RECORD OF DECISION DU 4-1 FOR SITE 12 TANK FARM 4 NS NEWPORT RI
9/1/2013
TETRA TECH

RECORD OF DECISION

DECISION UNIT 4-1
AT TANK FARM 4 – SITE 12
OPERABLE UNIT 11

NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND
SEPTEMBER 2013

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ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BERA	Baseline Ecological Risk Assessment
bgs	Below ground surface
BSW	Bottom sediment and water
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of concern
COPC	Contaminant of potential concern
CS	Confirmation study
CSF	Cancer slope factor
CSGWPP	Comprehensive State Groundwater Protection Program
CSM	Conceptual site model
CTE	Central tendency exposure
CWA	Clean Water Act
Cy	Cubic yard
DEC	Direct Exposure Criteria
DGA	Data Gaps Assessment
DU	Decision Unit
EPA	United States Environmental Protection Agency
EPC	Exposure point concentration
ERA	Ecological risk assessment
ER, N	Environmental Restoration, Navy
FEMA	Federal Emergency Management Association
FFA	Federal Facility Agreement
FS	Feasibility Study
HHRA	Human Health Risk Assessment
HI	Hazard index
HQ	Hazard quotient
IAS	Initial Assessment Study
ID	Identification
ILCR	Incremental lifetime cancer risk
IR	Installation Restoration
IRIS	Integrated Risk Information System
IUR	Inhalation unit risk

LUC	Land use control
LUC RD	Land Use Control Remedial Design
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/kg	Milligram per kilogram
MNA	Monitored natural attenuation
NAVSTA	Naval Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NETC	Naval Education and Training Center
NPL	National Priorities List
NPW	Net present worth
NRCS	Natural Resources Conservation Service
NTCRA	Non-Time-Critical Removal Action
NUSC	Naval Undersea Systems Center
NUWC	Naval Undersea Warfare Center
OU	Operable Unit
O&M	Operation and maintenance
OFFTA	Old Fire Fighting Training Area
OWS	Oil-water separator
OWSER	Office of Solid Waste and Emergency Response
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
POL	Petroleum, Oil and Lubricants
PRG	Preliminary Remediation Goal
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RD	Remedial Design
RfC	Reference concentration
RfD	Reference dose
RG	Remediation Goal
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
RME	Reasonable maximum exposure
ROD	Record of Decision
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act

SF	Slope factor
SWOS	Surface Warfare Officers School
SVOC	Semivolatile organic compound
TF4	Tank Farm 4
TPH	Total petroleum hydrocarbons
UPL	Upper predictive limit
UCL	Upper confidence limit
µg/kg	Microgram per kilogram
µg/L	Microgram per liter
UPL	Upper Predictive Limit
USGS	United States Geological Survey
UST	Underground storage tank
VOC	Volatile organic compound

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Tank Farm 4 (TF4) is located within the Naval Station (NAVSTA) Newport facility in Portsmouth, Rhode Island. TF4 is also identified as Site 12 and Operable Unit (OU) 11. Decision Unit (DU) 4-1 (the Site) is located within the TF4 boundary. DU 4-1 is defined as the portion of TF4 where Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) contaminants were likely released, based on historic records. NAVSTA Newport was formerly identified as the Naval Education and Training Center (NETC) and has been assigned United States Environmental Protection Agency (EPA) Identification (ID) number RI6170085470.

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the Selected Remedy for DU 4-1, as chosen by the Navy and EPA in accordance with provisions of CERCLA (amended by the Superfund Amendments and Reauthorization Act [SARA]) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The Rhode Island Department of Environmental Management (RIDEM) concurs with the Navy and EPA on the Selected Remedy for DU 4-1, as described in Section 1.4. This decision is based on information contained in the Administrative Record for DU 4-1, as described in the 'Detailed Administrative Record Reference Table', presented prior to the Appendices of this report.

1.3 ASSESSMENT OF SITE

The response action selected in this ROD is necessary to protect the public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment at DU 4-1. A CERCLA action is required because manganese concentrations in soil pose unacceptable risk to construction workers, polycyclic aromatic hydrocarbons (PAHs) concentrations in soil pose unacceptable risk to potential future residents, and arsenic, cobalt, iron, and manganese concentrations in groundwater pose unacceptable risk potential future residents(unacceptable risk is defined as cancer risk greater than $1x10^{-4}$ and/or hazard index greater than1). Additionally, some contaminants are present in soil at concentrations exceeding state regulatory criteria (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)flouranthene, (benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, pyrene, and manganese), and as such are being addressed by the remedy. No unacceptable human health risk was identified from site sediment or surface water. The screening ecological risk assessment (ERA) did not identify unacceptable ecological risks to terrestrial or aquatic receptors exposed to chemical constituents at DU 4-1 and therefore action is not required to protect ecological receptors.

