	3.16	891	0.89	65	183

Notes:

a Standard values (U.S. Army Corps of Engineers 1995)
b Default values for clays silt, sandy silt, and silty sand (API 2000)

This partitioning method, using the hypothetical maximum total soil concentration (C_t), indicates that the horizontal extent of apparent residual product generally corresponds with the apparent occurrence of free product based on groundwater concentrations (Figure 1-5).

1.4.6 Summary of Apparent Free-Phase Nonaqueous-Phase Liquid Occurrence

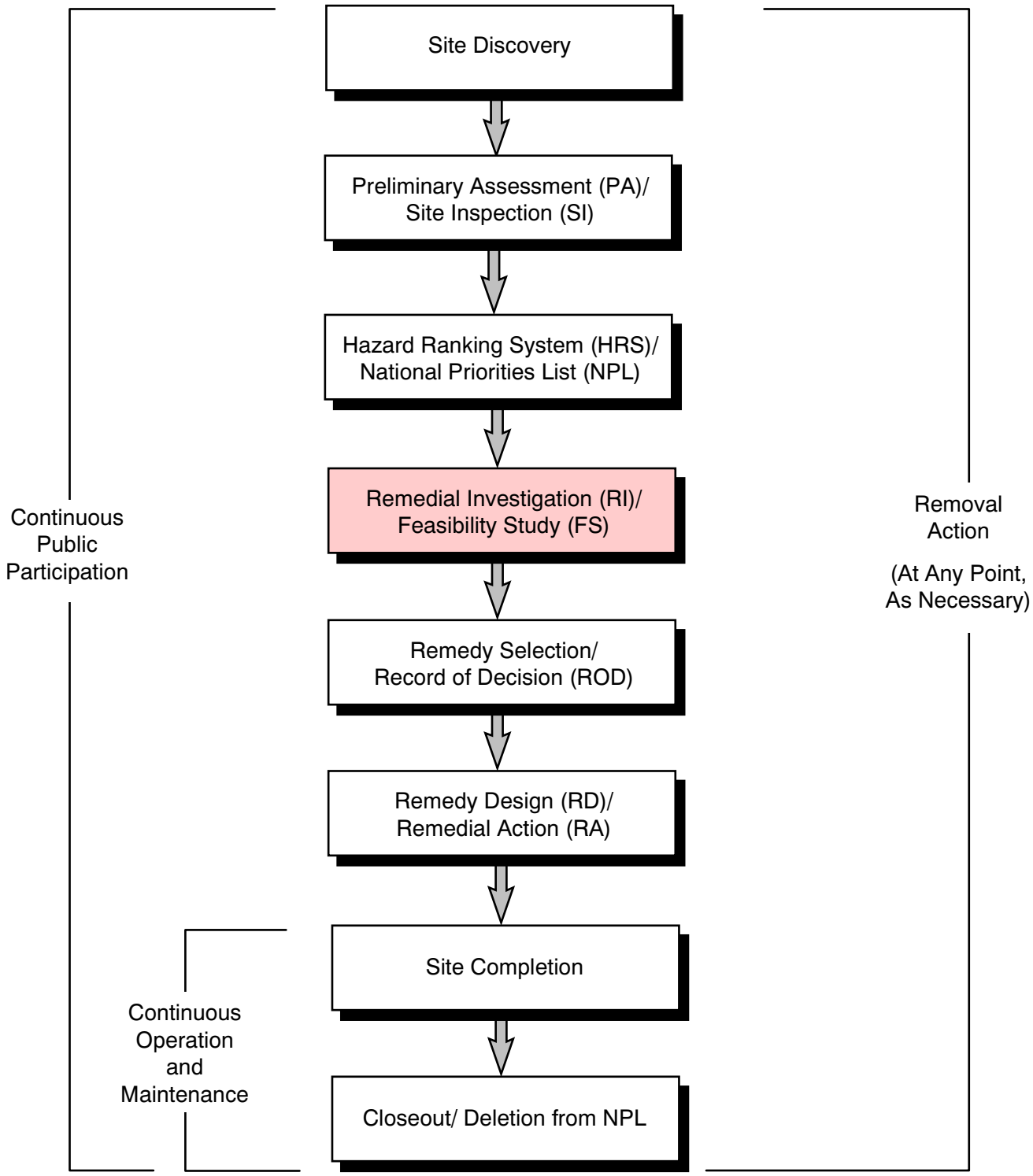
Given the limited apparent thickness (less than 0.01 foot) of free product observed in wells 17W12 and 17W15, it is unlikely that a measurable formation thickness of free product exists at the IR17 and Building 503 Area. Soil and groundwater concentrations indicate, however, that apparent free product occurrence is limited to the following areas (Figure 1-5):

- North of Building 503
- Utility corridors to the east and west of Cedar Avenue
- Eastern portion of the Former Southern Tank Farm

Product apparently present in these areas may not necessarily be mobile, but rather, may be present substantially as a residual phase. Based on historic groundwater seasonal fluctuation, the residual product smear zone is likely to be less than 4 feet thick.

FIGURES

The CERCLA Process



Tetra Tech EM Inc.

LEGEND

CERCLA Comprehensive Environmental Response, Compensatiion, and Liability Act

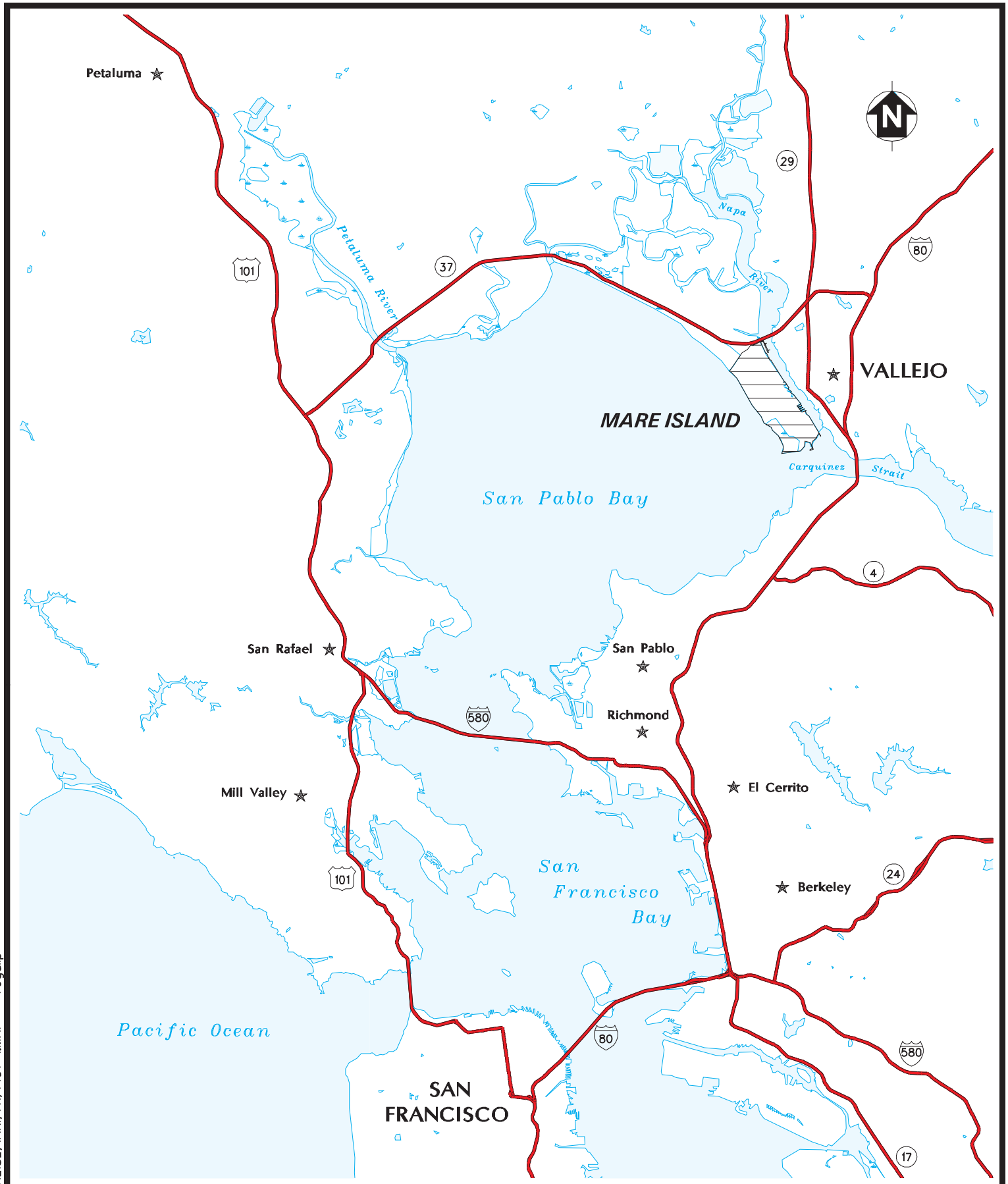
INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA

FIGURE 1-1
INSTALLATION RESTORATION PROGRAM
CERCLA PROCESS

IR17 AND BUILDING 503 AREA

R:\Navy\Mare Island\CERCLA.dsf DN deborah.ford

DS.B090.20508



2 0 2 4 MILES

10,000 0 20,000 FEET

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INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA

FIGURE 1–2
MARE ISLAND LOCATION MAP

DS B090 20508

K:/MAREISL/IARI/A1/FIG1–1.MAP rogallp

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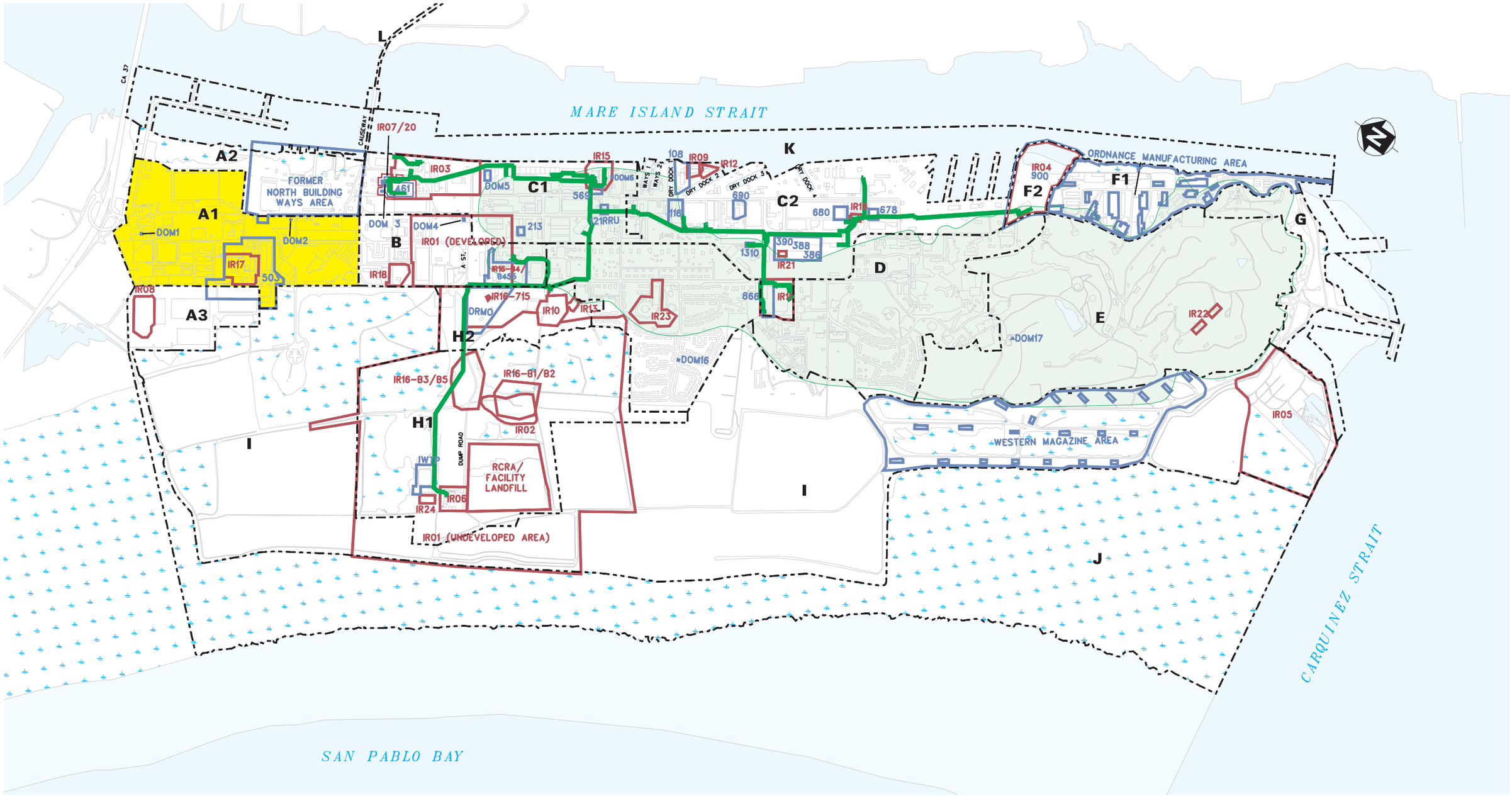


LEGEND

- A1 — INVESTIGATION AREA A1 BOUNDARY
- C1 — OTHER INVESTIGATION AREA BOUNDARY
- 503 — GROUP II/III SITE BOUNDARY
- IR08 — GROUP I SITE BOUNDARY
- INDUSTRIAL WASTEWATER PIPELINE (IR14)
- WETLANDS/TIDAL MARSH
- MUDFLATS
- SURFACE WATER
- ESTIMATED ORIGINAL EXTENT OF MARE ISLAND IN 1859

IR	INSTALLATION RESTORATION
DRMO	DEFENSE REUTILIZATION AND MARKETING OFFICE
RCRA	RESOURCE CONSERVATION AND RECOVERY ACT
IWTP	INDUSTRIAL WASTEWATER TREATMENT PLANT
DOM	DOMESTIC SANITARY SEWER PUMP STATION
121RRU	BUILDING 121 RESIN REGENERATION UNIT

750 0 750 1500

SCALE IN FEET

Tetra Tech EM Inc.

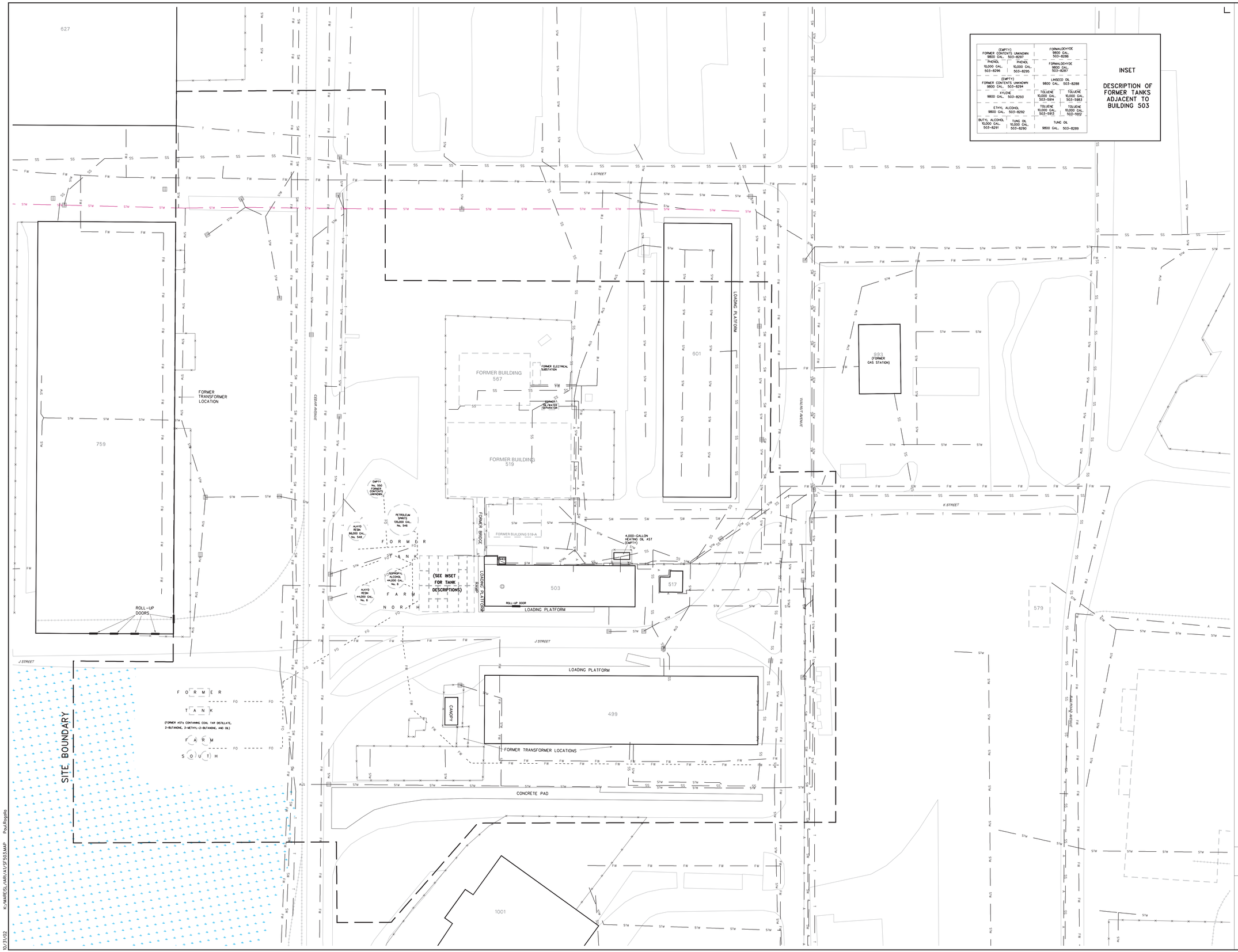
INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA

FIGURE 1-3

IR17 AND BUILDING 503
AREA AND SITE LOCATIONS

DS B090 20508

10/17/02 K:/MAREISL/IARI/A1/FIG1-2.MAP SAPFIG1-2.AML SMP



LEGEND

- FLOOR DRAIN
- STORM WATER DRAIN
- STORM WATER PIPELINE
- SANITARY SEWER
- SHARED STORM AND SANITARY SEWER
- FORMER PRODUCT DISTRIBUTION PIPELINE
- FRESH WATER PIPELINE
- ABANDONED FRESH WATER PIPELINE
- SALT WATER PIPELINE
- ABANDONED AIR LINE
- GAS LINE
- BURIED TELEPHONE LINE
- RAILROAD
- FENCE
- 503 — EXISTING BUILDING OR STRUCTURE
- 567 — FORMER BUILDING OR STRUCTURE
- SITE BOUNDARY IR17 AND BUILDING 503 AREA
- WETLAND

NOTE: ALL EXISTING AND FORMER TANKS IDENTIFIED ARE OR WERE ABOVEGROUND.

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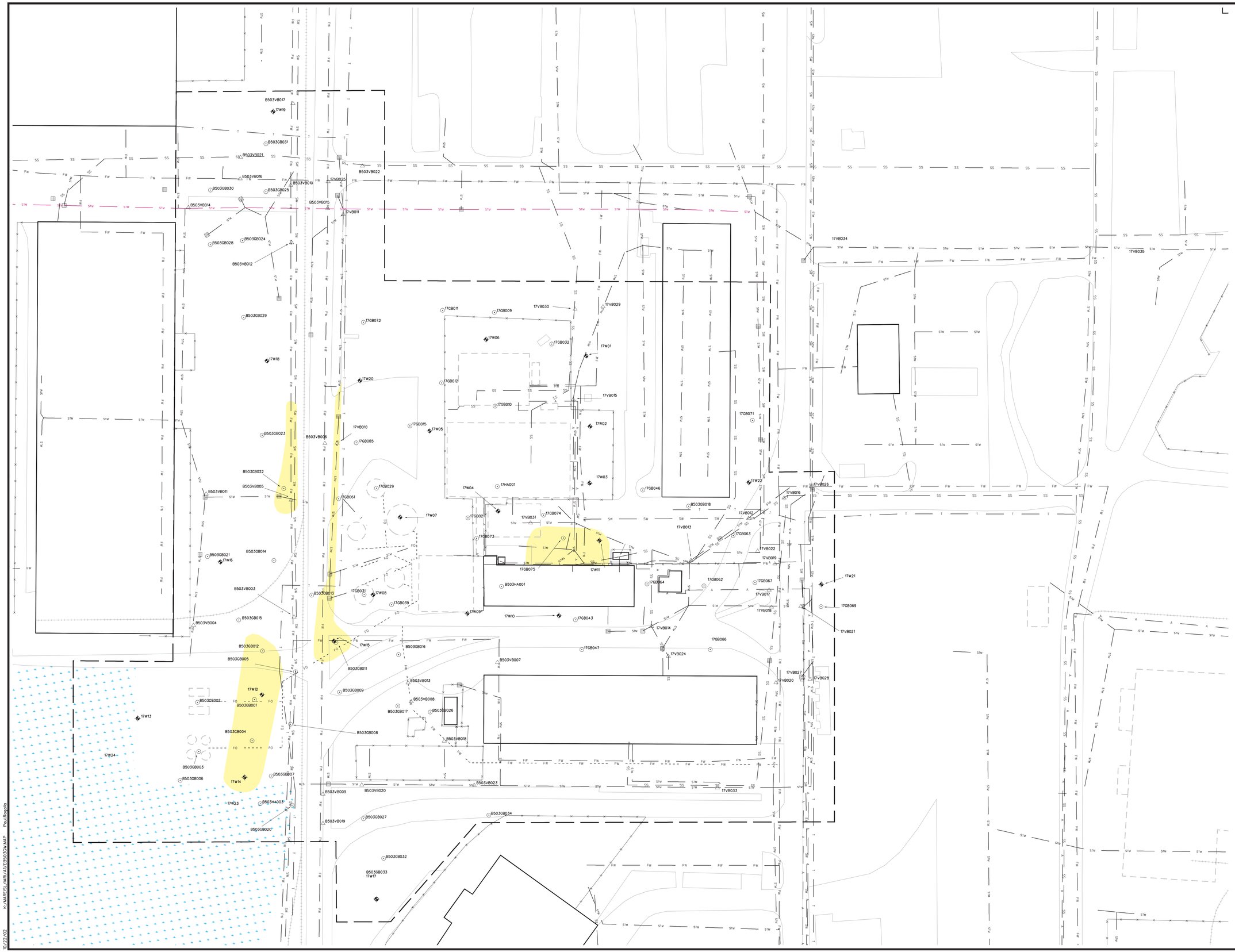
INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA

FIGURE 1–4
SITE FEATURES MAP
IR17 AND BUILDING 503 AREA

DS B090 20508

10/31/02 K:/MARE/SL/ARI/A1/SF503.MAP Paul Rogillo



LEGEND

- SOIL BORING LOCATION
- MONITORING WELL
- VACUUM EXCAVATION LOCATION
- STORM WATER DRAIN
- STORM WATER PIPELINE
- SANITARY SEWER
- SHARED STORM AND SANITARY SEWER
- FORMER PRODUCT DISTRIBUTION PIPELINE
- FRESH WATER PIPELINE
- ABANDONED FRESH WATER PIPELINE
- SALT WATER PIPELINE
- ABANDONED AIR LINE
- GAS LINE
- BURIED TELEPHONE LINE
- RAILROAD
- FENCE
- INFERRED AREA OF FREE PRODUCT OCCURRENCE
- WETLAND
- 503 EXISTING BUILDING OR STRUCTURE
- 567 FORMER BUILDING OR STRUCTURE
- SITE BOUNDARY

NOTES:
(1) THIS MAP REPRESENTS ONE INTERPRETATION BASED ON AVAILABLE DATA; OTHER INTERPRETATIONS ARE POSSIBLE.

30 0 30 60
SCALE IN FEET

Tetra Tech EM Inc.

INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA

FIGURE 1-5
INFERRED AREA OF FREE PRODUCT
IR17 AND BUILDING 503 AREA

DS B090 20508

10/22/02 K:\MARESI\ARI\A1\EB503W.MAP Paul Rogallo

2.0 IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, REMEDIAL ACTION OBJECTIVES, AND GENERAL RESPONSE ACTIONS

Sections 2.1, 2.2, and 2.3, respectively, present the ARARs, RAOs, and GRAs that were identified for the FS of the IR17 and Building 503 Area.

2.1 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 determined to be legally applicable or relevant and appropriate.

As the lead federal agency, the Navy has primary responsibility for selecting ARARs at the IR17 and Building 503 Area. Generally, state agencies are responsible for identifying state ARARs. The Navy has made a preliminary identification of state ARARs as part of this FS and will seek input from the states on this identification. This section identifies and evaluates potential federal ARARs and sets forth the Navy's initial determinations regarding those potential ARARs. Appendix A includes a detailed evaluation of potential ARARs. The final determination of ARARs will be made by the Navy in the ROD after public review as part of the response action selection process.

2.1.1 Overview

Applicable requirements are 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 identification of ARARs is a site-specific determination and involves a two-part analysis. First, a determination is made about whether a given requirement is applicable. If it is not applicable, a determination is made about whether it is relevant and appropriate. If the requirement is not applicable, the 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.

In addition to ARARs, agency advisories, criteria or other guidance issued by federal or state governments are not ARARs, but may have useful requirements that are to be considered (TBC). 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" (40 CFR §300.400[g][3]).

ARARs are generally divided into three categories: chemical-specific, location-specific, and action-specific. ARARs that affect the development of RAOs are discussed in Sections 2.1.2 through 2.1.5.

2.1.2 Chemical Specific

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 detected in or discharged to the ambient environment that is protective of human health and the environment. The HHRA concluded that the risks to human health are within the risk management range and the screening-level ERA concluded that the site did not pose an unacceptable risk to ecological receptors (Tetra Tech 2003); therefore, no remedial action is warranted. There are no chemical-specific ARARs.

2.1.3 Location Specific

Location-specific ARARs are regulations based on attributes of and resources present at the site (for example, cultural or historic resources or wetlands). Based on the location of the IR17 and Building 503 Area, the Navy identified the following location-specific ARARs:

- Executive Order Number 11990 codified at 40 CFR 6.302(a) – requiring federal agencies to minimize destruction, loss, or degradation of wetlands
- Coastal Zone Management Act (Title 16 of the *United States Code* [USC] §1456[c] – requires that activities near a coastal zone be conducted in a manner consistent with approved state management programs.
- California Coastal Act of 1976 (California Public Resource Code §30230 through 30240 – requiring the protection of sensitive habitats including wetlands
- The Endangered Species Act of 1973 (Title 16 USC §§1531 through 1543) – requiring federal agencies not to jeopardize the continued existence of a listed species or cause the destruction or adverse modification of critical habitat.

2.1.4 Potential Action Specific

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 a number of activities that were selected as part of potential remedial alternatives for the IR17 and Building 503 Area. Action-specific ARARs do not apply to the no-action alternative (alternative 1). These ARARs are summarized in Appendix A.

2.1.4.1 Removal of Free Product and Groundwater Monitoring

The following regulations are potential action-specific ARARs regarding removal of free product and groundwater monitoring:

- 40 CFR §280.12 sets forth definition of free product as a regulated substance present as a NAPL (for example, liquid not dissolved in water).

- 40 CFR §280.64(a)(b) sets forth requirements for the removal of free product to the maximum extent practicable. The removal of free product should be conducted in a manner that minimizes the spread of contamination into previously uncontaminated zones by using techniques appropriate to the hydrogeologic conditions at the site. The abatement of free product migration is identified as a minimum objective for the design of the free product removal system.

2.1.4.2 Temporary Storage and Off-Site Disposal of Skimmed Free Product

The regulations that are potential action-specific ARARs regarding temporary storage and off-site disposal of skimmed free product are as follows:

- Title 22 *California Code of Regulations* (CCR) §66264.553(b) requires temporary units to be located within the facility boundary and to be used only for treatment or storage of remediation wastes

- 22 CCR §66264.553(d) requires the temporary unit to operate for no more than 1 year and to have design, operating, and closure requirements

2.1.4.3 Bioremediation of Excavated Soil

The following regulations are potential action-specific ARARs regarding bioremediation in temporary units:

- 40 CFR §264.554(d)(1) sets forth siting standards, design criteria, and relief from land disposal restrictions [LDR] for temporary storage (less than 2 years) of remediation waste on contiguous property. Physical operations such as mixing, sizing, and blending, intended to prepare wastes for subsequent management or treatment are allowed to occur in temporary units regardless of whether the operations technically meet the Resource Conservation and Recovery Act (RCRA) definition of treatment. The standards and design criteria must facilitate a reliable, effective, and protective remedy; prevent or minimize releases of hazardous wastes and hazardous constituents into the environment; and minimize or adequately control cross-media transfer as necessary to protect human health and the environment. The facility must not operate for more than 2 years except when granted an operating term extension.

- Bay Area Air Quality Management District (BAAQMD) Regulation 8-40-110 sets forth exemptions for the calculation of aeration volumes under Section 8-40-204 for covered storage units.

- BAAQMD Regulation 8-40-304 sets forth requirements for active storage units of contaminated soil to be kept visibly moist by water spray, treated with a vapor suppressant, or covered with continuous heavy-duty plastic sheeting or other cover to minimize emissions of organic compounds to the atmosphere.

- BAAQMD Regulation 8-40-306 sets forth requirements for handling and treatment of exposed and stockpiled contaminated soil.

- BAAQMD Regulation 6-301 regulates emissions that are as dark or darker than No. 1 on the Ringleman Chart.

- BAAQMD Regulation 6-302 regulates emissions on the basis of opacity

- BAAQMD Regulation 6-305 regulates particulate emissions.

2.1.4.4 Off-Site Disposal of Excavated Soil

The following regulations are potential action-specific ARARs regarding off-site soil disposal:

- Title 22 CCR §§66261.21 through §66261.24 set forth sampling requirements to determine whether excavated soil is a RCRA characteristic hazardous waste.

- Title 22 CCR §66262.34 sets forth the allowance for on-site accumulation of hazardous waste for up to 90 days if the waste is stored in containers.

- Title 22 CCR §§66264.171, 66264.172, 66264.173, and 66264.174 set forth the requirements for containers to be maintained in good condition, be compatible with the hazardous waste to be stored, be closed during storage except to add or remove waste, and be inspected weekly for deterioration.

- Title 22 CCR §66264.175(a) and (b) set forth the requirements for containers to be placed on a sloped, crack-free base and protected from contact with accumulated liquid. Spilled leaks or wastes must be removed in a timely manner.

- Title 22 CCR §66262.30, 66262.31, 66262.32, and 66262.33 set forth the requirements for proper packaging, labeling, marking, and placarding.

2.1.4.5 Treatment and Control of Air Emissions

The following regulations are potential action-specific ARARs regarding treatment and control of air emissions related to multiphase and soil vapor extraction systems:

- BAAQMD Regulation 8-40-301 sets forth requirements that any air stripping and soil vapor extraction operations that emit benzene shall be vented to a control device to reduce benzene emissions by at least 90 percent by weight.

- BAAQMD Regulation 8-40-302 sets forth requirements that air stripping and soil vapor extraction operations with a total organic compound emission greater than 15 pounds per day shall be vented to a control device to reduce total organic compound emissions by at least 90 percent by weight.

- BAAQMD Regulation 8-40-401 sets forth requirements for operations at Superfund Amendments and Reauthorization Act (SARA) sites to notify the air pollution control officer of the intent to operate

- BAAQMD Regulation 8-40-603 sets forth requirements for the determination of organic compound emissions.

2.1.4.6 In-Situ Thermal Treatment of Soil

The following regulations are potential action-specific ARARs regarding the in-situ thermal treatment of soil:

- Title 22 CCR §66265.13 requires a waste analysis

- Title 22 CCR §66265.370 requires that owners or operators of facilities that thermally treat hazardous waste in devices other than enclosed devices using controlled flame combustion comply with Article 16

- Title 22 CCR §66265.373 requires the owner or operator to bring his thermal treatment process to steady state conditions of operation before adding hazardous waste

- Title 22 CCR §66265.375 requires a waste analysis under §66264.13 and requires a waste analysis to determine (1) the heating value of the waste; (2) halogen content and sulfur content in the waste; and (3) concentration of lead and mercury in the waste, unless the owner or operator has written, documented data that show that the element is not present

- Title 22 CCR §66265.377 requires monitoring and inspections

- Title 22 CCR §66265.381 presents closure requirements.

2.1.4.7 Disposal of Equipment

The Navy will determine whether remediation equipment (that is, multiphase extraction and in-situ thermal desorption equipment) meets the definition of a RCRA hazardous waste at the

time the equipment will be disposed. Potential federal action-specific ARARs for the identification of the equipment as a hazardous waste and off-site disposal of the equipment are the same as discussed in Sections 2.1.4.3 and 2.1.4.5 for off-site disposal of materials.

2.1.4.8 Institutional Controls

There are no federal ARARs for institutional controls.

2.1.5 To Be Considered

No guidance was identified as TBC for the IR17 and Building 503 Area.

2.2 REMEDIAL ACTION OBJECTIVES

RAOs are established to allow identification and screening of RAs that achieve protection of human health and the environment consistent with reasonably anticipated land use. The determination of RAOs includes consideration of site-specific risks and ARARs in accordance with CERCLA, as amended by the SARA.

RAOs consist of medium-specific and/or operable-unit-specific goals for protecting human health and the environment. RAOs are developed to allow identification and screening of RAs that achieve protection of human health and the environment consistent with a reasonably anticipated land use. RAOs specify:

- The contaminant(s) of concern
- Exposure route(s) and receptor(s)
- An acceptable contaminant level or range of levels for each exposure route

The RAOs presented in this section are specific to the removal of free-phase NAPL associated with the IR17 and Building 503 Area. The RAOs were developed based on the future light industrial land use of the IR17 and Building 503 Area, consistent with the Mare Island final reuse plan (City of Vallejo 1994).

As described in the draft final RI report, free-phase NAPL observed in the IR17 and Building 503 Area represents a continuing source of soil and groundwater contamination. Based on the requirements of CERCLA, ARARs, and the HHRA and ERA presented in the draft final RI report (Tetra Tech 2003), the following RAOs were developed to reduce free-phase NAPL volume within the IR17 and Building Area 503:

- Reduce Apparent Occurrence of Free Product - This RAO is to reduce the apparent occurrence of free product to the maximum extent practicable. Areas where free product may occur shall be remediated in a manner that minimizes the spread of contamination into previously uncontaminated zones, and abatement of free product migration shall be the predominant objective in the design of these activities.

- Human Health Protection - There is no RAO for human health protection. The total excess cancer risk for the commercial/industrial worker under the unchanged and modified site configurations were 6×10^{-6} and 8×10^{-6}, respectively, which are within the EPA risk management range. For each scenario, the HI did not exceed the threshold value of 1.0, indicating that adverse noncancer health effects are not expected for this receptor. Risk to human receptors (commercial/industrial work and construction worker) is within the risk management range for use as a light industrial area.

- Environmental Protection - There is no RAO for environmental protection. Potential risks to ecological receptors in the wetland area were evaluated during an onshore ERA. Wetland sediment sample data were evaluated, and food-chain modeling was conducted. The results of the food-chain modeling indicated that no immediate or significant risk exists to ecological receptors from exposure to sediments in the wetland. Furthermore, fate and transport analysis concluded that no significant contaminant migration pathways exist from the upland area to surface water sediment in the wetland.

2.3 GENERAL RESPONSE ACTIONS

This section describes broad categories of remedial measures or GRAs that could be used to achieve the RAOs. GRAs may include treatment, containment, excavation, extraction, disposal, institutional actions, or a combination of these. In addition, CERCLA requires that the no further action alternative be included among the GRAs evaluated in all FSs. The no-further-action alternative serves as a baseline for comparison for other alternatives. Like RAOs, GRAs are medium-specific.

The following are general descriptions of the GRAs presented in this FS:

- No Action: The no-action alternative serves as a baseline for comparison for other alternatives.

- Land Use Controls (LUC): LUC actions include nonengineering such as administrative and/or legal controls. They generally do not promote active remediation of contaminated sites, but they can minimize or prevent human exposure to contaminants in soil. They also can limit changes to site conditions that alter exposure mechanisms. There are four general categories for this type of GRA: government controls, proprietary controls, enforcement and permit tools, and informational devices.

- Containment Actions: Containment systems are designed to minimize exposure to soil and groundwater contaminants by minimizing direct contact by receptors. In addition, containment systems can be designed to reduce the mobility of contaminants by imposing physical barriers to transport. This type of GRA is designed to minimize exposure to contaminants by minimizing direct contact by receptors. In addition, containment systems can be designed to reduce the mobility of contaminants by imposing physical barriers to transport. The volume and toxicity of contaminants are not reduced.

- Active Remediation: Active remediation is designed to permanently remove contaminants from a site. The contaminants may be physically removed and transported to another location designed to handle them, or they may be treated and destroyed on site. This type of GRA is designed to affect the toxicity, mobility, or volume of contaminants at a site. Engineered removal actions are designed to permanently remove contaminants from a site. In situ treatments can reduce the toxicity, mobility, and/or volume of contaminants.

For each of these GRAs, specific technologies and process options within the technologies are further evaluated in the next section for their applicability at the IR17 and Building 503 Area.

3.0 PRELIMINARY SCREENING OF TECHNOLOGIES AND DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section presents the initial screening process for technology types and process options to reduce the apparent occurrence of free product to the maximum extent practicable. This section also presents the initial list of technologies and process options and summarizes the results of the preliminary screening process. Potentially applicable technologies and process options were identified using a variety of sources, including references developed for application to CERCLA sites (EPA 1999a, 1999b; U.S. Department of Defense [DoD] 1994) and more standard engineering texts not specifically directed toward hazardous waste sites.

3.1 SCREENING CRITERIA

Various technologies and process options were evaluated during the initial screening for their ability to treat fuel hydrocarbons and remove free product at the IR17 and Building 503 Area. The screening evaluations focused on each technology or process option's effectiveness in removing contamination, implementability, and cost. These screening evaluation criteria are discussed in the following text.

3.1.1 Effectiveness

The evaluation of effectiveness focused on (1) the ability of the technology to address contaminants of concern, (2) the ability of the technology to meet the cleanup goals within a reasonable timeframe, and (3) the reliability of the technology. The ability of a technology to address the contaminants of concern at the IR17 and Building 503 Area was evaluated based on its general applicability in treating fuel hydrocarbons and removing free product. Technologies were included in the initial screening evaluation if the Federal Remediation Technologies Roundtable (FRTR) rated them as "better" in treating fuel hydrocarbons and removing free product (FRTR 2002).

The ability of a technology to achieve the cleanup 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 cleanup goals after less than 3 years of implementation), medium term (achieving the cleanup goals after 3 to 10 years of implementation), or long term (requiring more than 10 years of implementation to achieve the cleanup goals) (FRTR 2002).

3.1.2 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 the permitting process and obtaining approvals from authorities.

3.1.3 Cost

The evaluation of cost addresses direct and indirect capital costs and annual operation and maintenance (O&M) costs. When the information is available, the cost range is presented quantitatively, with a margin of error of 30 percent low to 50 percent high. Otherwise, qualitative descriptions of low, moderate, and high are used. The cost ranges are based on a review of the literature, vendor quotations, and data prepared for other studies.

3.2 IDENTIFICATION AND SCREENING OF TECHNOLOGY AND PROCESS OPTIONS

This section describes how various technology types and process options were evaluated with respect to the three preliminary screening criteria described in Section 3.1. With this evaluation, technologies and process options were eliminated based on their failure to demonstrate acceptable levels of effectiveness in removing NAPL, implementability, or cost.

Potentially applicable technologies and process options were identified using a variety of sources, including references developed for application to CERCLA sites (EPA 1999a, 1999b; DOD 1994) and more standard engineering texts not specifically directed toward hazardous waste sites. The following four sources provided the majority of information on remedial technologies for this FS:

1. Remediation technology screening matrix of FRTR (FRTR 2002)
2. Environmental restoration web site of Naval Facility Engineering Service Center (NFESC 2002)
3. Technology profiles from the Superfund Innovative Technology Evaluation Reports (EPA 1999a, 1999b)
4. Office of Solid Waste and Emergency Response publication on LUCs (EPA 2000a)

The following sections identify and screen potential process options for the IR17 and Building 503 Area. The no-action and LUC alternatives are discussed first followed by a discussion of an overall evaluation of NAPL removal/treatment technologies. Table 3-1 summarizes the screening process for NAPL removal and treatment technologies. Table 3-2 presents a comparative analysis of the alternatives.

3.2.1 No Action

No action implies that no remedial action will be conducted on site. Under the no-action alternative, free-phase NAPL and contaminated groundwater would be left as is without implementing any LUCs, containment, removal, treatment, or other mitigating actions. Although this response action is protective of human health and the environment, it is not effective in reducing the apparent occurrence of free product to the maximum extent practicable. Because no action is taken, no cost is associated with this option. The NCP requires inclusion of the no-action response among the alternatives evaluated in every FS (40 CFR 300.430[e][6]). The no-action response provides a baseline for comparison to the other remedial response actions.

3.2.2 Land Use Controls

EPA defines LUCs 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 LUCs: governmental controls; proprietary controls; enforcement and permit tools with LUC components; and informational devices. LUCs are more often effective if they are layered or implemented in series. Layering means using different categories of LUCs at the same time 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.

The following subsections describe and evaluate LUCs that could be applied at the IR17 and Building 503 Area.

3.2.2.1 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 agency, they are not necessarily permanent. They can be repealed or local governments can grant exceptions after public hearings. For a long-term remedy, the implementation of zoning restrictions are usually layered with other LUC tools. At the IR17 and Building 503 Area, zoning restrictions are readily implementable at low cost; therefore, they were 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. The effectiveness of the groundwater use

restrictions depends on the willingness and ability of local government to monitor compliance and take enforcement action. Similar to zoning restrictions, groundwater use restrictions are typically layered with the implementation of other LUC tools. At the IR17 and Building 503 Area, groundwater use restrictions are readily implementable, potentially effective, and low cost; therefore, they were retained for further evaluation.

3.2.2.2 Proprietary Controls

Proprietary controls (PC) involve legal instruments placed in the chain of title of the site property. PCs can be implemented without the intervention of any federal, state, or local regulatory authority. PCs 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 monitoring is a critical component to assess the effectiveness of the LUC approach, an easement was 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 to establish an LUC where the 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 was retained for further evaluation.

3.2.2.3 Enforcement Tools with Land Use Control Components

Enforcement tools are defined as tools, such as administrative orders or consent decrees, available to EPA 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 PC.

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

3.2.2.4 Informational Devices

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 commonly 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 help ensure the overall reliability of other LUCs; therefore, deed notice was retained for further evaluation.

3.2.3 Containment

Containment technologies provide the ability to reduce the mobility of contaminants. Common examples include caps (for example, earthen covers), hydraulic capture via groundwater extraction wells, and physical barriers (for example, sheet pile walls, and low-permeability slurry walls). Implementation of a containment technology as a single remediation approach will not achieve the RAO to reduce free-phase NAPL, nor is it effective in removing free product to the maximum extent practicable; therefore, containment technologies were not retained for further consideration.

3.2.4 Active Remediation

This section presents the preliminary screening of technologies to actively remove free-phase NAPL at the IR17 and Building 503 Area.

3.2.4.1 Passive Free Product Collection

Passive collection technologies remove free product from wells either on a continuous or periodic basis. As product is removed, product from the surrounding formation flows toward the well. There are four main types of passive free product collection: (1) hand bailing, (2) sorbent socks, (3) belt skimmers, and (4) product-recovery pumps and trenches. Each is discussed further below.

Hand Bailing

Hand bailing consists of using a hand bailer on a periodic basis in all wells with free product. The bailer is used repeatedly until the apparent product thickness in the well is removed to a sheen. Removed product and groundwater is stored in drums or tanks and periodically disposed of off site.

Bailing would be conducted at wells 17W12 and 17W15 and five newly installed wells. Bailing would be conducted on a weekly basis initially, and then less frequently in response to declining recovery rates.

For small amounts of free product in permeable soils, bailing is an effective means of recovering free product. It is not applicable at sites with large amounts of free product (greater than 100 gallons) or sites with low permeability soils. Because of the small magnitude of free product at IR17, hand bailing was not retained for further consideration.

Sorbent Socks

Sorbent socks consist of sock-shaped tubes of oleophilic material, which is designed to attract and sorb petroleum hydrocarbons. The material is similar to that used in sorbent booms for product recovery from surface water spills. The socks are available in a variety of sizes for use

in wells of various diameters and are typically 2 to 6 feet in length, depending on water level variability.

The socks are placed in the well at the water table depth and secured to the top of the well with a rope. The socks are removed and inspected periodically to determine removal rates and the necessary change-out frequency. Spent socks are typically disposed of off site.

Although the socks can typically absorb more than their own weight in free product, they typically are not used in cases where more than a sheen of free product exists. Because of their limited capacity at the IR17 and Building 503 Area, sorbent socks would most likely be used near the end of remedial action, when only a sheen exists, or between periodic vacuum extraction events.

Belt Skimmers

Belt skimmers consist of a looped oleophilic tube that extends down into the well to the product layer. The belt is driven by a motor so that it continuously recirculates from the well to the top of the well. At the wellhead, a wiper mechanism removes the oil from the belt. The removed oil flows into a drum or tank. The collected product is periodically removed and disposed of or recycled off site. Because belt skimmers continuously collect and remove product, product recovery rates are typically higher than those achieved by hand bailing.

If selected, belt skimmers would be installed at wells 17W12, 17W15, and five newly installed wells or in a collection trench.

Belt skimmers work best for recovering free product from permeable soils. Belt skimmers work best on heavy oils such as diesel, motor oil, and crude oil, as these materials adhere to the belt better than gasoline and kerosene.

Product Recovery Pumps and Trenches

In-well product-recovery pumps typically consist of a collection chamber that floats on the water surface and below the product surface. Product flows by gravity into the collection chamber. When the collection chamber is full, valves are actuated, and compressed air is used to force the collected oil to the surface into a tank or a drum. The collected product is periodically removed and disposed of or recycled off site. Because product-recovery wells periodically collect and remove product, product recovery rates are typically higher than those achieved by hand bailing and similar to those achieved by belt skimmers.

Product recovery pumps work best for recovering free product from permeable soils. Product recovery pumps function best on lighter, low viscosity oils such as gasoline and kerosene. Of the three type of passive recovery systems, product recovery pumps are the best suited for IR17.

Given the heterogeneity of the soils at IR17, the use of wells for product recovery is not likely to achieve significant recovery throughout the area of concern. The installation of gravel-filled trenches will likely transect higher permeability zones and increase the product recovery rate. Use of trenches also reduces the number of pumps, as there would be only one pump per trench.

3.2.4.2 Active Free-Product Collection

Active free-product collection typically employs additional driving forces to collect free product (either vacuum, water table depression, or both).

Multiphase Extraction

Multiphase extraction (MPE), also known as vacuum-enhanced recovery, bioslurping, or dual-phase extraction, is an active NAPL removal technology. MPE offers an advantage over passive collection systems in that a high-pressure gradient is applied to a well to draw product from the formation and into the well. This pressure gradient is a combination of groundwater table depression and vacuum.

Typical systems consist of an extraction well screened across the water table. A drop tube is placed within the well to the oil/water interface. The drop tube is piped to a knockout chamber and into a liquid ring vacuum pump. When the pump is activated, a vacuum is applied to the well, drawing groundwater, free product, and vapor into the drop tube. The groundwater and free product are removed from the vapor stream via the knockout chamber. An oil/water separator is used to remove the bulk of the free product from the extracted groundwater, and the extracted groundwater is treated (often by air stripping and/or carbon adsorption) and discharged. The extracted vapor usually requires treatment, often by carbon adsorption, thermal oxidation, or catalytic oxidation.

The advantages of MPE are its aggressiveness in extracting and removing free product. Extraction rates via MPE are typically 2 to 10 times greater than passive systems, reducing cleanup timeframes and O&M costs. There are several additional benefits of MPE. First, because the system extracts significant volumes of vadose zone soil vapor, soil contamination is reduced in a manner similar to a soil vapor extraction system. Second, groundwater contaminant mass is reduced in a manner similar to a conventional pump-and-treat system. Finally, removal of groundwater and vadose zone vapors pulls air toward the well, which increases dissolved oxygen concentrations and promotes biodegradation.

Despite its advantages, MPE is not as effective in low-permeability soils. In low-permeability soils, the estimated radius of influence for an MPE system is approximately 10 feet, increasing the number of wells and extraction units needed. According to the A1 RI, the hydraulic conductivities measured within the four monitoring wells located within the area of inferred free product (17W04, 17W11, 17W12, and 17W14) ranged from 7.9×10^{-5} to 1×10^{-6} centimeter per second (cm/sec) (Tetra Tech 2003). Recommended hydraulic conductivities for MPE are 10^{-3} to 10^{-5} cm/sec (EPA 1999c). MPE may, therefore, only be applicable for the removal of free product along the utility corridors to the east and west of Cedar Avenue where backfill within the

utility corridors is expected to be a coarse-grained heterogeneous material with higher hydraulic conductivities.

Capital and O&M costs for MPE systems can be very high because these systems typically require vapor and groundwater treatment trains. In particular, the equipment required for treating extracted free product and groundwater can be extensive because these fluids are violently mixed (in most MPE configurations), which can create strong emulsions. Such emulsions are very difficult to separate from the extracted groundwater, often requiring chemical treatment and dissolved air floatation. In addition, MPE systems typically require both air and National Pollutant Discharge Elimination System permits for discharge of air and water; the Navy would prepare sample permits to demonstrate compliance with the substantive, but not administrative, requirements of these permits.

An MPE system would be expected to operate for 2 to 3 years. Other than the utility corridors along the east and west of Cedar Avenue, site conditions at IR17 are not particularly well suited for MPE.

Periodic Vacuum Extraction

Vacuum extraction consists of regular site visits by a local vender with a vacuum truck. Such trucks are typically equipped with a liquid-ring vacuum pump. The vacuum truck is connected to the extraction well (or several wells manifolded together). Vacuum is applied, and groundwater, free product, and vadose zone vapor are extracted in the same manner as in MPE. Extraction is conducted until the truck is full.

The chief advantages of vacuum extraction are its low cost and ease of implementation.

3.2.4.3 In-Situ Chemical Oxidation

In-situ chemical oxidation (ISCO) is an active fuel hydrocarbon and NAPL removal technology. ISCO is based on the delivery of chemical oxidants to contaminated media to destroy the contaminants by converting them to innocuous compounds. Oxidants typically applied to remediate fuel hydrocarbons include hydrogen peroxide and ozone.

The most common ISCO field application is based on Fenton's Reagent whereby hydrogen peroxide (H_2O_2) is applied with an iron (Fe^{+2}) catalyst creating a hydroxyl free radical (OH). The hydroxyl free radical is a very powerful nonspecific oxidizing agent capable of oxidizing complex organic compounds including fuel hydrocarbons. The contaminants are treated in situ and converted to innocuous or naturally occurring compounds (water [H_2O], carbon dioxide [CO_2], oxygen [O_2], and halide ions). At a number of sites, a "top-down" injection approach has been implemented with Fenton's reagent when contamination is relatively shallow. By delivering the reagents into the groundwater at a shallow depth, a "blanket" can be created to consume organic compounds as they rise because of volatilization from the heat generated by the exothermic reaction. The Fenton process is relatively fast acting, taking only days or weeks.

Residual hydrogen peroxide decomposes into water, and oxygen in the subsurface and any remaining iron precipitates out.

Important advantages of ISCO include its relatively low cost and speed of reaction; however, the design must account for the hazards of the chemicals and potential for vigorous uncontrolled reactions in the subsurface that may occur with Fenton's reagent. Hydrogen peroxide is potentially flammable or explosive when mixed with combustible chemicals such a fuel hydrocarbons. The exothermic breakdown of the peroxide generates heat and oxygen gas that tends to volatize contaminants from the soil and/or groundwater. This rapid decomposition reaction can create an explosive condition if used for treatment of flammable or combustible compounds associated with the resulting mixture of heat, oxygen, and flammable compounds. These reactions have resulted in explosions along utility corridors and, in once case, buckling of an asphalt parking lot and subsequent fire and explosion (Interstate Technology and Regulatory Cooperation Work Team 2001).

The effectiveness of ISCO is also dependent on the ability to deliver (inject) the chemical oxidant into the subsurface and into direct contact with the contaminant. An ISCO treatability study was previously completed at IR17. The conclusions of the study were that site-specific soil conditions including the high clay and the heterogeneity of the soil prevented the injection solution from contacting target contaminants. Furthermore, distinct tubular intrusions in the soil and observations of fluid backing up into the injection borings indicated that the ROI of the injection solution was limited to approximately 6 inches. ISCO was not retained for further evaluation.

3.2.4.4 In-Situ Thermal Desorption

In-situ thermal desorption (ISTD), or in-situ conduction heating, is an active hydrocarbon and NAPL removal process in which heat and vacuum are applied simultaneously to subsurface soils. As soil is heated using a series of thermal/vacuum wells, contaminants in the soil are vaporized or destroyed by a number of mechanisms including evaporation into the air stream, steam distillation into the water vapor stream, boiling, oxidation, and pyrolysis. Contaminants that are not destroyed in situ are removed via vacuum extraction to the surface and treated with an air pollution control system. For fuel hydrocarbons, the typical soil vapor treatment train consists of a heat exchanger, carbon bed absorbers, and vacuum blowers.

Typical ISTD systems consist of a series of heater and vacuum wells installed on a triangular grid with spacing of 5 to 7 feet between wells. The following considerations affect the choice of spacing: the required heating interval (that is, thickness of contaminated zone); type of contaminant (that is, contaminant volatility determines the temperature to which the soil must be heated); soil type and moisture content; and desired treatment time. In most applications to date, vertical wells are used; however, horizontal wells offer an efficient alternative for relatively shallow treatment depths between 3 to 10 feet.

For fuel hydrocarbons, ISTD can be used to apply a range of temperatures to induce steam distillation and superheating. To induce steam flooding, the soil temperature is raised to

approximately 100 ºC (boiling point of water) to generate steam. The resulting steam flood heats the soil and strips volatile and low-boiling volatile contaminants for subsequent collection by vapor extraction. Superheating refers to raising the soil temperature above the boiling point of water to the boiling point of the target contaminant (that is, 150 ºC for ethylbenzene). Superheating induces steam flooding and promotes contaminant volatilization for subsequent collection by vapor extraction. To achieve superheating temperatures in soil, the soil pore water must be first "boiled" off. Consequently, wells for superheating applications must be placed in the unsaturated zone, or if the saturated zone is required for treatment, dewatering of the saturated zone may be required. Steam distillation heating does not require dewatering because this approach is not intended to achieve a complete "boiling off" of all the pore water.

The main advantage of in-situ thermal treatment is that it allows soil and NAPL to be treated in situ without being excavated and transported. Thermal treatment offers quick cleanup times and typically achieves a high level of destruction and removal efficiency. ISTD is, however, generally a more costly treatment technology for the treatment of fuel-contaminated soil and groundwater, and there is more uncertainty in system performance because of the variability in contaminant, soil, and aquifer characteristics. Cost is generally driven by energy and equipment costs and is both capital and O&M-intensive.

3.2.5 Excavation and Ex-Situ Treatment or Disposal

Because of the heterogeneous nature of the soils and the shallow depth of the LNAPL at IR17, excavation is likely to be effective, implementable, and cost-effective. Unlike other recovery technologies, excavation physically removes the source and is not limited by soil permeability or other hydrogeological factors. Because the inferred free product at IR17 is present in a very thin, discontinuous layer, removing it via active or passive recovery methods is likely to present significant capital costs as well as long-term O&M costs.

Excavation avoids problems inherent in product recovery technologies by physically removing the smear zone soils to a depth below the water table. Because LNAPL has been detected on only one groundwater sampling event, it is likely discontinuous and, in many instances, expected to be strongly sorbed to soil particles. By excavating the entire area of apparent LNAPL occurrence, there is a greater degree of confidence in achieving the RAO of removing apparent free product to the maximum extent practicable.

Excavation of the inferred LNAPL would begin by surveying the site and delineating the area of excavation. Excavation would likely be conducted using one or more hydraulic excavators. To prevent sloughing and for worker safety, the side slopes of the excavation would sloped back based on the recommendations of a registered geotechnical engineer, but could be expected to be approximately 1 unit horizontally for every one unit of depth (1H:1V).

Excavation would begin with saw cutting, excavation, and removal of all asphalt from the areas to be excavated. Removed asphalt would be disposed of or recycled off site. An 8-inch cast iron storm drainpipe, a 12-inch transite freshwater pipe, and an 8-inch cast iron saltwater pipe transect various portions of the areas to be excavated. Each of these pipes would be capped at the edges

of the excavation during excavation activities. During backfilling and site restoration, the storm drain and fresh water pipes would be restored. The saltwater line, which is abandoned according to facility representatives, would not be restored. Contaminated soil excavated from above the water table would be excavated and loaded directly onto dump trucks to the extent possible to minimize handling costs.

To minimize excavation dewatering and maximize the removal of LNAPL in the smear zone, excavation would be conducted in the dry season during a period of low water tables. At that time, most of the smear zone soils would be unsaturated and excavation would be conducted to an average depth of 6 inches below the low water table to maximize the removal of LNAPL floating on the water table. Both Class I and Class II landfills require that soil for disposal contain no free liquid. Saturated soil will be dewatered in three steps. First, saturated soils will be excavated and stockpiled within the excavation so the free water is allowed to drain from the soils while remaining in the excavation. Second, soil from these stockpiles will be placed on a 60-mil high-density polyethylene (HDPE) liner placed adjacent to the excavation. The liner will be bermed and sloped so that runoff flows back into the excavation. Soil will be further allowed to dry on this staging area. Finally, if necessary, wet soils will be machine blended with dry vadose zone soils before they are placed in dump trucks for treatment or disposal.

Water and possibly free product are expected to collect within the excavations. Free product would be removed using oleophilic booms. Saturated booms will be removed and disposed of off site.

3.2.5.1 Ex-Situ Thermal Treatment (Low-Temperature Thermal Desorption)

Low-temperature thermal desorption is a well-proven method for the treatment of petroleum-contaminated soils at relatively low temperatures, typically less than 700 °F. This ex-situ technology involves heating contaminated soils to volatilize contaminant compounds. The off gas is then treated by vapor-phase activated carbon, catalytic oxidation, or other vapor-phase technology. The low operating temperatures and absence of oxygen in the treatment chamber prevent formation of dioxins and furans as by-products. Typical methods used to execute this technology are thermal blanket, heated auger, and rotary kiln. A number of mobile systems exist. Typical units can process 10 to 50 tons of soil per hour.

Proof-of-process testing and complying with the substantive requirements of air permits can delay implementing low-temperature thermal desorption. Thermal desorption can be a very costly treatment technology with costs ranging from $150 to $250 per cubic yard. Consequently, low temperature thermal desorption was not retained as a technology process option in this FS.

3.2.5.2 Ex-Situ Biological Treatment

Bioremediation is an ex-situ biological treatment that is also known as landfarming and ex-situ bioventing. Bioremediation is a proven, full-scale technology in which excavated soils are mixed with soil amendments and placed on a treatment area that is equipped with leachate

collection and aeration systems. It is used to reduce concentrations of petroleum constituents in excavated soils via aerobic biodegradation. Moisture, heat, nutrients, oxygen, and pH can be controlled to enhance biodegradation. Tilling and mixing of the soil breaks down larger, low-permeability clumps of soil, allowing oxygen, water, and nutrients to biodegrade contaminants that may otherwise remain bound within the soil matrix.

At the IR17 and Building 503 Area, the bioremediation temporary units would probably be located on site at an already paved area and covered with an additional impermeable liner to minimize the risk of contaminants leaching into uncontaminated soil. Nutrients and moisture would be added as necessary. Some vendors recommend the use of proprietary blends of microbes, but most research has shown that indigenous microorganisms are already adapted to the site-specific contaminants and conditions and that they actually perform better when provided with adequate oxygen, water, and nutrients.

In some instances and locations, bioremediation is conducted uncovered and volatilization of contaminants is uncontrolled. At the IR17 and Building 503 Area, however, BAAQMD regulations limit air emissions by limiting the volume of soil that can be aerated each day. BAAQMD Regulation 8, Rule 40, Section 301 allows uncontrolled aeration of 30 cubic yards of soil per day of soil containing 1,000 to 1,999 parts per million (ppm) of VOCs. The average total petroleum hydrocarbon concentration of the soil to be bioremediated is 1,980 ppm. At such a rate, treating the volume of all soil excavated from the site would take over 1.5 years.

To accelerate the remedial timeframe, emissions from the bioremediation temporary units would be controlled, thus allowing simultaneous treatment of an unlimited volume of soil. The temporary units would have a blower and an air distribution system buried under the soil to pass air through the soil. The soil units in this case would be up to 6 feet high. The temporary units would be covered with plastic to control runoff, evaporation, and volatilization and, to a lesser degree, promote solar heating. Vent piping, blowers, and vapor-phase granular activated carbon will be used to collect and treat vapor from the temporary units.

Bioremediation is a short-term technology. Duration of O&M is expected to last about 3 months. Soil would be treated to the EPA Region IX industrial preliminary remediation goal (PRG) for BTEX (EPA 2002) as an indication that product has been removed from the soil.

3.2.5.3 Off-Site Disposal

Off-site disposal entails transporting and disposing of sediments at a hazardous (Class I) or nonhazardous (Class II) permitted disposal facility.

Disposal of contaminated soils at an appropriate off-site landfill depends on the types and concentrations of compounds in the soil.

Before disposal, excavated sediments and soil would be characterized according to Title 22 CCR, Division 4.5, Chapter 11, Article 3, §66261.24 and Title 23 CCR, Division 3, Chapter 15,

Article 2, §2521(a) or Title 27 CCR, Division 2, Subdivision 1, Subchapter 2, Article 2, §20220, 20230 to determine whether it is hazardous waste and must be disposed of accordingly. Based on previous soil sampling results, soil from the IR17 and Building 503 Area, is expected to be classified as nonhazardous waste that can be disposed of at a Class II landfill.

Landfilling is an effective method for disposing of sediments and reducing the mobility of contaminants and is readily implementable for sediments and soils that meet landfill disposal requirements; however, associated costs for transportation can be high. Off-site disposal of untreated and treated sediments and soils was retained for further evaluation.

3.2.6 Monitored Natural Attenuation

This technology 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, especially when the plume is still expanding/migrating. The primary objective of site modeling is to demonstrate that natural processes of contaminant degradation will reduce contaminant concentrations below regulatory standards or risk-based levels before potential exposure pathways are completed. In addition, long-term monitoring must be conducted throughout the process to confirm that degradation is proceeding at rates consistent with meeting cleanup objectives.

The following three factors may limit the applicability and effectiveness of monitored natural attenuation (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. Implementation of MNA as a single remediation approach to achieve the RAO will require a long period of time, as discussed in the draft final RI report (Tetra Tech 2003); therefore, MNA was not retained for further consideration.

3.3 SELECTION OF REMEDIAL ALTERNATIVES

The following RAs for the IR17 and Building 503 Area have been developed based on the previously listed remedial technologies:

Alternative 1:	No Action
Alternative 2:	Construction of Extraction Trenches, Use Skimmer Pumps, and Institutional Controls,
Alternative 3:	Installation of Extraction Wells, Periodic Vacuum Extraction, and Institutional Controls

Alternative 4:	Soil Excavation, Bioremediation, Backfilling with Treated Soil, and Institutional Controls
Alternative 5:	Soil Excavation, Off-Site Disposal, Backfilling with Clean Soil, and Institutional Controls
Alternative 6:	Multiphase Extraction, In-Situ Thermal Desorption, and Institutional Controls

Detailed descriptions and analysis of these six alternatives are presented in Sections 3.5 through 3.10.

3.4 DETAILED ANALYSIS OF ALTERNATIVES

This section evaluates the six RAs based on nine criteria as required by the NCP in 40 CFR 300.430(e). These nine evaluation criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

These evaluation criteria are described in the following nine sections. Table 3-1 outlines the evaluation criteria as they relate to each of the alternatives. Table 3-2 presents the comparative analysis of the alternatives.

3.4.1 Overall Protection of Human Health and the Environment

This criterion assesses whether each alternative provides adequate protection of human health and the environment. The overall assessment of protection draws on the evaluations of long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. Protectiveness focuses on how site risks are reduced or eliminated by each alternative. Risk reductions are associated with how effectively an alternative meets the RAOs. This criterion is considered a threshold and must be met by the selected alternative.

3.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

This criterion is used to evaluate whether each alternative will meet all identified federal and state ARARs or whether justification exists for waiving one or more ARARs. The detailed analysis will describe how each alternative will meet these requirements. This criterion is also a threshold that must be met by the selected alternative unless an ARAR is waived. Section 2.0 summarizes the results of the ARARs evaluation for the IR17 and Building 503 Area. Appendix A identifies ARARs for the IR17 and Building 503 Area.

3.4.3 Long-term Effectiveness and Permanence

Each alternative is evaluated in terms of risk remaining at the site after RAOs have been met. The primary focus of this evaluation is the extent and effectiveness of controls used to manage the risk posed by treatment of residuals or untreated wastes. The following criteria are considered:

- Adequacy of mitigative controls
- Reliability of mitigative controls
- Magnitude of residual risk

3.4.4 Reduction in Toxicity, Mobility, and Volume through Treatment

This evaluation criterion addresses the statutory preference for treatment options that permanently and significantly reduce toxicity, mobility, or volume of the contaminants. This preference is satisfied when treatment reduces the principal threats through the following:

- Destruction of toxic contaminants
- Reduction in contaminant mobility
- Reduction of the total mass of toxic contaminants
- Reduction of total volumes of contaminated media

3.4.5 Short-term Effectiveness

This evaluation criterion addresses the effects of the alternative during the construction and implementation phase until RAOs are met. Under this criterion, alternatives are evaluated with respect to their effects on human health and the environment during remedial action implementation. The following factors are considered:

- Exposure of the community during implementation
- Exposure of the workers during construction
- Environmental impacts
- Time required to achieve RAOs

3.4.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. The following factors are considered.

- Ability to construct the technology
- Reliability of the technology
- Monitoring considerations
- Availability of equipment and specialists
- Ability to obtain approvals from regulatory agencies

3.4.7 Cost

The cost estimate for each alternative is based on estimates of capital and O&M costs. Capital costs consist of direct and indirect costs. Direct costs include the purchase of equipment, labor, and materials necessary to install the alternative. Indirect costs include those for engineering, financial, and other services, such as testing and monitoring. Annual O&M costs for each alternative include maintenance materials, labor, and auxiliary materials, as well as operating costs.

The cost estimates of the RAs are based on unit costs of implementation of the technology options and RAs at other sites published in the Remedial Action Cost Engineering and Requirements System model (Talisman 2000). The actual costs have been developed using site-specific quantities and information for the IR17 and Building 503 Area.

Accuracy of cost estimates for each alternative is intended to be within range of 50 percent above and 30 percent below actual costs (EPA 2000b). For the purpose of cost estimates for this FS, the postclosure O&M period is assumed to be 5 years (IRP horizon after remedial action is complete). Costs for each alternative are compiled in Appendix B.

3.4.8 State Acceptance

The assessment of the state's concerns regarding the proposed RA cannot be completed until comments of the RI/FS are received, but may be discussed to the extent possible in the following proposed plan issued for public comment (40 CFR 300.43[e][iii][H]): state comments on ARARs.

3.4.9 Community Acceptance

This assessment involves identifying community support for, reservations about, or opposition to various components of the alternatives. This assessment may not be completed until comments on the proposed plan are received (40 CFR 300.43[e][iii][I]).

The following text provides details on the six RAs with respect to the nine criteria. The objectives of the RAs analysis for the IR17 and Building 503 Area are to support the selection of an appropriate remedial response action.

3.5 ALTERNATIVE 1: NO ACTION

A no-further-action alternative is required by the NCP. The no-further-action alternative provides a baseline against which other alternatives are compared. Under this alternative, no action would be taken to alter the IR17 and Building 503 Area. No construction, operation, or maintenance of remedial measures would be required. Under the no-further-action alternative, existing actions such as general maintenance may continue.

3.5.1 Overall Protection of Human Health and the Environment

The no-further-action alternative does not eliminate, reduce, or control exposure to free product or contaminated soil. However, the RI and HHRA for the IR17 and Building 503 Area concluded that risks to human health are within the risk management range, based on the current condition and use of the site, and the screening level ERA concluded that the site did not pose an unacceptable risk to ecological receptors (Tetra Tech 2003). Therefore, human health and the environment would be protected under this alternative so long as there is no change in the use of the site. However, this alternative does not protect against potential future exposures that could occur in the event of a change in the use of the property.

3.5.2 Compliance with Applicable or Relevant and Appropriate Requirements

There is no need to identify action-specific ARARs for the no-action alternative because action-specific ARARs apply to "any removal or remedial action conducted entirely on-site," and "no action" is not a removal or remedial action (CERCLA 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 1991b).

Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.

3.5.3 Long-term Effectiveness and Permanence

The no-further-action alternative would provide a long-term effective solution for the permanent protection of human health and the environment provided that the current limited use of the site for temporary storage continues. Completed risk assessments have determined that there is no risk associated with the site based on current site use.

Without institutional controls, however, future worker exposure could not be controlled due to unrestricted land use and access.

3.5.4 Reduction in Toxicity, Mobility, and Volume through Treatment

The no-further-action alternative would not result in a reduction in toxicity, mobility, or volume of contaminants through the use of treatment options. Based on past reports and risk assessments completed for IR17 and Building 503 Area, the toxicity of the chemicals at the site is less than the risk criteria, and chemical mobility and migration is not a concern. No contaminant treatment is proposed as part of the alternative.

3.5.5 Short-term Effectiveness

The no-further-action alternative would provide short-term protection since all completed risk assessments and reports have demonstrated that there is no risk associated with the current use and condition of the site.

3.5.6 Implementability

The no-further-action alternative is readily implemented because no actions would need to be taken.

3.5.7 Cost

There are no costs associated with the no-action alternative because there are no actions proposed.

3.5.8 State Acceptance

Comments generated from state review of this FS will be considered and incorporated as necessary in the proposed plan and final record of decision (ROD).

3.5.9 Community Acceptance

Community acceptance will be evaluated after the public comment period on the proposed plan and will be documented in the final ROD.

3.6 ALTERNATIVE 2: CONSTRUCTION OF EXTRACTION TRENCHES, USE OF SKIMMER PUMPS, AND INSTITUTIONAL CONTROLS

Alternative 2 involves the construction of free product extraction trenches and the installation of free product skimmer pumps. After utility clearance and surface pavement removal, 6-inch wide trenches would be excavated using a chain trencher. Trenches would be excavated to at least 6 inches below the historical low water table elevation for each area. Figure 3-1 shows the general configuration of the trenches. The use of trenches is likely to transect higher-permeability soils, increasing free product collection. One or two free product skimmer pumps would be placed in each trench, typically at the area of lowest historical water table elevation. The product recovery pumps would collect and pump the free product into an adjacent 55-gallon drum with an 85-gallon overpack drum for secondary containment. Recovery free product would likely be reclaimed by a recycler, if possible, or disposed of off site. Sorbent socks may be used in conjunction with the pumps to improve collection efficiency.

Under Alternative 2, actions would be taken to restrict the future land use of the site. Based on all reports and risk assessments completed to date, there is no risk associated with the current use and conditions of the site; however, there are no controls in place to maintain the current site conditions. Institutional controls such as land-use restrictions would be used to ensure that the current conditions and site use are not compromised by unexpected changes in land use.

Trenches would be excavated throughout the site in the areas of where the presence of free product is inferred. The trenches would be backfill with high-permeability material to improve the interface between the skimmer pumps and free product.

3.6.1 Overall Protection of Human Health and the Environment

The RI and HHRA completed for the IR17 and Building 503 Area concluded that the risks to human health are within the risk management range, based on the current condition and use of the site, and the screening level ERA concluded that the site did not pose an unacceptable risk to ecological receptors (Tetra Tech 2003). Therefore, human health and the environment would be protected under this alternative so long as there is no change in the use of the site. Institutional controls and site boundary controls would restrict current and future access to the site, thereby preventing any alteration to the use of the site. The proposed controls used would ensure that the current risk conditions are maintained.

Removal of free product from the IR17 and Building 503 Area by the construction of extraction trenches and the installation of free product skimmer pumps will reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process.

3.6.2 Compliance with Applicable or Relevant and Appropriate Requirements

This alternative comprises trenching to a depth of 8 feet bgs in each of the four areas where the presence of free product has been inferred. At the low point of each trench, a skimmer pump would collect the free product on the surface of the groundwater in the trench. Collected free product would be temporarily stored on site in drums. The free product then would be disposed of off site in an appropriate landfill. Upon completion of the skimming, groundwater monitoring wells already located at the IR17 and Building 503 Area would be sampled to confirm the removal of free product. Once the removal of the free product to the maximum extent practicable is complete and confirmed, institutional controls would be put in place to restrict the use of the IR17 and Building 503 Area.

3.6.2.1 Federal ARARs

This section describes Alternative 2 compliance with federal ARARs.

Removal of Free Product and Groundwater Monitoring

In June 2002, free product was detected in well 17W15, and trace amounts of free product were detected in well 17W12. The source of the free product was most likely the ASTs removed from the site in the 1960s. No federal regulations apply to the removal of free product released from ASTs. There are federal regulations for the removal of free product released from USTs, codified at 40 CFR 280.64. Because the release of free product did not occur from USTs, these regulations are not applicable. The Navy evaluated these regulations for relevance and appropriateness against the criteria contained in 40 CFR 300.400(g)(2). Based on that criteria, the Navy determined that relevant portions of these regulations are potential federal action-specific ARARs for cleanup of the free product. The following regulations are potential action-specific ARARs:

- 40 CFR 280.12 – defines free product as a regulated substance present as a NAPL (for example, liquid not dissolved in water)
- 40 CFR 280.64 – requires removal of free product to the maximum extent practicable
- 40 CFR 280.64(a) – requires that the removal of free product be conducted in a manner that minimizes the spread of contamination into previously uncontaminated zones by using techniques appropriate to the hydrogeologic conditions at the site
- 40 CFR 280.64(b) – requires the use of abatement of free product migration as a minimum objective for the design of the free product removal system

Alternative 2 complies with these potential action-specific ARARs because it will remove free product to the maximum extent practical, as confirmed by sampling groundwater in existing groundwater monitoring wells. Alternative 2 is appropriate for the hydrogeologic conditions at the site because it takes into account the heterogeneous nature of the soil and the lateral

dispersion of the free product by increasing the capture zone. By skimming out the free product, Alternative 2 will significantly abate free product migration.

Temporary Storage and Off-Site Disposal of Skimmed Free Product

Other potential action-specific ARARs for the temporary storage and off-site disposal of the skimmed free product described in this alternative are contained in Title 22 CCR 66264.553. These regulations are part of California's RCRA program approved by the EPA on July 23, 1992 (Title 57 *Federal Register* 32726), and therefore are potential federal action-specific ARARs. Because it has not been determined that the free product meets the definition of a RCRA hazardous waste, these regulations are not applicable. Using the relevant and appropriate criteria listed in 40 CFR 300.400(g)(2), however, the Navy has determined that these regulations are relevant and appropriate. The following specific regulations are potential federal action-specific ARARs:

- Title 22 CCR 66264.553(b) – requires temporary units to be located within the facility boundary; used only for treatment or storage of remediation wastes
- Title 22 CCR 66264.553(d) – requires the temporary unit to operate for no more than 1 year and to have design, operating, and closure requirements

This alternative will comply with these regulations. The temporary units will have 85-gallon overpack drums to provide for secondary containment. The drums will be located within the areas where the skimming will take place and will be covered (closed) when the drums are not in use, and upon completion of the skimming, will be disposed of off site at an appropriate landfill no later than 1 year after initial use of these temporary units.

Institutional Controls

There are no federal ARARs for institutional controls. Potential state ARARs for institutional controls may be identified at a later date.

3.6.2.2 State ARARs

This section describes Alternative 2 compliance with state ARARs.

Removal of Free Product and Groundwater Monitoring

The AST requirements contained in *California Health and Safety Code* 25270 through 25270.13 do not address removal of free product released from ASTs. Because of this, those provisions are not ARARs for the removal of free product at IR17.

The California UST regulations contained in Title 23 CCR 2655(a) are identical to the federal regulations contained in 40 CFR 280.64. Because the state requirements are not more stringent than the relevant and appropriate federal requirements, Title 23 CCR 2655 is not a potential ARAR.

3.6.3 Long-term Effectiveness and Permanence

Institutional controls proposed would ensure that any future use of the site would comply with the selected remedial actions and that protection of human health and the environment would not be compromised.

Removal of any free product via the extraction trenches and skimmer pumps would be permanent. Because free product may be acting as a continuing source of contamination to groundwater and ambient air, any removal of free product would accelerate the natural attenuation process at the site.

Because of the heterogeneity of the site soils and the presence of clay soils that tend to sorb free product and limit its movement and because the volume of free product is already small, limiting the effectiveness of the technology, there is some uncertainty as to whether this technology can achieve the removal of free product to the maximum extent practicable.

3.6.4 Reduction in Toxicity, Mobility, and Volume through Treatment

Alternative 2 would result in a reduction in volume of contaminants through the use of treatment options. Based on the past reports and risk assessments completed for the IR17 and Building 503 Area, however, the toxicity of the chemicals at the site is less than the risk criteria and contaminant mobility and migration is not a concern.

3.6.5 Short-term Effectiveness

The community would be protected because free product would be removed via an in situ technology, minimizing direct exposure to contaminants. Exposure of workers to contaminants would be minimal during skimmer pump operation and off-site transportation and disposal of recovered free product. A health and safety plan would be developed to minimize the potential risk to workers involved the remediation. This plan would include requirements for personal protective equipment (PPE) and air monitoring. The free product would be removed from the environment. Therefore, the RAOs would be achieved relatively quickly.

This alternative would be effective in the short-term reduction of potential risk to humans and ecological receptors because it could be implemented quickly.

3.6.6 Implementability

Alternative 2 is technically feasible and uses demonstrated techniques that have proven to be effective at protecting human health and the environment. The alternative is of moderate complexity and can be completed using standard practices performed by licensed and experienced vendors. Normal skilled labor practiced on similar environmental remediation projects would be necessary and is readily available.

3.6.7 Cost

The total present value cost for Alternative 2 is approximately $1,176,000. This estimate includes institutional controls. Costs are based on a period of performance of 5 years and present value at a 3.9 percent discount rate.

3.6.8 State Acceptance

Comments generated from state review of the FS will be considered and incorporated as necessary in the proposed plan and final ROD.

3.6.9 Community Acceptance

Community acceptance will be evaluated after the public comment period on the proposed plan and will be documented in the final ROD.

3.7 ALTERNATIVE 3: INSTALLATION OF EXTRACTION WELLS, PERIODIC VACUUM EXTRACTION, AND INSTITUTIONAL CONTROLS

Extraction wells would be installed throughout the site in the areas of where the presence of free product is inferred. Because of low permeability soils at the site, wells would be located at approximately 10-foot intervals (Figure 3-2). The extraction wells would be periodically vacuumed by a local, licensed vendor, to mobilize and remove nearby free product for off site disposal. Sorbent socks would be placed in the wells between vacuum extraction events, to increase free product removal rates.

Under Alternative 3, actions would be taken to restrict the future land use of the site. Based on all reports and risk assessments completed to date, there is no risk associated with the current use and conditions of the site; however, there are no controls in place to maintain the current site conditions. Institutional controls such as land-use restrictions would be used to ensure that the current conditions and site use are not compromised by unexpected changes in land use.

3.7.1 Overall Protection of Human Health and the Environment

The RI and HHRA completed for the IR17 and Building 503 Area concluded that the risks to human health are within the risk management range, based on the current condition and use of the site, and the screening level ERA concluded that the site did not pose an unacceptable risk to ecological receptors (Tetra Tech 2003). Therefore, human health and the environment would be protected under this alternative so long as there is no change in the use of the site. Institutional controls and site boundary controls would restrict current and future access to the site, thereby preventing any alteration to the use of the site. The proposed controls used would ensure that the current risk conditions are maintained.

Removal of free product from the IR17 and Building 503 Area by the construction of extraction trenches and the installation of free product skimmer pumps will reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process.

3.7.2 Compliance with Applicable or Relevant and Appropriate Requirements

This alternative comprises the installation of free product extraction wells, vacuum truck removal of the free product, groundwater monitoring to confirm removal of free product to maximum extent practicable, and institutional controls.

3.7.2.1 Federal ARARs

This section describes Alternative 3 compliance with federal ARARs.

Removal of Free Product and Groundwater Monitoring

The potential federal action-specific ARARs for removal of free product and groundwater monitoring were discussed previously in Section 3.6.2.1.

Installation of Free Product Extraction Wells

RCRA requirements for identification and management of solid and hazardous wastes are also potential federal action-specific ARARs identified for this alternative. Soil cuttings and water generated during the installation and development of monitoring wells would be subject to RCRA requirements at Title 22 CCR 66262.10(a) and 66262.11 to determine whether such wastes should be classified as hazardous.

Even though the Navy has determined that the soil and well development water at the IR17 Building 503 Area would not be classified as RCRA-listed hazardous wastes, testing would still be required to classify these materials with respect to the RCRA hazardous waste characteristics. This determination would be made at the time the waste in generated. If the soil and well development water would meet the definition of a RCRA characteristic waste, pretransport requirements relating to packaging (Title 22 CCR 66262.30), labeling (Title 22 CCR 66262.31),

marking (Title 22 CCR 66262.32), and placarding (Title 22 CCR 66262.33) would be applicable. If it is determined that the soil and well development water is not a RCRA hazardous waste, these requirements would not be applicable or relevant and appropriate. The soil and well development water would instead be handled and disposed of as nonhazardous waste.

Institutional Controls

There are no federal ARARs for institutional controls. Potential state ARARs for institutional controls may be identified at a later date.

3.7.2.2 State ARARs

This section describes Alternative 3 compliance with state ARARs.

Removal of Free Product and Groundwater Monitoring

The potential state action-specific ARARs for removal of free product and groundwater monitoring were discussed previously in Section 3.6.2.2.

Installation of Free Product Extraction Wells

If soil and well development water generated during installation and development of the free product extraction wells is determined not to be a RCRA characteristic waste, a determination will be made as to whether soil and well development water is subject to solid waste classifications at 27 CCR §§20210, 20220, and 20230 to determine the applicability of waste management requirements. These classifications will then determine the proper method of disposal of the soil and well development water.

Institutional Controls

There are no state ARARs for institutional controls.

3.7.3 Long-term Effectiveness and Permanence

Institutional controls proposed would ensure that any future use of the site would comply with the selected remedial actions and that protection of human health and the environment would not be compromised.

Removal of any free product via the vacuum extraction wells would be permanent. Because free product may be acting as a continuing source of contamination to groundwater and ambient air, any removal of free product would accelerate the natural attenuation process at the site.

Because of the heterogeneity of site soils and the presence of clay soils that tend to sorb free product and limit its movement and because the volume of free product is already small, limiting the effectiveness of the technology, there is some uncertainty as to whether or not this technology can achieve the removal of free product to the maximum extent practicable.

3.7.4 Reduction in Toxicity, Mobility, and Volume through Treatment

Alternative 3 would result in a reduction in volume of contaminants through the use of treatment options. Based on the past reports and risk assessments completed for the IR17 and Building 503 Area, however, the toxicity of the chemicals at the site is less than the risk criteria, and contaminant mobility and migration are not a concern.

3.7.5 Short-term Effectiveness

The community would be protected because free product would be removed via an in situ technology, minimizing direct exposure to contaminants. Exposure of workers to contaminants would be minimal during vacuum extraction and off-site transportation and disposal of recovered free product and contaminated groundwater. A health and safety plan would be developed to minimize the potential risk to workers involved in the remediation. This plan would include requirements for PPE and air monitoring. The free product would be removed from the environment. Therefore, the RAOs would be achieved relatively quickly.

This alternative would be effective in the short-term reduction of potential risk to humans and ecological receptors because it could be implemented quickly.

3.7.6 Implementability

Alternative 3 is technically feasible and uses demonstrated techniques that have proven to be effective at removing free product. The alternative is of minimal complexity and can be completed using standard practices performed by licensed and experienced vendors. Normal construction and skilled labor would be necessary and are readily available.

3.7.7 Cost

The total present value cost for Alternative 3 is about $2,498,000. This estimate includes periodic vacuum truck visits, institutional controls, and monitoring. Costs are based on a period of performance of 5 years and present value at a 3.9 percent discount rate.

3.7.8 State Acceptance

Comments generated from state review of the FS will be considered and incorporated as necessary in the proposed plan and final ROD.

3.7.9 Community Acceptance

Community acceptance will be evaluated after the public comment period on the proposed plan and will be documented in the final ROD.

3.8 ALTERNATIVE 4: SOIL EXCAVATION, BIOREMEDIATION, BACKFILLING WITH TREATED SOIL, AND INSTITUTIONAL CONTROLS

Under Alternative 4, actions would be taken to restrict the future land use of the site. Based on all reports and risk assessments completed to date, the risk associated with the current use and conditions of the site is within the risk management range; however, there are no controls in place to maintain the current site conditions. Institutional controls such as land-use restrictions would be used to ensure that the current conditions and site use are not compromised by unexpected changes in land use.

Contaminated soil and any residual free product would be excavated from the inferred areas to a depth of 6 inches below the water table. Figure 3-3 shows the anticipated aerial extent of the excavations. Excavated soil would be treated using bioremediation in on-site temporary units to reduce BTEX concentrations to below industrial PRGs (EPA 2002).

The excavation pit would be dewatered as needed during excavation to allow for visual observation of the excavation and reduce materials handling problems resulting from contaminated water flowing from the recently excavated soil. Excavation will be conducted as quickly as possible to minimize the amount of water generated during dewatering. The excavation would be dewatered using a diaphragm pump that is powered by compressed air, minimizing the potential for explosion or fire if LNAPL or highly contaminated soil is encountered. The extracted water would be treated on-site using two trailer-mounted granular activated carbon (GAC) units in series. Such pre-fabricated units are readily available for rental in various capacities. All VOCs at the site are amenable to GAC adsorption. If possible, treated water would be discharged to the sanitary sewer for treatment by the publicly owned treatment works (POTW). Water will be sampled and analyzed as necessary to ensure that it meets the POTW pre-treatment standards. If there is no POTW, a temporary National Pollutant Discharge Elimination System (NPDES) discharge permit would be obtained from the RWQCB. Any discharged water would be analyzed to ensure that it meets all discharge requirements.

During bioremediation in temporary units, the excavation would remain open and be allowed to fill with groundwater. During this period, the excavation would be fenced to reduce the hazard posed by the open excavation. Immediately before backfilling, the excavation would be dewatered as necessary to aid in backfilling with adequate compaction (excessive moisture can prevent optimal compaction). Treated soil would then be backfilled into the excavations.

3.8.1 Overall Protection of Human Health and the Environment

The RI and HHRA completed for the IR17 and Building 503 Area concluded that the risks to human health are within the risk management range, based on the current condition and use of the site, and the screening level ERA concluded that the site did not pose an unacceptable risk to ecological receptors (Tetra Tech 2003). Therefore, human health and the environment would be protected under this alternative so long as there is no change in the use of the site. Institutional controls and site boundary controls would restrict current and future access to the site, thereby preventing any alteration to the use of the site. The proposed controls used would ensure that the current risk conditions are maintained.

Reduction of BTEX concentration to industrial PRGs (EPA 2002) and the removal of free product from the IR17 and Building 503 Area will reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process.

3.8.2 Compliance with Applicable or Relevant and Appropriate Requirements

This alternative comprises the excavation of the top 8 feet of soil from each of the four areas where the presence of free product has been inferred. The excavated soil would be placed in temporary units in each area. The soil would sit on a constructed pad with a 60-mil HDPE bottom liner, covered with another liner to prevent off-gas emissions from the unit. A perforated pipe would be laid in each unit to supply low-pressure sparge air to the soil. Additional perforated pipes would be laid in each unit to extract soil vapors. Extracted vapors would be treated by a carbon adsorption unit. Upon completion of treatment, when the BTEX compounds reach EPA Region IX industrial PRGs (EPA 2002), the soil would be transported back to the excavated areas and backfilled. Institutional controls would be used to restrict land use.

3.8.2.1 Federal ARARs

This section describes Alternative 4 compliance with federal ARARs.

Removal of Free Product and Groundwater Monitoring

The potential federal action-specific ARARs for removal of free product and groundwater monitoring were discussed previously in Section 3.6.2.1.

Bioremediation

Potential federal action-specific ARARs for bioremediation temporary units are contained in 40 CFR 264.554, which allows relief from LDRs for temporary storage (less than 2 years) of remediation waste on contiguous property. Physical operations such as mixing, sizing, blending, etc. that are intended to prepare wastes for subsequent management or treatment are allowed to occur in temporary units, regardless of whether it technically meets the RCRA definition of

treatment. Under 40 CFR 264.554, the following regulations are potential action-specific ARARs:

- 40 CFR 264.554(d)(1) – requires the standards and design criteria to facilitate a reliable, effective, and protective remedy; prevent or minimize releases of hazardous wastes and hazardous constituents into the environment; and minimize or adequately control cross-media transfer as necessary to protect human health and the environment. Also requires that the remedy not operate for more than 2 years except when granted an operating term extension

- 40 CFR 264.554(d)(2) – requires consideration of the following factors when setting standards and design criteria: length of time the temporary unit will be in operation, volumes of wastes planned for storage in the temporary unit, physical and chemical characteristics of the wastes to be stored in the unit, potential for releases from the unit, hydrogeological and other relevant environmental conditions at the facility that may influence the migration of any potential releases, and potential for human and environmental exposure to potential releases from the unit

- 40 CFR 264.554(g) – asserts that the bioremediation temporary unit does not constitute land disposal of hazardous wastes or create a unit that is subject to the minimum technological requirements of RCRA 3004(o)

- 40 CFR 264.554(h) – allows a temporary unit to operate for up to 2 years

- 40 CFR 264.554(i) – allows a 180-day extension of the 2 year operating term

- 40 CFR 264.554(j) – requires closure of the temporary unit within 180 days after operating term by removing or decontaminating all remediation waste, contaminated containment system components, structures and equipment contaminated with waste and leachate, and any contaminated subsoils

It is not known if the excavated soil would meet the definition of a RCRA characteristic waste; therefore, these regulations are not applicable. The Navy has determined that, based on the criteria listed in 40 CFR 300.400(g), these regulations are relevant and appropriate.

The bioremediation temporary units will comply with these regulations for the following reasons:

- Anticipated period of operation is 6 months

- The temporary unit would be on concrete lined with 60-mil HDPE liner that will prevent the release of hazardous substances into the environment and prevent contamination of subsoil

- Each temporary unit would be located adjacent to the area of excavated soil (within the same area of concern), which will prevent the spread of contamination into uncontaminated areas

- The quantity of soil to be placed in temporary units is minimal, totaling 18, 800 cubic yards

- Upon closure, the pipes would be removed and disposed of properly

The Navy has determined that replacing the treated soil is not subject to LDRs. LDRs are triggered when there is the placement of a restricted hazardous waste. Placement does not occur when wastes are moved within a single area of concern (EPA 1989). Areas of concern are delineated by the aerial extent or boundary of contiguous contamination. Since each temporary unit will be placed within the areas of concern, there is no placement of a potentially restricted hazardous waste.

Other potential federal action-specific ARARs for the bioremediation temporary units are contained in the BAAQMD regulations. The potential ARARs are:

- 8-40-110 – exempts calculations of aeration volume under Section 8-40-204 for covered temporary units

- 8-40-304 – requires active temporary units of contaminated soil to be kept visibly moist by water spray, treated with a vapor suppressant, or covered with continuous heavy duty plastic sheeting or other cover to minimize emissions of organic compounds to the atmosphere

- 8-40-306.1 – requires all exposed contaminated soil surfaces above existing grade level to be kept visibly moist, treated, or covered

- 8-40-306.3 – requires contaminated soil be stockpiled separately from soil that is not contaminated

- 8-40-306.4.3 – requires treatment of contaminated soil to begin within 45 days of excavation

- 8-40-306.6 – requires all exposed surfaces to be kept moist, treated, or covered during backfilling

The bioremediation temporary units would comply with the potential action-specific ARARs. The units would be covered and treatment would begin within 45 days of excavation. Uncontaminated soil will not be placed in the temporary units. In addition, dust control (that is, water spray) would be conducted during backfilling to minimize emissions of organic compounds.

Institutional Controls

There are no federal ARARs for institutional controls.

3.8.2.2 State ARARs

This section describes Alternative 4 compliance with state ARARs.

Removal of Free Product and Groundwater Monitoring

The potential state action-specific ARARs for removal of free product and groundwater monitoring were discussed previously in Section 3.6.2.2.

3.8.3 Long-term Effectiveness and Permanence

Institutional controls proposed would ensure that any future use of the site would comply with the selected remedial actions and that protection of human health and the environment would not be compromised.

Removal of any free product and reduction of contaminant mass in the vadose zone soils via excavation and bioremediation would be permanent. Because free product may be acting as a continuing source of contamination to groundwater and ambient air, any removal of free product would accelerate the natural attenuation process at the site.

3.8.4 Reduction in Toxicity, Mobility, and Volume through Treatment

Alternative 4 would result in a reduction in volume of contaminants through the use of treatment options. Based on the past reports and risk assessments completed for the IR17 and Building 503 Area, however, the toxicity of the chemicals at the site is less than the risk criteria, and contaminant mobility and migration is not a concern.

3.8.5 Short-term Effectiveness

The community would be protected because contaminated soils and any entrained free product would be excavated and managed in a controlled environment to minimize direct exposure to contaminants and then treated on site. Exposure of workers to contaminants would be minimal during excavation and treatment. A health and safety plan would be developed to minimize the potential risk to workers involved in the remediation. This plan would include requirements for PPE and air monitoring. The contaminants would be treated and removed from the environment. Therefore, the RAOs would be achieved relatively quickly.

This alternative would be effective in the short-term reduction of potential risk to humans and ecological receptors because it could be implemented quickly.

3.8.6 Implementability

Alternative 4 is technically feasible and uses techniques that have proven to be effective at removing free product. The alternative is of moderate complexity and can be completed using standard practices performed by licensed and experienced vendors. Normal construction and skilled labor with environmental experience would be necessary and are readily available. Since the excavation would be open while the soil is being treated, fencing would be required to secure the excavation until it is backfilled.

3.8.7 Cost

The total present value cost for Alternative 4 is about $3,280,000. This estimate includes excavation, bioremediation, institutional controls, and monitoring. Costs are based on a period of performance of 5 years and present value at a 3.9 percent discount rate.

3.8.8 State Acceptance

Comments generated from state review of the FS will be considered and incorporated as necessary in the proposed plan and final ROD.

3.8.9 Community Acceptance

Community acceptance will be evaluated after the public comment period on the proposed plan and will be documented in the final ROD.

3.9 ALTERNATIVE 5: SOIL EXCAVATION, OFF-SITE DISPOSAL, BACKFILLING WITH CLEAN SOIL, AND INSTITUTIONAL CONTROLS

Under Alternative 5, actions would be taken to restrict the future land use of the site. Based on all reports and risk assessments completed to date, there is no risk associated with the current use and conditions of the site; however, there are no controls in place to maintain the current site conditions. Institutional controls such as land-use restrictions would be used to ensure that the current conditions and site use are not compromised by unexpected changes in land use.

Contaminated soil and any residual free product would be excavated from the inferred areas to a depth of 6 inches below the water table. Figure 3-3 shows the anticipated aerial extent of the excavations. Excavated soil would be disposed of in a licensed off-site landfill. Clean fill would be backfilled into the excavations.

The excavation pit would be dewatered as needed during excavation to allow for visual observation of the excavation and reduce materials handling problems resulting from contaminated water flowing from the excavated soil. Excavation would be conducted as quickly as possible to minimize the amount of water generated by the dewatering operations.

Dewatering would be conducted using a diaphragm pump powered by compressed air, to minimize the potential for explosion or fire posed by LNAPLs or highly contaminated soil. The extracted water would be treated on-site using two trailer-mounted GAC units in series. Pre-fabricated units are readily available for rental in various capacities. All VOCs at the site are amenable to GAC adsorption. If possible, treated water would be discharged to the sanitary sewer for treatment by the base POTW. Water will be sampled and analyzed as necessary to ensure that it meets the POTW pre-treatment standards. If the POTW is not available, a temporary NPDES discharge permit would be obtained from the RWQCB. Any discharged water would be analyzed to ensure that it meets all discharge requirements.

3.9.1 Overall Protection of Human Health and the Environment

The RI and HHRA completed for the IR17 and Building 503 Area concluded that the risks to human health are within the risk management range, based on the current condition and use of the site, and the screening level ERA concluded that the site did not pose an unacceptable risk to ecological receptors (Tetra Tech 2003). Therefore, human health and the environment would be protected under this alternative so long as there is no change in the use of the site. Institutional controls and site boundary controls would restrict current and future access to the site, thereby preventing any alteration to the use of the site. The proposed controls used would ensure that the current risk conditions are maintained.

Reduction of BTEX-contaminated soil and the removal of free product from the IR17 and Building 503 Area will reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process.

3.9.2 Compliance with Applicable or Relevant and Appropriate Requirements

This alternative comprises the excavation of the top 8 feet of soil and off-site disposal of the soil. Institutional controls would be used to restrict land use.

3.9.2.1 Federal ARARs

This section describes Alternative 5 compliance with federal ARARs.