1.4 DESCRIPTION OF SELECTED REMEDY

The major components of the Selected Remedy for DU 4-1 include the following:

Excavation, backfill, and offsite disposal of selected soil from two target areas will occur along with the investigation and potential offsite disposal of wastes and soils from two additional target areas. The excavation/disposal of soil from the additional target areas will be based on presence of solid waste/soil contaminants and analytical data of soils in these additional target areas. In the target areas, PAH concentrations in soil above industrial clean-up levels and arsenic concentrations in soils between 0-2 feet that exceed 15 mg/kg will be excavated.

Monitored natural attenuation (MNA) of metals in groundwater will occur until groundwater cleanup standards are achieved. It has been estimated to take approximately 26 years for bedrock and 45 years for overburden.

Implementation of land use controls (LUCs) to ensure that future use of the property is limited to industrial activities (residential and unrestricted recreational site use will be prohibited), to ensure that subsurface soils containing constituents at concentrations that are above cleanup goals are not disturbed without appropriate safety precautions and that at least two feet of clean soil are maintained and ensured through inspections to prevent exposure, and to prohibit groundwater use until groundwater cleanup goals are achieved.

The Selected Remedy eliminates potential unacceptable human exposure to soil and groundwater through a combination of removal, MNA, and LUCs. Remedial actions at Site 12 DU 4-1 are not expected to adversely impact the current and reasonably anticipated future industrial land use. The Selected Remedy is expected to achieve substantial long-term risk reduction and allow the property to be used for the reasonably anticipated future land use. This ROD documents the final remedial action decision for DU 4-1 and does not include or affect any other sites at NAVSTA Newport. Implementation of this remedy will allow for continued industrial use of the site, which is consistent with current use and the overall cleanup strategy for NAVSTA Newport of restoring sites to support operations.

1.5 STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years of initiation of the remedial action and every 5 years thereafter to ensure that the remedy is protective of human health and the environment.

Federal regulations that pertain to the cleanup require a determination that there is no practical alternative to taking federal actions affecting federal jurisdictional wetlands, aquatic habitats and floodplains, per Section 404 of the Clean Water Act (CWA) and Executive Orders 11990 (Protection of Wetlands) and 11988 (Protection of Floodplains), as incorporated under Federal Emergency Management Agency (FEMA) regulations. In accordance with the CWA, the Navy has determined that the Selected Remedy is the Least Environmentally Damaging Practicable Alternative to protect wetland and floodplain resources because it provides the best balance of addressing contaminated soils within and adjacent to wetlands and waterways and minimizes both temporary and permanent alteration of wetlands and aquatic habitats on site,. Although the Selected Remedy involves disturbance (excavation) of wetland soils, it will remove the localized soil contamination (target areas), which will have immediate positive impacts on the quality of wetland soils, as well as positive long-term impacts on the functions and values associated with the wetland resource after restoration to native wetland conditions. To the extent that the installation, monitoring, and maintenance of wells used for the groundwater component of the remedy may impact federal jurisdictional wetlands and floodplain, alteration of protected resource areas will be minimized, and mitigation will be implemented, as required.

1.6 ROD DATA CERTIFICATION CHECKLIST

The locations in Section 2.0, Decision Summary, and Appendix B, Cost Estimates, of the information required to be included in the ROD are summarized in Table 1-1. Additional information can be found in the Administrative Record file for NAVSTA Newport, available online at http://go.usa.gov/Tsy.

TABLE 1-1. ROD DATA CERTIFICATION CHECKLIST

DATA	LOCATION IN ROD
Contaminants of concern (COCs) and their respective concentrations	Sections 2.5 and 2.7
Baseline risk represented by the COCs	Section 2.7
Cleanup levels established for COCs and the basis for these levels	Section 2.7 and 2.8
How source materials constituting principal threats are addressed	Section 2.11
Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the risk assessment	Section 2.6
Potential land and groundwater uses that will be available at the site as a result of the Selected Remedy	Section 2.12.3
Estimated capital, operation and maintenance (O&M), and total net present worth (NPW) costs; discount rate; and number of years over which the remedy costs are projected	Appendix B
Key factors that led to the selection of the remedy	Section 2.12.1

If contamination posing an unacceptable risk to human health or the environment is discovered after execution of this ROD and is shown to be the result of Navy activities, the Navy will undertake the necessary actions to ensure continued protection of human health and the environment.

1.7 (1 of 2) Authorizing Signatures

The signature provided below validate the Selected Remedy for OU11 (DU 4-1 at the TF4 – Site 12 Disposal Area at NAVSTA Newport in Portsmouth, Rhode Island) by the Navy and EPA. RIDEM concurs with the Selected Remedy, as indicated in Appendix A of this ROD.