Removal of Free Product and Groundwater Monitoring

The potential federal action-specific ARARs for removal of free product and groundwater monitoring were discussed previously in Section 3.6.2.1.

Off-site Disposal of Soil

Potential federal action-specific ARARs include Title 22 CCR 66261.21 through 66261.24, requiring the excavated soil be sampled to determine whether it is a RCRA characteristic

hazardous waste. If the excavated soil is determined to be a RCRA characteristic hazardous waste, the following potential federal action-specific ARARs may apply:

- Title 22 CCR 66262.34 – allows for on-site accumulation of hazardous waste for up to 90 days if the waste is stored in containers
- Title 22 CCR 66264.171, 66264.172, 66264.173, and 66264.174 – require containers be maintained in good condition, be compatible with the hazardous waste to be stored, be closed during storage except to add or remove waste, and be inspected weekly for deterioration
- Title 22 CCR 66264.175(a) and (b) – require containers be placed on a sloped, crack-free base and protected from contact with accumulated liquid as well as the timely removal of spilled or leaked wastes
- Title 22 CCR 66262.30, 66262.31, 66262.32, 66262.33 – require proper packaging, labeling, marking, and placarding
- Title 22 CCR Section 66268.1(f) 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 treatment standards of Title 22 CCR 66268.49; or (3) a treatability variance is obtained under Title 22 CCR 66268.44.

If the excavated soil is determined to be a RCRA characteristic hazardous waste, it will be disposed of at an appropriate landfill.

Institutional Controls

There are no federal ARARs for institutional controls.

3.9.2.2 State ARARs

This section describes Alternative 5 compliance with state ARARs.

Removal of Free Product and Groundwater Monitoring

The potential state action-specific ARARs for removal of free product and groundwater monitoring were discussed previously in Section 3.6.2.2.

Off-Site Disposal

If excavated soil is determined not to be a RCRA characteristic waste, another determination will be made as to whether the excavated soil is subject to solid waste classifications at 27 CCR §§20210, 20220, and 20230 to determine the applicability of waste management requirements. These classifications will then determine the proper method of disposal of the soil.

3.9.3 Long-term Effectiveness and Permanence

Institutional controls proposed would ensure that any future use of the site would comply with the selected remedial actions and that protection of human health and the environment would not be compromised.

Removal of any free product and reduction of contaminant mass in the vadose zone soils via excavation and off-site disposal would be permanent. Because free product may be acting as a continuing source of contamination to groundwater and ambient air, any removal of free product would accelerate the natural attenuation process at the site.

3.9.4 Reduction in Toxicity, Mobility, and Volume through Treatment

Alternative 5 does not reduce toxicity, mobility, and volume of contaminants through treatment. Based on the past reports and risk assessments completed for the IR17 and Building 503 Area, however, the toxicity of the chemicals at the site is less than the risk criteria, and contaminant mobility and migration is not a concern.

3.9.5 Short-term Effectiveness

The community would be protected because contaminated soils would be excavated and managed in a controlled environment to minimize direct exposure to contaminants and then transported off site. Exposure of workers to contaminants would be minimal during excavation and off-site transportation and disposal. A health and safety plan would be developed to minimize the potential risk to workers involved in the remediation. This plan would include requirements for PPE and air monitoring. The RAOs would be achieved relatively quickly.

Another potential short-term effect on the community is increased truck traffic. Noise and the potential for an increase in vehicle traffic accidents exist as soil is excavated and hauled off site. Waste hauling of this type is a routine and relatively safe activity; therefore, the potential for short-term effects to the community is anticipated to be minimal.

This alternative would be effective in the short-term reduction of potential risk to humans and ecological receptors because it could be implemented quickly.

3.9.6 Implementability

Alternative 5 is technically feasible and uses demonstrated techniques that have proven to be effective at removing free product. The alternative is of moderate complexity and can be completed using standard practices performed by licensed and experienced vendors. Normal construction and skilled labor with environmental experience would be necessary and are readily available.

3.9.7 Cost

The total present value cost for Alternative 5 is about $2,561,000. This estimate includes excavation, institutional controls, and monitoring. Costs are based on a period of performance of 5 years and present value at a 3.9 percent discount rate.

3.9.8 State Acceptance

Comments generated from state review of the FS will be considered and incorporated as necessary in the proposed plan and final ROD.

3.9.9 Community Acceptance

Community acceptance will be evaluated after the public comment period on the proposed plan and will be documented in the final ROD.

3.10 ALTERNATIVE 6: MULTIPHASE EXTRACTION, IN-SITU THERMAL DESORPTION, AND INSTITUTIONAL CONTROLS

Alternative 6 involves the installation of an MPE system in the utility corridors to the east and west of Cedar Avenue. In addition, ISTD systems would be installed in areas north of Building 503 and the South Tank Farm, where the presence of free product is inferred.

For the MPE system, horizontal wells would be installed in trenches excavated using a chain trencher. MPE horizontal well locations along the utility corridors are presented on Figure 3-4. After utility corridors are located and surface pavement is removed, the trenches would be excavated to intersect the upper portion of the seasonal groundwater table. The use of horizontal wells in these areas will allow for vapor phase extraction and the capture of NAPL and contaminated groundwater while minimizing the total volume of fluids extracted. The use of horizontal wells along the utility corridor is likely to transect higher-permeability soil, increasing contaminant and NAPL removal. The MPE system will use a blower to extract fluids and soil vapor; the required blower capacity (vacuum and flow rate) will be determined via pilot testing. The horizontal wells will be connected to the blower using a manifold, and the extracted fluids will be routed through a moisture separator to remove the fluids from the extracted air stream. The MPE system will use air emission controls (that is, carbon adsorption) to treat extracted soil vapor before it is discharged. Recovered liquids (entrained water and NAPL) will be collected

into an adjacent 55-gallon drum with an 85-gallon overpack drum for secondary containment and transported off site for recycling, treatment, and/or disposal.

The ISTD systems would be installed using thermal/vacuum vertical wells spaced at 12-foot intervals and completed to a total depth of 10 feet. The ISTD vertical well locations are presented on Figure 3-4. The ISTD systems will be operated to achieve superheating conditions with the target treatment temperature at the coolest regions of the well field (that is, the centroids), 150 ºC. Specific ISTD operating parameters to achieve superheating, including well spacing, will be confirmed during pilot testing. A surface seal, consisting of a light concrete layer, will be installed over the top of each treatment area to serve as a vapor barrier, insulation, and rain cover. The thermal and vacuum wells will be manifolded to allow for the collection of soil vapor and routed to an air quality control system using a catalytic oxidizer. Any recovered liquids (entrained water) will be collected into an adjacent 55-gallon drum with an 85-gallon overpack drum for secondary containment and will be transported off site for treatment and/or disposal.

Under Alternative 6, actions would be taken to restrict the future land use of the site. Based on all reports and risk assessments completed to date, there is no risk associated with the current use and conditions of the site; however, there are no controls in place to maintain the current site conditions. Institutional controls such as land-use restrictions would be used to ensure that the current conditions and site use are not compromised by unexpected changes in land use.

3.10.1 Overall Protection of Human Health and the Environment

The RI and HHRA completed for the IR17 and Building 503 Area concluded that the risks to human health are within the risk management range, based on the current condition and use of the site, and the screening level ERA concluded that the site did not pose an unacceptable risk to ecological receptors (Tetra Tech 2003). Therefore, human health and the environment would be protected under this alternative so long as there is no change in the use of the site. Institutional controls and site boundary controls would restrict current and future access to the site, thereby preventing any alteration to the use of the site. The proposed controls used would ensure that the current risk conditions are maintained.

Reduction of fuel-contaminants in soil and groundwater and the removal of free product from the IR17 and Building 503 Area will reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process.

3.10.2 Compliance with Applicable or Relevant and Appropriate Requirements

This alternative comprises the installation of MPE wells and in-situ thermal heater and vapor extraction wells, vacuum extraction and air emission control systems, groundwater monitoring to confirm removal of apparent free product to the maximum extent practicable, and institutional controls. This section describes the compliance of Alternative 6 with federal and state ARARs.

3.10.2.1 Federal ARARs

This section describes Alternative 6 compliance with federal ARARs regarding the removal of free product and groundwater monitoring, off-site disposal, air emission control and monitoring, and institutional control.

Removal of Free Product and Groundwater Monitoring

The potential federal action-specific ARARs for removal of free product and groundwater monitoring were discussed previously in Section 3.6.2.1.

Temporary Storage and Off-Site Disposal of Extracted Free Product

The potential federal action-specific ARARs for temporary storage and off-site disposal of extracted free product were discussed previously in Section 3.6.2.1.

Installation of Heater Wells and Vacuum Extraction Wells

The potential federal action-specific ARARs for installation of heater and vacuum extraction wells were previously discussed in Section 3.7.2.1.

In-Situ Thermal Treatment of Soil

Potential federal action-specific ARARs for thermal desorption are as follows:

- 22 CCR 66265.13 requires a waste analysis
- 22 CCR 66265.370 requires that owners or operators of facilities that thermally treat hazardous waste in devices other than enclosed devices using controlled flame combustion comply with Article 16
- 22 CCR 66265.373 requires the owner or operator to bring his thermal treatment process to steady state conditions of operation before adding hazardous waste
- 22 CCR 66265.375 requires a waste analysis under section 66264.13 and requires a waste analysis to determine (1) the heating value of the waste; (2) halogen content and sulfur content in the waste; and (3) concentration of lead and mercury in the waste, unless the owner or operator has written, documented data that show that the element is not present
- 22 CCR 66265.377 requires monitoring and inspections
- 22 CCR 66265.381 presents closure requirements.

Air Emission Control and Monitoring

Potential federal action-specific ARARs for air emission control and monitoring of VOC vapors are as follows:

- BAAQMD 8-47-301 requires MPE operations that emit benzene, vinyl chloride, perchloroethene, methylene chloride, and trichloroethene to be vented to a control device, which reduces emission to the atmosphere by at least 90 percent by weight.
- BAAQMD 8-47-302 requires any MPE extraction operation with a total organic compound emission greater than 15 pounds per day to be vented to a control device, which reduces the total organic compound emissions to the atmosphere be at least 90 percent by weight.
- BAAQMD 8-47-401 requires operations at SARA sites to notify the air pollution control officer of the intent to operate
- BAAQMD 8-47-603 requires emissions of organic compounds to be measured as specified in (1) BAAQMD Manual of Procedures, Volume IV, ST-7, or (2) EPA Method 25 or 25A.

Disposal of Equipment Used in the Thermal Desorption and MPE Operations

The Navy will make the determination of whether equipment used in the thermal desorption and MPE operations meets the definition of a RCRA hazardous waste at the time of unit disposal. The potential federal action-specific ARARs for identification of the equipment were previously discussed in Section 3.6.2.1 for the off-site disposal of skimmed free product.

Institutional Controls

There are no federal ARARs for institutional controls. Potential state ARARs for institutional controls may be identified at a later date.

3.10.2.2 State ARARs

There are no potential state action-specific ARARs for Alternative 6.

3.10.3 Long-term Effectiveness and Permanence

Institutional controls proposed would ensure that any future use of the site would comply with the selected remedial actions and that protection of human health and the environment would not be compromised.

Removal of any free product and reduction of contaminant mass in the vadose zone soils and groundwater via MPE or ISTD would be permanent. Because free product may be acting as a continuing source of contamination to groundwater and ambient air, any removal of free product would accelerate the natural attenuation process at the site.

3.10.4 Reduction in Toxicity, Mobility, and Volume through Treatment

Alternative 6 would result in a reduction in volume of contaminants through the use of treatment. Based on the past reports and risk assessments completed for the IR17 and Building 503 Area, however, the toxicity of the chemicals at the site is less than the risk criteria, and contaminant mobility and migration is not a concern.

3.10.5 Short-term Effectiveness

The community would be protected because contaminated soils would be excavated and managed in a controlled environment to minimize direct exposure to contaminants and then transported off site. Exposure of workers to contaminants would be minimal during excavation and off-site transportation and disposal. A health and safety plan would be developed to minimize the potential risk to workers involved in the remediation. This plan would include requirements for PPE and air monitoring. The RAOs would be achieved relatively quickly.

Another potential short-term effect on the community is increased truck traffic. Noise and vehicle traffic accidents may increase as soil is excavated and transported off site. Waste transportation of this type is a routine and relatively safe activity; therefore, the potential for short-term effects to the community is anticipated to be minimal.

This alternative would be effective in the short-term reduction of potential risk to humans and ecological receptors because it could be implemented quickly.

3.10.6 Implementability

Alternative 6 is technically feasible and uses demonstrated and innovative techniques that have proven to be effective at removing free product. Although ISTD is considered an innovative technology, it is a fully developed technology that has been demonstrated to effectively remove fuel hydrocarbons and NAPL in shallow soils and groundwater. In addition, a successful ISTD pilot test was previously completed at Mare Island for the removal of PCBs from soil (TerraTherm Environmental Services, Inc. [TerraTherm] and RT Environmental Services, Inc. 1998). Nevertheless, there are uncertainties regarding the overall effectiveness of ISTD with a recent system failure at the Rocky Mountain Arsenal located in Denver, Colorado (TerraTherm 2002). The alternative is of moderate to high complexity consisting of licensed and experienced vendors of standard and innovative practices. Normal construction and skilled labor with environmental experience would be necessary and are readily available to support the experienced vendors.

3.10.7 Cost

The total present value cost for Alternative 6 is about $4,035,000. This estimate includes pilot testing, installation of MPE and ISTD systems, institutional controls, and monitoring. Costs are based on a period of performance of 1 year (ISTD) to 2 years (MPE) and present value at a 3.9 percent discount rate.

3.10.8 State Acceptance

Comments generated from state review of the FS will be considered and incorporated as necessary in the proposed plan and final ROD.

3.10.9 Community Acceptance

Community acceptance will be evaluated after the public comment period on the proposed plan and will be documented in the final ROD.

3.11 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section compares each alternative to the nine criteria presented in Section 3.2 and analyzes the advantages as well as the disadvantages of each alternative.

For any alternative to be eligible for selection, it must meet the threshold criteria. The two threshold criteria are overall protection of human health and the environment and compliance with ARARs (unless an ARAR is waived). After comparison with threshold criteria, five additional criteria are used to analyze differences among alternatives. Since state and community acceptance will be assessed at a later date, they are not part of this comparative analysis. The following five modifying criteria are used for comparative analysis:

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

3.11.1 Threshold Criteria

Based on the RI and HHRA for the IR17 and Building 503 Area, the toxicity of the chemicals at the site is less than the risk criteria (Tetra Tech 2003). Thus, all six alternatives are protective of

human health; however, Alternative 1 does not meet the RAO and ARAR requiring reduction of the apparent occurrence of free product to the maximum extent practicable.

Alternatives 2 and 3 could potentially meet the RAO, but because of the presence of heterogeneous soils with low permeability, there is some uncertainty that these technologies can meet a strict interpretation of the RAO.

Alternatives 4, 5, and 6 have a very high probability of meeting the RAO.

3.11.2 Long-term Effectiveness and Permanence

Based on the RI (Tetra Tech 2003) and HHRA, there is no risk associated with the current use and conditions at the site. No measures are in place, however, to provide land-use restrictions and controls to ensure that the current risk conditions at the site remain unchanged, reducing the long-term effectiveness of Alternative 1. If successful in removing free product, long-term effectiveness and permanence of both Alternatives 2 and 3 will be high. Alternative 3, because it reduces vadose zone contaminant levels as well as removing free product, ranks high in long-term effectiveness and permanence. Alternatives 4, 5, and 6, because they eliminate most of the vadose zone contamination and free product, rank highest in long-term effectiveness and permanence.

Each of the six alternatives would result in some hazardous constituents or materials remaining at the site; consequently, in accordance with CERCLA Section 121(c), "a review of the selected remedy will be completed no less that each five years after the initiation of the remedial action." Specifically, the reviews will ensure that human health and the environment are continuing to be protected by the implemented remedial actions. As lead agency for the site, the Navy will be responsible for completing the review. The review will assess the presence of free product at the IR17 and Building 503 Area. Should the Navy's review determine that additional action under CERCLA is needed, the Navy is responsible for the completion of the action.

3.11.3 Reduction in Toxicity, Mobility, and Volume through Treatment

Alternatives 4 and 6 provide the greatest reduction in toxicity, mobility, and volume through treatment. These alternatives involve physical removal of the free product and reduce the overall mass of contaminants in the vadose zone and capillary fringe (smear zone). Alternatives 2 and 3 both remove free product to an extent dictated by site geology, thus reducing the volume of contaminants at the site. Alternative 1 does not reduce the toxicity, mobility, or volume of the contaminant. Alternative 5 does not reduce the toxicity or volume of the contaminant, but it does place contaminants in a controlled landfill, reducing mobility of the contaminants.

3.11.4 Short-term Effectiveness

Alternative 1 has no deleterious short-term effects. Alternatives 2, 3, 4, 5, and 6 all have minor short-term effects common to any mid-size environmental remediation projects because they all

require worker exposure with contaminants and increased site traffic. Alternatives 4 and 5 both require the movement of large volumes of soil. Alternative 5 offers the fastest remediation scenario of less than 2 months, and site conditions would remain unchanged.

3.11.5 Implementability

Alternative 1 is the easiest to implement since it requires no actions. Alternatives 2 through 6 require the implementation of institutional controls that are of minimal complexity. Alternatives 2 and 3 specify treatment technologies that also are of minimal complexity. Alternatives 4 and 5 are the next most difficult to implement as both major excavation projects. Alternative 4 is somewhat more difficult to implement than Alternative 5 because it involves the construction and operation of bioremediation temporary units for several months. Alternative 6 is the most difficult to implement because it involves pilot testing to determine appropriate operating parameters and involves design and implementation of innovative technologies. This alternative also requires the successful operation and monitoring or air emission controls; however, all of the alternatives are readily implementable and present no major engineering challenges.

3.11.6 Cost

Alternative 1 is the least costly of the six proposed alternatives. Alternatives 2, 3, and 5 are the next least costly at $1,211,000, 2,689,000, and $ 2,561,000, respectively. Alternative 4 represents moderate cost alternative at $3,280,000. Alternative 6 is the most expensive at $4,038,000.

3.11.7 State and Community Acceptance

Comments generated from state review of this FS will be incorporated in the proposed plan and final ROD. Community acceptance will be evaluated after the public comment period on the proposed plan and will be documented in the final ROD.

3.11.8 Summary

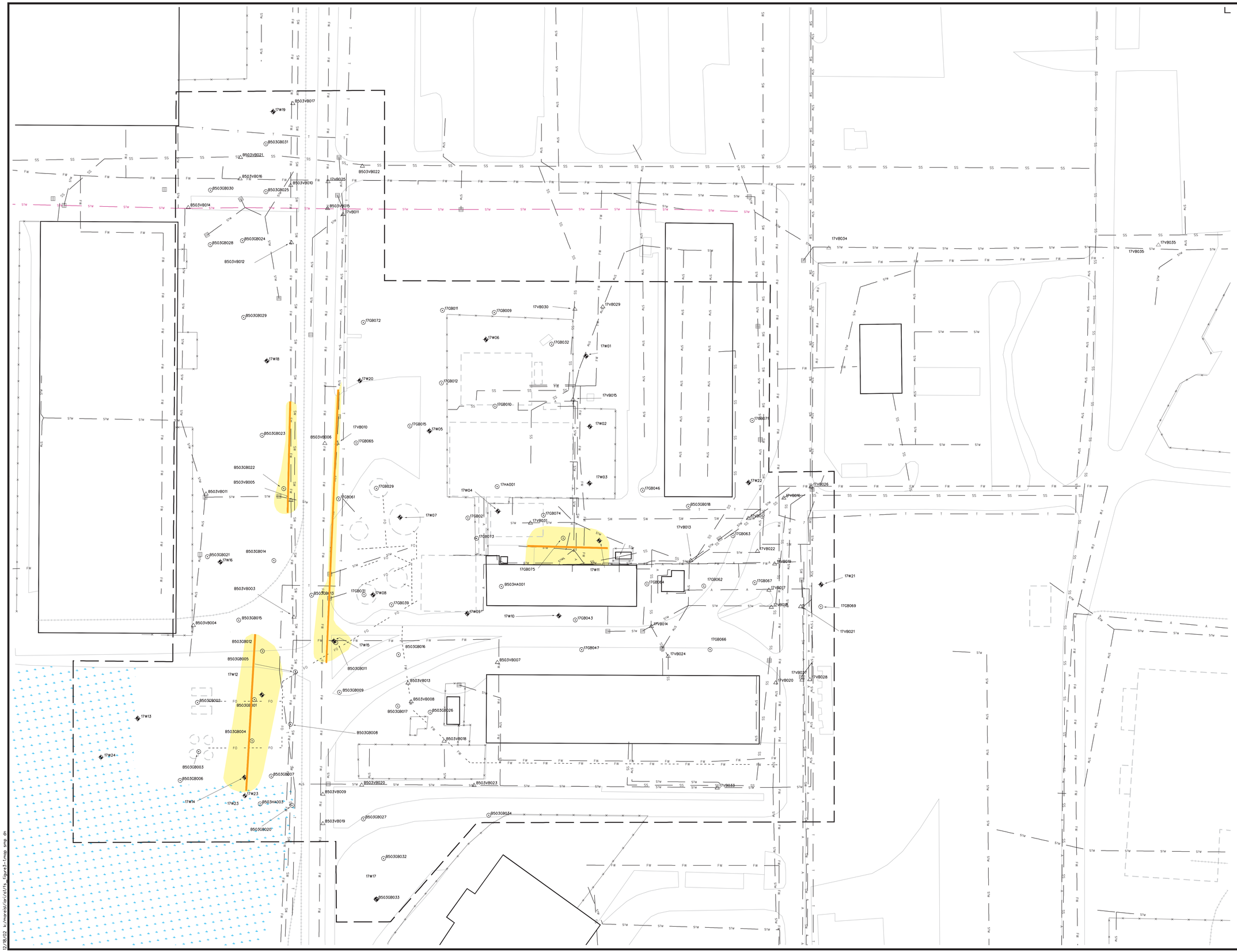
Human health and the environment are protected under all alternatives, based on the current conditions and use of the site. However, the no-action alternative may not remain protective of human health and the environment, if the current site use conditions were to change. Consequently, institutional controls are necessary at the site to ensure that the current conditions and use of the site remain unchanged and that access to the site is restricted.

Furthermore, federal and state ARARs require reduction of the apparent occurrence of free product to the maximum extent practicable. Because of site conditions that limit movement of free product, Alternatives 2 and 3 may not remove free product to the “maximum extent practicable,” especially when compared to Alternatives 4, 5, and 6. Alternatives 4, 5, and 6 are practicable and will remove free product.

Although Alternatives 4 and 5 are approximately the same in cost, Alternative 4 reduces the volume of contaminants, which is not achieved by Alternative 5. Alternative 6 also reduces the volume of contaminants but has increased costs compared to Alternatives 4 and 5. In addition, because Alternative 6 uses an innovative technology (ISTD), there are additional uncertainties regarding its potential overall performance, which may result in increased O&M costs. Compared to Alternative 5, Alternative 4 poses a greater degree of uncertainty in its success. Bioremediation, in many cases, requires extended treatment periods, thereby increasing labor, equipment, and especially laboratory costs.

The Navy believes that state and community input is essential to select a RA. Input will be collected after the alternatives are presented to the public, and a final decision will be made after review of state and community input.

FIGURES



LEGEND

- SOIL BORING LOCATION
- MONITORING WELL
- VACUUM EXCAVATION LOCATION
- STORM WATER DRAIN
- 3 (JUN 99) — ETHYLBENZENE CONCENTRATION IN µG/L (SAMPLE DATE)
- STORM WATER PIPELINE
- SANITARY SEWER
- SHARED STORM AND SANITARY SEWER
- FORMER PRODUCT DISTRIBUTION PIPELINE
- FRESH WATER PIPELINE
- ABANDONED FRESH WATER PIPELINE
- SALT WATER PIPELINE
- ABANDONED AIR LINE
- GAS LINE
- BURIED TELEPHONE LINE
- RAILROAD
- FENCE
- TRENCH (1 FT WIDE BY 8 FT DEEP)
- 503 — EXISTING BUILDING OR STRUCTURE
- 567 — FORMER BUILDING OR STRUCTURE
- SITE BOUNDARY
- EXTENT OF INFERRED FREE PRODUCT
- WETLAND

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SCALE IN FEET

Tetra Tech EM Inc.

INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA

FIGURE 3–1
REMEDIAL ALTERNATIVE 2
INSTITUTIONAL CONTROLS, CONSTRUCTION OF EXTRACTION TRENCHES AND INSTALLATION OF FREE PRODUCT SKIMMER PUMPS
IR17 AND BUILDING 503 AREA

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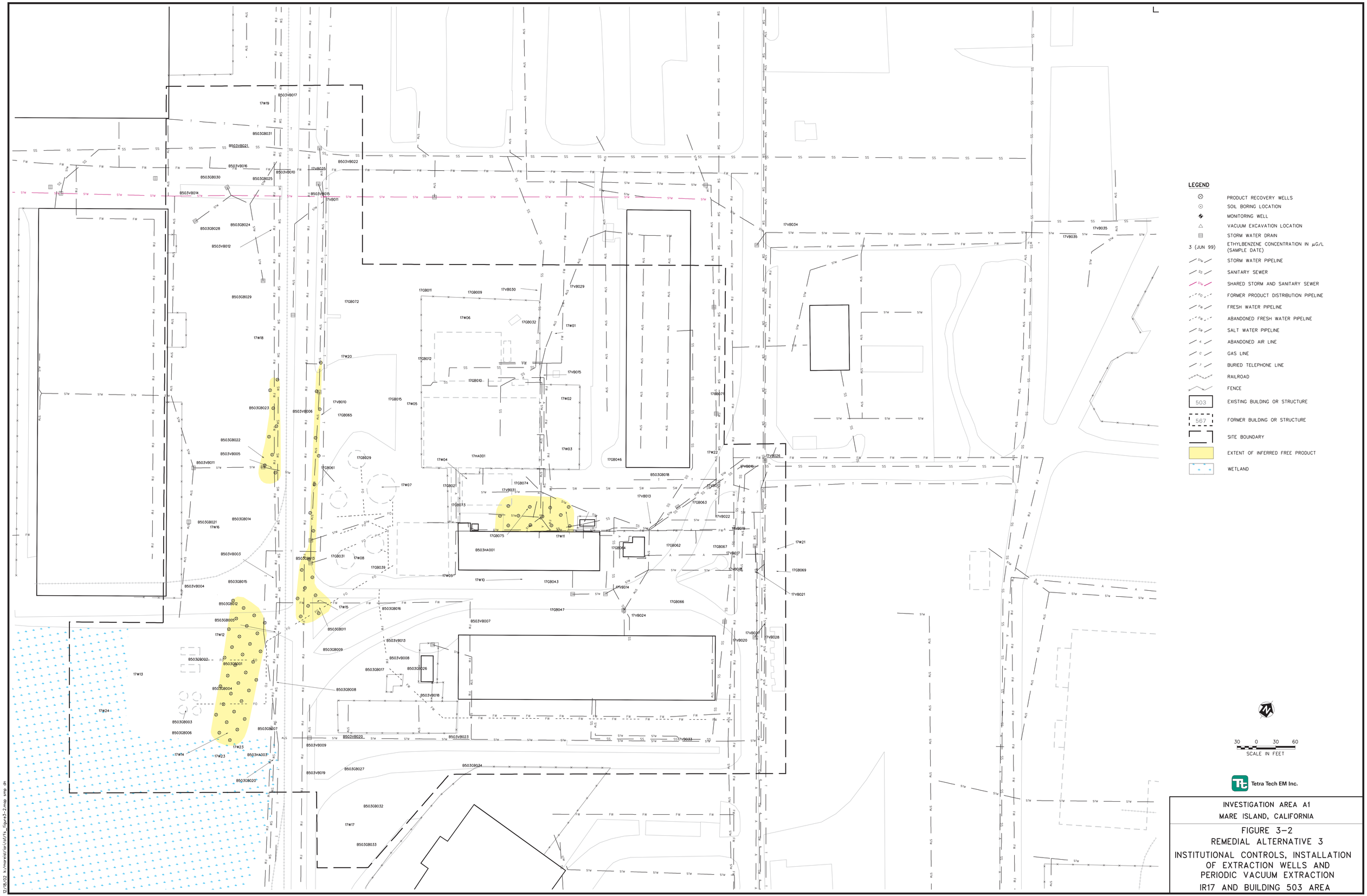
LEGEND
PRODUCT RECOVERY WELLS
SOIL BORING LOCATION
MONITORING WELL
VACUUM EXCAVATION LOCATION
STORM WATER DRAIN
3 (JUN 99)
ETHYLBENZENE CONCENTRATION IN µG/L (SAMPLE DATE)
STORM WATER PIPELINE
SANITARY SEWER
SHARED STORM AND SANITARY SEWER
FORMER PRODUCT DISTRIBUTION PIPELINE
FRESH WATER PIPELINE
ABANDONED FRESH WATER PIPELINE
SALT WATER PIPELINE
ABANDONED AIR LINE
GAS LINE
BURIED TELEPHONE LINE
RAILROAD
FENCE
503
EXISTING BUILDING OR STRUCTURE
567
FORMER BUILDING OR STRUCTURE
SITE BOUNDARY
EXTENT OF INFERRED FREE PRODUCT
WETLAND
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SCALE IN FEET
Tetra Tech EM Inc.
INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA
FIGURE 3-2
REMEDIAL ALTERNATIVE 3
INSTITUTIONAL CONTROLS, INSTALLATION OF EXTRACTION WELLS AND PERIODIC VACUUM EXTRACTION
IR17 AND BUILDING 503 AREA
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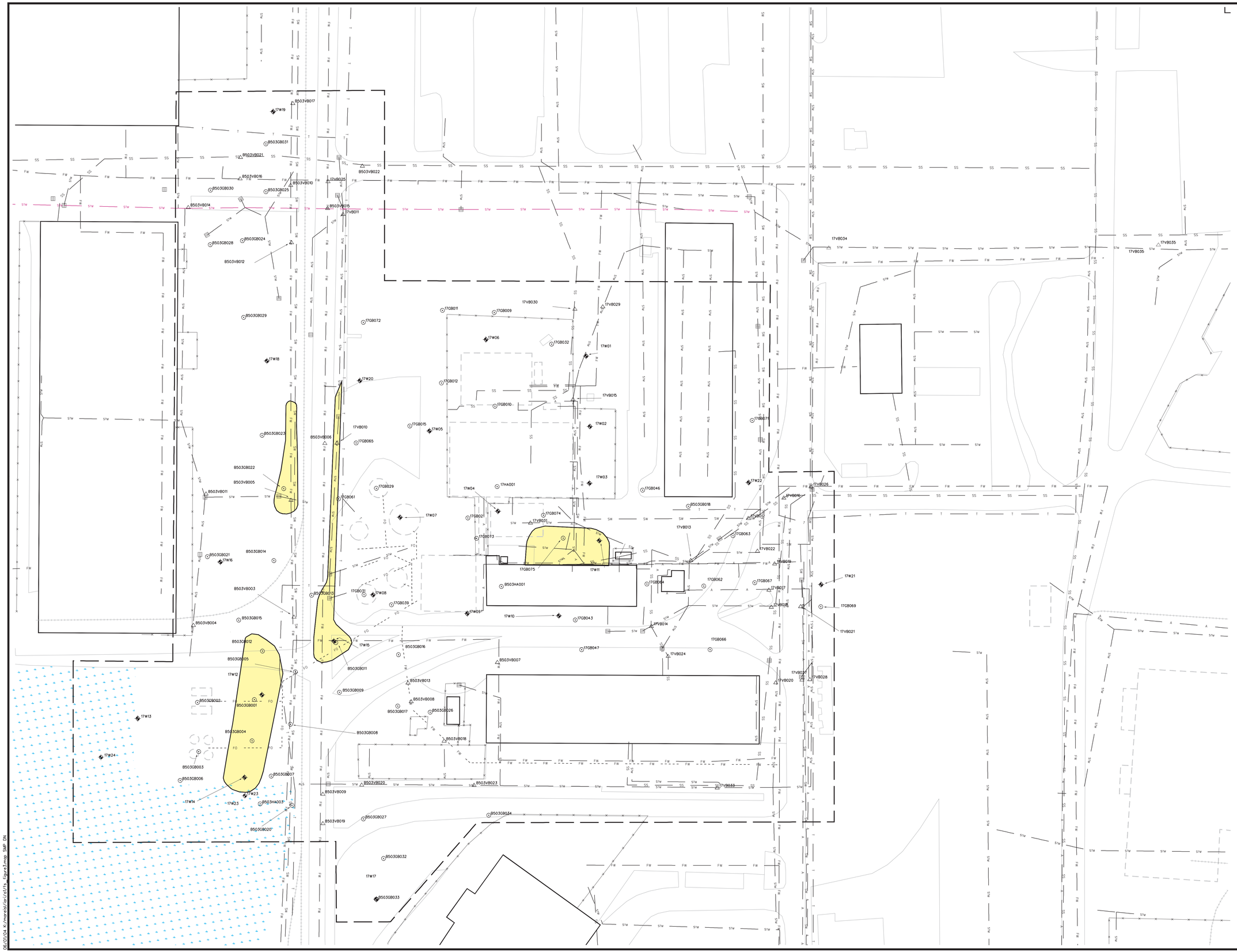

LEGEND

- SOIL BORING LOCATION
- MONITORING WELL
- VACUUM EXCAVATION LOCATION
- STORM WATER DRAIN
- 3 (JUN 99) — ETHYLBENZENE CONCENTRATION IN µG/L (SAMPLE DATE)
- STORM WATER PIPELINE
- SANITARY SEWER
- SHARED STORM AND SANITARY SEWER
- FORMER PRODUCT DISTRIBUTION PIPELINE
- FRESH WATER PIPELINE
- ABANDONED FRESH WATER PIPELINE
- SALT WATER PIPELINE
- ABANDONED AIR LINE
- GAS LINE
- BURIED TELEPHONE LINE
- RAILROAD
- FENCE
- 503 — EXISTING BUILDING OR STRUCTURE
- 567 — FORMER BUILDING OR STRUCTURE
- SITE BOUNDARY
- LIMIT OF EXCAVATION TO REMOVE INFERRED FREE PRODUCT
- WETLAND

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SCALE IN FEET

Tetra Tech EM Inc.

INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA

FIGURE 3–3

ALTERNATIVES 4 AND 5,
SOIL EXCAVATION, BIOREMEDIATION OR
OFF–SITE DISPOSAL, BACKFILLING WITH
TREATED OR CLEAN SOIL, AND
INSTITUTIONAL CONTROLS

IR17 AND BUILDING 503 AREA

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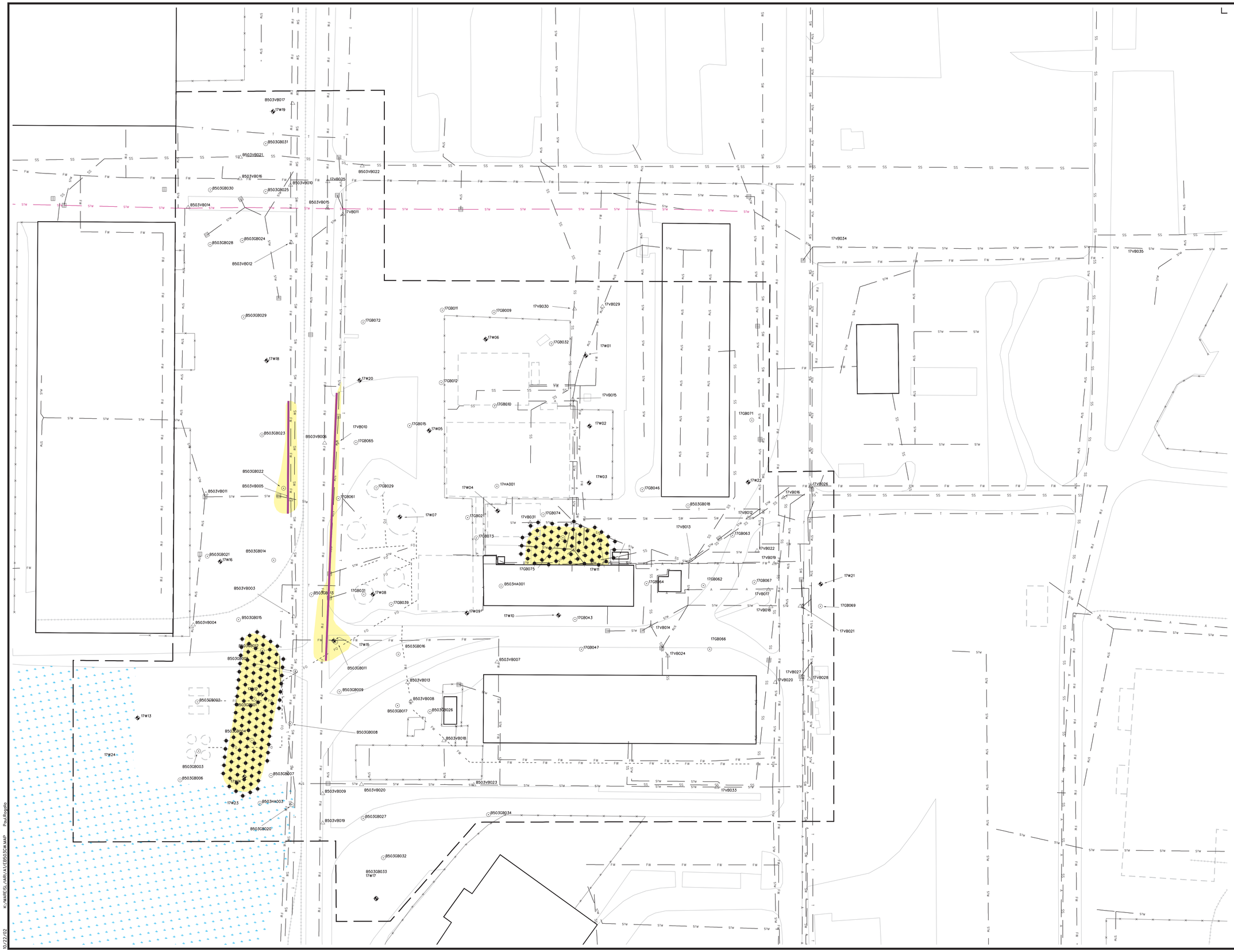

LEGEND

- SOIL BORING LOCATION
- MONITORING WELL
- VERTICAL THERMAL WELL
- VACUUM EXCAVATION LOCATION
- STORM WATER DRAIN
- STORM WATER PIPELINE
- SANITARY SEWER
- SHARED STORM AND SANITARY SEWER
- FORMER PRODUCT DISTRIBUTION PIPELINE
- FRESH WATER PIPELINE
- ABANDONED FRESH WATER PIPELINE
- SALT WATER PIPELINE
- ABANDONED AIR LINE
- GAS LINE
- BURIED TELEPHONE LINE
- RAILROAD
- FENCE
- HORIZONTAL MPE WELL
- INFERRED AREA OF FREE PRODUCT OCCURRENCE
- WETLAND
- 503 EXISTING BUILDING OR STRUCTURE
- 567 FORMER BUILDING OR STRUCTURE
- SITE BOUNDARY

NOTES:
(1) THIS MAP REPRESENTS ONE INTERPRETATION BASED ON AVAILABLE DATA; OTHER INTERPRETATIONS ARE POSSIBLE.

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SCALE IN FEET

Tetra Tech EM Inc.

INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA

FIGURE 3-4
REMEDIAL ALTERNATIVE 6
INSTITUTIONAL CONTROLS, MULTIPHASE EXTRACTION, AND IN-SITU THERMAL DESORPTION
IR17 AND BUILDING 503 AREA

10/22/02 K:\MARESI_IAR\A1\EB503W.MAP Paul Rogers

TABLES

TABLE 3-1: INITIAL SCREENING OF FREE PRODUCT REMOVAL TECHNOLOGIES

Final Feasibility Study, IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

General Response Action	Technology Group	Process Option	Description	Evaluation Result
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: 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
		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
	Proprietary Controls	Easements	A property right conveyed by a landowner to another party that gives the second party rights with regard to the first party'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
		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
	Enforcement and permit tools with LUC components	Administrative Orders	An order directly restricting the use of property by a named party.	Eliminated
	Informational Device	Deed Notice	Commonly refers to a nonenforceable, purely informational document filed in public land records that alerts anyone searching the records to important information about the property.	Retained

TABLE 3-1: INITIAL SCREENING OF FREE PRODUCT REMOVAL TECHNOLOGIES (Continued)
Final Feasibility Study, IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

General Response Action	Technology Group	Process Option	Description	Evaluation Result
Active Remediation	Passive Free Product Collection	Hand Bailing	Periodic removal of free product using hand bailer	Eliminated
		Sorbent socks	Continuous removal of small amount of free product using oleophilic socks placed in wells or trenches	Retained
		Belt Skimmers	Removal of free product using belt skimmers	Retained
		Product Recovery Pumps	Removal of free product using extraction trenches and product recovery pumps	Retained
	Active Free Product Collection	Multiphase Extraction	Removal of free product by simultaneously applying a vacuum to a well, depressing the water table, and removing and treating free product, vapor, and groundwater	Retained
		Periodic Vacuum Extraction	Periodic removal of free product, vapor, and groundwater via vacuum truck	Retained
Active Remediation	Excavation, Ex Situ Treatment, and Disposal	Excavation	Conventional excavation of vadose zone and free-product bearing soils. Adsorption of free product from excavation using oil-absorbent booms	Retained
		Low-Temperature Thermal Desorption	Ex situ treatment of hydrocarbon-contaminated soils and free product by heat soil, volatilizing contaminants and free product, and treating the off-gas	Eliminated
		Biological Treatment	Ex situ Biological treatment of soil in a temporary unit using aeration to promote biodegradation and volatilization of contaminants. Treatment of off-gas by vapor-phase carbon adsorption	Retained
		Off-Site Disposal	Disposal of soil in an a licensed off-site Class II landfill	Retained
	In-Situ Treatment	Chemical Oxidation	In-situ injection of chemical oxidants to treat soil by destroying contaminants to innocuous compounds.	Eliminated

TABLE 3-1: INITIAL SCREENING OF FREE PRODUCT REMOVAL TECHNOLOGIES (Continued)

Final Feasibility Study, IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

General Response Action	Technology Group	Process Option	Description	Evaluation Result
Active Remediation (Continued)	In-Situ Treatment	Thermal Desorption	In situ thermal treatment of soil and groundwater via steam distillation and volatilization of contaminants. Collection of volatilized contaminants via vapor extraction and treatment of off-gas by catalytic oxidation.	Retained
		Monitored Natural Attenuation	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	Eliminated

Notes:

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
IR17	Installation Restoration Site 17
LUC	Land Use Control
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

TABLE 3-2: COMPARATIVE ANALYSIS OF ALTERNATIVES

Final Feasibility Study, IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Effectiveness Criteria	Alternative 1: No Action	Alternative 2: Construction of Extraction Trenches, Use of Skimmer Pumps, and Institutional Controls	Alternative 3: Installation of Extraction Wells, Periodic Vacuum Extraction, and Institutional Controls	Alternative 4: Soil Excavation, Bioremediation, Backfilling with Treated Soil, and Institutional Controls	Alternative 5: Soil Excavation, Off-Site Disposal, Backfilling with Clean Soil, and Institutional Controls	Alternative 6: Multiphase Extraction, In-Situ Thermal Desorption, and Institutional Controls
1. Overall Protection of Human Health and the Environment[a]	Threshold achieved: The RI and the HHRA determined that the risks under current site conditions are within the risk management range for human health and the environment (Tetra Tech 2003).	Threshold achieved. The RI and the HHRA determined that the risks under current site conditions are within the risk management range for human health and the environment (Tetra Tech 2003). This alternative will reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process. Institutional controls will limit site usage.	Threshold achieved: The RI and the HHRA determined that the risks under current site conditions are within the risk management range for human health and the environment (Tetra Tech 2003). This alternative will reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process. Institutional controls will limit site usage.	Threshold achieved: The RI and the HHRA determined the risks under current site conditions are within the risk management range for human health and the environment (Tetra Tech 2003). This alternative will reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process. Institutional controls will limit site usage.	Threshold achieved: The RI and the HHRA that the risks under current site conditions are within the risk management range for human health and the environment (Tetra Tech 2003). This alternative will reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process. Institutional controls will limit site usage.	Threshold achieved: The RI and the HHRA the risks under current site conditions are within the risk management range for human health and the environment (Tetra Tech 2003). This alternative will reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process. Institutional controls will limit site usage.
2. Compliance with ARARs[a]	Threshold not achieved as free product is not removed to the maximum extent practicable.	Threshold achieved: Meets requirements for action-specific ARARs	Threshold achieved: Meets requirements for action-specific ARARs	Threshold achieved: Meets requirements for action-specific ARARs	Threshold achieved: Meets requirements for action-specific ARARs	Threshold achieved: Meets requirements for action-specific ARARs
3. Short-term Effectiveness[b]	No short-term risk because no active remediation activities are proposed.	Short-term risk is low: Uses standard environmental remediation techniques	Short-term risk is low: Uses standard environmental remediation techniques	Short-term risk is low to moderate: Uses standard environmental remediation techniques, but involves handling of significant volumes of contaminated soil	Short-term risk is low to moderate: Uses standard environmental remediation techniques, but involves handling of significant volumes of contaminated soil	Short-term risk is low to moderate: Uses standard and innovative environmental remediation techniques.
4. Long-term Effectiveness and Permanence[b]	Not effective and permanent because it does not address potential risks	Provides a sufficient level of long-term effectiveness and permanence.	Provides a sufficient level of long-term effectiveness and permanence.	Provides a sufficient level of long-term effectiveness and permanence.	Provides a sufficient level of long-term effectiveness and permanence	Provides a sufficient level of long-term effectiveness and permanence
5. Reduction in Toxicity, Mobility, and Volume through Treatment[b]	It would not reduce toxicity, mobility, or volume through treatment.	If successful, the volume of contaminants in the subsurface would be reduced.	If successful, the volume of contaminants in the subsurface would be reduced.	This alternative achieves the greatest reduction in toxicity, mobility, and volume of contamination through treatment.	Would not reduce the toxicity, mobility, and volume through treatment, but it would reduce or eliminate the risk pathways by removing contaminants from the site	This alternative achieves the greatest reduction in toxicity, mobility, and volume of contamination through treatment.
6. Technical Implementability[b]	It is readily implementable.	Technically feasible. Because of low-permeability soils, however, may not achieve removal of free product to the "maximum extent practicable"	Technically feasible. Because of low-permeability soils, however, may not achieve removal of free product to the "maximum extent practicable"	Technically feasible. May have some difficulty reaching treatment goals, thereby increasing costs.	Technically feasible.	Technically feasible. May have some uncertainty in overall remedial performance, thereby increasing O&M costs.
7. Cost (present value)[b]	$0	$1,211,000	$2,689,000	$3,280,000	$ 2,561,000	$ 4,038,000

Notes:

a The first two criteria are threshold criteria. All remedial alternatives must meet the threshold criteria.

b The remaining criteria are evaluation criteria used to select the alternative. State and community acceptance, the modifying criteria, will be included in the feasibility study once comments are received from the state and the public.

ARAR Applicable or relevant and appropriate requirement
IR17 Installation Restoration Site 17
HHRA Human health risk assessment
RI Remedial investigation
Tetra Tech Tetra Tech EM Inc.

Source:

Tetra Tech. 2003. "Revised Draft Final Remedial Investigation Report, Investigation Area A1, IR17 and Building 503 Area, Mare Island, Vallejo, California." August 27.

4.0 SUMMARY OF EVALUATION

This FS is consistent with the CERCLA requirements defined in EPA and Navy guidance documents. The purpose of this FS is to develop and evaluate candidate RAs to free product at the IR17 and Building 503 Area. A number of process options were screened with respect to effectiveness, implementability, and cost to identify components to formulate six candidate RAs as follows:

- Alternative 1: No Action
- Alternative 2: Construction of Extraction Trenches, Use of Skimmer Pumps, and Institutional Controls
- Alternative 3: Installation of Extraction Wells, Periodic Vacuum Extraction, and Institutional Controls
- Alternative 4: Soil Excavation, Bioremediation, Backfilling with Treated Soil, and Institutional Controls
- Alternative 5: Soil Excavation, Off-Site Disposal, Backfilling with Clean Soil, and Institutional Controls
- Alternative 6: Multiphase Extraction, In-Situ Thermal Desorption, and Institutional Controls

Of the first seven CERCLA criteria (Section 3.0), Alternative 5 meets all criteria and is the most cost-effective alternative with the least degree of uncertainty regarding overall performance. Alternative 5 is therefore the recommended alternative.

5.0 REFERENCES

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APPENDIX A
APPLICABLE RELEVANT AND APPROPRIATE REQUIREMENTS EVALUATION

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A-6 Mare Island Potential State Action-Specific Applicable or Relevant and Appropriate Requirements

ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or relevant and appropriate requirements
AST	Aboveground storage tank
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*
CZMA	Coastal Zone Management Act
DOD	Department of Defense
EPA	U.S. Environmental Protection Agency
ERA	Ecological risk assessment
ESA	Endangered Species Act
FS	Feasibility study
HSWA	Hazardous and Solid Waste Amendments of 1984
IC	Institutional control
IR	Installation Restoration
LDR	Land disposal restriction
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
RCRA	Resource Conservation and Recovery Act
ROD	Record of decision
RWQCB	Regional Water Quality Control Board
STLC	Soluble threshold limit concentrations
SWRCB	State Water Resources Control Board
TBC	To be considered
TCLP	Toxicity characteristic leaching procedure
Tetra Tech	Tetra Tech EM Inc.
TTLC	Total threshold limit concentrations
USC	*United States Code*
UST	Underground storage tank
VOC	Volatile organic compound

WET	Waste extraction test
WQO	Water quality objective

1.0 INTRODUCTION

This appendix identifies and evaluates potential federal and state of California applicable or relevant and appropriate requirements (ARAR) from available regulations, requirements, and guidance. This appendix sets forth the U.S. Department of the Navy (Navy) determinations regarding those potential ARARs for each response action alternative retained for detailed analysis in the feasibility study (FS) for Installation Restoration (IR) Site 17 (IR17) and Building 503 Area, Mare Island.

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 (ROD), after public review, as part of the remedial action selection process.

1.1 SUMMARY OF REQUIREMENTS

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (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 that are 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, then the requirement 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 response 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) Section 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
- 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 (EPA 1988a), a requirement may be "applicable" or "relevant and appropriate," but not both. Identification of ARARs must be done on a site-specific basis and involve a two-part analysis. First, a determination is made about whether a given requirement is applicable. If it is not applicable, a determination is made about whether it is nevertheless both relevant and appropriate. It is important to explain that some regulations may be applicable or, if not applicable, 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 though it were applicable (EPA 1988a).

Tables A-1, A-2, A-3, A-4, A-5, and A-6 included in this appendix present each potential ARAR with a determination of ARAR status (that is, applicable, relevant and appropriate, or not an ARAR). 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 response action contemplated and whether the requirement was well suited to the site. A negative determination of relevance and appropriateness indicates that the requirement did not meet the pertinent criteria. Negative determinations are documented in the tables of this appendix and are discussed in the text only for specific cases.

TABLE A-1: POTENTIAL FEDERAL CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
U.S. Environmental Protection Agency Guidelines for Groundwater Classification Under the Groundwater Protection Strategy				
Classifies groundwater according to ecological importance, replaceability, and vulnerability considerations.	Groundwater	*EPA Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy*	To be considered	The shallow groundwater at Mare Island meets the criteria for Class III groundwater.

Notes:

a Only the substantive provisions of the requirements cited in this table are potential ARARs

ARAR Applicable or relevant and appropriate requirement

EPA U.S. Environmental Protection Agency

TABLE A-2: POTENTIAL STATE CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
State and Regional Water Quality Control Boards[b]				
Authorizes the SWRCB and the RWQCB to establish water quality control plans that identify beneficial uses and numerical and narrative standards to protect surface water and groundwater quality. Authorizes the RWQCB to issue permits for discharges to land or surface or groundwater that could affect water quality, including NPDES permits, and to take enforcement action to protect water quality.	Surface water or groundwater	*Cal. Water Code Sections 13140, 13142, 13172, 13240 through 13243, 13263(a), 13267, 13307*	Applicable	The Navy accepts the these substantive provisions of the Cal. Water Code enabling legislation, as implemented in through the beneficial uses, WQOs, waste discharge requirements, and promulgated policies of the Basin Plan.
Describes the water basins in the San Francisco Bay Region, establishes beneficial uses of groundwater and surface water, established WQOs, including narrative and numerical standards, establishes implementation plans to meet WQOs and protect beneficial uses, and incorporates state-wide water quality control plans and policies.	Surface water or groundwater within the San Francisco Bay Region	*Comprehensive Water Quality Control Plan for the San Francisco Bay Region (Basin Plan)*	Applicable	The basin plan, as a potential chemical-specific ARAR, is applicable to the shallow groundwater that is part of this response action. The basin plan identifies beneficial uses of the shallow groundwater and further defines the municipal and domestic supply beneficial use in SWRCB Res. 88-63. According to the basin plan, the shallow groundwater is not a potential municipal and domestic supply.
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 practice.	Surface water or groundwater	*SWRCB Res. 88-63 (Sources of Drinking Water Policy)*	Applicable	This resolution is incorporated into the basin plan. The shallow groundwater at Mare Island meets the criteria for exemption from municipal and domestic supply.

TABLE A-2: POTENTIAL STATE CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (Continued)

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
Definitions of designate waste, nonhazardous waste, and inert waste.	Waste	Title *27 CCR Sections 20210, 20220, 20230*	Applicable	These are applicable to any operation that generates waste. The Navy will determine whether any waste generated from the response actions meets the definition of designated waste, nonhazardous solid waste, or inert waste at the time the waste is sent off site for disposal. If the waste meets the definition of designated or nonhazardous solid waste, the Navy will dispose of it appropriately in Class I or Class II landfills.

Notes:

a	Only the substantive provisions of the requirements cited in this table are potential ARARs
b	Statutes and policies as well as 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 statues or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirement of the specific citations are considered potential ARARs
ARAR	Applicable or relevant and appropriate requirement
Cal. Water Code	*California Water Code*
gpd	Gallons per day
NPDES	National Pollution Discharge Elimination System
ppm	Parts per million
RWQCB	Regional Water Quality Control Board
SWRCB	State Water Resources Control Board
TDS	Total dissolved solids
WQO	Water quality objective

TABLE A-3: POTENTIAL FEDERAL LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
Executive Order No. 11990, Protection of Wetlands					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands.	Wetland meeting definition of Section 7	Title 40 CFR Section 6.302(a)	Applicable	There is a seasonal wetland at IR17 and Building 503 Area. All remedial alternatives will comply with this requirement.
Executive Order No. 11988, Floodplain Management					
Within floodplain	Actions taken should avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values.	Action that will occur in a floodplain (such as lowlands) and relatively flat areas adjoining inland and coastal waters and other flood-prone areas	Title 40 CFR Section 6.302(b)	Applicable	Portions of IR17 and Building 503 Area are within a 100-year floodplain, and soil excavation will take place in the floodplain. No facilities will be constructed within the floodplain. All remedial alternatives will comply with this requirement.
Clean Water Act of 1977, as Amended, Section 404 (Title 33 USC Section 1344)b					
Wetland	Action to prohibit discharge of dredged or fill materials into wetland without permit.	Wetland as defined by Executive Order No. 11990 Section 7	Title 33 USC Section 1344	Applicable	All remedial alternatives will comply with this requirement.
Endangered Species Act of 1973 (Title 16 USC Sections 1531 to 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 Section 1536(a), (h)(1)(B)	Applicable	There is a federal endangered species and endangered species habitat in the seasonal wetland at IR17 and Building 503 Area. Current conditions at the site and the proposed remedial action will not affect the endangered species or any of its critical habitats.

TABLE A-3: POTENTIAL FEDERAL LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (Continued)

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
Coastal Zone Management Act (Title 16 USC Sections 1451 to 1464)b					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone, including lands thereunder and adjacent shore land.	Title 16 USC Section 1456(c) Title 15 CFR Section 930	Relevant and Appropriate	IR17 and Building 503 Area are within the coastal zone. This statutory provision and the regulations are not applicable because federal lands are specifically exempted from the statutory definition of coastal zone. These requirements are, however, relevant and appropriate, and the proposed remedial alternative will be conducted in accordance with California's approved state management plan.

Notes:

a Only the substantive provisions of the requirements cited in this table are potential ARARs

b Statutes and policies as well as 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 statues or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirement of the specific citations are considered potential ARARs

ARAR applicable or relevant and appropriate requirement

CFR *Code of Federal Regulations*

IR Installation Restoration

USC *United States Code*

TABLE A-4: POTENTIAL STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
California Coastal Act of 1976[b]					
Within coastal zone	Regulates activities associated with development to control direct significant impacts on coastal waters and to protect state and national interest in California coastal resources.	Any activity that could affect coastal waters and resources	*California Public Resources Code* Sections 30000 to –30900 and Title 14 *California Code of Regulations* Sections 13001to 13666.4	Relevant and Appropriate	IR17 and Building 503 Area are within a coastal zone. Regulations contained in the California Coastal Act of 1976 are not applicable because the federal Coastal Zone Management Act excludes federal lands from its definition of coastal zone. Regulations at *California Public Resources Code* Sections 30230 to 30240 are, however, relevant and appropriate.

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 statues or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirement of the specific citations are considered potential ARARs.

ARAR Applicable or relevant and appropriate requirement

IR Installation Restoration

TABLE A-5: POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Resource Conservation and Recovery Act (Title 42 USC, Chapter 82, Sections 6901 to 6991[i])[a]					
On-site waste generation	Person who generates waste shall determine whether that waste is a hazardous waste.	Generator of waste	Title 22 CCR Sections 66262.10(a), 66262.11	Applicable for determining whether waste is hazardous	Applicable for any operation where hazardous waste is generated. The determination will be made at the time the wastes are generated.
Definition of RCRA hazardous waste	Determine whether any of the wastes generated during the remedial action exhibit any of the hazardous characteristics.	Generation of waste	Title 22 CCR Sections 66261.21, 66261.22(a), 66261.23, 66261.24(a)(1), and 66261.100	Applicable for determining whether waste is hazardous	Applicable for any operation where hazardous waste is generated. The determination will be made at the time the wastes are generated.
Hazardous waste accumulation	On-site hazardous waste accumulated is allowed for up to 90 days as long as the waste is stored in containers in accordance with Sections 66262.171 to 178 or in tanks, drip pads, or inside buildings. The waste is labeled and dated.	Accumulate hazardous waste	Title 22 CCR Section 66262.34	Applicable to any operation which accumulates hazardous waste before off-site disposal	Applicable to any operation where hazardous waste is generated and transported for off-site disposal. The Navy does not anticipate accumulating any hazardous waste on site for more than 90 days.
Off-site disposal	Packaging, labeling, marking, and placarding requirements.	Off-site disposal of RCRA hazardous waste	Title 22 CCR Sections 66262.30 to 66262.33	Applicable to off-site disposal of hazardous waste	These regulations are applicable if it is determined that any of the waste generated on site meets the definition of RCRA hazardous waste and is going to be disposed of off site.
Container storage	Containers of RCRA hazardous waste must be (1) maintained in good condition, (2) compatible with hazardous waste to be stored, and (3) closed during storage except to add or remove waste. Inspect container storage areas weekly for deterioration.	Storage of RCRA hazardous waste no meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere, in a container	Title 22 CCR Sections 66264.171, 66264.172, 66264.173	Applicable to operations that store hazardous waste	Applicable for hazardous wastes to be stored in container before disposal. The Navy does not anticipate accumulating waste on site for more than 90 days.
	Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.	Storage in a container of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere	Title 22 CCR Sections 66264.175(a) and (b)	Applicable to operations that store hazardous waste	Applicable for hazardous wastes to be stored in container before disposal. The Navy does not anticipate accumulating waste on site for more than 90 days.
	At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers and liners.	Storage in a container of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere	Title 22 CCR Section 66264.178	Applicable to operations that store hazardous waste	Applicable to storage of waste in containers. All containers will be removed by closure of operations.
Store liquids in temporary units	Temporary units must be located within the facility boundary and used only for treatment or storage of remediation wastes. Temporary unit standards must consider length of time unit will be operational, type of unit, volume of waste, physical and chemical characteristics of waste, potential for release from the unit, relevant environmental conditions, and potential for exposure to human or environmental receptors.	Storage of RCRA hazardous waste Storage of RCRA hazardous waste	Title 22 CCR Section 66264.553(b) Title 22 CCR Section 66264.553(c)	Storage of RCRA hazardous waste	Applicable to an operation that stores hazardous waste. The Navy will determine whether the skimmed free product meets the definition of a RCRA hazardous waste at the time it is generated. Applicable to an operation that stores hazardous waste. The Navy will determine whether the skimmed free products meet the definition of a RCRA hazardous waste at the time it is generated.

TABLE A-5: POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (Continued)
Final Feasiblity Study for the IR17 and Building 503 Area Feasibility Study, Mare Island, Vallejo, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Resource Conservation and Recovery Act (Title 42 USC, Chapter 82, Sections 6901 to 6991[i])[a] (Continued)					
Store liquids in temporary units (continued)	Temporary unit may operate for no more than 2 years and will have design, operating, and closure requirements.	Storage of RCRA hazardous waste	Title 22 CCR Section 66264.553 (d) and (e)	Storage of RCRA hazardous waste	Applicable to an operation that stores hazardous waste. The Navy will determine whether the skimmed free product meets the definition of a RCRA hazardous waste at the time it is generated.
Release of free product	Removal of free product to the maximum extent practicable.	Release of free product	Title 40 CFR Sections 280.12, 280.64	Relevant and Appropriate	These regulations apply to releases of free product from USTs. The release at IR17 and Building 503 was from an AST.
	Removal of free product is conducted in a manner that minimizes the spread of contamination into previously uncontaminated zones by using techniques appropriate to the hydrogeologic conditions at the site.	Release of free product	Title 40 CFR Section 280.64(a)	Relevant and Appropriate	This regulation applies to releases from USTs and is, therefore, not applicable because the release at IR17 and Building 503 Area was from an AST. This requirement may be relevant and appropriate to the release of free product from an AST.
	Use abatement of free product migration as a minimum objective for the design of the free product removal system.	Release of free product	Title 40 CFR Section 280.64(b)	Relevant and Appropriate	This regulation applies to releases from USTs and is, therefore, not applicable because the release at IR17 and Building 503 Area was from an AST. This requirement may be relevant and appropriate to the release of free product from an AST.
Bioremediation	Alternative requirements that are protective of human health or the environment may replace design, operating, or closure standards for temporary tanks. Temporary units must be located within the facility boundary and used only for treatment or storage of remediation wastes. Temporary unit standards must consider length of time the unit will be operational, type of unit, volume of waste, physical and chemical characteristics of waste, potential for release from the unit, relevant environmental conditions, and potential for exposure to human or environmental receptors. Temporary units may operate for no more than 2 years and will have design, operating, and closure requirements	Hazardous remediation waste	Title 22 CCR Section 66264.553(b), (c), (d), and (e)	Relevant and appropriate	These regulations are not applicable because the Navy has not determined that the soil is a RCRA hazardous waste. The regulations are, however, relevant and appropriate to the temporary storage of remediation wastes.
Thermal desorption	Requires a waste analysis.	Facility that thermally treats hazardous waste in devices other than enclosed devices using controlled flame combustion.	Title 22 CCR Section 66265.13	Relevant and appropriate to operations that thermally treat hazardous waste.	This regulation is relevant and appropriate if the waste is determined to be RCRA hazardous waste.
	Requirements for owners or operators of facilities that thermally treat hazardous waste in devices other than enclosed devices using controlled flame combustion.	Facility that thermally treats hazardous waste in devices other than enclosed devices using controlled flame combustion.	Title 22 CCR Section 66265.370	Relevant and appropriate to operations that thermally treat hazardous waste.	This regulation is relevant and appropriate if the waste is determined to be RCRA hazardous waste.
	Owners of operators that thermally treat hazardous waste must bring thermal treatment process to steady state conditions of operation before adding hazardous waste.	Facility that thermally treats hazardous waste in devices other than enclosed devices using controlled flame combustion.	Title 22 CCR Section 66265.373	Relevant and appropriate to operations that thermally treat hazardous waste.	This regulation is relevant and appropriate if the waste is determined to be RCRA hazardous waste.

TABLE A-5: POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (Continued)
Final Feasiblity Study for the IR17 and Building 503 Area Feasibility Study, Mare Island, Vallejo, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Resource Conservation and Recovery Act (Title 42 USC, Chapter 82, Sections 6901 to 6991[i])[a] (Continued)					
Thermal desorption (continued)	Requires waste analysis to determine (1) the heating value of the waste; (2) halogen content and sulfur content in the waste; and (3) concentration of lead and mercury in the waste, unless the owner or operator has written, documented data that show that the elements are not present.	Facility that thermally treats hazardous waste in devices other than enclosed devices using controlled flame combustion.	Title 22 CCR Section 66265.375	Relevant and appropriate to operations that thermally treat hazardous waste.	This regulation is relevant and appropriate if the waste is determined to be RCRA hazardous waste.
	Requires owner or operator of facilities that thermally treat hazardous waste to monitor and inspect the facility.	Facility that thermally treats hazardous waste in devices other than enclosed devices using controlled flame combustion.	Title 22 CCR Section 66265.377	Relevant and appropriate to operations that thermally treat hazardous waste.	This regulation is relevant and appropriate if the waste is determined to be RCRA hazardous waste.
	Presents closure requirements.	Facility that thermally treats hazardous waste in devices other than enclosed devices using controlled flame combustion.	Title 22 CCR Section 66265.381	Relevant and appropriate to operations that thermally treat hazardous waste.	This regulation is relevant and appropriate if the waste is determined to be RCRA hazardous waste.
Land disposal	Requires generators of hazardous waste to determine whether waste has to be treated before it can be disposed of on land. Requires generators to notify treatment facility if a waste is subject to land disposal restrictions and does not meet applicable treatment standards. If the waste meets treatment standards, generators must sign a certification.	Hazardous waste land disposal	Title 22 CCR Section 66268.1(f), 66268.7, 66268.40, 66268.48, 66268.49, 66268.44	Applicable to operations that generate a restricted hazardous waste.	These requirements are applicable if restricted hazardous waste is to be disposed of on land. The Navy does not anticipate that it will dispose of any restricted hazardous waste to land.
Clean Air Act (Title 42 USC Sections 7401 to 7671)[a]					
Bioremediation	Exempts calculations of aeration volume under Section 8-40-204 for covered storage units.	Storage of material in a unit	BAAQMD Section 8-40-110	Applicable	This regulation is applicable to the bioremediation temporary unit, which will be covered.
	For active storage units, contaminated soil shall be kept visibly moist by water spray, treated with a vapor suppressant, or covered with continuous heavy duty plastic sheeting or other covering to minimize emissions of organic compounds to the atmosphere. Covering shall be in good condition, joined at the seams, and securely anchored to minimize headspace where vapors may accumulate. The surface area not covered by plastic sheeting or other covering shall not exceed 6,000 square feet.	Storage of materials containing organic compounds in units	BAAQMD Section 8-40-304	Applicable	This regulation is applicable to the bioremediation temporary units, which will be covered.
Bioremediation	During excavation, all exposed contaminated soil surfaces above existing grade level shall be kept visibly moist or covered as described above for Regulation 8-40-304.	Storage of materials containing organic compounds in units	BAAQMD Section 8-40-306.1	Applicable	This regulation is applicable to the bioremediation temporary units, which will be covered.

TABLE A-5: POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (Continued)

Final Feasiblity Study for the IR17 and Building 503 Area Feasibility Study, Mare Island, Vallejo, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Clean Air Act (Title 42 USC Sections 7401 to 7671)[a] (Continued)					
Bioremediation (continued)	All contaminated soil shall be stockpiled separately from soil that is not contaminated unless emissions from the storage unit are minimized according to provisions of this rule.	Storage of contaminated soil	BAAQMD Section 8-40-306.3	Applicable	This regulation is applicable to the bioremediation temporary units. No contaminated soil will be placed on uncontaminated soil.
	Requires treatment of contaminated soil to begin within 45 days of excavation.	Storage of contaminated soil in units	BAAQMD Section 8-40-306.4.3	Applicable	This regulation is applicable to the bioremediation temporary units.
	During backfilling, all exposed contaminated soil surfaces shall be kept visibly moist by water spray, treated with a vapor suppressant, or covered with continuous heavy duty plastic sheeting or other covering to minimize emissions of organic compounds to the atmosphere. During periods of inactivity longer than 12 hours, backfilled contaminated soil shall be covered with at least 6 inches of uncontaminated soil, or covered as described previously.	Exposed surfaces during backfilling	BAAQMD Section 8-40-306.6	Applicable	This regulation is applicable to the backfilling of the treated soil.
MPE operations	Requires MPE operations that emit benzene to be vented to a control device, which reduces emissions to the atmosphere by at least 90 percent by weight.	MPE operation that emits benzene.	BAAQMD Section 8-47-301	Applicable	This regulation is applicable to alternatives that contemplate MPE operations.
	Requires MPE operations with a total organic compound emission greater than 15 pounds per day to be vented to a control device which reduces the total organic compound emissions to the atmosphere by at least 90 percent by weight.	MPE operations that emit greater than 15 pounds per day of total organic compounds.	BAAQMD Section 8-47-302	Applicable	This regulation is applicable to alternatives that contemplate MPE operations.
	Requires persons responsible for MPE operations that have not applied for a District permit to provide written notification to the air pollution control officer of intention to operate.	MPE operations that do not apply for a permit.	BAAQMD Section 8-47-401	Applicable	This regulation is applicable to alternatives that contemplate MPE operations. Because CERCLA does not require the Navy obtain permits, the Navy will provide notification to the air pollution control officer if it decides to initiate an MPE operation.
MPE operations	Requires emission of organic compounds to be measured as prescribed by (1) BAAQMD Manual of Procedures, Volume IV, ST-7 or (2) EPA Method 25 or 25A.	MPE operation that emits organic compounds.	BAAQMD Section 8-47-603	Applicable	This regulation is applicable to alternatives that contemplate MPE operations.
Bioremediation and Excavation	Prohibits emissions that are as dark or darker than No.1 on the Ringelmann Chart and sets forth opacity limitations.	Excavation	BAAQMD Regulations 6, Regulations 6-301 and 6-302	Applicable	These requirements are applicable for bioremediation and excavation activities.
	Prohibits the emission of particles in sufficient number to cause annoyance.	Release of particles	BAAQMD Regulations 6, Regulations 6-305	Applicable	These requirements are applicable for bioremediation and excavation activities.

Notes:

a 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 follow each general heading, and only substantive requirements of the specific citations are considered potential ARARs.

AST Aboveground storage tank
BAAQMD Bay Area Air Quality Management District
LDR Land disposal restriction
MPE Multiphase Extraction
RCRA Resource Conservation and Recovery Act
UST Underground storage tank

TABLE A-6: POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
State Water Resources Control Board[a]					
Cleanup Actions	Actions taken be public agencies to clean up unauthorized releases are exempt from Title 27 except that wastes removed from immediate place of release and discharged to land must be managed in accordance with classification and siting requirement of Title 27 and wastes contained or left in place must comply with Title 27 to the extent feasible.	Cleanup action taken by public agency	Title 27 *California Code of Regulations* Section 20090(d)	Applicable	Applicable to the actions taken by the Navy at the site. Some alternatives contemplate the off-site disposal of free product or soil. For those alternatives, the Navy will determine whether the waste meets the definition of designated or nonhazardous solid waste under Title 27, and if so, dispose of the waste according to Title 27 disposal requirements.

Notes:

a 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 follow each general heading, and only substantive requirements of the specific citations are considered potential ARARs.

ARAR Applicable or relevant and appropriate requirement

To qualify as a state ARAR under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the following descriptions must apply:

- A state law or regulation
- An environmental or facility siting law or regulation
- 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; therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered to be ARARs. Permits are considered to be procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or nonenvironmental, including permit requirements, are not considered to be ARARs. CERCLA 121(e)(1), Title 42 USC Section 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 Section 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 "to be considered" (TBC). TBC (Title 40 CFR Section 300.400[g][3]) 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 into 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 the IR17 and Building 503 Area. Section 1.2.2 summarizes the process by which potential federal ARARs were identified for the site. Pursuant to the definition of the term "on-site" in Title 40 CFR Section 300.5, the area that is part of this action is the IR17 and Building 503 Area.

1.2 METHODOLOGY DESCRIPTION

The process of identifying and evaluating potential federal and state ARARs is summarized in the following sections.

1.2.1 General

As the lead federal agency, the Navy has primary responsibility for identification of potential ARARs for the IR17 and Building 503 Area. 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 the IR17 and Building 503 Area
- Reviewed potential state ARARs to determine whether they satisfy CERCLA and NCP criteria that must be met 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 or "controlling" ARARs for each alternative

As outlined in Section 2.0 of the FS report, the remedial action objectives for the IR17 and Building 503 Area is the removal of the free product to the maximum extent practicable. Free product shall be removed in a manner that minimizes the spread of contamination into previously uncontaminated zones, and abatement of free product migration shall be the predominant objective in the design of the free product removal process. The remedial actions retained for detailed analysis are designed to accomplish this remedial action objective. Removal of free product to the maximum extent practicable will be achieved by different methods including extraction, treatment, and excavation with off-site disposal. The alternatives considered for detailed analysis and for which an ARARs analysis is presented are as follows:

- Alternative 1: No Action
- Alternative 2: Construction of Extraction Trenches, Use of Skimmer Pumps, and Institutional Controls
- Alternative 3: Installation of Extraction Wells, Periodic Vacuum Extraction, and Institutional Controls
- Alternative 4: Soil Excavation, Bioremediation, Backfilling with Treated Soil, and Institutional Controls

- Alternative 5: Soil Excavation, Off-Site Disposal, Backfilling with Clean Soil, and Institutional Controls

- Alternative 6: Multiphase Extraction, In Situ Thermal Desorption, and Institutional Controls

1.2.2 Identifying and Evaluating Federal Applicable or Relevant and Appropriate Requirements

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 ROD. 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 RCRA, the Clean Water Act, the Safe Drinking Water Act, the Toxic Substances Control Act, and their implementing regulations, to name a few. (See NCP preamble at Title 55 *Federal Register* 8764 to 8765 [1990] for a more complete listing.)

The proposed remedial action alternatives were reviewed against all potential federal ARARs, including but not limited to those set forth at Title 55 *Federal Register* 8764 to 8765 (1990) to determine whether they were applicable or relevant and appropriate utilizing CERCLA and NCP criteria and procedures for ARARs identification by lead federal agencies.

1.2.3 Identifying and Evaluating State Applicable or Relevant and Appropriate Requirements

EPA guidance recommends that the lead federal agency consult with the state when identifying state ARARs for remedial actions (EPA 1988b). In essence, CERCLA and NCP requirements at Title 40 CFR Section 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 section details the Navy's efforts to date to identify and evaluate state ARARs.

The Navy generally followed the procedures set forth in Title 40 CFR Section 300.515 and the Mare Island Federal Facility Site Remediation Agreement in seeking state assistance in identifying state ARARs. The Navy requested state chemical- and location-specific ARARs for the IR17 and Building 503 Area on December 20, 1999, during the site characterization phase. The Navy requested action-specific ARARs from the California Environmental Protection Agency, Department of Toxic Substances Control on February 16, 2000, when remedial alternatives were identified. On October 10, 2003, the Navy received comments from the RWQCB on the draft FS. These comments contained an identification of potential state ARARs for groundwater remediation. The Navy has reviewed these potential state ARARs and has

included in the FS any potential state chemical- and action-specific ARARs. In addition, the Navy included a response to the RWQCB's identification of potential ARARs in the Navy's response to comments.

1.3 OTHER GENERAL ISSUES

General issues identified during the evaluation of ARARs for the IR17 and Building 503 Area are discussed in the following sections.

1.3.1 General Approach to Requirements of the Federal Resource Conservation and Recovery Act

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 the elimination of the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments of 1984 (HSWA) significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions (LDRs), 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 if either of the following descriptions applies:

- The waste was initially treated, stored, or disposed of 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 (Title 55 *Federal Register* 8666, 8742 [1990]). The State of California received approval for its based RCRA hazardous waste management program on July 23, 1992 (Title 57 *Federal Register* 32726 [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 EPA (Title 63 *Federal Register* 49118 [2001]).

The regulations of Title 22 CCR, Division 4.5, are 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 (Title 57 *Federal Register* 32726 [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.

The key threshold question for the ARARs analysis is whether the contaminants at IR17 constitute federal hazardous waste as defined under RCRA and the state's authorized program or qualify as non-RCRA, state-regulated hazardous waste. RCRA requirements are not applicable to the IR17 and Building 503 Area because the free product was initially stored and released before November 19, 1980, the effective date of RCRA. In addition, RCRA regulations are not relevant and appropriate to the release of free product. RCRA regulations may be applicable or relevant and appropriate if excavated soil is determined to be a characteristic hazardous waste. Specific RCRA regulations relating to the excavated soil are discussed in detail with the alternatives that contemplate the excavation of soil in Section 4.0.

1.3.2 California-Regulated Non-Resource Conservation and Recovery Act Hazardous Waste

A waste determined not to be an RCRA hazardous waste may 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 Section 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, the waste extraction test (WET), which uses a different acid reagent and has a different dilution factor (10-fold). Other state requirements 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 Section 66261.24.) A waste is considered hazardous if its total concentrations exceed the TTLCs or if the extract concentrations exceed the STLCs. A WET is required when the total concentrations exceed the STLC but are less than the TTLCs (Title 22 CCR, Chapter 11, Appendix II[b]).

As stated in Section 1.3.1, the RCRA regulations, including the definition of non-RCRA, state-regulated hazardous waste are not applicable to the release of free product at the IR17 and Building 503 Area because the release occurred before the effective date of RCRA. They may be applicable to or relevant and appropriate for excavated soil; therefore, they are discussed in detail with the alternatives that contemplate the excavation of soil in Section 4.0.

1.3.3 Other California Waste Classifications

For waste discharged after July 18, 1997, solid waste classifications at Title 27 CCR, Sections 20210, 20220, and 20230 are used to determine applicability of waste management requirements.

These regulations are not applicable to the free product release at the IR17 and Building 503 Area because the release occurred before July 18, 1997. Instead, these regulations may be relevant and appropriate state ARARs for the excavated soil and are discussed in more detail under Section 4.0. These solid waste classifications are summarized in the following text.

A "designated waste" under Title 27 CCR Section 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 Section 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 Section 20230, inert waste is that subset of 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.

2.0 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).

2.1 CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENT CONCLUSIONS BY MEDIUM

This section presents chemical-specific ARARs determination conclusions for groundwater, surface water, soil, sediment, and air at the IR17 and Building 503 Area.

2.1.1 Groundwater

Risks associated with groundwater vapors are discussed in Section 2.1.5. Other risks associated with groundwater are discussed in this section.

The shallow groundwater at Mare Island is not a potential drinking water source under EPA groundwater classification guidelines (EPA 1986), which is TBC for IR17. The shallow groundwater also does not meet the state definition of a potential drinking water source under the San Francisco Bay Regional Water Quality Control Plan (basin plan), which incorporates the definition of drinking water contained in SWRCB Resolution 88-63, a potential chemical-specific ARAR for the site. Because the shallow groundwater does not meet the definition of a potential drinking water source, the ingestion pathway is not complete and it was not evaluated in the HHRA. Further, drinking water standards, such as maximum contaminant levels, are not applicable, relevant, or appropriate requirements. The Navy is evaluating an institutional control (IC) in the form of a groundwater use restriction to prohibit the extraction and use of the groundwater as a potential municipal and domestic supply.

The human health risk assessment (HHRA) evaluated groundwater in commercial and industrial scenarios. Under these scenarios, the HHRA concluded that groundwater does not pose an unacceptable cancer or noncancer risk. Also, the ecological risk assessment (ERA) concluded that groundwater did not pose an unacceptable risk to ecological receptors.

There are no other potential chemical-specific ARARs for groundwater because the shallow groundwater is not a potential municipal and domestic supply and the groundwater does not pose unacceptable risks under commercial, industrial, or ecological scenarios.

2.1.2 Surface Water

Groundwater at the IR17 and Building 503 Area discharges to surface water in the seasonal wetland during the wet season. Groundwater modeling predicted that contaminants near the edge of the seasonal wetland will not extend appreciably into the wetland area. In addition, the seasonal wetland is dry during most of the year. During the wet season, the elevation of surface water in the wetland is higher than groundwater, so any flow would be downwards from surface water into groundwater.

The HHRA and the ERA concluded that the surface water does not pose unacceptable risks to human or ecological receptors; therefore, a remedial action for surface water is not warranted, and the requirement to meet ARARs is not triggered.

2.1.3 Soil

Risks associated with soil vapors are discussed in Section 2.1.5. Risks associated with other soil pathways are discussed in this section.

The HHRA evaluated soil in commercial, industrial, and residential scenarios. The HHRA concluded that soil posed cancer risks for all these scenarios in the risk management range or below 1×10^{-6}. The HHRA did not identify any cancer risks under any scenario at or above 1×10^{-4}. The HHRA further concluded that soil in the current site configuration for commercial and industrial scenarios posed noncancer risks at 1.1, only slightly above 1.0. There are no other noncancer risks above 1.0 for any other commercial or industrial scenario. The HHRA also concluded that noncancer risks under a residential scenario are above 1.0. Because the noncancer risks for a residential scenario are above 1.0, the Navy is evaluating an IC in the form of a land use restriction prohibiting the residential development and use of the property. In addition, pursuant to U.S. Department of Defense (DOD) guidance (DOD 2001), the Navy is evaluating an alternative that would clean up the soil to levels acceptable for unrestricted reuse and alleviate the necessity of establishing and maintaining an IC. This unrestricted use alternative is evaluated and described in detail in Appendix C. There are no potential federal or state chemical-specific ARARs for the soil.

The ERA concluded that soil does not pose any unacceptable risk to ecological receptors; therefore, no remedial action for ecological receptors is warranted, and the requirement to meet ARARs is not triggered.

In the FS, the Navy is also evaluating remedial alternatives designed to remove free product to the maximum extent practical through the excavation and treatment or off-site disposal of soil. Action-specific ARARs for the excavation and treatment or off-site disposal of soil are discussed in detail in Section 4.0.

2.1.4 Sediment

Based on the results of the fate and transport analysis, contaminant transport pathways from the upland area to the wetland are not considered significant; therefore, it is unlikely that a complete sediment exposure pathway exists in the wetland (Tetra Tech EM Inc. [Tetra Tech] 2002). As a result, the HHRA and the ERA concluded that sediments do not pose an unacceptable risk to human or ecological receptors. A remedial action is not warranted, and the requirement to meet ARARs is not triggered.

2.1.5 Air

Direct contact with groundwater is not expected, and potential exposure to chemical vapors released from groundwater to the atmosphere through the vadose zone represents the only complete exposure pathway for groundwater. Based on these exposure considerations, the complete exposure pathways identified and evaluated in the HHRA included inhalation of volatile organic compounds (VOC) released directly from soil and inhalation of VOCs from groundwater released from soil (Tetra Tech 2002).

The HHRA concluded that the inhalation of VOCs released directly from soil poses cancer risks slightly within the risk management range or below 1×10^{-6} for commercial, industrial, and

residential scenarios. The HHRA concluded that the inhalation of VOCs released from soil did pose noncancer risks above 1.0 under residential scenarios. For VOCs released from groundwater, the HHRA concluded that the cancer risks were not above 1×10^{-6} and that the noncancer risk were not above 1.0 for commercial, industrial, or residential scenarios. The Navy is evaluating an IC in the form of a land use restriction prohibiting the residential development or use of the property because of the noncancer risks posed by the soil vapors. In addition, according to DOD guidance, the Navy is evaluating an alternative that will cleanup the soil to levels acceptable for unrestricted reuse of the property and that would alleviate the necessity for establishing and maintaining an IC. This unrestricted use alternative is evaluated and explained in detail in Appendix C.

In addition, one alternative evaluates the in situ treatment technologies of multiphase extraction and thermal desorption, both of which may emit VOCs into the atmosphere. Potential ARARs associated with this air emission are discussed in Section 4.0.

2.2 DETAILED DISCUSSION OF GROUNDWATER APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The following subsection provides a detailed discussion of potential federal and state chemical-specific ARARs for groundwater.

2.2.1 Federal

One of the significant issues in identifying ARARs for groundwater under the SDWA is whether the groundwater at the site can be classified as a source of drinking water. EPA groundwater policy is set in the preamble to the NCP (Title 55 *Federal Register* 8666, 8752 through 8756 [1990]). This policy is based on 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, each groundwater system can be classified into one of three categories (Class I, II, or III) by applying criteria that assess its ecological importance, replaceability, and vulnerability. Irreplaceable groundwater that is being used by a substantial population, or groundwater that supports a vital habitat is considered to be Class I. Class II applies to groundwater that is currently being used or might be used as a source of drinking water in the future, but does not meet the criteria for Class I. 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 having a yield of less than 150 gallons per day (EPA 1986). Class III groundwater also can 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). According to the EPA classification criteria, the shallow groundwater at Mare Island is Class III groundwater.

2.2.2 State

Porter-Cologne Water Quality Control Act. The Porter-Cologne Water Quality Control Act (Porter-Cologne Act) became Division 7 of the California Water Code in 1969. The Porter-Cologne Act requires each regional board to formulate and adopt Basin Plans for all areas within the region (California Water Code Section 13240). It also requires each regional board to establish water quality objectives (WQOs) that will protect the beneficial uses of the water basin (California Water Code Section 13241). Other sections of the California Water Code pertaining to the establishment of Basin Plans are Section 13242, which provides authority for the regional boards to describe actions necessary to achieve water quality objectives, and Section 13243, which allows regional boards to specify conditions or areas where waste discharge is not permitted.

California Water Code Section 13000 is a statement of policy regarding the quality of the waters of the state. Sections 13140 through 13147 provide authority to the SWRCB to adopt policies for water quality control. The majority of the sections place requirements on the SWRCB when setting policy and requiring actions, and therefore, are not potential ARARs. Relevant sections include 13140 and 13142, which authorize the SWRCB to adopt policy regarding water quality and place requirements on the content of the SWRCB policy. Other powers and duties of the SWRCB are contained in California Water Code Section 13172, authorizing the board to classify waste and disposal sites as well as to regulate hazardous waste disposal sites.

California Water Code Sections 13260 through 13274 establish waste discharge requirements. Section 13260 requires certain persons to file waste discharge reports; Section 13263(a) prescribes waste discharge requirements for any discharge or waste to the waters of the state; Section 13267 provides authority for the Regional Boards to investigate waters within its region in establishing the basin plan and waste discharge requirements; and Section 13269 provides the RWQCBs authority for waivers for reports or compliance with requirements as long as it is not against the public interest.

Administrative enforcement and remedies for the RWQCBs are contained in California Water Code Sections 13300 through 13308. Section 13300 provides the RWQCBs with the authority to take corrective action for the violation or threat of violation of requirements prescribed by the RWQCBs or the SWRCB. Section 13304 sets for enforcement authority and an enforcement process. Section 13307 provides authority for the SWRCB and DTSC to establish policies and procedures for investigating and cleaning up a discharge of a hazardous substance.

The Navy accepts the enabling legislative provisions of Cal. Water Code §§ 13140, 13142, 13172, 13240 through 13243, 13263(a), 13267, and 13307 as potential ARARs implemented through the Basin Plan and the promulgated policies of the San Francisco RWQCB and the SWRCB.

Sections of the California Water Code that are not potential ARARs include Sections 13000, 13141, 13143 through 13147, 13260, 13300, and 13304. These sections present statements of policy, are procedural in nature, specify duties of the RWQCB or SWRCB, or provide

enforcement authority. These sections do not contain substantive environmental "standards, requirements, criteria, or limitation" (Title 40 CERCLA Section 121 [Title 42 USC Section 9621]) and are not in themselves directive in intent.

Comprehensive Water Quality Control Plan for the San Francisco Region (Basin Plan). The Navy accepts the substantive provisions in Chapters 2 and 3 of the basin plan for the San Francisco RWQCB and SWRCB Res. 88-63, incorporated into the basin plan, as potential state ARARs.

The basin plan for the San Francisco Bay Region was prepared and implemented by the RWQCB to protect and enhance the quality of the waters in the San Francisco Bay Region. The basin plan established location-specific beneficial uses and WQOs for the surface water and groundwater of the region and is the basis of the RWQCB 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 water of the region and to prevent nuisance.

Beneficial use and reuse of water are key aspects of the basin plan. Mare Island is located in the Napa-Sonoma Groundwater Basin. Each of the following beneficial use designations apply to this basin:

- Municipal and domestic supply
- Industrial process water supply
- Industrial service water supply
- Agricultural water supply
- Freshwater replenishment

Further defining the municipal and domestic supply beneficial use designation, SWRCB Res. 88-63 exempts groundwater meeting certain listed criteria from the definition of a potential municipal and domestic supply. Because the shallow groundwater falls within the exemption of a potential municipal and domestic supply, basin plan requirements applicable to water designated as a potential municipal and domestic supply are neither applicable, nor relevant and appropriate.

SWRCB Res. 68-16. SWRCB Res. 68-16, "Statement of Policy With Respect to Maintaining High Quality of Waters in California," established 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 no unreasonable 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 (a) pollution or a nuisance will not occur and (b) 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 Res. 92-49 II.F.1 (SWRCB 1992) 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."

Navy's Position Regarding SWRCB Res. 68-16. The Navy has determined that SWRCB Res. 68-16 is not a chemical-specific ARAR for determining response action goals; however, SWRCB Res. 68-16 is a potential action-specific ARAR for regulating discharged treated groundwater back into the aquifer. The Navy has determined that further migration of contaminated groundwater is not a discharge governed by the language in Res. 68-16. More specifically, the language of SWRCB Res. 68-16 indicates that it is prospective in intent, applying to new discharges to maintain existing high-quality waters. It is not intended to apply to restoration of waters that are already degraded.

State of California's Position Regarding SWRCB Res. 68-16. The state does not agree with the Navy determination that SWRCB Res. 68-16 is not a potential ARAR. SWRCB has interpreted the term "discharges" in the California Water Code to include the movement of waste from soil to groundwater and from contaminated to uncontaminated water (SWRCB 1994). The state agrees, however, that the proposed action would comply with SWRCB Res. 68-16. The state does not intend to dispute the ROD but reserves its rights to do so.

Whereas the Navy and the state of California have not agreed on whether SWRCB Res. 68-16 is a chemical-specific ARAR for this response action, this FS documents each of the parties' positions on the resolutions but does not attempt to resolve the issue.

SWRCB Res. 88-63, Adoption of Policy Entitled "Sources of Drinking Water." SWRCB Res. 88-63 established criteria to help RWQCBs 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 milligrams per liter (or electrical conductivity is greater than 5,000 microhms per centimeter) and the RWQCB does not reasonably expect the groundwater to supply a public 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.

The shallow groundwater falls within the exemption to the definition of a potential municipal and domestic supply.

NPDES Permits. The RWQCB has the authority to issue NPDES permits for site-specific discharges resulting from groundwater cleanup operations. Alternative 6 contemplates the discharge of treated groundwater. On-site CERCLA response actions are exempt from permit requirements under CERCLA 121(e); however, the Navy considers the substantive requirements of NPDES permits to be potential TBCs for complying with potential cleanup levels, such as water quality objectives in the basin plan. The RWQCB has issued general permits for the discharge of treated groundwater polluted by fuel leaks (CAG912002) and polluted by VOCs (CAG912003).

3.0 LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Potential location-specific ARARs are identified and discussed in this section. The discussions are presented based on various attributes of the site location, such as whether it is within a floodplain.

3.1 LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENT CONCLUSIONS BY RESOURCE CATEGORY

Wetlands protection and floodplain management, biological, and coastal resources are the resource categories relating to location-specific ARARs potentially affected at the IR17 and Building 503 Area.

An archeological survey found no historical or cultural resources on the site. There are no wild and scenic rivers on the site. Temporary facilities that may be constructed to store excavated soil will not be constructed within 60 meters of a Holocene fault.

The conclusions for ARARs pertaining to wetlands protection, biological, and coastal resources are presented in the following text. Table A-1 summarizes the requirements determined to be

potential federal location-specific ARARs, and Table A-2 summarizes the potential state location-specific ARARs.

3.1.1 Wetlands Protection and Floodplain Management

Because a seasonal wetland is located in the southern portion of the site, the substantive provisions of Executive Order No. 11990, codified at Title 40 CFR Section 6.302(a), are a potential location-specific ARAR.

Portions of the site are within the 100-year floodplain (Figure A-1); therefore, Executive Order No. 11988, codified at Title 40 CFR Section 6.302(b) and Title 40 CFR part 6 Appendix A Sections 6(a)(1), 6(a)(3), 6(a)(5), is a potential location-specific ARAR (Federal Emergency Management Agency 2002).

3.1.2 Biological Resources

There is viable habitat in the seasonal wetland located in the southern portion of the site. The seasonal wetland also contained potential habitat for the salt marsh harvest mouse, a federal and state endangered species; therefore, the federal Endangered Species Act (ESA) is a potential ARAR. There are no migratory birds, wildlife refuges, or other biological resources at the site.

3.1.3 Coastal Resources

The site is within the coastal zone; therefore, the federal and state Coastal Zone Management Acts (CZMA) are potential ARARs.

3.2 DETAILED DISCUSSION

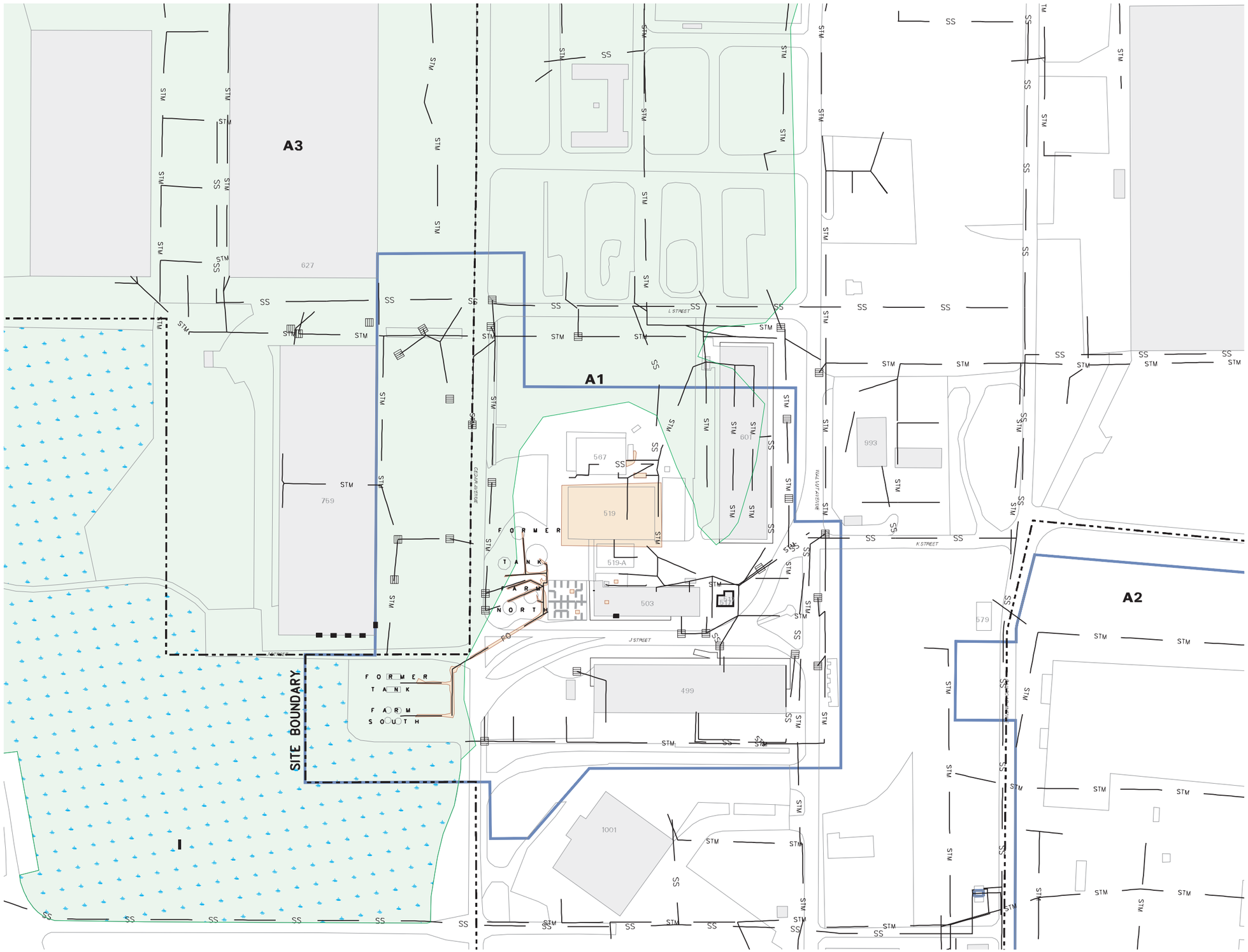
This section discusses the federal and state ARARs by location-specific resources.

3.2.1 Wetlands Protection and Floodplain Management

The federal ARARs for wetland protection and floodplain management are described in the following text. There are no state location-specific ARARs for wetland protection or floodplain management.