Concur and recommend for implementation:

9/18/13

CAPT D.W. Mikatarian
Commanding Officer
Naval Station Newport, Rhode Island
U.S. Navy

Date

1.7 (2 OF 2) AUTHORIZING SIGNATURES

The signature provided below validate the Selected Remedy for OU11 (DU 4-1 at the TF4 – Site 12 Disposal Area at NAVSTA Newport in Portsmouth, Rhode Island) by the Navy and EPA. RIDEM concurs with the Selected Remedy, as indicated in Appendix A of this ROD.

Concur and recommend for implementation:

Nancy Barmakian for 09/30/13

James T. Owens, III
Director, Office of Site Remediation and Restoration
Region 1 – New England
U.S. EPA

Date

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

NAVSTA Newport is located approximately 25 miles south of Providence, Rhode Island, on Aquidneck Island. The facility occupies approximately 1,000 acres, with portions of the facility located in the City of Newport and the Towns of Middletown, Portsmouth, and Jamestown, Rhode Island. The western boundary of NAVSTA Newport follows the western shoreline of Aquidneck Island for nearly 6 miles, facing the eastern passage of Narragansett Bay. The major commands currently located at NAVSTA Newport include the Surface Warfare Officers School (SWOS) Command, Naval Undersea Warfare Center (NUWC), and Naval War College. Research, development, and training are the primary activities at NAVSTA Newport. When previously identified as NETC Newport, NAVSTA Newport had EPA ID number RI6170085470.

TF4 occupies approximately 90 acres in the northern portion of the NAVSTA Newport facility and contains the remnants of 12 former 2.5-million-gallon-capacity underground storage tanks (USTs) originally used to store No. 6 fuel oil, and were closed in place. TF4 is partially fenced, and signs are posted at entrances restricting access to authorized personnel. Activities within TF4 are restricted to general industrial uses and bow hunting by permit authorized by the Commanding Officer. There are no functional buildings at TF4, and no above-ground structures are currently present at DU 4-1. DU 4-1 occupies approximately 14 acres at the southwestern corner of TF4 and is bounded to the north and east by other portions of TF4, to the south by a mixture of undeveloped and residential property, and to the west by Defense Highway, beyond which lies Narragansett Bay, as shown on Figure 2-1.

The construction of TF4, circa 1942

DU 4-1 includes two former oil-water separator (OWS) areas, and associated discharge pipes and discharge areas combined with Normans Brook. The easternmost of the two OWSs (Ruin 1) was originally constructed as a burning chamber for tank bottom sludge. Ruin 1 was later converted to an OWS that received discharge from the bottom sediment and water (BSW) piping that led from each tank area to the east. Excess fluids drained from the burning chamber/OWS to the wetland formed by Normans Brook to the south. The second OWS (Ruin 2) appears to have been installed for the purpose of accepting water from the ring drain surrounding Tank 41, which is located upgradient, to the east-southeast, of this OWS. Further investigations are ongoing in regard to tanks and fuel systems at the part of TF4 that is upgradient of DU 4-1. The tanks, fuel piping, and BSW lines have been addressed under the Navy's Petroleum, Oil and Lubricants (POL) Program and under state (RIDEM) authority and are not addressed under CERCLA.

Contaminants in soil, groundwater, surface water, and sediment were identified during past environmental assessments at DU 4-1 and were attributed to previous activities including uncontrolled burning of tank bottom sludge in the burning chamber/OWS structure and associated waste discharged into the environment via piping.

NAVSTA Newport is an active facility, with environmental investigations and remedial efforts funded under the Environmental Restoration, Navy (ER, N) program. The Navy is conducting its Installation Restoration (IR) Program (i.e., environmental investigation and remediation program) at NAVSTA Newport in accordance with a Federal Facility Agreement (FFA) between the Navy, EPA, and RIDEM. The FFA established the Navy as the lead agency for the investigation and specified cleanup of designated sites within the NAVSTA Newport property, with EPA and RIDEM providing oversight.

2.2 Site History and Enforcement Activities

Previous environmental investigations conducted to evaluate environmental quality at TF4, including DU 4-1, are summarized in Table 2-1. Results of these investigations indicated concentrations of PAHs and metals in soil and metals in groundwater that exceed acceptable risk levels or state regulatory standards. The nature and extent of contamination identified in soil and groundwater is discussed further in Section 2.5.