Protection of Wetlands, Executive Order No. 11990

Executive Order No. 11990, codified at Title 40 CFR Section 6.302(a), requires that federal agencies minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists. Because there is a seasonal wetland in the southern portion of the site, the substantive provisions of Executive Order No. 11990 are potential location-specific ARARs for the site.



LEGEND

- STORM WATER DRAIN
- STORM WATER PIPELINE
- SANITARY SEWER
- FUEL OIL PIPELINE
- 100-YEAR FLOOD PLAIN
- GROUP II/II SITE BOUNDARY
- A1 INVESTIGATION AREA BOUNDARY
- REMOVAL AREAS
- EXISTING BUILDING OR STRUCTURE
- WETLANDS/TIDAL MARSH

100 0 100 200

SCALE IN FEET

Tetra Tech EM Inc.

INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA

FIGURE A-1
100-YEAR FLOOD PLAIN
IR17 AND BUILDING 503 AREA

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11/19/02

A small portion of the plume near the southern tank farm appears to have migrated south toward the wetland under the influence of a southerly groundwater gradient in that area (Tetra Tech 2002). Based on the results of the fate and transport analysis, however, a pathway for contaminant transport from groundwater to surface water in the seasonal wetland does not appear to be complete for two reasons: (1) the seasonal wetland is dry during most of the year, and (2) during the wet season, the flow would be into groundwater, because the elevation of surface water in the wetland is higher than the groundwater table. Also, contaminant transport pathways from the upland area to the wetland are not considered significant; therefore, it is unlikely that a complete sediment exposure pathway exists in the wetland. Groundwater modeling predicted that contaminants near the edge of the seasonal wetland adjacent to the southern tank farm will not migrate appreciably into the wetland area.

The results of the screening-level ERA for the IR17 and Building 503 Area indicate the site does not pose unacceptable risk to ecological receptors; therefore, conditions at the site currently comply with Executive Order No. 11990.

The remedial actions retained for detailed analysis in this FS will also comply with this location-specific ARAR. None of them will destroy or degrade the seasonal wetland, and none of them contemplates constructing any facility within the wetland.

Clean Water Act (Title 33 USC Section 1344)

Section 404 of the Clean Water Act of 1977 governs the discharge of dredged and fill material into waters of the United States, including adjacent wetlands. Wetlands are areas that are inundated by water frequently enough to support vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mudflats, natural ponds, and similar areas. Both the EPA and the U.S. Army Corps of Engineers have jurisdiction over wetlands. EPA's Section 404 guidelines are promulgated in Title 40 CFR Section 230, and the U.S. Army Corps of Engineer's guidelines are promulgated in Title 33 CFR Section 320.

None of the remedial actions contemplates the discharge of dredged and fill material into the seasonal wetland; therefore, each remedial alternative will comply with Clean Water Act Section 404.

Floodplain Management, Executive Order No. 11988

Under Title 40 CFR Section 6.302(b), federal agencies are required to evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.

Portions of the IR17 and Building 503 Area are within a 100-year floodplain (Figure A-1). Therefore, the substantive provisions of Title 40 CFR Section 6.302(b) and Title 40 CFR Part 6,

Appendix A, Sections 6(a)(1), 6(a)(3), and 6(a)(5) are potential location-specific ARARs. These regulations require the following:

- 6(a)(1) – a determination of whether the action will be located in or affect a floodplain or wetlands
- 6(a)(3) – the preparation of a floodplain/wetlands assessment, if a proposed action is located in or affects a floodplain or wetlands, that describes the proposed action, a discussion of its effect on the floodplain/wetlands, and the alternatives considered
- 6(a)(5) – the minimization of potential harm to the floodplain or wetlands if there is no practicable alternative to locating in or affecting the floodplain or wetlands and the restoration and preservation of the natural and beneficial values of floodplains and wetlands as part of the analysis of all alternatives under consideration

The Navy will comply with this potential location-specific ARAR. Under Section 6(a)(1), the Navy has determined that alternatives 2 through 5 have components that will take place within the 100-year floodplain; for example, soil located within the 100-year floodplain will be excavated. None of the alternatives, however, contemplates the construction of a facility within the 100-year floodplain. This FS report satisfies the requirement under Section 6(a)(3) for a floodplain/wetland assessment. Pursuant to Section 6(a)(5), the Navy has determined that alternatives 2 through 5 will not harm the floodplain but instead, with the removal of free product, will restore and preserve the floodplain.

3.2.2 Biological Resources

This section describes the federal location-specific ARARs for the biological resources found at the site.

Endangered Species Act of 1973

The ESA (Title 16 USC Sections 1531 to 1543) provides a means for conserving various species of fish, wildlife, and plants threatened with extinction. The ESA 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 ESA, 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. Because consultation regulations at Title 50 CFR Section 402 are administrative in nature, they are not ARARs; however, they may be considered to comply with the substantive provisions of the ESA.

A site visit was conducted in 1998. The site visit determined that the seasonal wetland contained potential habitat for the salt marsh harvest mouse, a federal endangered species. Because of the presence of an endangered species, the federal ESA is a potential location-specific ARAR.

The results of the screening-level ERA indicate the site does not pose unacceptable risk to the salt marsh harvest mouse, its habitat, or other ecological receptors; therefore, conditions at the site currently comply with this ARAR. In addition, the remedial action alternatives retained for detailed analysis in this FS will comply with this ARAR. None of them will jeopardize or adversely affect the salt marsh harvest mouse or its critical habitat.

3.2.3 Coastal Resources

This section describes the federal and state location-specific ARARs for the coastal resources found at the site.

3.2.3.1 Federal

Coastal Zone Management Act

The CZMA (Title 16 USC Sections 1451 to 1464) specifically excludes federal lands from the coastal zone (Title 16 USC Section 1453[l]); therefore, the CZMA is not applicable to the IR17 and Building 503 Area. The CZMA will be evaluated as a potentially relevant and appropriate requirement. Section 1456(a)(1)(A) requires each federal agency activity within or outside the coastal zone that affects any land or water use or natural resource to conduct its activities in a manner that is consistent to the maximum extent practicable with enforceable policies of approved state management policies. A state coastal zone management program is developed under state law guided by the CZMA and its accompanying implementing regulations in Title 15 CFR Section 930. A state program sets objectives, policies, and standards to guide public and private uses of lands and water in the coastal zone. (See Section 3.2.3.2 for the state coastal zone management program.)

Because the site is within the coastal zone, the Navy has determined that the CZMA is a potential location-specific ARAR.

3.2.3.2 State

California Coastal Act of 1976

The California Coastal Act is codified at Public Resources Code (*California Public Resources Code*) Sections 30000 to 30900 and Title 14 CCR Sections 13001 to 13666.4. These sections regulate activities associated with development to control direct significant impacts on coastal waters and to protect state and national interests in California coastal resources. Since federal lands are specifically excluded from the definition of coastal zone, the California Coastal Act is not applicable to the IR17 and Building 503 Area but is evaluated further as a potentially

relevant and appropriate requirement. The California Coastal Act policies set forth in the act constitute the standards used by the California Coastal Commission in its coastal development permit decisions and for the review of local coastal programs. These policies contain the following substantive requirements:

- Protection and expansion of public access to the shoreline and recreation opportunities (*California Public Resources Code* Sections 30210 to 30224)
- Protection, enhancement, and restoration of environmentally sensitive habitats, including intertidal and nearshore waters, wetland, bays and estuaries, riparian habitat, grasslands, streams, lakes, and habitat for rare or endangered plants or animals (*California Public Resources Code* Sections 30230 to 30240)
- Protection of productive agricultural lands, commercial fisheries, and archaeological resources (*California Public Resources Code* Sections 30234 to 30244)
- Protection of the scenic beauty of coastal landscapes (*California Public Resources Code* Section 30251)
- Provisions for expansion, in an environmentally sound manner, of existing industrial ports and electricity-generating power plants (*California Public Resources Code* Section 30264)

Because the IR17 and Building 503 Area is within the coastal zone, the Navy has determined that the substantive provisions of the California Coastal Act, codified at *California Public Resources Code* Section 30230 to 30240, are potential location-specific ARARs. The conditions at the site currently comply with these potential ARARs because it has been determined that the release of free product has not harmed the seasonal wetland or any of the habitats or other ecological receptors associated with the seasonal wetland (Tetra Tech 2002). In addition, all alternatives will comply with this ARAR because they will not be conducted in or affect the seasonal wetland and they will remove free product, which will further reduce any affects to the seasonal wetland, its habitats, and its inhabitants.

4.0 ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The FS report evaluated remedial action alternatives for the release of free product at the IR17 and Building 503 Area. This ARAR analysis is based on the following six alternatives:

- Alternative 1: No Action
- Alternative 2: Construction of Extraction Trenches, Use of Skimmer Pumps, and Institutional Controls

- Alternative 3: Installation of Extraction Wells, Periodic Vacuum Extraction, and Institutional Controls

- Alternative 4: Soil Excavation, Bioremediation, Backfilling with Treated Soil, and Institutional Controls

- Alternative 5: Soil Excavation, Off-Site Disposal, Backfilling with Clean Soil, and Institutional Controls

- Alternative 6: Multiphase Extraction, In Situ Thermal Desorption, and Institutional Controls

Table A-3 summarizes and evaluates federal potential action-specific ARARs for the site. Potential state action-specific ARARs may be identified at a later date. The ARARs determined to be pertinent to each alternative being evaluated for the site are discussed in this section. A discussion of how the alternative complies with each identified ARAR is also provided.

4.1 ALTERNATIVE 1: NO ACTION

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 Section 9621[e]). CERCLA Section 121 (Title 42 USC Section 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). A discussion of compliance with action-specific ARARs is not, therefore, appropriate for this alternative.

4.2 ALTERNATIVE 2: CONSTRUCTION OF EXTRACTION TRENCHES, USE OF SKIMMER PUMPS, AND INSTITUTIONAL CONTROLS

This alternative comprises trenching to a depth of 8 feet below ground surface in each of the four areas where the presence of free product has been inferred. At the low point of each trench, a skimmer pump will collect the free product on the surface of the groundwater in the trench. Soil excavated from the trenches and collected free product will be temporarily stored on site in drums. Subsequently, the soil and free product will be disposed of or recycled off site. After the skimming is complete, samples will be collected from groundwater monitoring wells already located at the IR17 and Building 503 Area to confirm the removal of free product. Once the removal of free product to the maximum extent practicable is complete and confirmed, institutional controls in the form of use restrictions will restrict the residential use and development of the IR17 and Building 503 Area and will restrict the extraction and use of the groundwater as a potential municipal and domestic supply. The federal and state action-specific ARARs for alternative 2 are discussed in the following sections.

4.2.1 Federal

Removal of Free Product and Groundwater Monitoring

In June 2002, free product was detected in well 17W15, and trace amounts of free product were detected in well 17W12. The source of the free product was most likely the ASTs removed from the site in the 1960s. No federal regulations relate to the removal of free product released from ASTs. Federal regulations for the removal of free product released from USTs are codified at Title 40 CFR Section 280.64. Because the release of free product did not occur from USTs, these regulations are not applicable; however, the Navy evaluated these regulations for relevance and appropriateness against the criteria contained in Title 40 CFR Section 300.400(g)(2). Based on that criteria, the Navy determined that relevant portions of these regulations are potential federal action-specific ARARs for the cleanup of free product. The following regulations are potential action-specific ARARs:

- Title 40 CFR Section 280.12 defines free product as a regulated substance present as a nonaqueous-phase liquid (for example, liquid not dissolved in water).
- Title 40 CFR Section 280.64 requires removal of free product to the maximum extent practicable.
- Title 40 CFR Section 280.64(a) requires that the removal of free product be conducted in a manner that minimizes the spread of contamination into previously uncontaminated zones by using techniques appropriate to the hydrogeologic conditions at the site.
- Title 40 CFR Section 280.64(b) requires the use of abatement of free product migration as a minimum objective for the design of the free product removal system.

Alternative 2 complies with these potential action-specific ARARs because it will remove free product to the maximum extent practical, as confirmed by sampling groundwater in existing groundwater monitoring wells. Alternative 2 is appropriate for the hydrogeologic conditions at the site because it takes into account the heterogeneous nature of the soil and the lateral dispersion of the free product by increasing the capture zone. By free product, alternative 2 will abate free product migration.

Temporary Storage and Off-Site Disposal of Excavated Soil and Skimmed Free Product

Other potential action-specific ARARs for the temporary storage and off-site disposal of skimmed free product described in this alternative are contained in Title 22 CCR Section 66264.553. These regulations are part of California's RCRA program approved by EPA on July 23, 1992 (Title 57 *Federal Register* 32726 [1992]), and, therefore, are potential federal action-specific ARARs. Because it has not been determined that the soil excavated from the trenches and the free product meet the definition of RCRA hazardous wastes, these regulations are not applicable. Using the relevant and appropriate criteria listed in Title 40 CFR 300.400(g)(2),

however, the Navy has determined that these regulations are relevant and appropriate. The following specific regulations under this section are potential federal action-specific ARARs:

- Title 22 CCR Section 66264.553(b) requires temporary units to be located within the facility boundary and to be used only for treatment or storage of remediation wastes.
- Title 22 CCR Section 66264.553(c) presents standards to be considered in the temporary unit design.
- Title 22 CCR Section 66264.553(d) requires the temporary unit to operate for no more than 1 year and to have design, operating, and closure requirements.
- Title 22 CCR Section 66264.553(e) allows the 1 year operational period to be extended for an additional year.

This alternative will comply with these regulations. The temporary units will be 55-gallon drums placed inside 85-gallon overpack drums to provide for secondary containment. The drums will be located on the areas where the skimming will take place, and they will have a cover that will be closed when the drums are not in use. Full drums storing the free product will not be kept on site for more than 90 days in accordance with Title 22 CCR Section 66262.34. Upon completion of skimming, the drums will be disposed of off site at an appropriate landfill no later than 1 year after initial use of these temporary units. If the Navy determines that the soil excavated from the trenches or the recovered free product meets the definition of RCRA hazardous waste, the Navy will determine whether the soil or the free product is subject to the RCRA LDRs. If the soil or the free product is subject to the LDRs, the Navy will complete the required certifications under Title 22 CCR Section 66268.7 before off-site disposal.

Institutional Controls

There are no federal ARARs for institutional controls.

4.2.2 State

Removal of Free Product and Groundwater Monitoring

The AST requirements contained in California Health and Safety Code Sections 25270 to 25270.13 do not address removal of free product released from ASTs. The provisions of California Health and Safety Code Sections 25270 to 25270.13 are not, therefore, applicable or relevant and appropriate for the removal of free product at the IR17 and Building 503 Area.

The California UST regulations contained in Title 23 CCR Section 2655(a) are identical to the federal regulations contained in Title 40 CFR Section 280.64. Because the state requirements are less stringent than the relevant and appropriate federal requirements, Title 23 CCR Section 2655 is not a potential ARAR.

Institutional Controls

There are no state ARARs for institutional controls.

4.3 ALTERNATIVE 3: INSTALLATION OF EXTRACTION WELLS, PERIODIC VACUUM EXTRACTION, AND INSTITUTIONAL CONTROLS

This alternative consists of the installation of free product extraction wells, vacuum truck removal of free product, groundwater monitoring to confirm removal of free product to the maximum extent practicable, and institutional controls. The institutional controls would be in the form of use restrictions prohibiting the residential use or development of the IR17 and Building 503 Area and prohibiting the extraction and use of the groundwater as a potential municipal and domestic supply. The federal and state action-specific ARARs for Alternative 3 are discussed in the following sections.

4.3.1 Federal

Removal of Free Product and Groundwater Monitoring

The potential federal action-specific ARARs for removal of free product and groundwater monitoring are discussed in Section 4.2.1.

Installation of Free Product Extraction Wells

RCRA requirements for identification and management of solid and hazardous wastes are also potential federal action-specific ARARs identified for this alternative. The key threshold question for soil ARARs is whether the wastes located at the IR17 and Building 503 Area would be classified as hazardous waste. 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 soil is determined to be hazardous waste, the appropriate requirements will apply. Soil cuttings and water generated during installation and development of monitoring wells would be subject to RCRA requirements at Title 22 CCR Sections 66262.10(a) and 66262.11 to determine whether such wastes should be classified as hazardous.

The federal RCRA requirements at Title 40 CFR Part 261 do not apply in California because the state RCRA program is authorized. The authorized state RCRA requirements are, therefore, considered potential federal ARARs (Section 1.3.1). The applicability of RCRA requirements depends on (1) whether the waste is a RCRA hazardous waste; (2) whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement; and (3) whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. 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 a RCRA hazardous waste can be made by comparing the site waste with the definition of RCRA hazardous waste. The RCRA requirements at Title 22 CCR Sections 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 using the toxicity characteristic leaching procedure (TCLP). The maximum concentrations allowable for the TCLP listed in Section 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 (Section 1.3.1).

RCRA LDRs at Title 22 CCR Section 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 Section 66268.40 and the underlying hazardous constituents meet the Universal Treatment Standards at Title 22 CCR Section 66268.48, or (2) it is treated to meet the alternative soil treatment standards of Title 22 CCR Section 66268.49, or (3) a treatability variance is obtained under Title 22 CCR Section 66268.44. These are potentially applicable federal ARARs because they are part of the state-approved RCRA program.

State RCRA requirements included within the EPA-authorized RCRA program for California are considered to be potential federal ARARs and are discussed previously. 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 (Title 57 *Federal Register* 60848). 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.

The site waste characteristics should be compared with the definition of non-RCRA, state-regulated hazardous waste. The non-RCRA, state-regulated waste definition requirements at Title 22 CCR Section 66261.24(a)(2) are potential state ARARs for determining whether other RCRA requirements are potential state ARARs. This section lists the TTLCs and STLCs. Site waste may be compared with these thresholds to determine whether it meets the characteristics for a non-RCRA, state-regulated hazardous waste.

The Navy has determined that soil and well development water at the IR17 and Building 503 Area would not be classified as RCRA-listed hazardous wastes; however, testing would still be required to classify these materials with respect to the RCRA hazardous waste characteristics. This determination would be made at the time the waste is generated. It is unlikely that the soil and well development water will meet the definition of a RCRA characteristic waste. If it is determined that it meets the definition of a RCRA hazardous waste, however, pretransport requirements relating to packaging (Title 22 CCR Section 66262.30), labeling (Title 22 CCR Section 66262.31), marking (Title 22 CCR Section 66262.32), and placarding (Title 22 CCR Section 66262.33) would be applicable. If it is determined that the soil and well development water is not a RCRA hazardous waste, these requirements would not be applicable or relevant

and appropriate. Instead, soil and well development water would be handled and disposed of as nonhazardous waste.

Institutional Controls

There are no federal ARARs for institutional controls.

4.3.2 State

Removal of Free Product and Groundwater Monitoring

The potential state action-specific ARARs for removal of free product and groundwater monitoring are discussed in Section 4.2.2.

Installation of Free Product Extraction Wells

If soil and well development water generated during installation and development of the free product extraction wells is determined not to be a RCRA characteristic waste, a determination will be made as to whether soil and well development water is subject to solid waste classifications at Title 27 CCR Sections 20210, 20220, and 20230 to determine the applicability of waste management requirements. These classifications will then determine the proper method of disposal of the soil and well development water.

Institutional Controls

There are no state ARARs for institutional controls.

4.4 ALTERNATIVE 4: SOIL EXCAVATION, BIOREMEDIATION, BACKFILLING WITH TREATED SOIL, AND INSTITUTIONAL CONTROLS

This alternative comprises the excavation of the top 8 feet of soil from each of the four areas where the presence of free product has been inferred. Excavated soil will be placed in a temporary unit in each area. The temporary unit will sit on a constructed concrete pad with a 60-mil high-density polyethylene bottom liner, then it will be covered with another liner to prevent offgas emissions from the unit. A perforated pipe will be placed in the unit to supply low-pressure air to the soil. Additional perforated pipes will be placed in the unit to extract soil vapors. Extracted vapors will be treated by a carbon adsorption unit. Upon completion of treatment, when the benzene, toluene, ethylbenzene, and xylenes reach EPA Region IX industrial preliminary remediation goals that will be used to indicate the removal of free product has been successfully achieved, the soil will be transported back to the excavated areas and backfilled. Institutional controls in the form of use restrictions prohibiting the residential use or development of the property and prohibiting the extraction and use of the groundwater as a

potential municipal and domestic supply will be used. The federal and state action-specific ARARs for Alternative 4 are discussed in the following sections.

4.4.1 Federal

Removal of Free Product and Groundwater Monitoring

Potential federal action-specific ARARs for removal of free product are discussed in Section 4.2.1.

Under this alternative, existing groundwater monitoring wells will be removed, and new groundwater monitoring wells will be installed to confirm that the free product has been removed. Regulations associated with installation of new groundwater monitoring wells were evaluated as potential action-specific ARARs. RCRA requirements for identification and management of solid and hazardous wastes are potential federal action-specific ARARs identified for this alternative (Section 4.3.1). Soil cuttings and water generated during installation and development of the monitoring wells would be subject to RCRA requirements at Title 22 CCR Sections 66262.10(a) 66262.11, and 66264.13(a) and (b) to determine whether such wastes should be classified as hazardous.

The Navy determined that soil and well development water at the IR17 Building 503 Area would not be classified as RCRA-listed hazardous wastes; however, testing would still be required to classify these materials with respect to the RCRA hazardous waste characteristics. This determination would be made at the time the waste in generated. It is unlikely that soil and well development water will meet the definition of a RCRA characteristic waste; however, if it is determined that it meets the definition of a RCRA hazardous waste, pretransport requirements relating to packaging (Title 22 CCR Section 66262.30), labeling (Title 22 CCR Section 66262.31), marking (Title 22 CCR Section 66262.32), and placarding (Title 22 CCR Section 66262.33) would be applicable. If it is determined that soil and well development water is not a RCRA hazardous waste, these requirements would not be applicable or relevant and appropriate. Instead, soil and well development water would be handled and disposed of as nonhazardous waste.

Bioremediation

Potential federal action-specific ARARs for bioremediation are contained in Title 22 CCR Section 66264.553, the temporary unit regulations. These regulations allow alternative design, operating, and closure standards for temporary treatment or storage of remediation waste in tanks. Under Title 22 CCR Section 66264.553, the following regulations are potential action-specific ARARs:

- Title 22 CCR Section 66264.553(b) requires the temporary unit be located within the facility boundary and used only for treatment or storage of remediation wastes.

- Title 22 CCR Section 66264.553(c) presents standards to be considered in the design of the temporary unit.

- Title 22 CCR Section 66264.553(d) requires the DTSC to specify the alternative design, operating, and closure standards and the length of time the temporary unit will be allowed to operate in the permit.

- Title 22 CCR Section 66264.553 (d)(1) requires that temporary units must be designed to facilitate a reliable, effective, and protective remedy; prevent or minimize releases of hazardous wastes and hazardous constituents into the environment; minimize or adequately control cross-media transfer, as necessary, to protect human health and the environment; and to not operate for more than 2 years except when granted an operating term extension.

- Title 22 CCR Section 66264.553(e) allows the length of time the temporary unit is operational to be extended up to one additional year.

The Navy is not required under CERCLA to obtain a permit for the temporary tank it is contemplating under this alternative. The Navy would use the permit requirements as TBCs for complying with the requirements under Title 22 CCR Section 66264.553(b), (c), (d), and (e).

These regulations apply to the temporary treatment of RCRA hazardous remediation waste. The Navy has not concluded that the excavated soil meets the definition of a RCRA hazardous waste; therefore, these regulations are not applicable. The Navy has determined that, based on the criteria listed in Title 40 CFR Section 300.400(g), these regulations are relevant and appropriate.

The Navy has determined that replacing the treated soil is not subject to LDRs. LDRs are triggered when there is the placement of a restricted hazardous waste. Placement does not occur when wastes are moved within a single area of concern (EPA 1989). Areas of concern are delineated by the areal extent or boundary of contiguous contamination. Since each temporary unit will be placed within the areas of concern, there is no placement of a potentially restricted hazardous waste.

Other potential federal action-specific ARARs for the temporary units are contained in the BAAQMD regulations. The potential ARARs are presented as follows:

- 8-40-110 exempts calculations of aeration volume under Section 8-40-204 for covered storage units.

- 8-40-304 requires active storage units of contaminated soil to be kept visibly moist by water spray, treated with a vapor suppressant, or covered with continuous heavy-duty plastic sheeting or other cover to minimize emissions of organic compounds to the atmosphere.

- 8-40-306.1 requires all exposed contaminated soil surfaces above existing grade level to be kept visibly moist, treated, or covered.

- 8-40-306.3 requires contaminated soil be stockpiled separately from soil that is not contaminated.

- 8-40-306.4.3 requires treatment of contaminated soil to begin within 45 days after excavation.

- 8-40-306.6 requires all exposed surfaces to be kept moist, treated, or covered during backfilling.

- Regulation 6-301: regulates emissions that are as dark or darker than Number 1 on the Ringelmann Chart.

- Regulation 6-302: prohibits emissions with opacities equal to or greater than 20 percent for a period aggregating more than 3 minutes in any hour of emission.

- Regulation 6-305: prohibits the emissions of visible particles in sufficient number to cause annoyance.

The temporary units will comply with the potential action-specific ARARs. The temporary units will be covered, will not be stockpiled with or on uncontaminated soil, and will begin treatment within 45 days of excavation.

Institutional Controls

There are no federal ARARs for institutional controls.

4.4.2 State

Removal of Free Product and Groundwater Monitoring

The potential state action-specific ARARs for removal of free product are discussed in Section 4.2.1. Under this alternative, the Navy will remove existing groundwater monitoring wells and install new groundwater monitoring wells to confirm that free product has been removed; therefore, state regulations associated with installation of new groundwater monitoring

wells were evaluated as potential action-specific ARARs. If soil and well development water generated during installation and development of the free product extraction wells is determined not to be a RCRA characteristic waste, a determination will be made as to whether soil and well development water is subject to solid waste classifications at Title 27 CCR Sections 20210, 20220, and 20230 to determine the applicability of waste management requirements. These classifications will then determine the proper method of disposal of soil and well development water.

Institutional Controls

There are no state ARARs for institutional controls.

4.5 ALTERNATIVE 5: SOIL EXCAVATION, OFF-SITE DISPOSAL, BACKFILLING WITH CLEAN SOIL, AND INSTITUTIONAL CONTROLS

This alternative consists of the excavation and off-site disposal of the top 8 feet of soil. Institutional controls in the form of use restrictions prohibiting the residential use or development of the property and prohibiting the extraction and use of the groundwater as a potential municipal and domestic water supply will be used. The federal and state action-specific ARARs for Alternative 5 are discussed in the following sections.

4.5.1 Federal

Removal of Free Product and Groundwater Monitoring

Potential federal action-specific ARARs for removal of free product and groundwater monitoring are discussed in Section 4.2.1.

Off-Site Disposal of Soil

Potential federal action-specific ARARs include Title 22 CCR Sections 66261.21 through 66261.24 and require that excavated soil be sampled to determine whether it is a RCRA characteristic hazardous waste. If the excavated soil is determined to be a RCRA characteristic hazardous waste, the following are potential federal action-specific ARARs:

- Title 22 CCR Section 66262.34 allows for on-site accumulation of hazardous waste for up to 90 days if the waste is stored in containers.
- Title 22 CCR Sections 66264.171, 66264.172, 66264.173, and 66264.174 require containers be maintained in good condition, be compatible with the hazardous waste to be stored, be closed during storage except to add or remove waste, and be inspected weekly for deterioration.

- Title 22 CCR Sections 66264.175(a) and (b) require containers be placed on a sloped, crack-free base and protected from contact with accumulated liquid and the timely removal of spilled or leaked wastes.

- Title 22 CCR Sections 66262.30, 66262.31, 66262.32, and 66262.33 require proper packaging, labeling, marking, and placarding.

- Title 22 CCR Section 66268.1(f) prohibits the disposal of hazardous waste to land unless (1) it is treated in accordance with the treatment standards of Title 22 CCR Section 66268.40 and the underlying hazardous constituents meet the Universal Treatment Standards at Title 22 CCR Section 66268.48; (2) it is treated to meet the alternative treatment standards of Title 22 CCR Section 66268.49; or (3) a treatability variance is obtained under Title 22 CCR Section 66268.44.

The soil will then be disposed of at an appropriate landfill. If excavated soil is determined to be a RCRA characteristic hazardous waste, the Navy will determine whether it is subject to LDRs. If it is subject to LDRs, the Navy will make the required certifications under Title 22 CCR Section 66268.7.

Institutional Controls

There are no federal ARARs for institutional controls.

4.5.2 State

Removal of Free Product and Groundwater Monitoring

Potential state action-specific ARARs for removal of free product and groundwater monitoring are discussed in Section 4.2.1.

Off-Site Disposal

If excavated soil is determined not to be a RCRA characteristic waste, another determination will be made as to whether the excavated soil is subject to solid waste classifications at Title 27 CCR Sections 20210, 20220, and 20230 to determine the applicability of waste management requirements. These classifications will then determine the proper method of disposal of the soil.

Institutional Controls

There are no state ARARs for institutional controls.

4.6 ALTERNATIVE 6: MULTIPHASE EXTRACTION, IN SITU THERMAL DESORPTION, AND INSTITUTIONAL CONTROLS

Alternative 6 contemplates the use of two different types of in situ treatment technologies based on the varying conditions present at the different locations of the site. In the area north of Building 503 and the southern tank farm, the Navy will install heater wells and heating elements. Vacuum extraction wells will then be installed to collect and remove the VOC vapor and liquid processed through the heating elements. The VOC vapors will be treated through a catalytic oxidation unit, and the liquids will be collected and disposed of off site. In the utility corridor, the Navy will install extraction wells, collect and remove the VOC vapors and liquids, treat the vapors through a GAC unit, and contain the liquids in 55-gallon drums to be disposed of off site. Both the thermal desorption and soil vapor extraction operations will operate until samples collected from existing groundwater monitoring wells confirm the removal of free product to the maximum extent practicable. Institutional controls prohibiting the residential use or development of the property and prohibiting the extraction and use of the groundwater as a potential municipal and domestic supply will be used.

4.6.1 Federal

Removal of Free Product and Groundwater Monitoring

Potential federal action-specific ARARs for removal of free product and groundwater monitoring are discussed in Section 4.2.1.

Temporary Storage and Off-Site Disposal of Extracted Liquids

The potential ARARs for identification, storage, and off-site disposal of skimmed free product in Section 4.2.1 are potential ARARs for the identification, storage, and disposal of extracted liquids under this alternative.

Installation of Heater Wells and Vacuum Extraction Wells

The installation of these wells will generate soil cuttings and water. The potential ARARs discussed in Section 4.3.1, Installation of Free Product Extraction Wells, are potential ARARs for the installation of these wells.

Treatment of Soil by In Situ Thermal Desorption

Potential federal action-specific ARARs for thermal desorption are as follows:

- Title 22 CCR Section 66265.13 requires a waste analysis.

- Title 22 CCR Section 66265.370 requires that owners or operators of facilities that thermally treat hazardous waste in devices other than enclosed devices using controlled flame combustion comply with Article 16.

- Title 22 CCR Section 66265.373 requires the owner or operator to bring his thermal treatment process to steady state conditions of operation before adding hazardous waste.

- 22 CCR Section 66265.375 requires a waste analysis under section 66264.13 and requires a waste analysis to determine (1) the heating value of the waste; (2) halogen content and sulfur content in the waste; and (3) concentration of lead and mercury in the waste, unless the owner or operator has written, documented data that show that the element is not present.

- Title 22 CCR Section 66265.377 requires monitoring and inspections.

- Title 22 CCR Section 66265.381 presents closure requirements.

Air Emission Control and Monitoring

Potential federal action-specific ARARs for air emission control and monitoring of VOC vapors, such as through the use of a catalytic oxidation unit or a GAC unit, are contained in the BAAQMD regulations. Potential ARARs are as follows:

- 8-47-301 requires MPE operations that emit benzene, vinyl chloride, perchloroethene, methylene chloride, and trichloroethene to be vented to a control device, which reduces emission to the atmosphere by at least 90 percent by weight.

- 8-47-302 requires any MPE extraction operation with a total organic compound emission greater than 15 pounds per day to be vented to a control device, which reduces the total organic compound emissions to the atmosphere be at least 90 percent by weight.

- 8-47-401 requires operations at SARA sites to notify the air pollution control officer of the intent to operate.

- 8-47-603 requires emissions of organic compounds to be measured as specified in (1) BAAQMD Manual of Procedures, Volume IV, ST-7 or (2) EPA Method 25 or 25A.

Disposal of Equipment Used in the Thermal Desorption and MPE Operations

The Navy will make the determination of whether equipment used in the thermal desorption and MPE operations meets the definition of a RCRA hazardous waste at the time of unit disposal. Potential federal action-specific ARARs for the identification of the equipment as a hazardous waste and off-site disposal of the equipment are the same as discussed in Section 4.2.1 for the off-site disposal of skimmed free product.

Institutional Controls

There are no federal ARARs for institutional controls.

4.6.2 State

There are no potential state action-specific ARARs for Alternative 6.

5.0 SUMMARY

Based on site-specific characterization and data information collected during several site investigations, including remedial investigations, the HHRA concluded that the risk at the site is within the risk management range and that the current conditions at the IR17 and Building 503 Area do not pose an unacceptable risk to ecological receptors. The risk to human receptors was only slightly within EPA's risk management range of 1×10^{-4} to 1×10^{-6}. Because there is no unacceptable risk posed by the site, remedial action is not warranted; however, in June 2002, free product was detected in two groundwater monitoring wells. The Navy will, therefore, act to remove the free product to the maximum extent practicable. Site-specific factors, including the hydrogeologic conditions present at the areas in which the free product was released, were the foundation on which the alternatives retained for detailed analysis in this FS were developed.

6.0 REFERENCES

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APPENDIX B
REMEDIAL ACTION ALTERNATIVE COST SUMMARY SHEETS

TABLE B-1: REMEDIAL ALTERNATIVE SUMMARY

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Remedial Alternative	Loaded Capital Cost	Loaded Annual Cost	Contingency (25%)	Total Capital Cost	Annual Cost	Periodic Cost
Alternative 1				**$0**	**$0**	**$0**
No Action	*$0*		*$0*			
No Action	$0					
Alternative 2				**$592,022**	**$129,334**	**$50,000**
Institutional Controls	*$65,190*		*$16,298*		(Years 1-5)	
Institutional Controls	$65,190					
Skimmer Pump	*$408,427*		*$102,106.80*			
Trenching and Backfill	$99,887					
Skimmer Recovery System	$129,210					
Decontamination Facitlities	$61,633					
Design	$117,696					
Operation and Maintenance		*$23,197*	*$5,799*			
O&M and Free Product Disposal		$23,197				
Monitoring		*$80,270*	*$20,068*			
Groundwater Monitoring		$80,270				
Alternative 3				**$1,683,908**	**$215,838**	**$50,000**
Institutional Controls	*$65,190*		*$16,298*		(Years 1-5)	
Institutional Controls	$65,190					
Product Recovery Wells	*$1,281,937*		*$320,484*			
Product Recovery Wells	$925,302					
Design	$356,635					
Operation and Maintenance		*$92,400*	*$23,100*			
O&M and Free Product Disposal		$92,400				
Monitoring		*$80,270*	*$20,068*			
Groundwater Monitoring		$80,270				
Alternative 4				**$2,790,900**	**$100,338**	**$50,000**
Institutional Controls	*$65,190*		*$16,298*		(Years 1-5)	
Institutional Controls	$65,190					
Biopile	*$2,167,529*		*$541,882*			
Excavation and Backfill	$752,100					
Load and Haul (to biopile)	$33,586					
Biopile	$835,991					
Carbon Adsorption (Vapor)	$98,759					
Load and Haul (to backfill)	$33,586					
Decontamination Facitlities	$76,385					
Design	$337,122					
Operation and Maintenance		*$0*	*$0*			
O&M		$0				
Monitoring		*$80,270*	*$20,068*			
Groundwater Monitoring		$80,270				

TABLE B-1: REMEDIAL ALTERNATIVE SUMMARY (Continued)
Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Remedial Alternative	Loaded Capital Cost	Loaded Annual Cost	Contingency (25%)	Total Capital Cost	Annual Cost	Periodic Cost
Alternative 5				**$2,071,361**	**$100,338**	**$50,000**
Institutional Controls	*$65,190*		*$16,298*		(Years 1-5)	
Institutional Controls	$65,190					
Excavation and Off-Site Disposal	*$1,591,899*		*$397,975*			
Excavation and Backfill	$746,339					
Offsite Transportation and Disposal	$534,295					
Decontamination Facitlities	$76,385					
Design	$234,880					
Operation and Maintenance		*$0*	*$0*			
O&M		$0				
Monitoring		*$80,270*	*$20,068*			
Groundwater Monitoring		$80,270				
Alternative 6				**$3,150,962**	**$311,078**	**$50,000**
Institutional Controls	*$65,190*		*$16,298*		(Years 1-2)	
Institutional Controls	$65,190				**$100,338**	
					(Years 3-5)	
Thermal Desorption & Multiphase Extraction	*$2,455,580*		*$613,895*			
Thermal Desorption and Multiphase Extraction	$2,063,512					
Design	$392,067					
Operation and Maintenance		*$116,633*	*$75,811*			
O&M and Free Product Disposal		$116,633				
Monitoring		*$94,907*	*$23,727*			
Monitoring		$94,907				

Notes:

Distibutive costs for project management, field office, health and safety, quality control are included in each line item.

Periodic costs are for conducting a five year review of the remedy.

Design Costs includes planning, construction oversight, reporting, drawings, permitting, and public notice labor costs.

All costs inflated 1.0404 percent to bring costs into 2004 dollars.

TABLE B-2: PRESENT VALUE SUMMARY

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

No Action

Alternative 1					
Year	Capital Costs ($)	Annual O&M Costs ($)	Periodic Costs ($)	Total Annual Cost ($)	Present Value at 3.9% ($)
0	$0	$0	$0	$0	$0
1	$0	$0	$0	$0	$0
2	$0	$0	$0	$0	$0
3	$0	$0	$0	$0	$0
4	$0	$0	$0	$0	$0
5	$0	$0	$0	$0	$0
Total	**$0**	**$0**	**$0**	**$0**	**$0**

Trenching, Skimmer Pump, and Institutional Controls

Alternative 2					
Year	Capital Costs ($)	Annual O&M Costs ($)	Periodic Costs ($)	Total Annual Cost ($)	Present Value at 3.9% ($)
0	$592,022	$0	$0	$592,022	$592,022
1	$0	$129,334	$0	$129,334	$124,480
2	$0	$129,334	$0	$129,334	$119,807
3	$0	$129,334	$0	$129,334	$115,310
4	$0	$129,334	$0	$129,334	$110,982
5	$0	$129,334	$50,000	$179,334	$148,111
Total	**$592,022**	**$646,672**	**$50,000**	**$1,288,694**	**$1,210,711**

Product Recovery Wells, VAC Truck Extraction, and Institutional Controls

Alternative 3					
Year	Capital Costs ($)	Annual O&M Costs ($)	Periodic Costs ($)	Total Annual Cost ($)	Present Value at 3.9% ($)
0	$1,683,908	$0	$0	$1,683,908	$1,683,908
1	$0	$215,838	$0	$215,838	$207,736
2	$0	$215,838	$0	$215,838	$199,938
3	$0	$215,838	$0	$215,838	$192,434
4	$0	$215,838	$0	$215,838	$185,210
5	$0	$215,838	$50,000	$265,838	$219,553
Total	**$1,683,908**	**$1,079,189**	**$50,000**	**$2,813,097**	**$2,688,779**

TABLE B-2: PRESENT VALUE SUMMARY (Continued)

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Excavation, Biopile, and Institutional Controls

Alternative 4

Year	Capital Costs ($)	Annual O&M Costs ($)	Periodic Costs ($)	Total Annual Cost ($)	Present Value at 3.9% ($)
0	$2,790,900	$0	$0	$2,790,900	$2,790,900
1	$0	$100,338	$0	$100,338	$96,571
2	$0	$100,338	$0	$100,338	$92,947
3	$0	$100,338	$0	$100,338	$89,458
4	$0	$100,338	$0	$100,338	$86,100
5	$0	$100,338	$50,000	$150,338	$124,162
Total	**$2,790,900**	**$501,689**	**$50,000**	**$3,342,588**	**$3,280,138**

Excavation, Disposal, and Institutional Controls

Alternative 5

Year	Capital Costs ($)	Annual O&M Costs ($)	Periodic Costs ($)	Total Annual Cost ($)	Present Value at 3.9% ($)
0	$2,071,361	$0	$0	$2,071,361	$2,071,361
1	$0	$100,338	$0	$100,338	$96,571
2	$0	$100,338	$0	$100,338	$92,947
3	$0	$100,338	$0	$100,338	$89,458
4	$0	$100,338	$0	$100,338	$86,100
5	$0	$100,338	$50,000	$150,338	$124,162
Total	**$2,071,361**	**$501,689**	**$50,000**	**$2,623,050**	**$2,560,599**

In Situ Thermal Desorption, Multiphase Extraction, and Institutional Controls

Alternative 6

Year	Capital Costs ($)	Annual O&M Costs ($)	Periodic Costs ($)	Total Annual Cost ($)	Present Value at 3.9% ($)
0	$3,150,962	$0	$0	$3,150,962	$3,150,962
1	$0	$311,078	$0	$311,078	$299,401
2	$0	$311,078	$0	$311,078	$288,163
3	$0	$100,338	$0	$100,338	$89,458
4	$0	$100,338	$0	$100,338	$86,100
5	$0	$100,338	$50,000	$150,338	$124,162
Total	**$3,150,962**	**$923,169**	**$50,000**	**$4,124,131**	**$4,038,246**

TABLE B-3: COMPARISON OF SOIL OPTIONS

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Remedial Action	Cost	Notes	
Excavation and Backfill (Southern Area)	$361,008		
Excavation and Backfill (Western Area)	$127,857		
Excavation and Backfill (Central Area)	$112,815		
Excavation and Backfill (Eastern Area)	$150,420		
Load and Haul (to treatment)	$33,586		
Load and Haul (to backfill)	$33,586		
Decontamination Facitlities	$76,385		
Design	$337,122		
Biopile			
Biopile	$835,991		
Carbon Adsorption (Vapor)	$98,759		
BIOPILE TOTAL	**$2,167,529**		$244.86
On-site Thermal Desorption #1			
Mobilization/Demobilization	$230,000	Quote from Midwest Soil Remediation, Inc.	
Thermal Desorption ($55/CY +10% subcontractor cost)	$379,369	Quote from Midwest Soil Remediation, Inc.	
ON-SITE THERMAL DESORPTION TOTAL #1	**$1,842,147**		$208.10
On-site Thermal Desorption #2			
Mobilization/Demobilization	$230,000		
Thermal Desorption ($130/CY+10% subcontractor cost)	$896,690	Quote from EPA CLU-IN	
ON-SITE THERMAL DESORPTION TOTAL #2	**$2,359,469**		$266.54
Off-site Disposal			
Excavation and Backfill (Southern Area)	$358,243		
Excavation and Backfill (Western Area)	$126,878		
Excavation and Backfill (Central Area)	$111,951		
Excavation and Backfill (Eastern Area)	$149,268		
Off-site Transportation and Disposal	$534,295	Quotes from Den Beste Trucking and Waste Management Altamont Landfill	
Decontamination Facitlities	$76,385		
Design	$234,880		
OFF-SITE DISPOSAL TOTAL	**$1,591,899**		$179.83

Notes: Costs presented above are loaded capital costs only. No contingency or annual costs have been incorporated into the estimate.

Alternative 1 – No Action

Alternative 2 – Construction of Extraction Trenches, Use of Skimmer Pumps, and Institutional Controls

Trenching Includes:

- Construction of trenches.
- Construction and operation of decontamination facilities

Skimmer Pump Includes:

- Installation of skimmer pumps in each newly constructed trenches
- Construction of overhead electrical distribution

Institutional Controls Include:

- Land Use Control Implementation and Certification Plan
- Environmental restrictions on deed and covenant to restrict future use of the property
- Deed filing and registration

Operation and Maintenance Includes:

- Operation of skimmer pumps
- Free product disposal

Monitoring Includes:

- Annual groundwater sampling of all existing wells
- Sample analysis reporting
- Quarterly oil-water level measurement

5-Year Review Includes:

- Preparation of report

Alternative 2
Institutional Controls

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Institutional Controls
ID: 0003
Type: None

Phase Element

Name: Institutional Controls
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: N/A
Secondary Media/Waste Type: N/A
Contaminant: None
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: User-Defined Estimate
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Includes: Land Use Control Implementation and Certification Plan ($10,000), Environmental Restrictions on Deed and Covenant to Restrict Future Use of Property ($9,000), and Deed Filing & Registration ($1,000)

Unit of Assembly	Description	Quantity	Material Measure	Labor Unit Cost	Equipment Unit Cost	Extended Unit Cost	Cost Cost
33220150	User Defined Labor Cost 01	200.00	HR	0.00	313.29	0.00	$62,658.75
						Total Technology Cost	**$62,658.75**

Alternative 2
Trenching and Backfill

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Skimmer Pump
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Trenching/Piping
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Assume: 35 CY/HR Output

Alternative 2
Trenching and Backfill

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17020201	Demolish Bituminous Road with Power Equipment	136.59	CY	0.00	32.13	10.88	$5,874.74	
17030278	3 CY, Crawler-mounted, Excavator	2,185.46	CY	0.00	1.96	2.28	$9,266.44	
17030415	Backfill with Excavated Material	2,513.30	CY	0.38	5.68	1.09	$17,970.10	
18020301	Bituminous Paving"	819.56	SY	6.69	1.03	0.00	$6,327.00	
99010102	Site Project Manager - Average Cost	3.10	MWK	0.00	3,724.16	0.00	$11,627.25	
99010202	Superintendent - Average Cost	3.10	MWK	0.00	3,489.34	0.00	$10,894.12	
99010301	Clerk - Average Cost	1.60	MWK	0.00	728.58	0.00	$1,137.36	
99010402	Field Engineer - Average Cost	6.20	MWK	0.00	2,284.38	0.00	$14,264.19	
99010702	Safety Engineer - Average Cost	3.10	MWK	0.00	2,690.14	0.00	$8,398.92	
99010802	Quality Control - Average Cost	3.10	MWK	0.00	2,690.14	0.00	$8,398.92	
99040102	Temporary Office 32' x 8'	1.00	MO	301.03	0.00	0.00	$301.03	
99040201	Temporary Storage Trailer 16' x 8'	1.00	MO	98.47	0.00	0.00	$98.47	
99040501	Portable Toilets - Chemical	1.00	MO	100.82	0.00	0.00	$100.82	
20020301	1/0 ACSR Conductor	318.00	LF	0.25	0.92	0.08	$397.50	
20020310	1/C #2 Aluminum, Bare, Wire	106.00	LF	0.19	0.89	0.08	$122.96	
20039902	4’ Rigid Steel Conduit	30.00	LF	11.09	14.29	0.00	$761.40	
33420101	Electrical Charge	843.00	KWH	0.08	0.00	0.00	$67.44	
						Total Technology Cost	**$96,008.66**	

Alternative 2
Skimmer Recovery System

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Skimmer Pump
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Free Product Removal
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Assume Task Duration is 4 WK.

Alternative 2
Skimmer Recovery System

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
20020301	1/0 ACSR Conductor	3,180.00	LF	0.27	1.21	0.07	$4,900.92	
20020310	1/C #2 Aluminum, Bare, Wire	1,060.00	LF	0.20	1.17	0.07	$1,518.57	
20020403	40' Class 3 Treated Power Pole	5.00	EA	396.40	681.60	57.27	$5,676.34	
20020420	Straight-line Structure, 5 KV Pole Top	4.00	EA	135.43	614.21	51.61	$3,204.97	
20020430	Terminal Structure, 5 KV Pole Top	2.00	EA	1,530.63	2,330.65	195.83	$8,114.22	
20020545	5 KV, 1/0 to 4/0 Conductor, Terminations & Splicing	6.00	EA	590.79	464.45	0.00	$6,331.45	
20039902	4" Rigid Steel Conduit	40.00	LF	11.71	18.71	0.00	$1,216.79	
33109656	550 Gallon Single-wall Steel Aboveground Tank	1.00	EA	1,144.21	1,048.15	0.00	$2,192.36	
33230804	Product Recovery Pump, 2" Oil Skimmer, 360 GPD, Controls & Compressor, Pneumatic	4.00	EA	3,952.29	951.53	0.00	$19,615.28	
33260101	1" Carbon Steel Piping	82.00	LF	1.15	7.38	0.30	$723.37	
33420101	Electrical Charge	1,080.00	KWH	0.08	0.00	0.00	$90.65	
99010102	Site Project Manager - Average Cost	4.00	MWK	0.00	3,724.16	0.00	$14,896.66	
99010202	Superintendent - Average Cost	4.00	MWK	0.00	3,489.34	0.00	$13,957.35	
99010301	Clerk - Average Cost	2.00	MWK	0.00	728.58	0.00	$1,457.16	
99010402	Field Engineer - Average Cost	8.00	MWK	0.00	2,284.38	0.00	$18,275.03	
99010702	Safety Engineer - Average Cost	4.00	MWK	0.00	2,690.14	0.00	$10,760.57	
99010802	Quality Control - Average Cost	4.00	MWK	0.00	2,690.14	0.00	$10,760.57	

Alternative 2
Skimmer Recovery System

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
99040102	Temporary Office 32' x 8'	1.00	MO	301.03	0.00	0.00	$301.03	
99040201	Temporary Storage Trailer 16' x 8'	1.00	MO	98.47	0.00	0.00	$98.47	
99040501	Portable Toilets - Chemical	1.00	MO	100.82	0.00	0.00	$100.82	
						Total Technology Cost	**$124,192.56**	

Alternative 2
Decontamination Facilities

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Skimmer Pump
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Decontamination Facilities
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Assume: Facility construction duration is 1 WK
Decon duration is 12 WK

Alternative 2
Decontamination Facilities

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17030109	Pad Subgrade Preparation	35.56	CY	0.00	3.56	3.48	$250.24	
17030257	Cat 215, 1.0 CY, Soil, Shallow, Trenching	1.78	CY	0.00	1.11	0.98	$3.72	
17030501	Compact Subgrade, 2 Lifts	35.56	CY	0.00	0.36	0.36	$25.55	
17030510	Dry Roll Gravel, Steel Roller	106.67	SY	0.00	0.97	0.21	$125.33	
18010102	Gravel, Delivered & Dumped	14.81	CY	24.43	4.13	2.29	$456.84	
18010103	Gravel (90%) & Sand Base (10%), with Calcium Chloride 3/4 - 1 Lb/CY	14.81	CY	24.37	4.59	2.45	$465.29	
18010203	Asphalt Curb 8" W x 6" H	120.00	LF	1.73	4.84	4.62	$1,343.11	
18010310	Prime Coat	88.89	SY	0.39	0.06	0.04	$43.75	
18010312	Asphalt Wearing Course, 1 Pass (Line Item Includes 5% Waste)	19.33	TON	37.83	35.83	16.59	$1,744.48	
18020203	26" x 26", 5' Deep Area Drain with Grate	1.00	EA	1,892.91	2,148.33	38.59	$4,079.83	
19020313	5' x 5' x 5' Reinforced Concrete Sump	1.00	EA	1,818.82	3,045.40	120.04	$4,984.26	
19020604	12" x 12" CIP Concrete In-Ground Trench Drain with Metal Grate	20.00	LF	48.30	97.94	0.66	$2,938.14	
19040604	1,500 Gallon Steel Sump, Aboveground with Supports & Fittings	1.00	EA	2,007.19	1,605.84	0.00	$3,613.03	
33080503	Polymeric Liner Anchor Trench, 3' x 1.5'	144.00	LF	0.06	1.23	0.23	$218.94	
33080532	8 oz/sy Erosion Control/Drainage Filter Fabric (80 Mil)	106.67	SY	0.84	1.00	0.05	$201.69	
33080571	40 Mil Polymeric Liner, High-density Polyethylene	960.00	SF	0.34	2.10	0.24	$2,576.99	

Alternative 2
Decontamination Facilities

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33170818	1,800 PSI Pressure Washer Rental	3.00	MO	795.58	0.00	0.00	$2,386.75	
33170823	Operation of Pressure Washer, Including Water, Soap, Electricity, Labor	120.00	HR	9.94	77.03	0.00	$10,436.65	
33231306	High Sump Level Switch for Avoiding Overflow	1.00	EA	265.19	317.18	0.00	$582.37	
33260623	(2 1/2", 4") PVC Double-wall Piping, with Fittings	30.00	LF	19.57	41.54	0.00	$1,833.30	
33290401	25 GPM, 1 1/2" Discharge, Cast-iron Sump Pump	1.00	EA	2,539.37	738.59	0.00	$3,277.96	
99010102	Site Project Manager - Average Cost	1.00	MWK	0.00	3,724.16	0.00	$3,724.16	
99010202	Superintendent - Average Cost	1.00	MWK	0.00	3,489.34	0.00	$3,489.34	
99010301	Clerk - Average Cost	0.50	MWK	0.00	728.58	0.00	$364.29	
99010402	Field Engineer - Average Cost	2.00	MWK	0.00	2,284.38	0.00	$4,568.76	
99010702	Safety Engineer - Average Cost	1.00	MWK	0.00	2,690.14	0.00	$2,690.14	
99010802	Quality Control - Average Cost	1.00	MWK	0.00	2,690.14	0.00	$2,690.14	
99040102	Temporary Office 32' x 8'	0.25	MO	301.03	0.00	0.00	$75.26	
99040201	Temporary Storage Trailer 16' x 8'	0.25	MO	98.47	0.00	0.00	$24.62	
99040501	Portable Toilets - Chemical	0.25	MO	100.82	0.00	0.00	$25.20	
						Total Technology Cost	**$59,240.14**	

Alternative 2
Design

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Skimmer Pump
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Professional Labor Management
Prime Markup: 100 %
Sub Markup: 0 %

Alternative 2
Design

Element: Professional Labor Percentage

Assembly	Description	Percent	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	3.75%	0.00	25,867.25	0.00	$25,867.25	
33220139	Planning Documents Labor Cost	3.50%	0.00	24,142.77	0.00	$24,142.77	
33220140	Construction Oversight Labor Cost	3.00%	0.00	20,693.80	0.00	$20,693.80	
33220141	Reporting Labor Cost	0.50%	0.00	3,448.97	0.00	$3,448.97	
33220142	As-Built Drawings Labor Cost	0.50%	0.00	3,448.97	0.00	$3,448.97	
33220143	Public Notice Labor Cost	0.15%	0.00	1,034.69	0.00	$1,034.69	
33220144	Site Closure Activities Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
33220145	Permitting Labor Cost	5.00%	0.00	34,489.67	0.00	$34,489.67	
33220148	Other Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
					Total Element Cost	**$113,126.11**	
					Total Technology Cost	**$113,126.11**	

Alternative 2
O&M and Free Product Disposal

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Skimmer Pump
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Operations and Maintenance (12 months
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Operations and Maintenance
Templates: System Water-Fuels

Alternative 2
O&M and Free Product Disposal

Element: Treatment Train Miscellaneous

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010423	Disposable Gloves (Latex)	40.00	PAIR	0.21	0.00	0.00	$8.44	
33010425	Disposable Coveralls (Tyvek)	40.00	EA	4.42	0.00	0.00	$176.61	
33190340	Non Haz Drummed Site Waste - Load, Transp, & Landfill Disp (55-Gal Drums)	1.00	EA	202.94	0.00	0.00	$202.94	
33199921	DOT Steel Drum, 55 Gallon	1.00	EA	74.68	0.00	0.00	$74.68	
33240104	Startup Costs	1.00	LS	1,029.81	1,029.81	514.90	$2,574.52	
99020110	Annual Maintenance Materials and Labor	1.00	LS	561.29	561.29	280.65	$1,403.23	
					Total Element Cost		**$4,440.42**	

Element: Free Product Removal

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33021618	Volatile Organic Analysis (EPA 624) Water Analysis	2.00	EA	243.10	0.00	0.00	$486.19	
33021694	Total Petroleum Hydrocarbons (SW8015B), Water Analysis	2.00	EA	74.31	0.00	0.00	$148.62	
33022150	BTEX/MTBE/TVPH (EPA 8021B/8015B), Water Analysis	2.00	EA	117.03	0.00	0.00	$234.07	

Alternative 2
O&M and Free Product Disposal

Element: Free Product Removal

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33190341	Free Product Disposal	19,963.00	GAL	0.34	0.00	0.00	$6,787.42	
33220106	Staff Engineer	27.00	HR	0.00	107.38	0.00	$2899.26	
33220112	Field Technician	133.00	HR	0.00	72.59	0.00	$9654.47	
33420101	Electrical Charge	2,043.00	KWH	0.07	0.00	0.00	$133.20	
						Total Element Cost	**$19,474.35**	
						1st Year Technology Cost Subtotal	**$23,914.77**	
						Runtime Percent Cost Adjustment	**97%**	
						1st Year Technology Cost	**$23,197.33**	

Alternative 2
Groundwater Monitoring

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Monitoring
ID: 0008
Type: None

Phase Element

Name: Skimmer Pump Monitoring
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Description: 1 YR Costs

Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Monitoring (12 months only)
Prime Markup: 100 %
Sub Markup: 0 %
Comments: User Defined Analysis includes rental cost of an oil-water interface probe (assume $75/WK)
Assume: Annual sampling; Quarterly oil-water level measurement
Additional 16 hours added to field technician time and 300 miles added to car or van mileage for oil-water level measurement events.

Templates: System Water-Fuels

Alternative 2
Groundwater Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	51.00	EA	10.95	0.00	0.00	$558.57	
33020402	Decontamination Materials per Sample	51.00	EA	9.70	0.00	0.00	$494.67	
33021509	Water Quality Parameter Testing Device	1.00	WK	288.46	0.00	0.00	$288.46	
33021618	Volatile Organic Analysis (EPA 624), Water Analysis	51.00	EA	253.85	0.00	0.00	$12,946.42	
33021694	Total Petroleum Hydrocarbons (SW8015B), Water Analysis	51.00	EA	94.62	0.00	0.00	$4,825.72	
33022150	BTEX/MTBE/TVPH (EPA 8021B/8015B), Water Analysis	51.00	EA	149.02	0.00	0.00	$7,600.14	
33029501	User Defined Analysis 1	4.00	LS	100.82	0.00	0.00	$403.29	
33231186	Well Development Equipment Rental (weekly)	1.00	WK	288.46	0.00	0.00	$288.46	
33231189	Furnish 55 Gallon Drum for Development/Purge Water	24.00	EA	100.48	0.00	0.00	$2,411.61	
33232407	Disposable Bailer, Polyethylene, 1.5" Outside Diameter x 36"	24.00	EA	12.49	0.00	0.00	$299.75	
						Total Element Cost	**$30,117.09**	

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Car or Van Mileage Charge	600.00	MI	0.44	0.00	0.00	$265.85	
33220102	Project Manager	4.00	HR	0.00	181.23	0.00	$724.91	

Alternative 2
Groundwater Monitoring

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220105	Project Engineer	30.00	HR	0.00	115.71	0.00	$3,471.33	
33220108	Project Scientist	219.00	HR	0.00	110.04	0.00	$24,098.07	
33220109	Staff Scientist	80.00	HR	0.00	90.22	0.00	$7,217.64	
33220112	Field Technician	90.00	HR	0.00	72.59	0.00	$6,532.82	
33220114	Word Processing/Clerical	38.00	HR	0.00	57.22	0.00	$2,174.46	
33220115	Draftsman/CADD	34.00	HR	0.00	75.03	0.00	$2,551.06	
						Total Element Cost	**$47,036.14**	
						1st Year Technology Cost	**$77,153.23**	

Alternative 3 – Installation of Extraction Wells, Periodic Vacuum Extraction, and Institutional Controls

Installation of Extraction Wells:

- Installation of extraction wells

Institutional Controls Includes:

- Land Use Control Implementation and Certification Plan
- Environmental restrictions on deed and covenant to restrict future use of the property
- Deed filing and registration

Operation and Maintenance Includes:

- Quarterly extraction via Vacuum Truck with disposal of collected liquids

Monitoring Includes:

- Annual groundwater sampling of all existing wells and newly installed product recovery wells
- Sample analysis reporting
- Quarterly oil-water level measurement

5-Year Review Includes:

- Preparation of report

Alternative 3
Institutional Controls

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Institutional Controls
ID: 0003
Type: None

Phase Element

Name: Institutional Controls
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: N/A
Secondary Media/Waste Type: N/A
Contaminant: None
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: User-Defined Estimate
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Includes: Land Use Control Implementation and Certification Plan ($10,000), Environmental Restrictions on Deed and Covenant to Restrict Future Use of Property ($9,000), and Deed Filing & Registration ($1,000)

Unit of Assembly	Description	Quantity	Material Measure	Labor Unit Cost	Equipment Unit Cost	Extended Unit Cost	Cost Cost
33220150	User Defined Labor Cost 01	200.00	HR	0.00	313.29	0.00	$62,658.75
						Total Technology Cost	**$62,658.75**

Alternative 3
Product Recovery Wells

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Product Wells
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Groundwater Extraction Wells
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Used to approximate free product recovery wells.
Assume: Task duration is 28 WK
4" PVC Manifold Piping used to approximate costs for VAC truck extraction manifold.

Alternative 3
Product Recovery Wells

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17020203	Demolish Bituminous Pavement with Air Equipment	13.80	CY	0.00	63.19	10.86	$1,021.90	
20020301	1/0 ACSR Conductor	318.00	LF	0.27	1.21	0.07	$490.09	
20020310	1/C #2 Aluminum, Bare, Wire	106.00	LF	0.20	1.17	0.07	$151.86	
20039902	4" Rigid Steel Conduit	30.00	LF	11.71	18.71	0.00	$912.59	
33010101	Mobilize/DeMobilize Drilling Rig & Crew	1.00	LS	0.00	1,743.37	2,816.12	$4,559.49	
33020303	Organic Vapor Analyzer Rental, per Day	152.00	DAY	143.49	0.00	0.00	$21,810.38	
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	118.00	DAY	138.03	0.00	0.00	$16,287.99	
33220112	Field Technician	344.00	HR	0.00	80.51	0.00	$27,694.55	
33230103	6" PVC, Schedule 40, Well Casing	276.00	LF	4.92	8.37	13.52	$7,397.96	
33230203	6" PVC, Schedule 40, Well Screen	690.00	LF	11.20	13.95	22.53	$32,894.86	
33230303	6" PVC, Well Plug	69.00	EA	75.40	21.79	35.20	$9,135.11	
33231103	Hollow Stem Auger, 11" Dia Borehole, Depth <= 100 ft	966.00	LF	0.00	24.90	40.22	$62,906.62	
33231172	Split Spoon Sample, 2" x 24", During Drilling	97.00	EA	51.22	0.00	0.00	$4,967.98	
33231176	Standby For Drilling	69.00	EA	60.74	217.92	352.02	$43,516.77	
33231178	Move Rig/Equipment Around Site	68.00	EA	69.85	250.61	404.82	$49,319.01	
33231182	Furnish 55 Gallon Drum for Drill Cuttings & Development Water	238.00	EA	96.13	0.00	0.00	$22,879.67	

Alternative 3
Product Recovery Wells

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33231186	Well Development Equipment Rental (weekly)	21.70	WK	290.39	0.00	0.00	$6,301.42	
33231403	6" Screen, Filter Pack	690.00	LF	9.37	12.64	20.42	$29,272.40	
33232103	6" Well, Bentonite Seal	69.00	EA	43.52	78.45	126.73	$17,160.08	
33232206	Restricted Area, Well Protection (with 4 Posts & Explosionproof Receptacle)	69.00	EA	667.74	663.32	2.72	$92,030.36	
33260445	4" PVC, Schedule 40, Manifold Piping	100.00	LF	2.32	13.76	0.00	$1,608.12	
33420101	Electrical Charge	5,863.00	KWH	0.08	0.00	0.00	$492.11	
99010102	Site Project Manager - Average Cost	21.70	MWK	0.00	3,901.36	0.00	$84,659.48	
99010202	Superintendent - Average Cost	21.70	MWK	0.00	3,678.27	0.00	$79,818.42	
99010301	Clerk - Average Cost	10.90	MWK	0.00	775.92	0.00	$8,457.51	
99010402	Field Engineer - Average Cost	43.40	MWK	0.00	2,408.29	0.00	$104,519.62	
99010702	Safety Engineer - Average Cost	21.70	MWK	0.00	3,777.48	0.00	$81,971.26	
99010802	Quality Control - Average Cost	21.70	MWK	0.00	3,427.97	0.00	$74,386.99	
99040102	Temporary Office 32' x 8'	5.20	MO	317.81	0.00	0.00	$1,652.64	
99040201	Temporary Storage Trailer 16' x 8'	5.20	MO	103.96	0.00	0.00	$540.58	
99040501	Portable Toilets - Chemical	5.20	MO	106.44	0.00	0.00	$553.48	
						Total Technology Cost	**$889,371.29**	

Alternative 3
Design

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Product Wells
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Professional Labor Management
Prime Markup: 100 %
Sub Markup: 0 %

Alternative 3
Design

Element: Professional Labor Percentage

Assembly	Description	Percent	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	5.00%	0.00	90,206.86	0.00	$90,206.86	
33220139	Planning Documents Labor Cost	4.00%	0.00	72,165.48	0.00	$72,165.48	
33220140	Construction Oversight Labor Cost	3.25%	0.00	58,634.46	0.00	$58,634.46	
33220141	Reporting Labor Cost	0.75%	0.00	13,531.03	0.00	$13,531.03	
33220142	As-Built Drawings Labor Cost	0.75%	0.00	13,531.03	0.00	$13,531.03	
33220143	Public Notice Labor Cost	0.25%	0.00	4,510.34	0.00	$4,510.34	
33220144	Site Closure Activities Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
33220145	Permitting Labor Cost	5.00%	0.00	90,206.86	0.00	$90,206.86	
33220148	Other Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
					Total Element Cost	**$342,786.06**	
					Total Technology Cost	**$342,786.06**	

Alternative 3
O&M and Free Product Disposal

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Product Wells
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Operations and Maintenance (12 months
Templates: System Water-Fuels
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Operations and Maintenance
Assume: $10/GAL VAC Truck Fee
Additional 24 HR/MONTH added for oversight of VAC Truck Activities

Alternative 3
O&M and Free Product Disposal

Element: Treatment Train Miscellaneous

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010423	Disposable Gloves (Latex)	158.00	PAIR	0.21	0.00	0.00	$33.35	
33010425	Disposable Coveralls (Tyvek)	158.00	EA	4.42	0.00	0.00	$697.60	
33190340	Non Haz Drummed Site Waste - Load, Transp, & Landfill Disp (55-Gal Drums)	4.00	EA	202.94	0.00	0.00	$811.77	
33190341	Free Product Disposal	19,963.00	GAL	0.28	0.00	0.00	$5,561.69	
33199921	DOT Steel Drum, 55 Gallon	4.00	EA	74.68	0.00	0.00	$298.70	
33240104	Startup Costs	1.00	LS	2,957.20	2,957.20	1,478.60	$7,393.00	
99020110	Annual Maintenance Materials and Labor	1.00	LS	4,780.73	4,780.73	2,390.37	$11,951.84	
					Total Element Cost		**$26,747.95**	

Element: Groundwater Extraction Wells

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33021618	Volatile Organic Analysis (EPA 624), Water Analysis	28.00	EA	199.36	0.00	0.00	$5,582.10	
33021694	Total Petroleum Hydrocarbons (SW8015B), Water Analysis	28.00	EA	74.31	0.00	0.00	$2,080.71	
33022150	BTEX/MTBE/TVPH (EPA 8021B/8015B), Water Analysis	28.00	EA	117.03	0.00	0.00	$3,276.95	
33220106	Staff Engineer	106.00	HR	0.00	107.38	0.00	$11,382.28	
33220112	Field Technician	580.00	HR	0.00	72.59	0.00	$42,102.20	
33420101	Electrical Charge	5,928.30	KWH	0.07	0.00	0.00	$386.53	

Alternative 3
O&M and Free Product Disposal

Total Element Cost	**$64,810.77**
1st Year Technology Cost Subtotal	**$91,558.72**
Runtime Percent Cost Adjustment	**97%**
1st Year Technology Cost	**$88,811.96**

Alternative 3
Groundwater Monitoring

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Monitoring
ID: 0008
Type: None

Phase Element

Name: VAC Truck Monitoring
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Description: 1 YR Costs

Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Monitoring (12 months only)
Prime Markup: 100 %
Sub Markup: 0 %
Comments: User Defined Anlaysis includes rental cost of an oil-water interface probe ($75/WK)
Assume: Annual sampling; Quarterly oil-water level measurement
Additional 16 hours added to field technician time and 300 miles added to car or van mileage for oil-water level measurement events.

Templates: System Water-Fuels

Alternative 3
Groundwater Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	51.00	EA	10.95	0.00	0.00	$558.57	
33020402	Decontamination Materials per Sample	51.00	EA	9.70	0.00	0.00	$494.67	
33021509	Water Quality Parameter Testing Device	1.00	WK	288.46	0.00	0.00	$288.46	
33021618	Volatile Organic Analysis (EPA 624), Water Analysis	51.00	EA	253.85	0.00	0.00	$12,946.42	
33021694	Total Petroleum Hydrocarbons (SW8015B), Water Analysis	51.00	EA	94.62	0.00	0.00	$4,825.72	
33022150	BTEX/MTBE/TVPH (EPA 8021B/8015B), Water Analysis	51.00	EA	149.02	0.00	0.00	$7,600.14	
33029501	User Defined Analysis 1	4.00	LS	100.82	0.00	0.00	$403.29	
33231186	Well Development Equipment Rental (weekly)	1.00	WK	288.46	0.00	0.00	$288.46	
33231189	Furnish 55 Gallon Drum for Development/Purge Water	24.00	EA	100.48	0.00	0.00	$2,411.61	
33232407	Disposable Bailer, Polyethylene, 1.5" Outside Diameter x 36"	24.00	EA	12.49	0.00	0.00	$299.75	
						Total Element Cost	**$30,117.09**	

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Car or Van Mileage Charge	600.00	MI	0.44	0.00	0.00	$265.85	
33220102	Project Manager	4.00	HR	0.00	181.23	0.00	$724.91	

Alternative 3
Groundwater Monitoring

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220105	Project Engineer	30.00	HR	0.00	115.71	0.00	$3,471.33	
33220108	Project Scientist	219.00	HR	0.00	110.04	0.00	$24,098.07	
33220109	Staff Scientist	80.00	HR	0.00	90.22	0.00	$7,217.64	
33220112	Field Technician	90.00	HR	0.00	72.59	0.00	$6,532.82	
33220114	Word Processing/Clerical	38.00	HR	0.00	57.22	0.00	$2,174.46	
33220115	Draftsman/CADD	34.00	HR	0.00	75.03	0.00	$2,551.06	
						Total Element Cost	**$47,036.14**	
						1st Year Technology Cost	**$77,153.23**	

Alternative 4 – Soil Excavation, Bioremediation, Backfilling with Treated Soil, and Institutional Controls

Soil Excavation and Backfilling with Treated Soil Includes:

- Excavation to 8 feet below ground surface of each area
- Transport excavated soil to newly constructed active bioremediation facility
- Backfilling with treated soil
- Construction and operation of decontamination facilities

Bioremediation Includes:

- Construction and operation of bioremediation facility
- Installation of carbon adsorption unit to treat vapors from the bioremediation facility
- Construction of overhead electrical distribution

Institutional Controls Includes:

- Land Use Control Implementation and Certification Plan
- Environmental restrictions on deed and covenant to restrict future use of the property
- Deed filing and registration

Monitoring Includes:

- Annual groundwater sampling of all existing wells
- Sample analysis reporting
- Quarterly oil-water level measurement

5-Year Review Includes:

- Preparation of report

Alternative 4
Institutional Controls

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Institutional Controls
ID: 0003
Type: None

Phase Element

Name: Institutional Controls
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: N/A
Secondary Media/Waste Type: N/A
Contaminant: None
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: User-Defined Estimate
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Includes: Land Use Control Implementation and Certification Plan ($10,000), Environmental Restrictions on Deed and Covenant to Restrict Future Use of Property ($9,000), and Deed Filing & Registration ($1,000)

Unit of Assembly	Description	Quantity	Material Measure	Labor Unit Cost	Equipment Unit Cost	Extended Unit Cost	Cost Cost
33220150	User Defined Labor Cost 01	200.00	HR	0.00	313.29	0.00	$62,658.75
						Total Technology Cost	**$62,658.75**

Alternative 4
Excavation and Backfill

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Biopile
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Excavation
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Assume: 35 CY/HR Output

Alternative 4
Excavation and Backfill

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17020201	Demolish Bituminous Road with Power Equipment	699.92	CY	0.00	32.13	10.88	$30,102.90	
17030278	3 CY, Crawler-mounted, Hydraulic Excavator	10,021.31	CY	0.00	1.96	2.28	$42,490.89	
17030415	Backfill with Excavated Material	11,548.43	CY	0.38	5.68	1.09	$82,600.30	
18020301	Bituminous Paving	29,528.00	SY	8.61	1.62	0.00	$302,122.17	
20020301	1/0 ACSR Conductor	3,180.00	LF	0.27	1.21	0.07	$4,900.92	
20020310	1/C #2 Aluminum, Bare, Wire	1,060.00	LF	0.20	1.17	0.07	$1,518.57	
20020403	40' Class 3 Treated Power Pole	5.00	EA	396.40	681.60	57.27	$5,676.34	
20020420	Straight-line Structure, 5 KV Pole Top	4.00	EA	135.43	614.21	51.61	$3,204.97	
20020430	Terminal Structure, 5 KV Pole Top	2.00	EA	1,530.63	2,330.65	195.83	$8,114.22	
20020545	5 KV, 1/0 to 4/0 Conductor, Terminations & Splicing	6.00	EA	590.79	464.45	0.00	$6,331.45	
20039902	4" Rigid Steel Conduit	40.00	LF	11.71	18.71	0.00	$1,216.79	
33170803	Decontaminate Heavy Equipment	4.00	EA	0.00	651.54	0.00	$2,606.16	
33420101	Electrical Charge	3,375.00	KWH	0.08	0.00	0.00	$283.28	
99010102	Site Project Manager - Average Cost	12.50	MWK	0.00	3,724.16	0.00	$46,552.06	
99010202	Superintendent - Average Cost	12.50	MWK	0.00	3,489.34	0.00	$43,616.72	
99010301	Clerk - Average Cost	6.20	MWK	0.00	728.58	0.00	$4,517.20	
99010402	Field Engineer - Average Cost	25.00	MWK	0.00	2,284.38	0.00	$57,109.46	

Alternative 4
Excavation and Backfill

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
99010702	Safety Engineer - Average Cost	12.50	MWK	0.00	2,690.14	0.00	$33,626.77	
99010802	Quality Control - Average Cost	12.50	MWK	0.00	2,690.14	0.00	$33,626.77	
99040102	Temporary Office 32' x 8'	3.10	MO	301.03	0.00	0.00	$933.20	
99040201	Temporary Storage Trailer 16' x 8'	3.10	MO	98.47	0.00	0.00	$305.25	
99040302	Security Fencing 6' Chain-Link	1,000.00	LF	6.10	5.02	0.00	$11,126.32	
99040501	Portable Toilets - Chemical	3.10	MO	100.82	0.00	0.00	$312.53	
						Total Technology Cost	**$722,895.25**	

Alternative 4
Load and Haul (to Biopile)

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Biopile
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Load and Haul
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Assume: Distance between site and biopile is 1,000 FT

Alternative 4
Load and Haul (to Biopile)

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17030226	988, 7.0 CY, Wheel Loader	37.00	HR	0.00	64.36	216.38	$10,387.36	
17030296	50 Ton, 773, Off-highway Truck	73.20	HR	0.00	50.86	248.24	$21,894.60	
						Total Technology Cost	**$32,281.96**	

Alternative 4
Biopile

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Biopile
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Ex Situ Vapor Extraction
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Task construction duration is 3 WK.

Alternative 4
Biopile

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17030217	953, 2.0 CY, Track Loader	342.00	HR	0.00	81.07	88.03	$57,834.34	
17030419	Crushed Stone, 1/2" to 3/4"	829.54	CY	23.92	7.07	1.17	$26,683.41	
17030420	Backfill Trench, Borrow Material, Delivered & Dumped Only	159.72	CY	6.76	2.78	2.45	$1,915.45	
17039903	Hand Place Small Earth Fill Berm	159.72	CY	0.00	129.77	0.00	$20,727.39	
19020601	12" x 12" Underground French Drain	888.00	LF	2.64	2.30	0.38	$4,726.16	
19040621	550 Gallon Horizontal Plastic Sump with 4" NPT Connection	1.00	EA	1,783.09	515.79	0.00	$2,298.88	
33021506	Monitoring Port with Gas Monitor	17.00	EA	1.33	32.12	0.00	$568.66	
33021807	BTEX/Total Volat Petro Hydrocarbs, Air (5041/8021B/8015B)	24.00	EA	106.08	0.00	0.00	$2,545.87	
33080503	Polymeric Liner Anchor Trench, 3' x 1.5'	920.00	LF	0.06	1.30	0.24	$1,478.53	
33080563	40 Mil Polymeric Liner, PVC	50,736.00	SF	0.41	2.22	0.24	$145,838.43	
33231503	3,000 PSI, 6” Thick Concrete Pad	669.00	CY	71.90	147.95	9.93	$153,722.82	
18010206	Concrete Curb, 8” x 8”	760.00	LF	1.79	2.49	0.10	$3,328.80	
33080590	Waste Pile Cover, 135 Lb Tear, 2 - 2.5 Year Life	5,766.56	SY	2.03	0.46	0.00	$14,379.66	
33132342	Purchase, 30.0 HP, 580 SCFM Vapor Extraction Blower	7.00	EA	12,663.04	893.99	0.00	$94,899.25	
33132343	Knockout Drum	7.00	EA	96.13	0.00	0.00	$672.93	
33139001	Blower 98 SCFM, 3.2 HP, 5 PSI	1.00	EA	5,156.71	2,569.35	0.00	$7,726.06	
33220112	Field Technician	288.00	HR	0.00	80.51	0.00	$23,186.13	
33260445	4" PVC, Schedule 40, Manifold Piping	528.44	LF	2.32	13.76	0.00	$8,497.94	
33260802	4" Slotted PVC Pipe	2,125.00	LF	6.63	5.09	0.00	$24,909.48	

Alternative 4
Biopile

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33270106	4" PVC, Schedule 40, Tee	22.00	EA	18.52	0.00	0.00	$407.54	
33270116	4" PVC, Schedule 40, 90 Degree, Elbow	9.00	EA	12.48	0.00	0.00	$112.35	
33270404	4" Iron Body Check Valve	17.00	EA	294.54	190.27	0.00	$8,241.76	
33290412	15 GPM Submersible Sump Pump	1.00	EA	1,000.93	164.82	0.00	$1,165.75	
33310209	Pressure Gauge	17.00	EA	82.69	93.35	0.00	$2,992.73	
33420101	Electrical Charge	1,688,357.00	KWH	0.08	0.00	0.00	$141,712.89	
99010102	Site Project Manager - Average Cost	3.00	MWK	0.00	3,724.16	0.00	$11,172.49	
99010202	Superintendent - Average Cost	3.00	MWK	0.00	3,489.34	0.00	$10,468.01	
99010301	Clerk - Average Cost	1.50	MWK	0.00	728.58	0.00	$1,092.87	
99010402	Field Engineer - Average Cost	6.00	MWK	0.00	2,284.38	0.00	$13,706.27	
99010702	Safety Engineer - Average Cost	3.00	MWK	0.00	2,690.14	0.00	$8,070.42	
99010802	Quality Control - Average Cost	3.00	MWK	0.00	2,690.14	0.00	$8,070.42	
99040102	Temporary Office 32' x 8'	0.75	MO	301.03	0.00	0.00	$225.77	
99040201	Temporary Storage Trailer 16' x 8'	0.75	MO	98.47	0.00	0.00	$73.85	
99040501	Portable Toilets - Chemical	0.75	MO	100.82	0.00	0.00	$75.61	
						Total Technology Cost	**$803,528.91**	

Alternative 4
Carbon Adsorption (Vapor)

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Biopile
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Carbon Adsorption (Gas)
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Construction duration is 1 WK

Alternative 4
Carbon Adsorption (Vapor)

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
18020324	12" Structural Slab on Grade	180.00	SF	6.40	6.88	0.54	$2,488.07	
20020301	1/0 ACSR Conductor	3,180.00	LF	0.27	1.21	0.07	$4,900.92	
20020310	1/C #2 Aluminum, Bare, Wire	1,060.00	LF	0.20	1.17	0.07	$1,518.57	
20020403	40' Class 3 Treated Power Pole	5.00	EA	396.40	681.60	57.27	$5,676.34	
20020420	Straight-line Structure, 5 KV Pole Top	4.00	EA	135.43	614.21	51.61	$3,204.97	
20020430	Terminal Structure, 5 KV Pole Top	2.00	EA	1,530.63	2,330.65	195.83	$8,114.22	
20020545	5 KV, 1/0 to 4/0 Conductor, Terminations & Splicing	6.00	EA	590.79	464.45	0.00	$6,331.45	
20039902	4" Rigid Steel Conduit	40.00	LF	11.71	18.71	0.00	$1,216.79	
33021501	Saturation Indicator	2.00	EA	59.67	0.00	0.00	$119.34	
33131982	Dual Bed,2500 CFM Series/5000 CFM Parallel,5000 Lb Fill each	1.00	EA	43,327.09	0.00	0.00	$43,327.09	
33310209	Pressure Gauge	2.00	EA	82.69	93.35	0.00	$352.09	
33420101	Electrical Charge	270.00	KWH	0.08	0.00	0.00	$22.66	
99010102	Site Project Manager - Average Cost	1.00	MWK	0.00	3,724.16	0.00	$3,724.16	
99010202	Superintendent - Average Cost	1.00	MWK	0.00	3,489.34	0.00	$3,489.34	
99010301	Clerk - Average Cost	0.50	MWK	0.00	728.58	0.00	$364.29	
99010402	Field Engineer - Average Cost	2.00	MWK	0.00	2,284.38	0.00	$4,568.76	
99010702	Safety Engineer - Average Cost	1.00	MWK	0.00	2,690.14	0.00	$2,690.14	
99010802	Quality Control - Average Cost	1.00	MWK	0.00	2,690.14	0.00	$2,690.14	

Alternative 4
Carbon Adsorption (Vapor)

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
99040102	Temporary Office 32' x 8'	0.25	MO	301.03	0.00	0.00	$75.26	
99040201	Temporary Storage Trailer 16' x 8'	0.25	MO	98.47	0.00	0.00	$24.62	
99040501	Portable Toilets - Chemical	0.25	MO	100.82	0.00	0.00	$25.20	
						Total Technology Cost	**$94,924.41**	

Alternative 4
Decontamination Facilities

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Biopile
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Decontamination Facilities
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Assume: Construction of facility duration is 1 WK
Decon duration is 26 WK

Alternative 4
Decontamination Facilities

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17030109	Pad Subgrade Preparation	35.56	CY	0.00	3.83	3.30	$253.49	
17030257	Cat 215, 1.0 CY, Soil, Shallow, Trenching	1.78	CY	0.00	1.19	0.97	$3.84	
17030501	Compact Subgrade, 2 Lifts	35.56	CY	0.00	0.39	0.36	$26.62	
17030510	Dry Roll Gravel, Steel Roller	106.67	SY	0.00	1.04	0.37	$150.56	
18010102	Gravel, Delivered & Dumped	14.81	CY	25.79	4.46	2.07	$478.77	
18010103	Gravel (90%) & Sand Base (10%), with Calcium Chloride 3/4 - 1 Lb/CY	14.81	CY	25.73	4.96	2.17	$486.73	
18010203	Asphalt Curb 8" W x 6" H	120.00	LF	1.82	5.10	4.54	$1,375.98	
18010310	Prime Coat	88.89	SY	0.41	0.07	0.04	$45.92	
18010312	Asphalt Wearing Course, 1 Pass (Line Item Includes 5% Waste)	19.33	TON	39.94	36.10	18.85	$1,834.13	
18020203	26" x 26", 5' Deep Area Drain with Grate	1.00	EA	1,998.44	2,281.26	30.47	$4,310.17	
19020313	5' x 5' x 5' Reinforced Concrete Sump	1.00	EA	1,920.24	3,227.14	107.46	$5,254.83	
19020604	12" x 12" CIP Concrete In-Ground Trench Drain with Metal Grate	20.00	LF	50.99	104.82	0.77	$3,131.64	
19040604	1,500 Gallon Steel Sump, Aboveground with Supports & Fittings	1.00	EA	2,119.09	1,708.54	0.00	$3,827.64	
33080503	Polymeric Liner Anchor Trench, 3' x 1.5'	144.00	LF	0.06	1.30	0.24	$231.42	
33080532	8 oz/sy Erosion Control/Drainage Filter Fabric (80 Mil)	106.67	SY	0.89	1.05	0.03	$210.41	
33080571	40 Mil Polymeric Liner, High-density Polyethylene	960.00	SF	0.36	2.23	0.24	$2,713.16	

Alternative 4
Decontamination Facilities

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33170814	1,800 PSI Pressure Washer, 6 HP, 4.8 GPM	1.00	EA	2,154.71	0.00	0.00	$2,154.71	
33170823	Operation of Pressure Washer, Including Water, Soap, Electricity, Labor	260.00	HR	8.29	81.11	0.00	$23,242.87	
33231306	High Sump Level Switch for Avoiding Overflow	1.00	EA	271.82	339.49	0.00	$611.31	
33260623	(2 1/2", 4") PVC Double-wall Piping, with Fittings	30.00	LF	20.66	44.52	0.00	$1,955.51	
33290401	25 GPM, 1 1/2" Discharge, Cast-iron Sump Pump	1.00	EA	2,680.94	785.90	0.00	$3,466.84	
99010102	Site Project Manager - Average Cost	1.00	MWK	0.00	3,724.16	0.00	$3,724.16	
99010202	Superintendent - Average Cost	1.00	MWK	0.00	3,489.34	0.00	$3,489.34	
99010301	Clerk - Average Cost	0.50	MWK	0.00	728.58	0.00	$364.29	
99010402	Field Engineer - Average Cost	2.00	MWK	0.00	2,284.38	0.00	$4,568.76	
99010702	Safety Engineer - Average Cost	1.00	MWK	0.00	2,690.14	0.00	$2,690.14	
99010802	Quality Control - Average Cost	1.00	MWK	0.00	2,690.14	0.00	$2,690.14	
99040102	Temporary Office 32' x 8'	0.25	MO	301.03	0.00	0.00	$75.26	
99040201	Temporary Storage Trailer 16' x 8'	0.25	MO	98.47	0.00	0.00	$24.62	
99040501	Portable Toilets - Chemical	0.25	MO	100.82	0.00	0.00	$25.20	
						Total Technology Cost	**$73,418.46**	

Alternative 4
Load and Haul (to Backfill)

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Biopile
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Load and Haul
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Assume: Distance between site and biopile is 1,000 FT

Alternative 4
Load and Haul (to Backfill)

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17030226	988, 7.0 CY, Wheel Loader	37.00	HR	0.00	64.36	216.38	$10,387.36	
17030296	50 Ton, 773, Off-highway Truck	73.20	HR	0.00	50.86	248.24	$21,894.60	
						Total Technology Cost	**$32,281.96**	

Alternative 4
Design

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Biopile
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Professional Labor Management
Prime Markup: 100 %
Sub Markup: 0 %

Alternative 4
Design

Element: Professional Labor Percentage

Assembly	Description	Percent	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	2.00%	0.00	67,966.58	0.00	$67,966.58	
33220139	Planning Documents Labor Cost	2.00%	0.00	67,966.58	0.00	$67,966.58	
33220140	Construction Oversight Labor Cost	2.50%	0.00	84,958.23	0.00	$84,958.23	
33220141	Reporting Labor Cost	0.25%	0.00	8,495.82	0.00	$8,495.82	
33220142	As-Built Drawings Labor Cost	0.25%	0.00	8,495.82	0.00	$8,495.82	
33220143	Public Notice Labor Cost	0.04%	0.00	1,189.42	0.00	$1,189.42	
33220144	Site Closure Activities Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
33220145	Permitting Labor Cost	2.50%	0.00	84,958.23	0.00	$84,958.23	
33220148	Other Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
					Total Element Cost	**$324,030.69**	
					Total Technology Cost	**$324,030.69**	

Alternative 4
Groundwater Monitoring

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Monitoring
ID: 0008
Type: None

Phase Element

Name: Soil Options Monitoring
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Description: 1 YR Costs

Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Monitoring (12 months only)
Prime Markup: 100 %
Sub Markup: 0 %
Comments: User Defined Analysis includes rental cost of an oil-water interface probe (assume $75/WK)
Assume: Annual sampling; Quarterly oil-water level measurement
Additional 16 hours added to field technician time and 300 miles added to car or van mileage for oil-water level measurement events.

Templates: System Water-Fuels

Alternative 4
Groundwater Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	51.00	EA	10.95	0.00	0.00	$558.57	
33020402	Decontamination Materials per Sample	51.00	EA	9.70	0.00	0.00	$494.67	
33021509	Water Quality Parameter Testing Device	1.00	WK	288.46	0.00	0.00	$288.46	
33021618	Volatile Organic Analysis (EPA 624), Water Analysis	51.00	EA	253.85	0.00	0.00	$12,946.42	
33021694	Total Petroleum Hydrocarbons (SW8015B), Water Analysis	51.00	EA	94.62	0.00	0.00	$4,825.72	
33022150	BTEX/MTBE/TVPH (EPA 8021B/8015B), Water Analysis	51.00	EA	149.02	0.00	0.00	$7,600.14	
33029501	User Defined Analysis 1	4.00	LS	100.82	0.00	0.00	$403.29	
33231186	Well Development Equipment Rental (weekly)	1.00	WK	288.46	0.00	0.00	$288.46	
33231189	Furnish 55 Gallon Drum for Development/Purge Water	24.00	EA	100.48	0.00	0.00	$2,411.61	
33232407	Disposable Bailer, Polyethylene, 1.5" Outside Diameter x 36"	24.00	EA	12.49	0.00	0.00	$299.75	
						Total Element Cost	**$30,117.09**	

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Car or Van Mileage Charge	600.00	MI	0.44	0.00	0.00	$265.85	
33220102	Project Manager	4.00	HR	0.00	181.23	0.00	$724.91	

Alternative 4
Groundwater Monitoring

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220105	Project Engineer	30.00	HR	0.00	115.71	0.00	$3,471.33	
33220108	Project Scientist	219.00	HR	0.00	110.04	0.00	$24,098.07	
33220109	Staff Scientist	80.00	HR	0.00	90.22	0.00	$7,217.64	
33220112	Field Technician	90.00	HR	0.00	72.59	0.00	$6,532.82	
33220114	Word Processing/Clerical	38.00	HR	0.00	57.22	0.00	$2,174.46	
33220115	Draftsman/CADD	34.00	HR	0.00	75.03	0.00	$2,551.06	
						Total Element Cost	**$47,036.14**	
						1st Year Technology Cost	**$77,153.23**	

Alternative 5 – Soil Excavation, Off-Site Disposal, Backfilling with Clean Soil, and Institutional Controls

Soil Excavation, Off-Site Disposal, and Backfilling with Clean Soil Includes:

- Excavation to 8 feet below ground surface of each area
- Transport excavated soil to off-site disposal facility
- Backfilling with clean soil
- Construction and operation of decontamination facilities

Institutional Controls Includes:

- Land Use Control Implementation and Certification Plan
- Environmental restrictions on deed and covenant to restrict future use of the property
- Deed filing and registration

Monitoring Includes:

- Annual groundwater sampling of all existing wells
- Sample analysis reporting
- Quarterly oil-water level measurement

5-Year Review Includes:

- Preparation of report

Alternative 5
Institutional Controls

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Institutional Controls
ID: 0003
Type: None

Phase Element

Name: Institutional Controls
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: N/A
Secondary Media/Waste Type: N/A
Contaminant: None
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: User-Defined Estimate
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Includes: Land Use Control Implementation and Certification Plan ($10,000), Environmental Restrictions on Deed and Covenant to Restrict Future Use of Property ($9,000), and Deed Filing & Registration ($1,000)

Unit of Assembly	Description	Quantity	Material Measure	Labor Unit Cost	Equipment Unit Cost	Extended Unit Cost	Cost Cost
33220150	User Defined Labor Cost 01	200.00	HR	0.00	313.29	0.00	$62,658.75
						Total Technology Cost	**$62,658.75**

Alternative 5
Excavation and Backfill

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Disposal
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Excavation
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Assume: 35 CY/HR Output

Alternative 5
Excavation and Backfill

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17020201	Demolish Bituminous Road with Power Equipment	699.92	CY	0.00	34.33	8.66	$30,090.60	
17030278	3 CY, Crawler-mounted, Hydraulic Excavator	10,021.31	CY	0.00	2.06	1.71	$37,788.53	
17030415	Backfill with Excavated Material	5,774.21	CY	0.40	6.01	1.10	$43,430.65	
17030423	Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	6,270.56	CY	7.17	2.53	2.86	$78,728.65	
18020301	Bituminous Paving	29,528.00	SY	8.61	1.62	0.00	$302,122.17	
20020301	1/0 ACSR Conductor	318.00	LF	0.27	1.21	0.07	$490.09	
20020310	1/C #2 Aluminum, Bare, Wire	106.00	LF	0.20	1.17	0.07	$151.86	
20039902	4" Rigid Steel Conduit	30.00	LF	11.71	18.71	0.00	$912.59	
33170803	Decontaminate Heavy Equipment	4.00	EA	0.00	689.77	0.00	$2,759.08	
33420101	Electrical Charge	3,375.00	KWH	0.08	0.00	0.00	$283.28	
99010102	Site Project Manager - Average Cost	12.50	MWK	0.00	3,724.16	0.00	$46,552.06	
99010202	Superintendent - Average Cost	12.50	MWK	0.00	3,489.34	0.00	$43,616.72	
99010301	Clerk - Average Cost	6.20	MWK	0.00	728.58	0.00	$4,517.20	
99010402	Field Engineer - Average Cost	25.00	MWK	0.00	2,284.38	0.00	$57,109.46	
99010702	Safety Engineer - Average Cost	12.50	MWK	0.00	2,690.14	0.00	$33,626.77	
99010802	Quality Control - Average Cost	12.50	MWK	0.00	2,690.14	0.00	$33,626.77	
99040102	Temporary Office 32' x 8'	3.10	MO	301.03	0.00	0.00	$933.20	

Alternative 5
Excavation and Backfill

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
99040201	Temporary Storage Trailer 16' x 8'	3.10	MO	98.47	0.00	0.00	$305.25	
99040501	Portable Toilets - Chemical	3.10	MO	100.82	0.00	0.00	$312.53	
						Total Technology Cost	**$717,357.47**	

Alternative 5
Decontamination Facilities

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Disposal
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Decontamination Facilities
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Assume: Construction of facility duration is 1 WK

Alternative 5
Decontamination Facilities

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17030109	Pad Subgrade Preparation	35.56	CY	0.00	3.83	3.30	$253.49	
17030257	Cat 215, 1.0 CY, Soil, Shallow, Trenching	1.78	CY	0.00	1.19	0.97	$3.84	
17030501	Compact Subgrade, 2 Lifts	35.56	CY	0.00	0.39	0.36	$26.62	
17030510	Dry Roll Gravel, Steel Roller	106.67	SY	0.00	1.04	0.37	$150.56	
18010102	Gravel, Delivered & Dumped	14.81	CY	25.79	4.46	2.07	$478.77	
18010103	Gravel (90%) & Sand Base (10%), with Calcium Chloride 3/4 - 1 Lb/CY	14.81	CY	25.73	4.96	2.17	$486.73	
18010203	Asphalt Curb 8" W x 6" H	120.00	LF	1.82	5.10	4.54	$1,375.98	
18010310	Prime Coat	88.89	SY	0.41	0.07	0.04	$45.92	
18010312	Asphalt Wearing Course, 1 Pass (Line Item Includes 5% Waste)	19.33	TON	39.94	36.10	18.85	$1,834.13	
18020203	26" x 26", 5' Deep Area Drain with Grate	1.00	EA	1,998.44	2,281.26	30.47	$4,310.17	
19020313	5' x 5' x 5' Reinforced Concrete Sump	1.00	EA	1,920.24	3,227.14	107.46	$5,254.83	
19020604	12" x 12" CIP Concrete In-Ground Trench Drain with Metal Grate	20.00	LF	50.99	104.82	0.77	$3,131.64	
19040604	1,500 Gallon Steel Sump, Aboveground with Supports & Fittings	1.00	EA	2,119.09	1,708.54	0.00	$3,827.64	
33080503	Polymeric Liner Anchor Trench, 3' x 1.5'	144.00	LF	0.06	1.30	0.24	$231.42	
33080532	8 oz/sy Erosion Control/Drainage Filter Fabric (80 Mil)	106.67	SY	0.89	1.05	0.03	$210.41	
33080571	40 Mil Polymeric Liner, High-density Polyethylene	960.00	SF	0.36	2.23	0.24	$2,713.16	

Alternative 5
Decontamination Facilities

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33170814	1,800 PSI Pressure Washer, 6 HP, 4.8 GPM	1.00	EA	2,154.71	0.00	0.00	$2,154.71	
33170823	Operation of Pressure Washer, Including Water, Soap, Electricity, Labor	260.00	HR	8.29	81.11	0.00	$23,242.87	
33231306	High Sump Level Switch for Avoiding Overflow	1.00	EA	271.82	339.49	0.00	$611.31	
33260623	(2 1/2", 4") PVC Double-wall Piping, with Fittings	30.00	LF	20.66	44.52	0.00	$1,955.51	
33290401	25 GPM, 1 1/2" Discharge, Cast-iron Sump Pump	1.00	EA	2,680.94	785.90	0.00	$3,466.84	
99010102	Site Project Manager - Average Cost	1.00	MWK	0.00	3,724.16	0.00	$3,724.16	
99010202	Superintendent - Average Cost	1.00	MWK	0.00	3,489.34	0.00	$3,489.34	
99010301	Clerk - Average Cost	0.50	MWK	0.00	728.58	0.00	$364.29	
99010402	Field Engineer - Average Cost	2.00	MWK	0.00	2,284.38	0.00	$4,568.76	
99010702	Safety Engineer - Average Cost	1.00	MWK	0.00	2,690.14	0.00	$2,690.14	
99010802	Quality Control - Average Cost	1.00	MWK	0.00	2,690.14	0.00	$2,690.14	
99040102	Temporary Office 32' x 8'	0.25	MO	301.03	0.00	0.00	$75.26	
99040201	Temporary Storage Trailer 16' x 8'	0.25	MO	98.47	0.00	0.00	$24.62	
99040501	Portable Toilets - Chemical	0.25	MO	100.82	0.00	0.00	$25.20	
						Total Technology Cost	**$73,418.46**	

Alternative 5
Offsite Transportation and Disposal

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Disposal
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Off-site Transportation and Waste Disposal
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Landfill Fee from Waste Management Altamont Landfill, Livermore, CA
Hauling Quote from Den Beste Transportation

.