Table 2-1. Previous Investigations and Site Documentation

Investigation	Date	Activities
Initial Assessment Study (IAS)	1983	The IAS concluded that TF4 should be investigated further due to uncontrolled burning and potential disposal of tank bottom sludge.
Confirmation Study	1986	Sediment, surface water, soil, groundwater and tank water samples were collected. Results indicated that historic uses of the site had potentially impacted site media. It was concluded that further investigations at the site were needed to determine the extent of the impacts and that there was still work to be done to officially decommission the tanks.
National Priority List (NPL) listing	1989	NAVSTA Newport (identified as NETC Newport) was listed on the EPA National Priorities List (NPL).
Remedial Investigation (RI)	1992	As part of a **RI** completed by the Navy for NETC Newport, soil, groundwater, surface water, sediment, and soil gas samples were collected across the site. After the results were analyzed, additional studies were recommended to further define the extent of total petroleum hydrocarbons (TPH) in surface soils and to determine the significance of elevated metals concentrations in soil and groundwater. Borings and wells were installed across TF4 to identify the presence of suspected sludge pits for disposal of tank bottom sludge. Although sludge pits were not found, data indicated that there had been releases of petroleum from some of the tanks and that residual petroleum was bound within some of the tank's ring drains.
Tank Demolition	1996-1999	The Navy **demolished the underground tanks** upgradient of DU 4-1 that had been used for fuel storage since the 1940s. Prior to demolition, the ring drains were pumped to remove residual oils. This action was conducted under RIDEM UST regulations.
Site Investigation/ Removal Action	2004-2007	Under both CERCLA and RIDEM UST regulations, the Navy conducted an extensive **Site Investigation** and removal action in several portions of TF4, including the area that later became DU 4-1. The work included further search for possible former sludge disposal pits, assessing underground piping, demolishing and removing piping, and sampling. No evidence of former sludge pits was found. The OWSs were demolished and an extensive soil removal was conducted in the former OWS discharge areas. Approximately 2,293 tons of soil were removed from the former Ruin 1 discharge area. Sediment in the Ruin 1 area and soil and sediment from the former Ruin 2 area did not require excavation. Lead was found in the soil at the fence line (outside of DU 4-1) and is currently being addressed by a maintenance action.
Background Soil Investigation	2006	The Basewide **Background Soil Investigation** was conducted in 2006 to provide a background data set for comparisons to soil and sediment data collected from CERCLA sites at NAVSTA Newport. The objective of the investigation was to identify levels of inorganics expected to be present had the various Navy activities not occurred. Both naturally occurring and anthropogenic metals were included. Surface and subsurface soil samples were collected at offsite locations representative of NAVSTA Newport soil types mapped by the United States Department of Agriculture Natural Resources Conservation Service (NRCS). The background data set was published as the Basewide Background Soil Investigation in 2008.

TABLE 2-1. PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION (CONT.)		
INVESTIGATION	**DATE**	**ACTIVITIES**
Data Gaps Investigation	2010	A **Data Gaps Assessment (DGA)** was conducted to provide up-to-date site-representative data for DU 4-1 to aid in determining post-excavation conditions and residual risks to potential human and ecological receptors following the 2004 – 2007 removal actions. During development of the work plan for the DGA, Category 1DUs (CERCLA-regulated releases) and Category 2 DUs (areas of petroleum contamination regulated under RIDEM UST regulations) were established. The DGA included the collection of soil, groundwater, surface water, and sediment samples, a baseline Human Health Risk Assessment (HHRA) and screening-level ERA. The **baseline HHRA** indicated potentially unacceptable risk to receptors from PAHs and metals in soil and from metals in groundwater. The **screening ERA** indicated that a baseline ERA was not necessary because of limited potential ecological risks.
Feasibility Study (FS) For DU 4-1	2013	The FS was conducted for DU4-1, the target area of TF4 where CERCLA contaminants were confirmed to be present. The FS identified cleanup goals, screened potential remedial technologies, and developed and evaluated **remedial alternatives** for soil and groundwater based on information from previous investigations. The final FS presented three remedial alternatives to address contamination in site soil and three remedial alternatives to address contamination in site groundwater.

*Additional information about terms in **blue text** is provided in the Administrative Record Reference Table included at the end of this ROD.*

There have been no cited violations under federal or state environmental law or any past or pending enforcement actions pertaining to the cleanup of Site 12 DU 4-1.

2.3 COMMUNITY PARTICIPATION

The Navy performs public participation activities as part of the site cleanup process at NAVSTA Newport in accordance with CERCLA and the NCP. Through this process, the Navy developed a comprehensive community relations program, known as the NAVSTA Newport Community Involvement Plan, to foster effective communication with the public on the status and progress of designated sites at the facility. The community involvement plan includes regular technical and Restoration Advisory Board (RAB) meetings with local officials and the establishment of an online Information Repository for dissemination of information to the community (available at http://go.usa.gov/Tsy).