Alternative 5
Offsite Transportation and Disposal

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33190102	Bulk Solid Hazardous Waste Loading Into Truck	6,270.56	CY	0.00	1.50	2.10	$22,563.25	
33190205	Transport & Dispose Bulk Solid Hazardous Waste At Altamont as nonhazardous waste (assume 1 CY = 1.45 ton)	9,092.31	TON	54.00	0.00	0.00	$490,984.85	
						Total Technology Cost	**$513,548.10**	

Alternative 5
Design

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Disposal
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Professional Labor Management
Prime Markup: 100 %
Sub Markup: 0 %

Alternative 5
Design

Element: Professional Labor Percentage

Assembly	Description	Percent	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	2.00%	0.00	47,353.78	0.00	$47,353.78	
33220139	Planning Documents Labor Cost	2.00%	0.00	47,353.78	0.00	$47,353.78	
33220140	Construction Oversight Labor Cost	2.50%	0.00	59,192.22	0.00	$59,192.22	
33220141	Reporting Labor Cost	0.25%	0.00	5,919.22	0.00	$5,919.22	
33220142	As-Built Drawings Labor Cost	0.25%	0.00	5,919.22	0.00	$5,919.22	
33220143	Public Notice Labor Cost	0.04%	0.00	828.69	0.00	$828.69	
33220144	Site Closure Activities Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
33220145	Permitting Labor Cost	2.50%	0.00	59,192.22	0.00	$59,192.22	
33220148	Other Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
					Total Element Cost	**$225,759.13**	
					Total Technology Cost	**$225,759.13**	

Alternative 5
Groundwater Monitoring

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Monitoring
ID: 0008
Type: None

Phase Element

Name: Soil Options Monitoring
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Description: 1 YR Costs

Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Monitoring (12 months only)
Prime Markup: 100 %
Sub Markup: 0 %
Comments: User Defined Analysis includes rental cost of an oil-water interface probe (assume $75/WK)
Assume: Annual sampling; Quarterly oil-water level measurement
Additional 16 hours added to field technician time and 300 miles added to car or van mileage for oil-water level measurement events.

Templates: System Water-Fuels

Alternative 5
Groundwater Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	51.00	EA	10.95	0.00	0.00	$558.57	
33020402	Decontamination Materials per Sample	51.00	EA	9.70	0.00	0.00	$494.67	
33021509	Water Quality Parameter Testing Device	1.00	WK	288.46	0.00	0.00	$288.46	
33021618	Volatile Organic Analysis (EPA 624), Water Analysis	51.00	EA	253.85	0.00	0.00	$12,946.42	
33021694	Total Petroleum Hydrocarbons (SW8015B), Water Analysis	51.00	EA	94.62	0.00	0.00	$4,825.72	
33022150	BTEX/MTBE/TVPH (EPA 8021B/8015B), Water Analysis	51.00	EA	149.02	0.00	0.00	$7,600.14	
33029501	User Defined Analysis 1	4.00	LS	100.82	0.00	0.00	$403.29	
33231186	Well Development Equipment Rental (weekly)	1.00	WK	288.46	0.00	0.00	$288.46	
33231189	Furnish 55 Gallon Drum for Development/Purge Water	24.00	EA	100.48	0.00	0.00	$2,411.61	
33232407	Disposable Bailer, Polyethylene, 1.5" Outside Diameter x 36"	24.00	EA	12.49	0.00	0.00	$299.75	
						Total Element Cost	**$30,117.09**	

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Car or Van Mileage Charge	600.00	MI	0.44	0.00	0.00	$265.85	
33220102	Project Manager	4.00	HR	0.00	181.23	0.00	$724.91	

Alternative 5
Groundwater Monitoring

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220105	Project Engineer	30.00	HR	0.00	115.71	0.00	$3,471.33	
33220108	Project Scientist	219.00	HR	0.00	110.04	0.00	$24,098.07	
33220109	Staff Scientist	80.00	HR	0.00	90.22	0.00	$7,217.64	
33220112	Field Technician	90.00	HR	0.00	72.59	0.00	$6,532.82	
33220114	Word Processing/Clerical	38.00	HR	0.00	57.22	0.00	$2,174.46	
33220115	Draftsman/CADD	34.00	HR	0.00	75.03	0.00	$2,551.06	
						Total Element Cost	**$47,036.14**	
						1st Year Technology Cost	**$77,153.23**	

Alternative 6 – Multiphase Extraction, In-Situ Thermal Desorption, and Institutional Controls

Multiphase Extraction (MPE) Includes:

- Pilot test for MPE system
- Installation of horizontal recovery wells
- Installation of MPE unit with fluid separation/storage and off-gas treatment

In-Situ Thermal Desorption (ISTD) Includes:

- Pilot test for ISTD system
- Installation of vertical thermal heating/vacuum wells
- Installation of surface seal, vacuum manifolds, and connection to air quality control system

Institutional Controls Includes:

- Land Use Control Implementation and Certification Plan
- Environmental restrictions on deed and covenant to restrict future use of the property
- Deed filing and registration

Operation and Maintenance Includes:

- MPE system periodic evaluation of operational parameters and maintenance (oil change, belt and filter replacement) – Years 1 and 2 only
- MPE system monthly collection and off-site disposal of extracted liquids – Years 1 and 2 only

Monitoring Includes:

- Confirmation soil and groundwater sampling to evaluation completion of ISTD – Year 1 only
- Quarterly air emission sampling with increased sampling frequency during system startup – Years 1 and 2 only
- Annual groundwater sampling of existing monitoring wells
- Quarterly oil-water level measurement
- Sample analysis reporting

5-Year Review Includes:

- Preparation of report

Alternative 6
Institutional Controls

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Institutional Controls
ID: 0003
Type: None

Phase Element

Name: Institutional Controls
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: N/A
Secondary Media/Waste Type: N/A
Contaminant: None
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: User-Defined Estimate
Prime Markup: 100 %
Sub Markup: 0 %
Comments: Includes: Land Use Control Implementation and Certification Plan ($10,000), Environmental Restrictions on Deed and Covenant to Restrict Future Use of Property ($9,000), and Deed Filing & Registration ($1,000)

Unit of Assembly	Description	Quantity	Material Measure	Labor Unit Cost	Equipment Unit Cost	Extended Unit Cost	Cost Cost
33220150	User Defined Labor Cost 01	200.00	HR	0.00	313.29	0.00	$62,658.75
						Total Technology Cost	**$62,658.75**

Alternative 6
Thermal Desorption and Multi-Phase Extraction

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Product Wells
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Groundwater Extraction Wells
Prime Markup: 100 %
Sub Markup: 0 %
Comments:

Alternative 6
Thermal Desorption and Multi-Phase Extraction

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17020203	Demolish Bituminous Pavement with Air Equipment	416.89	CY	0.00	59.63	11.16	$29,511.64	
17030259	Cat 225, 1.5 CY, Soil/Sand, Trenching	4,370.96	CY	0.00	0.86	0.76	$7,080.96	
17030415	Backfill with Excavated Material	5,900.80	CY	0.38	5.76	1.11	$42,780.80	
18020301	Bituminous Paving	2,501.33	SY	8.12	16.75	14.32	$98,027.12	
33132361	1,000 SCFM, Vapor Recovery System	1.00	EA	29,768.09	0.00	0.00	$29,768.09	
33220112	Field Technician	93.00	HR	0.00	71.24	0.00	$6,625.32	
33230101	2" PVC, Schedule 40, Well Casing	80.00	LF	1.34	5.55	5.84	$1,018.40	
33131913	1,000 CFM, 400 lb Fill, Radial Flow	1.00	EA	2,601.00	0.00	0.00	$2,601.00	
33230112	4" PVC, Schedule 80, Well Casing	1.00	LF	5.35	8.32	8.76	$22.43	
33230212	4" PVC, Schedule 80, Well Screen	921.00	LF	7.40	8.32	8.76	$22,546.08	
33230302	4" PVC, Well Plug	10.00	EA	27.23	12.20	12.85	$522.80	
33231407	Gravel Pack for Horizontal Well Installation	274.00	CF	0.91	0.10	0.07	$295.92	
33260428	2” PVC, Schedule 80 Connection Piping	461.00	LF	0.99	6.04	0.00	$3,240.83	
33260460	4” PVC, Schedule 80 Manifold Piping	230.50	LF	2.95	13.03	0.00	$3,683.39	
33270124	2” PVC, Schedule 80 Tee	10.00	EA	14.19	0.00	0.00	$141.90	
33270134	2” PVC, Schedule 80, 90 Degree, Elbow	10.00	EA	3.86	0.00	0.00	$38.60	
33270136	4” PVC, Schedule 80, 90 Degree, Elbow	10.00	EA	15.96	0.00	0.00	$150.60	
33270167	4” x 2” Reducer, PVC Schedule 80	10.00	EA	41.59	0.00	0.00	$415.90	

Alternative 6
Thermal Desorption and Multi-Phase Extraction

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33420101	Electrical Charge	843.00	KWH	0.08	0.00	0.00	$67.44	
99010102	Site Project Manager - Average Cost	3.10	MWK	0.00	3,724.16	0.00	$11,627.25	
99010202	Superintendent - Average Cost	3.10	MWK	0.00	3,489.34	0.00	$10,894.12	
99010301	Clerk - Average Cost	1.60	MWK	0.00	728.58	0.00	$1,137.36	
99010402	Field Engineer - Average Cost	6.2	MWK	0.00	2,284.38	0.00	$14,264.19	
99010702	Safety Engineer - Average Cost	3.10	MWK	0.00	2,690.14	0.00	$8,398.92	
99010802	Quality Control - Average Cost	3.10	MWK	0.00	2,690.14	0.00	$8,398.92	
99040102	Temporary Office 32' x 8'	0.70	MO	301.03	0.00	0.00	$223.77	
99040201	Temporary Storage Trailer 16' x 8'	0.70	MO	98.47	0.00	0.00	$73.20	
99040501	Portable Toilets - Chemical	0.70	MO	100.82	0.00	0.00	$74.95	
20020301	1/0 ACSR Conductor	318.00	LF	0.25	0.92	0.08	$397.50	
20020310	1/C #2 Aluminum, Bare, Wire	106.00	LF	0.19	0.89	0.08	$122.96	
20039902	4” Rigid Steel Conduit	30.00	LF	11.09	14.29	0.00	$761.40	
Vendor Quote, In Situ Thermal Treatment (plus pilot)		1.00	LS	1,580,000	0.00	0.00	$1,580,000.00	
Vendor Quote, Additional Electrical Charge		2,420,000.00	KWH	0.04	0.00	0.00	$96,800.00	
						Total Technology Cost	**$1,983,383.62**	

Alternative 6
Design

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Product Wells
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Professional Labor Management
Prime Markup: 100 %
Sub Markup: 0 %

Alternative 6
Design

Element: Professional Labor Percentage

Assembly	Description	Percent	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	5.00%	0.00	99,169.18	0.00	$99,169.18	
33220139	Planning Documents Labor Cost	4.00%	0.00	79,335.34	0.00	$79,335.34	
33220140	Construction Oversight Labor Cost	3.25%	0.00	64,459.97	0.00	$64,459.97	
33220141	Reporting Labor Cost	0.75%	0.00	14,875.38	0.00	$14,875.38	
33220142	As-Built Drawings Labor Cost	0.75%	0.00	14,875.38	0.00	$14,875.38	
33220143	Public Notice Labor Cost	0.25%	0.00	4,958.46	0.00	$4,958.46	
33220144	Site Closure Activities Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
33220145	Permitting Labor Cost	5.00%	0.00	99,169.18	0.00	$99,169.18	
33220148	Other Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
					Total Element Cost	**$376,842.89**	
					Total Technology Cost	**$376,842.89**	

Alternative 6
O&M and Free Product Disposal

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Free Product Options
ID: 0001
Type: None

Phase Element

Name: Product Wells
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Operations and Maintenance (12 months)
Prime Markup: 100 %
Sub Markup: 0 %
Comments:
Templates: System Water-Fuels

Alternative 6
O&M and Free Product Disposal

Element: Treatment Train Miscellaneous

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010423	Disposable Gloves (Latex)	114.00	PAIR	0.21	0.00	0.00	$22.80	
33010425	Disposable Coveralls (Tyvek)	114.00	EA	5.38	0.00	0.00	$613.32	
33190340	Non Haz Drummed Site Waste - Load, Transp, & Landfill Disp (55-Gal Drums)	3.00	EA	247.46	0.00	0.00	$742.38	
33190341	Free Product Disposal	1,320.00	GAL	0.34	15.72	0.00	$21,199.20	
33199921	DOT Steel Drum, 55 Gallon	3.00	EA	96.23	0.00	0.00	$288.69	
33220106	Staff Engineer	4.00	HR	0.00	106.16	0.00	$424.64	
33220112	Field Technician	12.00	HR	0.00	71.24	0.00	$854.88	
33240104	Startup Costs	1.00	LS	5,223.49	6,471.58	2,681.08	$14,376.15	
99020110	Annual Maintenance Materials and Labor	1.00	LS	1,680.39	2,081.90	862.50	$4,624.79	
					Total Element Cost		**$43,146.85**	

Element: Thermal Desorption and MPE

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33021832	Hydrocarbon Separation, C1-C22, GC/FID, Air (TO-12/14)	12.00	EA	600.00	0.00	0.00	$7,200.00	
33220106	Staff Engineer	76.00	HR	0.00	107.38	0.00	$8,160.88	
33220112	Field Technician	754.00	HR	0.00	72.59	0.00	$54,732.86	
33420101	Electrical Charge	29,127.00	KWH	0.08	0.00	0.00	$2,330.16	

Alternative 6
O&M and Free Product Disposal

Total Element Cost	**$72,423.9**
1st Year Technology Cost Subtotal	**$115,570.75**
Runtime Percent Cost Adjustment	**97%**
1st Year Technology Cost	**$112,103.63**

Alternative 6
Monitoring

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Monitoring
ID: 0008
Type: None

Phase Element

Name: VAC Truck Monitoring
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Description: 1 YR Costs

Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Monitoring (12 months only)
Prime Markup: 100 %
Sub Markup: 0 %
Comments: User Defined Analysis includes rental cost of an oil-water interface probe ($75/WK)
Assume: Annual sampling; Quarterly oil-water level measurement
Additional 16 hours added to field technician time and 300 miles added to car or van mileage for oil-water level measurement events.

Templates: System Water-Fuels

Alternative 6
Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	51.00	EA	10.95	0.00	0.00	$558.57	
33020402	Decontamination Materials per Sample	51.00	EA	9.70	0.00	0.00	$494.67	
33021509	Water Quality Parameter Testing Device	1.00	WK	288.46	0.00	0.00	$288.46	
33021618	Volatile Organic Analysis (EPA 624), Water Analysis	51.00	EA	253.85	0.00	0.00	$12,946.42	
33021694	Total Petroleum Hydrocarbons (SW8015B), Water Analysis	51.00	EA	94.62	0.00	0.00	$4,825.72	
33022150	BTEX/MTBE/TVPH (EPA 8021B/8015B), Water Analysis	51.00	EA	149.02	0.00	0.00	$7,600.14	
33029501	User Defined Analysis 1	4.00	LS	100.82	0.00	0.00	$403.29	
33231186	Well Development Equipment Rental (weekly)	1.00	WK	288.46	0.00	0.00	$288.46	
33231189	Furnish 55 Gallon Drum for Development/Purge Water	24.00	EA	100.48	0.00	0.00	$2,411.61	
33232407	Disposable Bailer, Polyethylene, 1.5" Outside Diameter x 36"	24.00	EA	12.49	0.00	0.00	$299.75	
						Total Element Cost	**$30,116.62**	

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Car or Van Mileage Charge	600.00	MI	0.44	0.00	0.00	$265.85	
33220102	Project Manager	4.00	HR	0.00	181.23	0.00	$724.91	

Alternative 6
Monitoring

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220105	Project Engineer	30.00	HR	0.00	115.71	0.00	$3,471.33	
33220108	Project Scientist	219.00	HR	0.00	110.04	0.00	$24,098.07	
33220109	Staff Scientist	80.00	HR	0.00	90.22	0.00	$7,217.64	
33220112	Field Technician	90.00	HR	0.00	72.59	0.00	$6,532.82	
33220114	Word Processing/Clerical	38.00	HR	0.00	57.22	0.00	$2,174.46	
33220115	Draftsman/CADD	34.00	HR	0.00	75.03	0.00	$2,551.06	
						Total Element Cost	**$47,035.06**	

Element: Soil Sampling

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020603	Surface Soil Sampling Equipment	1.00	EA	439.35	0.00	0.00	$439.35	
33021102	Soil Moisture Content ASTM D2216	40.00	EA	28.97	0.00	0.00	$1,158.80	
33021722	PAH (SW 8310), w/prep, Soil Analysis	40.00	EA	142.71	0.00	0.00	$5,708.40	
33021732	TPH (SW 5030/SW 8015B), Soil Analysis	40.00	EA	78.48	0.00	0.00	$3,139.20	
33021776	BTEX/MTBE/TVPH (EPA 8021B/8015B)	40.00	EA	90.61	0.00	0.00	$3,624.40	
						Total Element Cost	**$14,070.15**	
						1st Year Technology Cost	**$91,221.83**	

Present Value Analysis – All costs include a 25 percent contingency (15 percent scope plus 10 percent bid). Contingency is applied according to U.S. Environmental Protection Agency's *Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (2000b). Costs are presented as follows:

Capital Costs (year 0)

- Alternative 2: Trenching, skimmer pumps, decontamination facilities, and institutional controls.
- Alternative 3: Product recovery wells and institutional controls.
- Alternative 4: Excavation, transportation, bioremediation facility, backfilling, decontamination facilities, and institutional controls.
- Alternative 5: Excavation, transportation, disposal, backfilling, decontamination facilities, and institutional controls.
- Alternative 6: Multiphase extraction (MPE), in-situ thermal desorption (ISTD), and institutional controls.

Annual Operation and Maintenance (O&M) and Monitoring Costs (beginning in year 1)

- Alternative 2: O&M of skimmer pumps, free product disposal, and groundwater sampling and sample reporting.
- Alternative 3: Vacuum truck extraction, free product disposal, and groundwater sampling and sample reporting.
- Alternative 4: Groundwater sampling and sample reporting.
- Alternative 5: Groundwater sampling and sample reporting.
- Alternative 6: MPE and ISTD system operation and maintenance, free product disposal, and air emission and groundwater sampling and sample reporting.

Periodic Costs (year 5)

- 5-Year Review

Total Actual Costs

- Sum of the total cost per year

Present Value Costs (assuming a 3.9 percent discount factor)

Present value of the total cost per year

RACER Markups Template Preferences Report

Template: System Defaults

Description	Professional Labor	Craft Labor	Materials	Equipment
Prime General Conditions < 10,000	25.00	25.00	17.00	40.00
Prime General Conditions 10,000 to 25,000	15.00	20.00	12.00	30.00
Prime General Conditions 25,001 to 50,000	10.00	17.50	10.00	20.00
Prime General Conditions 50,001 to 100,000	7.50	15.00	8.00	15.00
Prime General Conditions 100,001 to 250,000	5.00	12.00	6.50	10.00
Prime General Conditions 250,001 to 500,000	5.00	10.00	5.00	8.00
Prime General Conditions > 500,000	5.00	8.00	5.00	6.00
Prime Overhead	160.00	30.00	8.00	8.00
Sub General Conditions < 10,000	25.00	25.00	17.00	40.00
Sub General Conditions 10,000 to 25,000	15.00	20.00	12.00	30.00
Sub General Conditions 25,001 to 50,000	10.00	17.50	10.00	20.00
Sub General Conditions 50,001 to 100,000	7.50	15.00	8.00	15.00
Sub General Conditions 100,001 to 250,000	5.00	12.00	6.50	10.00
Sub General Conditions 250,001 to 500,000	5.00	10.00	5.00	8.00
Sub General Conditions > 500,000	5.00	8.00	5.00	6.00
Sub Overhead	160.00	30.00	8.00	8.00

Prime Markup on Sub	3.5
Prime Profit	8.5
Risk (Contingency)	0
Owner Cost	5
Sub Profit	8.5

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APPENDIX C
REMEDIAL EVALUATION FOR THE UNRESTRICTED REUSE SCENARIO

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Attachment

C1 Cost Summary Sheets for Unrestricted Reuse Scenario

Figure

C-1 Modified Alternative 5: Soil Excavation, Off-Site Disposal, and Backfilling with Clean Soil for Unrestricted Reuse Scenario

Table

C-1 Human Health Risk Assessment for the Residential Reuse Scenario

ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or relevant and appropriate requirement
CTE	Central tendency exposure
DoD	U.S. Department of Defense
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
FS	Feasibility study
GRA	General response action
HHRA	Human health risk assessment
HI	Hazard index
IR17	Installation Restoration Site 17
mg/kg	Milligrams per kilogram
NAPL	Nonaqueous-phase liquid
PAH	Polynuclear aromatic hydrocarbon
PRG	Preliminary remediation goal
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial action objective
RI	Remedial investigation
RME	Reasonable maximum exposure
ROD	Record of decision
Tetra Tech	Tetra Tech EM Inc.
VOC	Volatile organic compound

1.0 INTRODUCTION

This appendix presents an addendum to the feasibility study (FS) for Installation Restoration Site 17 (IR17) and the Building 503 Area at the former Mare Island Naval Shipyard in Vallejo, California. The purpose of this addendum is to define the additional risk and further actions that would be relevant if the reuse of site was unrestricted. Although the site is planned for light industrial reuse (City of Vallejo 1994), the U.S. Department of Defense's (DoD) "Memorandum on Policy on Land Use Controls Associated with Environmental Restoration Activities" (DoD 2001) requires that the unrestricted use alternative must be evaluated when land use restrictions are proposed. Land use restrictions are currently being proposed, as discussed in Section 3.2.2 of the main text, to prevent or limit exposure to hazardous substances left in place at a site and to assure the effectiveness of a selected remedy (U.S. Environmental Protection Agency [EPA] 2000).

The human health risks associated with unrestricted reuse were evaluated in the remedial investigation (RI) (Tetra Tech EM Inc. [Tetra Tech] 2003) assuming risk would be posed to human health by the following pathways:

- Exposure to a resident via ingestion of soil
- Direct contact with soil
- Inhalation of dust particles
- Inhalation of volatile organic compounds (VOC) released from soil

Exposure to drinking water was not evaluated because groundwater at the site does not meet state and federal potability requirements, primarily as they relate to well yield and total dissolved solids (Tetra Tech 2003). These human health risks were used in this FS to identify additional soil and groundwater requiring remediation and associated costs. As discussed in Section 1.3.5.4 of the main text, potential risk to ecological receptors from exposure to sediment in the wetland area of the site was evaluated in the onshore ecological risk assessment (Tetra Tech 2002). No immediate or significant ecological risk was identified (Tetra Tech 2003). Thus, this FS addendum focuses only on remediating contamination to address human health risks under an unrestricted reuse scenario.

This FS addendum does not evaluate new alternatives to remediate the site for unrestricted reuse. Instead, it was assumed that the preferred remedial alternative discussed in Section 3.9 of the main text could be modified to successfully reduce the risk for unrestricted use. Therefore, the preferred remedial alternative, as modified, is the only remedial alternative presented in this appendix.

This appendix consists of five sections, including this introduction. Section 2.0 summarizes the recommendations of the human health risk assessment (HHRA) for a residential scenario conducted for the IR17 and Building 503 Area (Tetra Tech 2003), including a discussion of the

chemicals driving risk for the residential scenario. Section 3.0 presents the remedial action objectives (RAO) and an evaluation of the preferred alternative for the unrestricted use scenario. Section 4.0 provides a summary of the remedial evaluation. Section 5.0 lists the documents used to prepare this appendix.

Figures, tables, and Attachment C1, respectively, are presented after Section 5.0. Attachment C1 contains the cost summary sheets for the unrestricted use scenario.

2.0 HUMAN HEALTH RISK ASSESSMENT FOR RESIDENTIAL USE

This section summarizes the potential cancer risks and risks of adverse noncancer health effects associated with contaminants present at the site under an unrestricted reuse scenario for a hypothetical future resident. Except for lead, the risk characterization followed the approach outlined in the risk assessment guidance (EPA 1998). The objective of the HHRA, which was presented in the RI (Tetra Tech 2003), is to provide a basis for risk management decisions regarding cancer risks, noncancer risks, and lead exposure associated with potential human exposure to contaminants in soil and inhalation of subsurface VOCs under a residential use scenario. Two site configurations were evaluated to develop recommendations for unrestricted use. Sections 2.1 and 2.2 discuss each site configuration, and Section 2.3 discusses the assessment of lead. Section 2.4 presents the recommendations of the HHRA for unrestricted use at the IR17 and Building 503 Area.

2.1 UNCHANGED SITE CONFIGURATION

Potential exposures for residential receptors in the residential use scenario were evaluated using the same site configuration that was presented in the RI (that is, a 0- to 2-foot depth interval for exposures to soil). Total excess lifetime cancer risk estimates are 3×10^{-6} under the central tendency exposure (CTE) scenario and 1×10^{-5} under the reasonable maximum exposure (RME) scenario (both within the target risk range). For the CTE scenario, the excess cancer risk is driven by benzo(a)pyrene in soil (2×10^{-6}). Both the child and adult resident have no unacceptable CTE noncancer hazard, as even total HI for all contaminants in the unchanged configuration was less than unity (1.0).

For the RME scenario, the excess cancer risk is driven by benzo(a)anthracene (1×10^{-6}), benzo(a)pyrene (1×10^{-5}), and 4,4'-dichlorodiphenyltrichloroethane in soil (1×10^{-6}). Table C-1 summarizes the human health risk assessment results for residential reuse. Under the RME scenario for the unchanged site configuration, the segregated HIs in the table below equal or exceed 1. (Note: HIs for the child are discussed because the child resident is at greater noncancer risk than the adult.) Risks and health hazards discussed are significant only to one significant figure, as recommended by "Risk Assessment Guidance for Superfund (RAGS) Part A" (EPA 1989). However, to enable checks for mathematical accuracy to additional decimals, the summary tables include results beyond the single significant figure.

Target Organ	Segregated Hazard Index	Risk Driver	Contribution
Blood	1.4 (of 1.8 total)	Antimony	1.4
Other organs	<0.4	No drivers identified	< 0.4

The remaining residual contributors to the total child HI of 1.8 did not affect the blood or other target organs cumulatively, so the residual HI of about 0.4 does not include other hazard drivers.

2.2 MODIFIED SITE CONFIGURATION

For the modified site configuration (0- to 10-foot depth interval for soil), potential exposures for the residential receptor were evaluated. Total excess cancer risk estimates are 4×10^{-6} under the CTE scenario and 2×10^{-5} under the RME scenario (both within the target risk range). For the CTE scenario, the excess cancer risk is driven by benzo(a)pyrene in soil (2×10^{-6}). Both the child and adult resident have no unacceptable CTE noncancer hazards, as even total HI for all contaminants in the modified configuration was less than unity (1.0).

For the RME scenario, the excess cancer risk is driven by 1,4-dioxane (2×10^{-6}), benzo(a)anthracene (1×10^{-6}), benzo(a)pyrene (2×10^{-6}), benzo(b)fluoranthene (1×10^{-6}), benzo(k)fluoranthene (2×10^{-6}), dibenzo(a,h)anthracene (4×10^{-6}), and indeno(1,2,3-cd)pyrene (1×10^{-6}). Under the RME scenario for the modified site configuration, the segregated HIs in the table below equal or exceed 1. (Note: HIs for the child are discussed because the child resident is at greater noncancer risk than the adult.) Risks and health hazards discussed are significant only to one significant figure, as recommended by RAGS Part A (EPA 1989). However, to enable checks for mathematical accuracy to additional decimals, the summary tables include results beyond the single significant figure.

Target Organ	Segregated Hazard Index	Risk Driver	HI Contributed by Driver Listed
Nervous System	1.1 (of 3.5 total)	1,3,5-Trimethylbenzene	1.1
Kidney	1.4 (of 3.5 total)	Isopropylbenzene	1.4
Other organs	<1	No drivers identified	< 1

The remaining residual contributors to the total child HI of 3.5 did not affect the nervous system, kidney, or other target organs cumulatively, so the residual HI of about 1 does not include other hazard drivers.

2.3 LEAD ASSESSMENT

The potential for human health effects from lead exposure was evaluated by comparing exposure point concentrations (EPC) for lead in soil with the EPA Region IX's preliminary remediation goal (PRG) for residential soil available at the time the HHRA was completed (400 milligrams per kilogram [mg/kg]) (EPA 2002). EPCs above PRGs are considered to represent a potential threat to human health. The RME concentration in soil was 185 mg/kg for the 0- to 2-foot depth interval and 64.8 mg/kg for the 0- to 10-foot depth interval, both of which are less than the PRG of 400 mg/kg (EPA 2002). These concentrations are also less than the current Mare Island site-specific comparison criteria for lead, which is 210 mg/kg.

2.4 HUMAN HEALTH RISK ASSESSMENT RECOMMENDATIONS FOR UNRESTRICTED USE

The HHRA determined that risk is present at the site because chemicals were detected in soil at concentrations above the risk management range for an unrestricted use scenario. A remedial action would be required to reduce the risk from chemicals in soil to residential receptors under an unrestricted use scenario. The HHRA indicated that the risk from vapor inhalation from subsurface VOCs is within the risk management range for a residential receptor (Tetra Tech 2003).

The noncancer risk drivers at the site are antimony, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and isopropylbenzene, and the cancer risk drivers are 1,4-dioxane, and polynuclear aromatic hydrocarbons (PAH). The primary pathways of exposure for residential receptors from these chemicals are ingestion of soil, direct contact with soil, inhalation of dust particles, and inhalation of VOCs released from soil. Reducing the concentrations of these chemicals at the site would reduce the risk to human health to levels that are acceptable under an unrestricted use scenario.

While cancer risks are within the risk management range, these risks are driven primarily by PAHs, which have no discernable pattern in soil at the site and are likely associated with background concentrations in fill material used at Mare Island, and not a result of activities at the site (Tetra Tech 1998). For these reasons, PAH compounds in soil were not addressed as part of this FS.

3.0 REMEDIAL EVALUATION FOR THE UNRESTRICTED USE SCENARIO

This section summarizes the results of the remedial evaluation for the unrestricted use scenario. The evaluation is based on Alternative 5, which is described in Section 3.9 of the main text of the FS. It consists of soil excavation, off-site disposal, and backfilling with clean soil. The following subsections present the applicable or relevant and appropriate requirements (ARAR) (Section 3.1), RAOs (Section 3.2), and general response actions (GRA) (Section 3.4) identified for the unrestricted use scenario and describe how the preferred alternative would be applied to reduce risk for an unrestricted use scenario.

3.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs identified and evaluated for the unrestricted use scenario are outlined in Appendix A of the FS report. As detailed in the appendix, the final determination of ARARs will be made by the Navy in the record of decision (ROD) after public review as part of the process to select response actions.

3.2 REMEDIAL ACTION OBJECTIVES

The RAO presented in this section is specific to the removal of chemicals in soil that represent unacceptable risk to residential receptors. As discussed previously in Section 2.1, chemicals present in soil at the site contribute an HI greater than 1, indicating a noncancer health effect to residents exposed to soil at the site. Thus, the RAO for this site is to prevent exposure to soil posing an unacceptable noncancer risk at the site under an unrestricted reuse scenario.

Groundwater is not being evaluated in this appendix. Because groundwater at the site does not meet potability requirements (Tetra Tech 2003), risk from the ingestion pathway was not calculated in the HHRA for this site.

3.3 GENERAL RESPONSE ACTIONS

GRAs for this FS are discussed in Section 2.3 of the main text. Because this appendix only considers the preferred alternative to reduce risk under an unrestricted use scenario, the GRAs are those applicable to active remediation, in particular soil excavation, off-site disposal, and backfilling with clean soil.

3.4 PRELIMINARY SCREENING OF TECHNOLOGIES AND DEVELOPMENT OF REMEDIAL ALTERNATIVES

The initial screening process for technology types and process options is presented in Section 3.0 of the main text. Because this appendix only considers the preferred alternative to reduce risk under an unrestricted use scenario, additional technologies were not screened and additional remedial alternatives were not developed. This section describes how the preferred alternative would be applied to reduce risk under an unrestricted use scenario.

Alternative 5 would be modified to meet the requirements for an unrestricted future land use at the site. Based on the risk assessment completed for a residential scenario, there is unacceptable risk to residential receptors at the site. This alternative would be modified to address this risk.

With this modified Alternative 5, the following materials would be removed from the site: any residual free product from the inferred areas to a depth of 6 inches below the water table, nonaqueous-phase liquid (NAPL) contaminated soil, and soils contaminated with chemicals driving risk for a residential receptor. The chemicals driving risk at the site are antimony; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; isopropylbenzene; and 1,4-dioxane. Except for antimony, most of these chemicals are within the areas of inferred product and would be removed under an industrial reuse scenario for the site. To remove antimony, about 2,200 cubic

yards of soil would be excavated outside the inferred area of product at the site. Figure C-1 shows the chemicals driving risk at the site that are above their respective PRGs for a residential receptor. Figure C-1 also shows the anticipated aerial extent and proposed depths of the excavations necessary to reduce the risk for unrestricted use. The excavation depths vary depending on where each contaminant was detected above comparison criteria. The excavation would extend to a maximum depth of eight feet below ground surface. As with the industrial/commercial scenario, soil excavated to address these chemicals would be disposed of in a licensed off-site landfill. Clean fill would be placed back into the excavations.

Overall Protection of Human Health and the Environment

Reduction of soil contaminated with VOCs and the removal of free product from the IR17 and Building 503 Area would reduce the volume of contaminants in the subsurface and accelerate the natural attenuation process. Removal of soil with antimony concentrations above comparison criteria would reduce the risk to residential receptor.

Compliance with Applicable or Relevant and Appropriate Requirements

This modified Alternative 5 would comply with all ARARs. A discussion of the compliance with ARARs for this Alternative is presented in Section 3.9.2 of the main text.

Long-Term Effectiveness and Permanence

Excavation and off-site disposal would remove free product and permanently reduce contaminant mass at the site. As previously discussed, free product may be acting as a continuing source of contamination to groundwater and ambient air; therefore, any removal of free product would accelerate the natural attenuation process of contamination in groundwater at the site.

Reduction in Toxicity, Mobility, and Volume through Treatment

As explained in the main text, Alternative 5 does not reduce toxicity, mobility, and volume of contaminants through treatment. However, the alternative would reduce toxicity at the IR17 and Building 503 Area by removing chemicals from the site that exceed risk criteria for the unrestricted site use scenario. In addition, these removed contaminants would be placed into an engineered facility where they would be practically immobilized.

Short-Term Effectiveness

Modified Alternative 5 has minor short-term effects common to any mid-size environmental remediation project because it requires worker exposure with contaminants and increased site traffic. Modified Alternative 5 also requires the movement of large volumes of soil. Finally, modified Alternative 5 offers a quick remediation scenario of less than 2 months.

This alternative would be effective in the short-term reduction of potential risk to humans and ecological receptors because it could be implemented quickly.

Implementability

The modified Alternative 5 is technically feasible and uses techniques that have proven to be effective at removing free product and other contaminants such as antimony. The alternative is of moderate complexity and could be completed using standard practices performed by licensed and experienced vendors.

Cost

With the additional volume of soil that would be excavated to address antimony in soil, the total present value cost for this modified Alternative 5 is about $3,239,000. This cost is $678,000 higher than the cost estimate for Alternative 5 presented in Section 3.9 of the main text of this FS. As with the cost estimate presented in the main text, this modified alternative includes excavation and monitoring. Costs are based on a period of performance of 5 years and present value at a 3.9 percent discount rate.

State Acceptance

Comments generated from state review of the FS will be considered and incorporated as necessary in the proposed plan and final ROD.

Community Acceptance

Community acceptance will be evaluated after the public comment period on the proposed plan and will be documented in the final ROD.

Summary

Human health and the environment would be protected under modified Alternative 5 for an unrestricted use scenario.

Federal and state ARARs require reduction of the apparent occurrence of free product to the maximum extent practicable. The modified Alternative 5 is practicable and would remove free product and other contaminants.

The modified Alternative 5 is the most cost effective alternative for the unrestricted site use scenario.

The Navy believes that state and community input is essential to select a remedial action. Input will be collected after the alternatives are presented to the public, and a final decision will be made after review of state and community input.

4.0 SUMMARY OF REMEDIAL EVALUATION FOR THE UNRESTRICTED REUSE SCENARIO

This FS addendum is consistent with the Comprehensive Environmental Response, Compensation, and Liability Act requirements defined in EPA and Navy guidance documents (EPA 1988; Navy 2001). The purpose of this FS addendum is to evaluate the preferred alternative (Alternative 5), as modified for achievement of an unrestricted use scenario at the IR17 and Building 503 Area. The components of Alternative 5 would not be modified; they consist of soil excavation, off-site disposal, and backfilling with clean soil. Modification of the alternative would involve additional areas that would be excavated to remove the chemicals driving risk in the HHRA for a residential reuse scenario. The modified Alternative 5 meets all criteria and is the most cost-effective alternative with the least degree of uncertainty regarding overall performance to achieve the RAO for unrestricted use. If the modified Alternative 5 is selected for unrestricted use, a post-remediation HHRA would confirm that remaining risk at the site is within or below the risk management range.

5.0 REFERENCES

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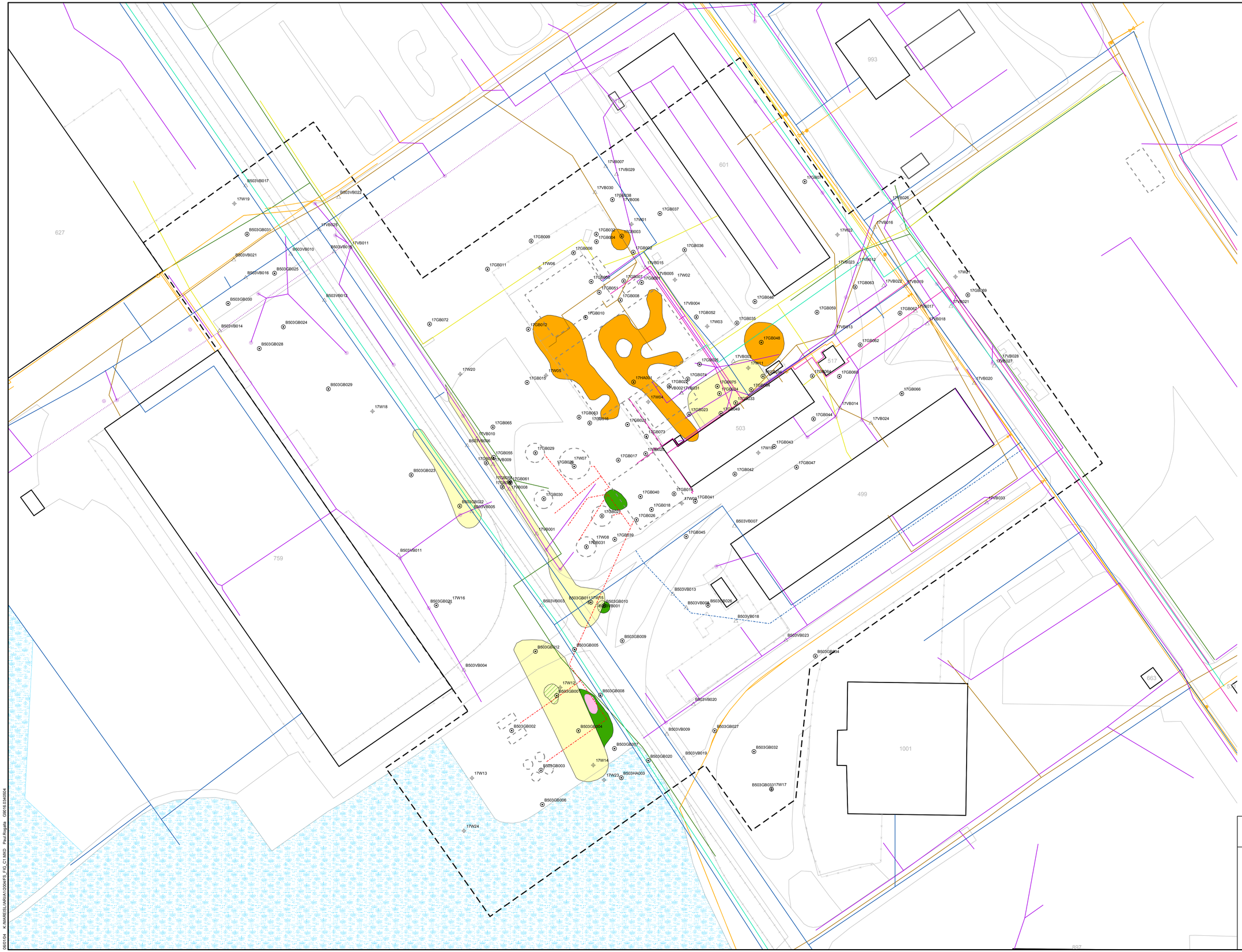
FIGURE



LEGEND

- SOIL BORING LOCATION
- MONITORING WELL
- VACUUM EXCAVATION LOCATION
- STORM WATER DRAIN
- SITE BOUNDARY
- FRESH WATER PIPELINE
- ABANDONED FRESH WATER PIPELINE
- SALT WATER PIPELINE
- ABANDONED SALT WATER PIPELINE
- STORM WATER PIPELINE
- ABANDONED STORM WATER PIPELINE
- SHARED STORM WATER PIPELINE AND SANITARY SEWER
- GAS LINE
- FORMER PRODUCT DISTRIBUTION PIPELINE
- BURIED TELEPHONE LINE
- SANITARY SEWER
- RAILROAD
- FENCE
- LIMIT OF EXCAVATION TO REMOVE SOIL CONTAINING 1,3,5-TRIMETHYLBENZENE AT GREATER THAN 21 MG/KG (0 TO 4 FEET BELOW GROUND SURFACE)
- LIMIT OF EXCAVATION TO REMOVE INFERRED FREE PRODUCT (4 TO 8 FEET BELOW GROUND SURFACE)
- OVERLAP BETWEEN INFERRED FREE PRODUCT AND 1,3,5-TRIMETHYLBENZENE EXCAVATIONS
- LIMIT OF EXCAVATION TO REMOVE SOIL CONTAINING 1,4-DIOXANE AT GREATER THAN 18 MG/KG (0 TO 4 FEET BELOW GROUND SURFACE)
- LIMIT OF EXCAVATION TO REMOVE SOIL CONTAINING ANTIMONY AT GREATER THAN 31 MG/KG (0 TO 3 FEET BELOW GROUND SURFACE)
- 503 BUILDING OR STRUCTURE
- 567 FORMER BUILDING OR STRUCTURE
- WETLAND

N

30 0 30 60
SCALE IN FEET

Tetra Tech EM, Inc.

INVESTIGATION AREA A1
MARE ISLAND, CALIFORNIA

FIGURE C-1
MODIFIED ALTERNATIVE 5

EXCAVATION AND OFF-SITE DISPOSAL FOR UNRESTRICTED USE

IR17 AND BUILDING 503 AREA

5/6/01/04 K:\MARESIS\JAN\IA1\2004\FS_F10_C1.MXD - Paul Rogalla 03/01/6 03/45/04

TABLE

TABLE C-1: HUMAN HEALTH RISK ASSESSMENT FOR THE RESIDENTIAL REUSE SCENARIO

Final Feasibility Study, IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Risk Types and Risk Drivers	Risks for Soil (0 to10 feet bgs)		Risks for Soil (0 to2 feet bgs)	
	Adult	**Child**	**Adult**	**Child**
RME Residential Cancer Risks	**Excess Lifetime Cancer Risks**			
Benzo(a)pyrene	3.5E-06 (48%)	7.4E-06	3.2E-06 (100%)	6.6E-06
Dibenzo(ah)anthracene	1.3E-06 (18%)	2.7E-06	Not a COPC	Not a driver
1,4-Dioxane[a]	Not a driver	1.1E-06[b]	Not a COPC	Not a COPC
Totals:	**2.2E-05**		**1.4E-05**	
RME Residential Noncancer Hazards	**Hazard Indices**			
Antimony (blood)	Not a driver	Not a driver	0.15	**1.4**
Isopropylbenzene (kidney)	0.60	**1.4** (40%)	Not a driver	Not a driver
1,3,5-Trimethylbenzene (CNS)	0.46	**1.1** (31%)	Not a driver	Not a driver
Totals:	**1.3**	**3.5**	**0.3**	**1.8**

Notes:

a The toxicity value for 1,4-dioxane is presently under review in IRIS for 2004. It is unlikely that the current cancer slope factor will remain in IRIS as tumors (localized nasal epithelial tumors) are induced in rodents as a result of drinking water from a tube; these tumors are unlikely to occur in humans. The cancer potency should go down in IRIS, resulting in no unacceptable risk for a future child resident from 1,4-dioxane in soil once the slope factor is revised. It is not recommended that remediation be instituted for 1,4-dioxane based on this information.

bgs Below ground surface
COPC Chemical of potential concern
CNS Central nervous system
HI Hazard index
HQ Hazard quotient
IRIS Integrated Risk Information System (U.S. Environmental Protection Agency (EPA). 2004. "Integrated Risk Information System (IRIS). Online Database." Available online the web at: http://www.epa.gov/iris)
RME Reasonable maximum exposure
VOC Volatile organic carbon

ATTACHMENT C1
COST SUMMARY SHEETS FOR UNRESTRICTED REUSE SCENARIO

TABLE C1-1: REMEDIAL ALTERNATIVE SUMMARY

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Remedial Alternative	Loaded Capital Cost	Loaded Annual Cost	Contingency (25%)	Total Capital Cost	Annual Cost	Periodic Cost
Alternative 5				**$2,614,631**	**$130,650** (Years 1-5)	**$50,000**
Excavation and Offsite Disposal	*$2,091,705*		*$522,926*			
Excavation and Backfill	$935,230					
Offsite Transportation and Disposal	$774,766					
Decontamination Facitlities	$76,385					
Design	$305,325					
Operation and Maintenance		*$0*	*$0*			
O&M		$0				
Monitoring		*$104,520*	*$26,130*			
Groundwater Monitoring		$104,520				

Notes:

Distibutive costs for project management, field office, health and safety, quality control are included in each line item.

Periodic costs are for conducting a five year review of the remedy.

Design Costs includes planning, construction oversight, reporting, drawings, permitting, and public notice labor costs.

All costs inflated 1.0404 percent to bring costs into 2004 dollars.