The Navy organized the RAB in 1990 to review and discuss NAVSTA Newport environmental issues with local community officials and concerned citizens. The RAB consists of representatives of the Navy, EPA, and RIDEM and members of the local community. The RAB has met frequently since its inception and now meets bi-monthly. Site 12 investigation activities, results, and associated remedial decisions have been discussed at RAB meetings as they became available. Documents and other relevant information relied on in the remedy selection process are available for public review as part of the Administrative Record. For additional information about the IR Program at NAVSTA Newport, contact Ms. Lisa Rama, Public Affairs Office, 690 Peary Street, Naval Station Newport, Newport, Rhode Island 02841 (lisa.rama@navy.mil).

In accordance with Sections 113 and 117 of CERCLA, the Navy provided a public comment period from June 19 to July 19, 2013, for the proposed remedial action described in the Proposed Plan for Site 12 DU 4-1. A public meeting to present the Proposed Plan was held on June 19, 2013, at the Hampton Inn, 317 West Main Road in Middletown RI. A **public notice** of the meeting and availability of documents was published in the *Newport Daily News* on June 16 and June 18, 2013. Immediately following the public informational meeting, the Navy held a public hearing to solicit public comments for the record. Several oral comments were received during the public hearing, and one written comment was received during the 30-day comment period. The comments are summarized in the Navy's Responsiveness Summary, presented in Section 3 of this ROD A transcript of the oral comments received during the public hearing was prepared and is available for review as part of the TF4 Administrative Record.

2.4 SCOPE AND ROLE OF OPERABLE UNIT

DU 4-1 is part of a comprehensive environmental investigation and cleanup program currently being performed at NAVSTA Newport under CERCLA authority pursuant to the FFA dated March 23, 1992. Fifteen IR sites have been identified at NAVSTA Newport. An IAS, completed in 1983, identified 18 sites where contamination was suspected to pose a threat to human health and the environment. Six of the 18 sites, including TF4, were investigated further in a Confirmation Study (CS), completed in 1986. A RI was completed in 1992 and included McAllister Point Landfill (Site 1), Melville North Landfill (Site 2), Old Fire Fighting Training Area (OFFTA) (Site 9), TF4 (Site 12), and Tank Farm 5 (Site 13). The McAllister Point Landfill, Melville North Landfill, and TF4 had been previously investigated during both the IAS and CS, and Tank Farm 5 was investigated during the IAS.

Investigations at four of the five sites continued under the Department of Defense IR Program following the listing of NAVSTA Newport (then NETC) on the NPL in 1989. RODs have been signed for the McAllister Point Landfill, OFFTA (combined with the SWOS), Tank Farm 5 - Tanks 53 and 56, and Naval Undersea Systems Center (NUSC) Disposal Site. The Melville Water Tower, was addressed through a Non-Time-Critical Removal Action (NTCRA). Nine additional sites (Tank Farm 1, Tank Farm 2, Tank Farm 3, Coddington Cove Rubble Fill Area, TF4, the remaining portions of Tank Farm 5, Derecktor Shipyard, Building 32 at Gould Island, and Carr Point) are also being investigated under the IR Program. The Melville North Landfill was investigated and remediated under RIDEM regulations, rather than under the IR Program because it was not owned by the Navy at the time of the NPL listing.

The DU 4-1 portion of TF4 is where contaminant releases regulated under CERCLA have been detected. The Navy believes that petroleum contamination in the remaining portions of TF4 has been addressed through separate Site Investigations, removal actions, and Corrective Action Plans under the RIDEM UST regulations, as appropriate.

Investigations at DU 4-1 indicated the presence of soil and groundwater contamination from past operating practices (uncontrolled burning and disposal of tank bottom sludge) that poses unacceptable risk to current and potential future human receptors. In addition, concentrations of some chemical contaminants including chemicals associated with sludge burning and disposal exceed state cleanup criteria. Previous actions taken in response to the contamination at TF4 are summarized in Table 2-1. The remedy documented in this ROD will achieve the Remedial Action Objectives (RAOs) for DU 4-1, as listed in Section 2.8. Implementation of this remedy will allow for continued industrial use of the site, which is consistent with current and reasonably anticipated future use and the overall cleanup strategy for NAVSTA Newport of restoring sites to support Navy operations.

2.5 SITE CHARACTERISTICS

Figure 2-2 presents the DU 4-1 conceptual site model (CSM), a graphical interpretation of contaminant sources, contaminant release mechanisms, transport routes, and receptors under current and future land use scenarios. Historical activities at DU 4-1 have resulted in the presence of PAHs and metals in soil and metals in groundwater at concentrations that exceed acceptable risk levels or state regulatory standards. The nature and extent of contamination at the site is described in Section 2.5.2. The evaluated contaminant exposure pathways and potential human and ecological receptors under current and potential future land use scenarios are presented in Section 2.7.1 and 2.7.2, respectively.

2.5.1 Physical Characteristics

Geologic and hydrogeologic conditions at both DU 4-1 and TF4 are summarized in this section based on a combination of information from published maps and site data collected during the RI, Site Investigation, and DGA field investigations.

Setting and Conceptual Site Model

DU 4-1 is a 14 acre area, located in the south western corner of Tank Farm 4. Normans brook, bisects the site, flowing east to west. Normans brook is an intermittent stream and has associated wetland and floodplain areas bounding both the north and south sides, particularly in the western most portion of the site.

The Conceptual Site Model (CMS) developed in the RI, and refined in the DGA and the FS shows that the OWS structures received drainage water and petroleum sludge through Bottom-Sediment-Water (BSW) piping that led from the upgradient tanks. After providing separation of the petroleum from the water, the water was discharged to Normans Brook and the associated wetland and floodplain. Additionally, releases of petroleum to the ground at DU 4-1 may have created an oxidation reduction environment and natural biological degradation of this petroleum may be creating a geochemical condition that favors the dissolution of metals (particularly iron and manganese) from soil and rock and cause them to move with groundwater. While unconfirmed, this condition may also be an upgradient condition associated with petroleum releases at the former tank locations at TF4.

Currently the site is mostly unused and is heavily vegetated with invasive plants and secondary growth forest. Tank Farm 4 is being evaluated for redevelopment as a wind farm, and is currently utilized for deer hunting by bow, and only by qualified NAVSTA employees selected through lottery and only during State-authorized hunting season.

Geology

The overburden thickness at TF4 ranges from approximately 1 to 40 feet, generally increasing in flat-lying areas and becoming thinner on slopes. The thickest overburden is present in the areas immediately surrounding the former USTs where bedrock was blasted to accommodate tank construction efforts and the blasted materials were used as fill around the tank structures.

At TF4, overburden materials classified as either glacial till or fill, are generally mixtures of silt, sand and gravel, as well as boulders and gravel-sized pieces of bedrock. In soil borings, the fill can be difficult to distinguish from native materials because fill typically appears to be surficial materials that originated from another part of the site or that resulted from the blasting of the bedrock during tank installation activities. The blasted bedrock is difficult to distinguish from weathered bedrock, and the weathered bedrock/overburden interface is difficult to determine due to the soft and extremely weathered nature of much of the bedrock. The density of the overburden generally varies from loose to medium but is not a reliable indicator as to the nature of the overburden materials (native or fill).

Specifically at DU 4-1, the overburden is dominated by sandy silts and silty sands, although some locations also include gravel mixed in with these silts and sands. The gravelly materials are usually present deeper in the subsurface and/or directly above the bedrock surface, and the silts and sands occur more continuously and are more likely to be found near the ground surface.

Bedrock within DU 4-1, as encountered during the DGA, was characterized as fine-grained, foliated, metamorphic rock consisting of shale and phyllite. The upper surface of the bedrock is weathered, and the bedrock is typically soft, as evidenced by bedrock boreholes advanced using roller-bit drilling methods. The depths to weathered bedrock observed during drilling within DU 4-1 were between 2 and 16 feet bgs. More competent bedrock was encountered between 1 and 8 feet below the top of weathered bedrock.

Hydrogeology

Depths to groundwater at TF4 range from approximately 1 to 30 feet bgs. Regional **groundwater flow** is in a westerly direction, generally following surface topography, and ultimately discharges into Narragansett Bay. Horizontal hydraulic gradients calculated for TF4 bedrock and overburden using May 2010 groundwater elevation measurements were calculated at 0.02 and 0.04, respectively.

Groundwater flow across DU 4-1 does not vary greatly from the westerly direction of flow across the remainder of TF4. DU 4-1 is located in the most downgradient section of TF4, so groundwater entering DU 4-1 is coming from the other parts of the Tank Farm located to the east. Groundwater from DU 4-1 discharges either to Normans Brook or travels further through subsurface materials and eventually discharges into Narragansett Bay, which lies to the west of DU 4-1. The groundwater potentiometric surface measured at DU 4-1 was between 12 feet bgs and 1.3 feet above the ground surface. Artesian conditions were observed in the area around former Ruin 2, which is located at the bottom of a steep hill that rises up to the east and north to the location of former Tank 41. Artesian conditions in the area of former Ruin 2 were observed during installation of monitoring wells MW-912 and MW- 913. The potentiometric surface is below ground surface at MW-919, in the area closer to Norman's Brook.

Groundwater flow conditions are not artesian in the area of former Ruin 1, as observed at monitoring wells MW-920, MW-921, and MW-922. In the area downgradient of former Ruin 1, in the wetland at MW-914, groundwater levels were measured above the ground surface.