TABLE C1-2: PRESENT VALUE SUMMARY

Final Feasibility Study for the IR17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California

Alternative 5					
Year	Capital Costs ($)	Annual O&M Costs ($)	Periodic Costs ($)	Total Annual Cost ($)	Present Value at 3.9% ($)
0	$2,614,631	$0	$0	$2,614,631	$2,614,631
1	$0	$130,650	$0	$130,650	$125,746
2	$0	$130,650	$0	$130,650	$121,026
3	$0	$130,650	$0	$130,650	$116,483
4	$0	$130,650	$0	$130,650	$112,111
5	$0	$130,650	$50,000	$180,650	$149,197
Total	**$2,614,631**	**$653,252**	**$50,000**	**$3,317,884**	**$3,239,196**

Modified Alternative 5 – Soil Excavation, Off-Site Disposal, and Backfilling with Clean Soil

Soil Excavation, Off-Site Disposal, and Backfilling with Clean Soil Includes:

- Excavation to 8 feet below ground surface of each area
- Transport excavated soil to off-site disposal facility
- Backfilling with clean soil
- Construction and operation of decontamination facilities

Monitoring Includes:

- Annual groundwater sampling of all existing wells
- Sample analysis reporting
- Quarterly oil-water level measurement

5-Year Review Includes:

- Preparation of report

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Excavation and Backfill

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Disposal
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Excavation
Comments: Assume: 35 CY/HR Output

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Excavation and Backfill

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17020201	Demolish Bituminous Road with Power Equipment	699.92	CY	0.00	34.33	8.66	$30,090.60	
17030278	3 CY, Crawler-mounted, Hydraulic Excavator	12,843.31	CY	0.00	2.06	1.71	$48,419.28	
17030415	Backfill with Excavated Material	5,774.21	CY	0.40	6.01	1.10	$43.430.65	
17030423	Unclassified Fill, 6" Lifts, Off-Site, Includes Delivery, Spreading, and Compaction	9,092.56	CY	7.17	2.53	2.86	$114,202.55	
18020301	Bituminous Paving	38,386.40	SY	8.61	1.62	0.00	$392,692.87	
20020301	1/0 ACSR Conductor	318.00	LF	0.27	1.21	0.07	$490.09	
20020310	1/C #2 Aluminum, Bare, Wire	106.00	LF	0.20	1.17	0.07	$151.86	
20039902	4" Rigid Steel Conduit	30.00	LF	11.71	18.71	0.00	$912.59	
33170803	Decontaminate Heavy Equipment	4.00	EA	0.00	689.77	0.00	$2,759.08	
33420101	Electrical Charge	4,375.00	KWH	0.08	0.00	0.00	$350.28	
99010102	Site Project Manager - Average Cost	15.00	MWK	0.00	3,724.16	0.00	$55,862.40	
99010202	Superintendent - Average Cost	15.00	MWK	0.00	3,489.34	0.00	$52,340.10	
99010301	Clerk - Average Cost	8.20	MWK	0.00	728.58	0.00	$5,974.36	
99010402	Field Engineer - Average Cost	30.00	MWK	0.00	2,284.38	0.00	$68,531.40	
99010702	Safety Engineer - Average Cost	15.00	MWK	0.00	2,690.14	0.00	$40,352.10	
99010802	Quality Control - Average Cost	15.00	MWK	0.00	2,690.14	0.00	$40,352.10	
99040102	Temporary Office 32' x 8'	4.00	MO	301.03	0.00	0.00	$1,204.12	

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Excavation and Backfill

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
99040201	Temporary Storage Trailer 16' x 8'	4.00	MO	98.47	0.00	0.00	$393.88	
99040501	Portable Toilets - Chemical	4.00	MO	100.82	0.00	0.00	$403.28	
						Total Technology Cost	**$898,913.59**	

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Decontamination Facilities

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Disposal
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Decontamination Facilities
Comments: Assume: Construction of facility duration is 1 WK

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Decontamination Facilities

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
17030109	Pad Subgrade Preparation	35.56	CY	0.00	3.83	3.30	$253.49	
17030257	Cat 215, 1.0 CY, Soil, Shallow, Trenching	1.78	CY	0.00	1.19	0.97	$3.84	
17030501	Compact Subgrade, 2 Lifts	35.56	CY	0.00	0.39	0.36	$26.62	
17030510	Dry Roll Gravel, Steel Roller	106.67	SY	0.00	1.04	0.37	$150.56	
18010102	Gravel, Delivered & Dumped	14.81	CY	25.79	4.46	2.07	$478.77	
18010103	Gravel (90%) & Sand Base (10%), with Calcium Chloride 3/4 - 1 Lb/CY	14.81	CY	25.73	4.96	2.17	$486.73	
18010203	Asphalt Curb 8" W x 6" H	120.00	LF	1.82	5.10	4.54	$1,375.98	
18010310	Prime Coat	88.89	SY	0.41	0.07	0.04	$45.92	
18010312	Asphalt Wearing Course, 1 Pass (Line Item Includes 5% Waste)	19.33	TON	39.94	36.10	18.85	$1,834.13	
18020203	26" x 26", 5' Deep Area Drain with Grate	1.00	EA	1,998.44	2,281.26	30.47	$4,310.17	
19020313	5' x 5' x 5' Reinforced Concrete Sump	1.00	EA	1,920.24	3,227.14	107.46	$5,254.83	
19020604	12" x 12" CIP Concrete In-Ground Trench Drain with Metal Grate	20.00	LF	50.99	104.82	0.77	$3,131.64	
19040604	1,500 Gallon Steel Sump, Aboveground with Supports & Fittings	1.00	EA	2,119.09	1,708.54	0.00	$3,827.64	
33080503	Polymeric Liner Anchor Trench, 3' x 1.5'	144.00	LF	0.06	1.30	0.24	$231.42	
33080532	8 oz/sy Erosion Control/Drainage Filter Fabric (80 Mil)	106.67	SY	0.89	1.05	0.03	$210.41	
33080571	40 Mil Polymeric Liner, High-density Polyethylene	960.00	SF	0.36	2.23	0.24	$2,713.16	

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Decontamination Facilities

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33170814	1,800 PSI Pressure Washer, 6 HP, 4.8 GPM	1.00	EA	2,154.71	0.00	0.00	$2,154.71	
33170823	Operation of Pressure Washer, Including Water, Soap, Electricity, Labor	260.00	HR	8.29	81.11	0.00	$23,242.87	
33231306	High Sump Level Switch for Avoiding Overflow	1.00	EA	271.82	339.49	0.00	$611.31	
33260623	(2 1/2", 4") PVC Double-wall Piping, with Fittings	30.00	LF	20.66	44.52	0.00	$1,955.51	
33290401	25 GPM, 1 1/2" Discharge, Cast-iron Sump Pump	1.00	EA	2,680.94	785.90	0.00	$3,466.84	
99010102	Site Project Manager - Average Cost	1.00	MWK	0.00	3,724.16	0.00	$3,724.16	
99010202	Superintendent - Average Cost	1.00	MWK	0.00	3,489.34	0.00	$3,489.34	
99010301	Clerk - Average Cost	0.50	MWK	0.00	728.58	0.00	$364.29	
99010402	Field Engineer - Average Cost	2.00	MWK	0.00	2,284.38	0.00	$4,568.76	
99010702	Safety Engineer - Average Cost	1.00	MWK	0.00	2,690.14	0.00	$2,690.14	
99010802	Quality Control - Average Cost	1.00	MWK	0.00	2,690.14	0.00	$2,690.14	
99040102	Temporary Office 32' x 8'	0.25	MO	301.03	0.00	0.00	$75.26	
99040201	Temporary Storage Trailer 16' x 8'	0.25	MO	98.47	0.00	0.00	$24.62	
99040501	Portable Toilets - Chemical	0.25	MO	100.82	0.00	0.00	$25.20	
						Total Technology Cost	**$73,418.46**	

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Off-Site Transportation and Disposal

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Disposal
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ

Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Off-site Transportation and Waste Disposal

Comments: Landfill Fee from Waste Management Altamont Landfill, Livermore, CA
Hauling Quote from Den Beste Transportation

.

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Off-Site Transportation and Disposal

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33190102	Bulk Solid Hazardous Waste Loading Into Truck	9,092.56	CY	0.00	1.50	2.10	$32,733.22	
33190205	Transport & Dispose Bulk Solid Hazardous Waste At Altamont as nonhazardous waste (assume 1 CY = 1.45 ton)	13,184.21	TON	54.00	0.00	0.00	$711,947.45	
						Total Technology Cost	**$744,680.67**	

Alternative 5 (Including Additional Excavation for Unrestricted Use) Design

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Soil Options
ID: 0002
Type: None

Phase Element

Name: Excavation/Disposal
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Media/Waste Type: Soil
Secondary Media/Waste Type: Free Product
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Professional Labor Management

Alternative 5 (Including Additional Excavation for Unrestricted Use) Design

Element: Professional Labor Percentage

Assembly	Description	Percent	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220138	Project Management Labor Cost	2.00%	0.00	61,559.91	0.00	$61,559.91	
33220139	Planning Documents Labor Cost	2.00%	0.00	61,559.91	0.00	$61,559.91	
33220140	Construction Oversight Labor Cost	2.50%	0.00	76,949.89	0.00	$76,949.89	
33220141	Reporting Labor Cost	0.25%	0.00	7,694.99	0.00	$7,694.99	
33220142	As-Built Drawings Labor Cost	0.25%	0.00	7,694.99	0.00	$7,694.99	
33220143	Public Notice Labor Cost	0.04%	0.00	1077.30	0.00	$1077.30	
33220144	Site Closure Activities Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
33220145	Permitting Labor Cost	2.50%	0.00	76,949.89	0.00	$76,949.89	
33220148	Other Labor Cost	0.00%	0.00	0.00	0.00	$0.00	
					Total Element Cost	**$293,468.88**	
					Total Technology Cost	**$293,468.88**	

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Groundwater Monitoring

Folder: PROJECT

Project

Name: Mare Island Feasibility Study
ID: 0006
Location: VALLEJO, CALIFORNIA
Modifiers: **Material** 1.03
Labor 1.419
Equipment 1.088
Category: None

Report Option: Fiscal Year

Site

Name: Monitoring
ID: 0008
Type: None

Phase Element

Name: Soil Options Monitoring
Type: Remedial Action
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Approach: Ex Situ
Description: 1 YR Costs

Media/Waste Type: Free Product
Secondary Media/Waste Type: N/A
Contaminant: Fuels
Secondary Contaminant: None
Markup Template: System Defaults

Technology

Name: Monitoring (12 months only)
Comments: User Defined Analysis includes rental cost of an oil-water interface probe (assume $75/WK)
Assume: Annual sampling; Quarterly oil-water level measurement
Additional 16 hours added to field technician time and 300 miles added to car or van mileage for oil-water level measurement events.

Templates: System Water-Fuels

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Groundwater Monitoring

Element: Groundwater

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33020401	Disposable Materials per Sample	66.00	EA	10.95	0.00	0.00	$722.70	
33020402	Decontamination Materials per Sample	66.00	EA	9.70	0.00	0.00	$640.20	
33021509	Water Quality Parameter Testing Device	2.00	WK	576.92	0.00	0.00	$576.92	
33021618	Volatile Organic Analysis (EPA 624), Water Analysis	66.00	EA	253.85	0.00	0.00	$16,754.10	
33021694	Total Petroleum Hydrocarbons (SW8015B), Water Analysis	66.00	EA	94.62	0.00	0.00	$6,244.92	
33022150	BTEX/MTBE/TVPH (EPA 8021B/8015B), Water Analysis	66.00	EA	149.02	0.00	0.00	$9,835.32	
33029501	User Defined Analysis 1	5.00	LS	100.82	0.00	0.00	$504.10	
33231186	Well Development Equipment Rental (weekly)	2.00	WK	288.46	0.00	0.00	$576.92	
33231189	Furnish 55 Gallon Drum for Development/Purge Water	31.00	EA	100.48	0.00	0.00	$3,114.88	
33232407	Disposable Bailer, Polyethylene, 1.5" Outside Diameter x 36"	31.00	EA	12.49	0.00	0.00	$387.19	
					Total Element Cost		**$39,357.25**	

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33010104	Car or Van Mileage Charge	780.00	MI	0.44	0.00	0.00	$343.20	
33220102	Project Manager	5.00	HR	0.00	181.23	0.00	$906.15	

Alternative 5 (Including Additional Excavation for Unrestricted Use)
Groundwater Monitoring

Element: General Monitoring

Assembly	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Cost Override
33220105	Project Engineer	39.00	HR	0.00	115.71	0.00	$4,512.69	
33220108	Project Scientist	285.00	HR	0.00	110.04	0.00	$31,361.40	
33220109	Staff Scientist	104.00	HR	0.00	90.22	0.00	$9,382.88	
33220112	Field Technician	117.00	HR	0.00	72.59	0.00	$8,493.03	
33220114	Word Processing/Clerical	49.00	HR	0.00	57.22	0.00	$2,803.78	
33220115	Draftsman/CADD	44.00	HR	0.00	75.03	0.00	$3,301.32	
						Total Element Cost	**$61,104.45**	
						1st Year Technology Cost	**$100,461.70**	

APPENDIX D
RESPONSES TO REGULATORY AGENCY COMMENTS ON THE DRAFT FEASIBILITY STUDY

RESPONSES TO REGULATORY AGENCY COMMENTS ON THE DRAFT FEASIBILITY STUDY FOR INSTALLATION RESTORATION SITE 17 AND BUILDING 503 AREA, INVESTIGATION AREA A1 MARE ISLAND, VALLEJO, CALIFORNIA

This document presents the U.S. Department of the Navy's (Navy) responses to comments from the U.S. Environmental Protection Agency (EPA) and the California Regional Water Quality Control Board (RWQCB) on the "Draft Feasibility Study for Installation Restoration Site 17 and Building 503 Area, Investigation Area A1, Mare Island, Vallejo, California," dated January 2003. The comments addressed below were received from the EPA on May 21, 2003 and the RWQCB on October 10, 2003.

RESPONSES TO EPA COMMENTS ON THE DRAFT FEASIBILITY STUDY

General Comments

1. **Comment:** **Please assure that any modifications to the Remedial Investigation Report made to address agency comments are reflected in the revised Feasibility Study Report.**

   Response: The feasibility study (FS) report will reflect any changes made to the remedial investigation (RI) report. Based on the meeting between the Navy and agencies with the Base Realignment and Closure Cleanup Team (BCT) on June 11, 2003, to discuss the human health risk assessment (HHRA), the Navy responded to comments on the draft final RI report, revised the uncertainties section of Appendix A (HHRA) in the draft final RI report, and issued the revised draft final RI report. This revision included a discussion of the issues associated with the Johnson and Ettinger (J&E) model and a discussion of the updated risk assessment guidance since the HHRA and RI were completed.

2. **Comment:** **EPA generally supports the proposed alternative to excavate contaminated soil to remove the LNAPL source. However, we believe that the extent of excavation required to achieve this goal is likely to be underestimated based upon our experience at other similar sites.**

   Response: The estimated size of the area of light nonaqueous phase liquids (LNAPL) is based on data collected at the site and the best available methods for estimating free product. Risks at the site are within the risk management range based on the planned reuse of the site. Thus, no immediate action is required to remove the potential LNAPL. Please provide the referenced data on similar sites for the Navy to review.

3. **Comment:** **EPA is also concerned that even after removal of hot spots of contamination, that the indoor air exposure pathway will remain significant. Please assure that any Institutional Controls implemented at IR17 protect both future site residents and workers in an occupational exposure scenario.**

Response: Based on the results of the draft final RI report, risks are within the risk management range and no remedial action is required based on the proposed reuse of the site for light industry. More specific language regarding the institutional controls (IC) will be added to the text.

4. **Comment:** **In a large number of places in the Feasibility Study (FS) report, the Navy indicates that there is no unacceptable human health risk at Installation Restoration (IR) Site 17 and Building 503 and that any of the proposed alternatives would be protective of human health and the environment. This is not true. Risks to a potential future resident were not evaluated in the human health risk assessment and the risks posed by the site to future industrial/commercial and construction workers were above the point of departure (10^{-6} risk); and thus poses a risk that must be managed. Please revise the FS report to remove all statements indicating that the site does not pose a risk to human health or that the risk posed by the site is not significant.**

Response: The text in the FS will be reworded to indicate that the risks calculated in the HHRA are within the risk management range. Please note that risks to potential residential receptors were evaluated in Attachment A2 of the HHRA. The risks were evaluated for a child and an adult resident in both the current and redeveloped scenarios.

5. **Comment:** **The Navy used a discount rate of 7% to calculate the present value of future operations and maintenance costs. For federal projects, the Office of Management and Budget (OMB) publishes discount rates as Appendix C to OMB Circular No. A-94. The current 5-year real interest rate recommended by OMB for use as a discount rate for federal projects with expected lifetimes greater than 5 years is 2.8% (2.1% for projects lasting less than 3 years). Please revise the cost evaluation to use a discount rate of 2.1 or 2.8%, depending on the expected lifetime of the project.**

Response: According to the Office of Management and Budget (OMB), OMB Circular No. A-94, Appendix C, the correct discount rate for use on federal projects is 3.9 percent. The discount factor will be revised.

6. **Comment:** **The Navy indicates that the basis for the construction of a staging pile to treat the remedial waste generated at IR17 at Mare Island (the Alternative 4 biopile) are the Hazardous Remediation Waste Management Requirements (HRWMR) promulgated at 40CFR264.554 As California is an authorized state for implementing the Resource Conservation and Recovery Act (RCRA) and California has not adopted the staging pile provisions of HRWMR, which is part of RCRA, it does not appear that implementing a staging pile at Mare Island would satisfy the applicable requirement (Title 22 of the California Code of Regulations, which in this case is more stringent than RCRA). Even if California did adopt the staging pile regulations, the Navy is contemplating treatment and not staging for the soil to be excavated at IR17, so the staging pile regulations would not be applicable. It appears that what the Navy wants to construct at IR17 is a temporary treatment unit which requires a permit from the Department of Toxic Substances Control (DTSC), see Title 22 of the California Code of Regulations, Section 66264.553. Even though this is a CERCLA action, the substantive requirements of the temporary unit permit would still be applicable. Hence, DTSC would have to provide design and construction requirements for the temporary unit. Although this is not EPA's regulation, DTSC may want the FS report to be revised to discuss the administrative details for obtaining DTSC approval of a temporary unit for the biopile treatment unit to be constructed under Alternative 4.**

Response: The Navy will construct temporary tanks and put excavated soil into the tanks. The Navy will then have temporary units and will follow Title 22 *California Code of Regulations* Section 66264.553 as applicable or relevant and appropriate requirements (ARAR). The text will be revised to reflect the use of temporary units.

Specific Comments

1. **Comment:** **<u>Section 1.3.5.2, Presence of Free Product, Page 1-8</u>: The FS report indicates that free product is likely present only in the vicinity of monitoring wells 17W12 and 17W15. The same description is also contained within Section 1.4.1. However, Figure 1-5 shows extensive areas, including areas not adjacent to these wells, where free product is inferred to be present. Please revise the FS report to eliminate this discrepancy.**

Response: Sections 1.3.5.3 and 1.4.1 state that free product (less than 0.01 foot) has only been observed at monitoring wells 17W12 and 17W15 and that, based on visual observation alone, the apparent extent of free product is limited to the area near these wells. The inferred area of free product, as shown on Figure 1-5 and discussed in Section 1.4, is based on partitioning evaluations utilizing contaminant concentrations in soil and groundwater to estimate the potential occurrence of product.

2. Comment: **<u>Section 1.4.4, Occurrence of Free Product Based on Groundwater Concentrations, Page 1-13</u>: Please provide the reference for the organic carbon-water partition coefficients (K_{oc}) listed in the table. It is also assumed that the partition coefficients between pore water and soil solids (Kd_s) were calculated based upon the K_{oc}; please clarify this. The table also lists default values for the water-filled porosity, dry bulk density of soil, and fraction of organic carbon. These default values are not referenced in EPA 1992, "Estimating Potential for Occurrence of DNAPL at Superfund Sites"; provide the reference for the applied default values.**

Response: Equations for estimating the partition coefficient between pore water and soil solids (K_d) are presented in Section 1.4.5 (page 1-12). In general, these equations use the octanol-water partition coefficient (K_{ow}) to estimate K_d. As indicated in the table notes (page 1-13), Log K_{ow} values were obtained from the 1995 U.S. Army Corps of Engineers manual, "Engineering and Design, Soil Vapor Extraction and Bioventing."

As discussed in the FS report, default values were selected for water-filled porosity (ϕw), soil dry bulk density (ρ_b), and fraction of organic carbon (f_{oc}) because of the limited site-specific data. A note will be added to the report data table (page 1-13) indicating that the default parameters are based on a range of values presented in the American Petroleum Institute (API), "Soil and Groundwater Research Bulletin No. 9 – Non-Aqueous Phase Liquid (NAPL) Mobility Limits in Soil," June 2000. The reported default parameters were conservatively selected to indicate the occurrence of residual NAPL (that is, to overestimate NAPL occurrence). For example, the default values (ϕw = 0.15, ρ_b = 1.5 grams per cubic centimeter, f_{oc} = 0.02) provided in California Department of Toxic Substances Control guidance (DTSC 1994) would result in a decreased area of interpreted NAPL occurrence.

Review of the partitioning equation presented in Section 1.4.5 indicates that there was a typographical error in the equation. The section will be revised to indicate the following partitioning equation (Feenstra and other 1991):

$$C_t = \frac{C_w\left(K_d \rho_b + \phi_w\right)}{\rho_b}$$

3. **Comment:** **<u>Section 2.2, Remedial Action Objectives, Page 2-7</u>: The FS report indicates, "There is no Remedial Action Objective (RAO) for human health protection. The total excess cancer risk for the commercial/industrial worker under the unchanged and modified site configurations were 6 x 10^{-6} and 8 x 10^{-6}, respectively, which are within the EPA risk management range." Conclusions about the acceptability of risk should not be made in the FS, as this is a risk management issue. The remedial project manager will evaluate the decision that they must make of whether a risk is acceptable after consultation with all of the stakeholders involved with the site. As the risk to future workers exceeds 10^{-6}, the remedial action objective for human health protection is to assure that no worker is exposed to cancer-causing chemicals that pose a significant risk to their health. Please list protection of site workers as the RAO and assure that remedial options are proposed to reduce the future risk to site workers to below the risk management range (i.e., 10^{-6}). The remedial project managers will weight the risk versus the benefit of the remedial options and determine what actions to take.**

Response: As indicated in the response to EPA General Comment 4, text in the FS will be reworded to indicate that the risks calculated in the HHRA are within the risk management range. The RAO wording will be considered.

4. **Comment:** **<u>Section 3.5, Alternative 1: No Action, Page 3-17</u>: The analysis of this alternative indicates that there is no unacceptable human health risk, so the alternative meets the threshold criteria of protecting human health. As is mentioned in the general comments, this statement is not justified untrue. Even if it were true that there is no significant additional risk under the future commercial/industrial scenario, the alternative would still not be protective as the human health risk assessment only evaluated risks to industrial/commercial and construction workers. The assessment did not address potential risks to residents or include an evaluation of any special receptors, such as a school. "No Action" implies means there would be nothing to stop no controls (e.g., deed restrictions) would be required for reuse of the site for residential or school uses. Even though the City of Vallejo has indicated that they will reuse the property for light industrial use, unless the risk assessment demonstrates that there are no unacceptable risks to all receptors (including residential), then the site can not be turned over to the City without deed restrictions limiting use of the property to that of industrial. A proper risk assessment of potential indoor air exposures must also be conducted before the site can be deemed suitable for industrial use. (See comment #1 on the RI report) In addition, the "Site Description" indicated that part of the site is designated for recreational/open space. It is not clear whether the risk assessment included this scenario and if it did, if the results**

indicated acceptable risk levels to the recreational receptor. This scenario must also be included in the evaluation of "No Action". Please revise the FS report to indicate that the No Action alternative does not meet the threshold criterion of being protective of human health. In addition, the report should be revised to state that under the current scenario and based upon the risk assessment results, deed restrictions and/or institutional controls would be required, as defined in the General Response Action (GRA) for Land Use Controls (LUC).

Response: As indicated in the response to EPA General Comment 4, text in the FS will be reworded to indicate that the risks calculated in the HHRA are within the risk management range. Risks to potential residential receptors were evaluated in Attachment A2 of the HHRA. The risks were evaluated for a child and an adult resident in both the current and redeveloped scenarios. Risks to recreational receptors were not evaluated in the HHRA. Although exposure may occur in other situations, such as recreational visits in areas designated for future open space use, such exposures are unlikely to be greater than that characterized by the scenarios used. The frequency and duration of exposure of recreational exposures at the site is expected to be much lower than for site workers, and exposure to indoor air is not expected in the open space recreational area (see Section 3.2.2 in the draft final RI report).

As discussed in EPA General Comment 1, the uncertainties section of the HHRA of the RI will be revised to discuss the issues associated with the J&E model. Based on the June 11, 2003 meeting, the Navy and agencies concurred that a post-remediation HHRA is appropriate at this site once the remedial action is completed.

Additional information on ICs will be added to the FS to clarify the need for ICs for unrestricted reuse.

5. Comment: **Section 3.5.2, Compliance with Applicable or Relevant and Appropriate Requirements, Page 3-17: The FS report indicates that, "There is no need to identify ARARs for the no-action alternative because Applicable or Relevant and Appropriate Requirements (ARARs) apply to 'any removal or remedial action conducted entirely on-site' and 'no-action' is not a removal or remedial action." The National Contingency Plan (NCP) states, "40CFR300.400(g) *Identification of applicable or relevant and appropriate requirements.* (1) The lead and support agencies shall identify requirements applicable to the release or remedial action contemplated based upon an objective determination of whether the requirement specifically addresses a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site." The guidance the Navy used to support their interpretation of**

CERCLA refers to a "No Action" remedial decision. It is true that if all the stakeholders agreed that "no action" was necessary, satisfaction of ARARs would not be necessary. However, to determine if the No Action alternative should be selected, the ARARs must be identified and assessed to determine if an action is required. Please remove the quoted sentence.

Response: The text will be revised to read, "There is no need to identify action-specific ARARs…."

6. Comment: **<u>Section 3.8, Alternative 4: Soil Excavation, Biopiling, Backfilling with Treated Soil, and Institutional Controls, Page 3-26</u>: The Navy anticipates backfilling the treated soil into the excavations. It is understood that placing the treated soil back into the excavations avoids having to deal with waste disposal requirements for slightly contaminated soil. However, it does not appear to be practical to leave the excavations open for six months (let alone five years). In addition to being a hazard, the excavations will fill with water after rainfall and during the rainy season when the groundwater table rises. Please revise the FS report to include a more detailed description of how the biopiling will be implemented to avoid leaving large open excavations at the site for long periods of time.**

Response: The excavated area can be secured with fencing. The open excavation will be discussed in the Alternative 4 implementability section.

Errata

1. Comment: **<u>Section 3.9.7, Cost, Page 3-34</u>: The cost of alternative 5 should not include biopiling.**

Response: The text will be corrected to remove biopiling from Alternative 5.

REFERENCES

California Department of Toxic Substances Control (DTSC). 1994. "Preliminary Endangerment Assessment Guidance Manual, Appendix B." January.

RESPONSES TO RWQCB COMMENTS ON THE DRAFT FEASIBILITY STUDY

General Comments

1. **Comment:** **RWQCB staff have reviewed the above-referenced document. State Applicable or Relevant and Appropriate Requirements (ARARs) for the protection of water quality are not identified in the Feasibility Study (FS). Potential ARARs are attached to this letter for inclusion in the draft final FS. An evaluation of ARARs must be conducted for all remedial alternatives, including Alternative 1 (No Action). Furthermore, staff concur with U.S. EPA's Specific Comment 5 in their May 28, 2003 correspondence on this issue disagreeing with the FS report statement that identification of ARARs is not necessary.**

   Response: The Navy does not accept Porter-Cologne Water Quality Control Act §§ 13000, 13304, 13260, 13141, 13143-13147 as potential ARARs because many of them are policy statements and do not establish, contain or enable the development of substantive environmental standards, requirements, criteria, or limitations, which is a prerequisite to qualification as an ARAR.

   All other Porter-Cologne Water Quality Control Act sections identified by the RWQCB were accepted as potential state ARARs.

   The Navy accepts the provisions contained in the Water Quality Control Plan for the San Francisco Bay Basin (1995) pertaining to designation of beneficial uses, including incorporation of State Water Resource Control Board Resolution 88-63, and water quality objectives as potential state ARARs because there are waters of the state on IR Site 17. The Navy does not accept the other provisions of the Basin Plan identified by the RWQCB as potential state ARARs because many of them apply to active or passive groundwater treatment actions and no active or passive groundwater treatment actions are planned or required under CERCLA.

   The Navy accepts 27 CCR § 20090(d) as a potential state ARAR. This section requires that wastes removed from the immediate place of release and discharge be managed in accordance with classification and siting requirements of Title 27. Some of the remedial alternatives evaluated in the Feasibility Study contemplate the excavation and off-site removal of soil. The Navy will determine whether this soil is designated, nonhazardous solid, or inert waste as defined in 27 CCR §§ 20210, 20220, and 20230, respectively. If the soil meets the definition of a designated or nonhazardous solid waste, the in accordance with 27 CCR § 20090(d) the Navy will dispose of the soil at a Class I or Class II landfill, whichever is appropriate.

The Navy does not accept any other regulations contained in Title 27 that were identified by the RWQCB as potential state ARARs because many of them apply to waste management units or corrective action associated with waste management units. There are no waste management units and the Navy is not contemplating the construction of a waste management unit at IR Site 17. The Navy also is not contemplating any active or passive groundwater treatment actions.

The Navy does not accept any of the Title 23 regulations identified by the RWQCB as potential state ARARs. The identified regulations apply to hazardous waste management units or corrective action at hazardous waste management units. There is no hazardous waste management unit and the Navy is not contemplating the construction of a hazardous waste management unit at IR Site 17. The Navy also is not contemplating any active or passive groundwater treatment actions. In addition, the Navy has determined that if there is any hazardous waste at IR Site 17, the requirements contained Title 23 are not more stringent than the hazardous waste regulations contained in Title 22, which the Navy has identified as federal ARARs.

2. Comment: **Staff also concur with U.S. EPA's comments regarding the need for future institutional controls to prevent residential use of the site, and those requesting removal of statements in the FS that there is no unacceptable human health risk at the site. As discussed in a number of meetings, the regulatory agencies and the Navy disagree over the methodology used to model future indoor air exposures to site occupants. Resolution of these concerns may include soil gas and/or indoor air sampling for which planning discussions are underway. Regardless, the risk identified in the Remedial Investigation exceeds $1x10^{-6}$, making a statement of no unacceptable risk inappropriate in the FS.**

Response: As indicated in the response to EPA General Comment 4, text in the FS will be reworded to indicate that the risks calculated in the HHRA are within the risk management range.

As discussed in EPA General Comment 1, the uncertainties section of the HHRA of the RI will be revised to discuss the issues associated with the J&E model. Based on the June 11, 2003 meeting, the Navy and agencies concurred that a post-remediation HHRA is appropriate at this site once the remedial action is completed.

ARARs FOR GROUNDWATER REMEDIATION

#	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
1	Porter-Cologne Water Quality Control Act (California Water Code Section 13000 et seq.)	California Water Code Section 13243	The RWQCB may specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted.	Applicable	Applies to groundwater remedial action.
2	Porter-Cologne Water Quality Control Act (California Water Code Sections 13240, 13241, 13242, 13243)	Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin, RWQCB, SFB	Establishes water quality objectives, including narrative and numerical standards, that protect the beneficial uses and water quality objectives of surface and ground waters in the region. Describes implementation plans and other control measures designed to ensure compliance with statewide plans and policies and provide comprehensive water quality planning. Mare Island lies within the Napa-Sonoma Groundwater Basin. Existing and potential beneficial uses of this groundwater are: municipal and domestic supply, industrial process water supply, industrial service water supply, agricultural water supply, and freshwater replenishment to surface water.	Applicable	Specific applicable portions of the Basin Plan include beneficial uses of affected water bodies and water quality objectives to protect those uses. Any activity, including, but not limited to, the discharge of contaminated soils or waters or in-situ treatment or containment of contaminated soils or waters, must not result in actual water quality exceeding water quality objectives.
3	Porter-Cologne Water Quality Control Act (California Water Code Sections 13000, 13304, 13240, 13241, 13242, 13243)	RWQCB, SFB Basin Plan, "Implementation Plan, Groundwater Protection and Management, Cleanup of Polluted Sites."	Establishes and describes policy for investigation and remediation of contaminated sites. Also includes implementation actions for setting groundwater and soil cleanup standard.	Applicable	Cleanup standards for water should be equal to background concentrations unless such levels are technically and economically infeasible to achieve. In such cases, cleanup standards should not exceed applicable water quality objectives.

ARARs FOR GROUNDWATER REMEDIATION (Continued)

#	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
4	Porter-Cologne Water Quality Control Act (California Water Code Sections 13240, 13241, 13242, 13243)	RWQCB, SFB Basin Plan, "Water Quality Objectives"	This policy defines water quality objectives and explains how the Regional Water Board applies numerical and narrative water quality objectives to ensure the reasonable protection of beneficial uses of water and how the Regional Water Board applies Resolution No. 68-16 to promote the maintenance of existing high-quality waters.	Applicable	Applies to groundwater remedial actions.
5	Porter-Cologne Water Quality Control Act (California Water Code Sections 13240, 13241, 13242, 13243)	RWQCB, SFB Basin Plan, "Discharge of Treated Groundwater"; RWQCB Resolution No. 88-160.	Requires applicants for waste discharge requirements and discharge permits to evaluate land disposal as an alternative to discharge to surface waters.	Applicable	Applies to groundwater extracted by groundwater treatment system.
6	Porter-Cologne Water Quality Control Act (California Water Code Sections 13000, 13140, 13263, 13304)	State Water Resources Control Board Resolution No. 68-16 ("Anti-degradation Policy").	Requires that high quality surface and ground waters be maintained to the maximum extent possible. Degradation of waters will be allowed (or allowed to remain) only if it is consistent with the maximum benefit to the people of the state, does not unreasonably affect present and anticipated beneficial uses, and does not result in water quality less than that prescribed in RWQCB and SWRCB policies. If degradation is allowed, the discharge must meet best practicable treatment or control, which must prevent pollution or nuisance and result in the highest water quality consistent with maximum benefit to the people of the state.	Applicable	Applies to discharges of waste to waters, including discharges to soil that may affect surface or ground waters. In-situ cleanup levels for contaminated ground waters must be set at background level, unless allowing continued degradation is consistent with the maximum benefit of the people of the state. If degradation of waters is allowed, or allowed to remain, the discharge must meet best practical treatment or control standards, and result in the highest water quality possible that is consistent with the maximum benefit to the people of the state. In no case may water quality objectives be exceeded.

ARARs FOR GROUNDWATER REMEDIATION (Continued)

#	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
7	Porter-Cologne Water Quality Control Act (California Water Code Sections 13000, 13140, 13240, 13260, 13263, 13267, 13300, 13304, 13307)	State Water Resources Control Board Resolution No. 92-49 (As amended April 21, 1994)	Establishes requirements for investigation and cleanup and abatement of discharges. Among other requirements, dischargers must clean up and abate the effects of discharges in a manner that promotes the attainment of either background water quality, or the best water quality that is reasonable if background water quality cannot be restored. Requires the application of Title 23, CCR, Section 2550.4, requirements to cleanups.	Applicable	Applies to groundwater remedial actions.
8	Porter-Cologne Water Quality Control Act (California Water Code Sections 13000, 13140, 13240)	State Water Resources Control Board Resolution No. 88-63 ("Sources of Drinking Water Policy") (as contained in the RWQCB's Water Quality Control Plan)	Specifies that, with certain exceptions, all ground and surface waters must have the beneficial use of municipal or domestic water supply.	Applicable	Applies in determining beneficial uses for waters that may be affected by discharges of waste.
9	Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 27, CCR, Division 2, Subdivision 1(Section 20080 et seq.) Title 23, CCR, Division 3, Chapter 15 (Section 2510 et seq.).	Establishes waste and siting classification systems and minimum waste management standards for discharges of waste to land for treatment, storage, and disposal. Engineered alternatives that are consistent with Title 27/Title 23 performance goals may be considered. Establishes corrective action requirements for responding to discharges to land, including spills and leaks and other unauthorized discharges.	Applicable	The application of specific sections of Title 27/Title 23 is discussed below. Provisions of Title 23 apply to hazardous waste and provisions of Title 27 apply to designated and nonhazardous solid waste.

ARARs FOR GROUNDWATER REMEDIATION (Continued)

#	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
10	Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 27, CCR, Section 20090(d) Title 23, CCR. Section 2511 (d)	Action taken by public agencies to clean up unauthorized releases are exempt from Title 27/ Title 23 except that wastes removed from immediate place of release and discharged to land must be managed in accordance with classification (Title 27, CCR, Section 20200/ Title 23, CCR, Section 2520) and siting requirements of Title 27 or Title 23 and wastes contained or left in place must comply with Title 27 or Title 23 to the extent feasible.	Applicable	Applies to remediation and monitoring of sites.
11	Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 27, CCR, Section 20400 Title 23, CCR, Section 2550.4.	Concentration limits must be established for groundwater, surface water, and the unsaturated zone. Must be based on background, equal to background, or for corrective actions, may be greater than background, not to exceed the lower of the applicable water quality objective or the concentration technologically or economically achievable. Specific factors must be considered in setting cleanup standards above background levels.	Applicable	Applies in setting ground water cleanup levels for all discharges of waste to land.
12	Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 27, CCR, Section 20410 Title 23, CCR, Section 2550.6	Requires monitoring for compliance with remedial action objectives for three years from the date of achieving cleanup standards.	Applicable	Applies to groundwater remedial actions.

ARARs FOR GROUNDWATER REMEDIATION (Continued)

#	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
13	Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 27, CCR, Section 20415 Title 23, CCR, Section 2550.7.	Requires general soil, surface water, and ground water monitoring.	Applicable	Applies to all areas at which waste has been discharged to land.
14	Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title, 27, CCR, Section 20425 Title, 23, CCR, Section 2550.9.	Requires an assessment of the nature and extent of the release, including a determination of the spatial distribution and concentration of each constituent.	Applicable	Applies to areas at which monitoring results show statistically significant evidence of a release.
15	Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 27, CCR, Section 20430 Title 23, CCR, Section 2550.10	Requires implementation of corrective action measures that ensure that cleanup levels are achieved throughout the zone affected by the release by removing the waste constituents or treating them in place. Source control may be required. Also requires monitoring to determine the effectiveness of the corrective actions.	Applicable	Applies to groundwater remedial actions.

ARARs FOR GROUNDWATER REMEDIATION (Continued)

#	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
16	Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13263, 13267, 13304).	Title 27, CCR, Section 21090	Requires a final cover constructed in accordance with specific prescriptive standards, to be maintained as long as wastes pose a threat to water quality.	Applicable	Applies to wastes contained or left in place at the end of remedial actions that could affect water quality. Includes closure of landfills and other areas where wastes have been discharged to land.
				Relevant & Appropriate	Relevant and appropriate for "closed, abandoned, or inactive" landfills and other areas where wastes have been discharged to land and water quality is threatened
17	California Safe Drinking Water Act (California Health & Safety Code Section 4010 et seq.)	Title 22, CCR, Section 64400 et seq.	Requirements for public water systems. Includes Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant Levels (SMCL).	Relevant and Appropriate	The act is legally applicable for an aquifer and associated distribution and pre-treatment system that is currently defined as “public water system” If it is only a potential “Public water system,” then the act is relevant and appropriate.
18	Staff Report of the RWQCB, Central Valley Region	"A Compilation of Water Quality Goals"	Provides guidance on selecting numerical values to implement narrative water quality objectives contained in the Basin Plan.	To Be Considered	Performance Standard. To be considered in selecting appropriate numerical values to implement the Basin Plan for setting cleanup levels and discharge limits. The numerical values contained in the staff report may be ARARs or Performance Standards, depending on the source of the values.

APPENDIX E
RESPONSES TO REGULATORY AGENCY COMMENTS ON THE REVISED DRAFT FINAL INVESTIGATION AREA A1, REMEDIAL INVESTIGATION REPORT, INSTALLATION RESTORATION SITE 17 AND BUILDING 503 AREA AND DRAFT FINAL FEASIBILITY STUDY, INSTALLATION RESTORATION SITE 17 AND BUILDING 503 AREA

RESPONSES TO REGULATORY AGENCY COMMENTS ON THE REVISED DRAFT FINAL INVESTIGATION AREA A1, REMEDIAL INVESTIGATION REPORT, INSTALLATION RESTORATION SITE 17 AND BUILDING 503 AREA AND THE DRAFT FINAL FEASIBILITY STUDY, INSTALLATION RESTORATION SITE 17 AND BUILDING 503 AREA, FORMER MARE ISLAND NAVAL SHIPYARD, VALLEJO, CALIFORNIA

This appendix presents the U.S. Department of the Navy (Navy) responses to comments from the Department of Toxic Substances Control (DTSC) and the California Regional Water Quality Control Board (Water Board) on the "Revised Draft Final Investigation Area A1, Remedial Investigation Installation Restoration Site 17 and Building 503 Area, Former Mare Island Shipyard, Solano County, Vallejo, California," dated December 12, 2002; and the "Draft Final Feasibility Study Installation Restoration Site 17 and Building 503 Area, Former Mare Island Shipyard, Solano County, Vallejo, California," dated June 25, 2004. The comments addressed below were received from the DTSC on September 6, 2005 and the Water Board on January 19, 2006.

RESPONSES TO COMMENTS FROM DTSC

General Comments

1. **Comment:** **<u>Recommendations and actions proposed for the Path forward letter</u>: Mr. Alan K. Lee's November 24, 2004 letter to Mr. Chip Gribble, proposed several recommendations on moving forward with the site cleanup at the Installation Restoration Site 17 (IR 17). Recommendations included a process for finalizing the Remedial Investigation/Feasibility Study (RI/FS), preparation of the proposed plan and addressing the risk issues during the remedial action phase of the Comprehensive Environmental Response, Compensation, and Liability Action (CERCLA) process. In response to the Navy letter, on June 30, 2005, DTSC issued a letter to Mr. Jerry Dunaway accepting the proposed strategy, and made a few more recommendations to stream line the process. In our letter, we stated that the RI/FS should be revised to include changes to the Executive Summary and the Human Health Risk Assessment (HHRA) that makes a statement regarding the deficiencies of the HHRA. Please notice that DTSC is in the process of reviewing your August 24, 2005 letter addressing the future indoor air exposure for IR 17 and will prepare a response in the near future. Once an agreement is reached, the details should be outlined in the RI and the FS, including all pertinent sections within the two reports. These sections include the Executive Summary, Introduction, HHRA, and the summary and conclusion sections.**

Response: The Revised Draft Final RI for the IR17 and Building 503 Area, Investigation Area A1 was issued on August 26, 2003. A PDF version of the Revised Draft Final RI was forwarded to Mr. Rizgar Ghazi of the DTSC on November 3, 2005. As agreed to at the June 11, 2003 meeting between the Navy and regulatory agencies, the RI was previously revised to include a discussion of the limitations of the Johnson and Ettinger model in predicting vapor concentrations at the site. This revision is presented in Attachment A3 of Appendix A of the RI.

The Navy will revise the executive summary of the RI and the FS respectively, to include a discussion of the limitations of the Johnson and Ettinger model. The approach for conducting an HHRA during the remedial action phase agreed to by all parties will be detailed in the executive summary of each report, and in the remedial action plan/record of decision (RAP/ROD) and remedial design documents.

2. Comment: **<u>Post Remedial Action Residual Risks</u>: Although DTSC agrees that the proposal to remove soils and ground water that is visually contaminated with free product, we remain concerned that post remediation risk assessment will identify a significant unremediated risk, or that the risk assessment will not be adequate to characterize risk in the indoor air pathway. The low permeability of soils in which potentially contaminated groundwater resides may make ground water unsusceptible to complete remediation under the proposal, and greatly limits available remediation strategies. Additionally, the difficulties of modeling the indoor air pathway at this site make it unclear how residual risk will be calculated, and also make it unclear how the effectiveness of potentially required engineered controls will be evaluated. In any case, in the absence of an adequate residual risk calculation that clearly demonstrates that no further action is necessary, additional remedy selection and implementation will be required.**

Response: The Navy agrees that due to the low permeability soil present at the site, it is difficult to remediate the site. Because of these site conditions, the most feasible remediation alternative is to excavate and dispose of the soil off site, as discussed in the FS. All the areas where elevated concentrations of volatile organic compounds have been detected in soil and groundwater will be excavated. As proposed in the letter to DTSC from the Navy, dated August 24, 2005, the post-remediation site conditions will be designed to make the vapor model suitable for the site so that post-remediation concentrations can be estimated. If the post-remediation HHRA demonstrates that significant unremediated risks remain at the site, additional action will be conducted and/or site reuse restrictions will be added as necessary.

Specific Comments

1. **Comment:** **<u>RI, Executive Summary</u>. Please revise the Executive Summary to reflect the proposed strategy for the cleanup of the site. The risk assessment discussion within the executive summary should be revised to discuss the deficiencies of the HHRA and the proposed approach for conducting an HHRA during the Remedial Action Phase of the site cleanup.**

   Response: As explained in the response to DTSC General Comment 1, the Navy will revise the executive summary to include a discussion of the limitations of the Johnson and Ettinger model based on site conditions at IR17. These limitations are also discussed in Attachment A3 of Appendix A of the RI. The approach for conducting an HHRA during the remedial action phase agreed to by all parties also will be discussed in the executive summaries, and in the RAP/ROD and remedial design documents.

2. **Comment:** **<u>RI, Appendix A, Human Health Risk Assessment</u>. As discussed in the above comments, a similar statement should be provided at the beginning of the Appendix.**

   Response: As discussed in the response to DTSC General Comment 1 and DTSC Specific Comment 1, the limitations of the Johnson and Ettinger model to predict vapor concentrations based on the site conditions at IR17 are discussed in Attachment A3 of Appendix A of the RI report.

3. **Comment:** **<u>RI, Section 4.0 Summary, Conclusions, and Recommendations</u>. Please revise this section to reflect the proposed strategy for the cleanup of the site.**

   Response: The approach for conducting an HHRA during the remedial action phase agreed to by all parties is discussed in Section 4.4 of the RI.

4. **Comment:** **<u>FS, Executive Summary</u>. Please revise this section to reflect the proposed strategy for the cleanup of the site.**

   Response: As explained in the response to DTSC General Comment 1, the Navy will revise the executive summary of the FS to discuss the approach for conducting a post-remediation HHRA. The proposed strategy also will be discussed in the RAP/ROD and remedial design documents.

RESPONSES TO COMMENTS FROM WATER BOARD

General Comments

1. **Comment:** **We reviewed the Feasibility Study, Installation Restoration Site 17, Bldg 503 Area, Investigation Area A1, Mare Island, Vallejo, California, dated June 25, 2004 . The report describes six remedial alternatives for cleanup of the contamination at the site and is based on site information presented in the technical report Remedial Investigation for Installation Restoration Site 17, Bldg 503 Inv. Area A1, dated August 26, 2003 . Alternative 5 is a satisfactory remedial action, which involves soil excavation, off-site disposal, backfilling with clean soil and implementation of institutional controls.**

   Response: Comment noted.

2. **Comment:** **The remedy should at a minimum, comply with State Board Resolution No. 92-49 which requires that contaminant sources be removed to the maximum extent practicable, and if residual contamination persists after remediation, groundwater monitoring is required to verify that natural attenuation is occurring and that the pollutants are not migrating. In addition, a soil gas study should be implemented at undisturbed areas to verify the suitability of the site for its final land use. The monitoring program should adequately monitor the site for all chemicals of concern. Wells should be properly placed, surveyed for elevation to the nearest 100th of a foot and properly screened across the contaminated zone(s). The analyses for hydrocarbons should include a chromatogram to determine if unreported contaminants exist. If groundwater contamination exceeds the ESLs, or the site's screening criteria, monitoring will be required for a minimum of four consecutive quarters. If groundwater contamination cannot be shown to be receding by naturally occurring processes, additional remedial actions may be needed.**

   Response: Groundwater monitoring is part of the preferred alternative. As discussed in the response to DTSC General Comment 2, additional action will be conducted and/or site reuse restrictions will be added as necessary if the post-remediation HHRA demonstrates that significant unremediated risks remain at the site. Based on the shallow depth of groundwater at the site, a soil gas survey may not be appropriate. The post-remediation site conditions will be designed to make the vapor model suitable for the site so that post-remediation concentrations can be estimated.

3. Comment: We can consider the case for closure or "No Further Action", if the pollutant concentrations in the groundwater are receding by naturally occurring processes and will likely continue to do so. Any request for closure should include an estimate for the time needed to eventually achieve water quality objectives.

Response: Comment noted. As discussed in the previous response, groundwater monitoring will be conducted at the site after the remedial action. Post-remediation concentrations will be compared to appropriate screening criteria and will be used to estimate residual risk at the site.

REFERENCES

Tetra Tech EM Inc. 2003. "Revised Draft Final Remedial Investigation Report, Investigation Area A1, IR17 and Building 503 Area, Mare Island, Vallejo, California." August 26.

Tetra Tech EM Inc. 2004. "Draft Final Feasibility Study Report, Investigation Area A1, IR17 and Building 503 Area, Mare Island, Vallejo, California." June 25.

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Tetra Tech EM Inc. 2003. "Revised Draft Final Remedial Investigation Report, Investigation Area A1, IR17 and Building 503 Area, Mare Island, Vallejo, California." August 26.

Tetra Tech EM Inc. 2004. "Draft Final Feasibility Study Report, Investigation Area A1, IR17 and Building 503 Area, Mare Island, Vallejo, California." June 25.