2.5.2 Nature and Extent and Fate and Transport of Contamination

Past operations in the area of DU 4-1 were found to have resulted in the release of contaminants to surface and subsurface soil, and groundwater. Surface water, and sediment were evaluated and only low concentrations of contaminants were found within these media. The presumed source of the soil and groundwater contaminants, which has been eliminated through site demolition and removal actions, was burned and unburned fuel sludge and by-products. The nature and extent of contamination at DU 4-1 has been influenced by the following factors:

- Contaminants associated with the **burning of sludge** and from discharge of burned sludge to the wetland areas were likely released to the ground at and downgradient of the former burn chamber.

- Contaminants passing through the OWSs would most likely have been released to the brooks and entrained within the wetland soils.

- These contaminants were mitigated significantly through the removal of the burn chamber/OWS at Ruin 1, and the OWS at Ruin 2). Contamination was further mitigated through removal of the pipelines and soil and sediment around the discharge areas at the wetland.

Contaminants of potential concern (COPCs) were identified as part of the HHRA presented in the DGA report. COCs were determined after the risk assessment process, as further discussed in Section 2.7 of this document. A summary of sample results for the DU 4-1 COCs is presented in Table 2-2. The extent of COCs exceeding cleanup goals in surface soil, subsurface soil, and groundwater is presented on Figures 2-3 through 2-5, respectively. Contaminants in surface water and sediment do not require remediation, as discussed further in Section 2.7. The nature and extent of contamination described in this section is limited to the media that is being addressed by the chosen remedy. Only the contaminants in these media that require action under CERCLA are discussed. For a full description of the nature and extent in all media, refer to the DGA report (Tetra Tech, 2012).

TABLE 2-2. SUMMARY OF RESULTS FOR DU 4-1 COCS

COC	FREQUENCY OF DETECTION	CONCENTRATION RANGE
Surface Soil		
SVOCs (µg/kg)		
Benzo(a)anthracene(1)	21/24	8.2 - 54,000
Benzo(a)pyrene(1)	21/24	8.5 - 24,000
Benzo(b)fluoranthene(1)	22/24	4.3 - 49,000
Benzo(g,h,i)perylene(2)	21/24	6 – 8,500

TABLE 2-2. SUMMARY OF RESULTS FOR DU 4-1 COCS (CONT).		
COC	FREQUENCY OF DETECTION	CONCENTRATION RANGE
Benzo(k)fluoranthene(1)	21/24	7.4 - 19,000
Chrysene(2)	21/24	12 - 59,000
Dibenzo(a,h)anthracene(1)	14/24	3.8 - 3,900
Fluoranthene(2)	22/24	5.1 – 83,000
Indeno(1,2,3-cd)pyrene(1)	21/24	5.7 - 8,500
Pyrene(2)	22/24	4.4 – 86,000
Metals (mg/kg)		
Arsenic(1)	24/24	4.2 - 59.5
Manganese(2)	24/24	144 - 818
Subsurface Soil		
SVOCs (µg/kg)		
Benzo(a)anthracene(1)	15/42	3.9 - 320
Benzo(a)pyrene(1)	14/42	3.3 - 250
Benzo(b)fluoranthene(1)	15/42	4.2 - 610
Benzo(g,h,i)perylene(2)	12/42	4.2 - 180
Benzo(k)fluoranthene(1)	13/42	4.8 - 490
Chrysene(2)	15/42	4.3 - 440
Dibenzo(a,h)anthracene(1)	6/42	5.6 - 46
Indeno(1,2,3-cd)pyrene(2)	11/42	3.3 - 140
Metals (mg/kg)		
Arsenic(2)	42/42	4.9 – 42.9
Manganese(1)	42/42	58.3 – 4,480
Groundwater		
Total and Dissolved Metals (µg/L)		
Arsenic(1)	4/7	1.6 – 6.3
Cobalt(1)	7/7	1.2 – 12.6
Iron (1)	7/7	252 – 17,100
Manganese(1)	7/7	321 – 5,030

1 COC selected by Human Health Risk Assessment.
2 COC selected by exceedance of state criteria or included at regulatory request.

2.5.2.1 Nature and Extent of Contamination in Soil

During the DGA, a number of analytes were detected at low concentrations in DU 4-1 soil samples collected after the 2004 through 2007 removal actions. Soil samples were collected from 24 locations, with 24 surface soil samples collected and 44 subsurface soil samples collected. These soil sampling locations are shown on Figures 2-3 and 2-4. Surface and subsurface soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), dioxins, TPH, and metals. Soil results were compared to EPA Regional Screening Levels (RSLs) for residential and industrial soils. SVOCs (mainly PAHs) and metals were the primary analyte groups detected and subsequently identified as COPCs. The full data set is provided in Appendix A of the FS Report (Tetra Tech, 2013).

PAHs

The distribution of PAHs around the discharge area of the former burning chamber/OWS identified as Ruin 1 shows a pattern of higher concentrations of PAHs in soil around the former discharge area. Increased PAH concentrations around the former terminus of the discharge pipe for former Ruin 2 were also detected, but the maximum total PAH concentration in the former Ruin 2 area was approximately 25 feet upstream of the former discharge pipe (location SB-931). In surface soil, seven PAHs were detected at concentrations exceeding screening levels in one or more samples, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene. Some of these exceedances were up to 100 times the screening levels in one specific location, identified as SB934, located near the former discharge point from the former burning chamber/OWS (Ruin 1). In subsurface soil samples, four PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(a,h)anthracene were detected at concentrations over 100x screening levels at this same location. Other locations indicated presence of PAHs in excess of screening levels, though these concentrations were very low in comparison to those at SB934 (Fig 2-3a).

Metals

Unlike PAHs, a distribution pattern of metals at elevated levels in soil around discharge areas was not evident. Concentrations of metals above screening criteria were detected in every sampling location. Arsenic was detected above screening levels at every surface soil sampling location. Arsenic and manganese, were detected in subsurface soil at concentrations exceeding screening levels. Arsenic was detected above screening levels at every subsurface interval sampled. Manganese was detected above screening levels less frequently. Arsenic was present at high concentrations (above RIDEM threshold concentration of 43 mg/kg) in surface soil at one location (SB943), though this location was not affiliated with any specific site feature.

Background concentrations have been established for both arsenic and manganese in soils at NAVSTA Newport and DU 4-1 (Tetra Tech, 2008) in an EPA-approved background study. For this site, concentrations of metals measured in four soil types mapped by the US Department of Agriculture within DU 4-1 were considered as potential background conditions for the site soil. The background concentration for arsenic is calculated at 19 mg/kg in surface soil and 24 mg/kg in subsurface soil for DU 4-1, and the background concentration for manganese is 360 mg/kg in surface soil and 1,030 mg/kg in subsurface soil for DU 4-1. These site-specific background concentrations are 95% UPL values for these constituents in the four soil types that were mapped within DU 4-1 prior to development of Tank Farm 4. Use of data from the represented soil types combined, allows for consideration of the mixing of these soils during the historic construction of the tank farm.

Later in this document it is noted that while arsenic poses risk to the residential and unrestricted recreational receptors, statistical analysis of metals data in soil concluded that the site concentrations are below this calculated background concentration. However, the one location where arsenic was found in excess of the RIDEM threshold concentration of 43 mg/kg is notable because this concentration is more than twice the background concentration for arsenic in surface soil and as such, this hot spot was identified as a target for remediation.

Statistical analysis also shows that site concentrations (95% UCL) for manganese are above background concentrations at this site, and therefore manganese in soil is actionable under this ROD.

Other

During review of the FS report, RIDEM and EPA identified two areas that were not evaluated in detail during the DGA. A berm near SB930 is suspected to contain debris that could be classified as solid waste. A series of former test pits to the northwest of SB924 is identified in the 2007 SI report as a location where petroleum was previously identified by screening tests. Based on the EPA and RIDEM request, these two locations will also be evaluated for inclusion as part of the remedial actions for soil as a target excavation area. The locations will be included in the remedial action if COCs are found at concentrations above remediation goals in soil/co-mingled solid waste. Solid waste or debris found in these areas will be removed as a voluntary maintenance action and not part of the remedy.

2.5.2.2 Nature and Extent of Contamination in Groundwater

During the investigation of DU 4-1 groundwater quality, data were collected from seven groundwater monitoring wells, including three located in the former Ruin 1 area (TF4-MW-920, 921 and 922), one in the former Ruin 1 discharge area (TF4-MW- 914), and three in the former Ruin 2 area (TF4-MW-912, 913 and 919) (Figure 2-5). Groundwater samples collected from DU 4-1 monitoring wells were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. Metals and PAHs were the primary analyte groups identified, though PAHs were detected only at trace concentrations not exceeding screening criteria (EPA RSLs). The nature and extent of metals are discussed below because these COCs were the only constituents to pose risk or exceed regulatory criteria and therefore are the only COCs in groundwater that require a remedy. The complete data set is provided in the FS report (Tetra Tech, 2013). Sample results were compared to EPA RSLs for tap water and EPA Maximum Contaminant Levels (MCLs).

Arsenic, cobalt, and manganese were detected in groundwater samples at concentrations exceeding screening levels. Arsenic was detected above the tapwater RSL at four monitoring wells; MW-912, MW-913, MW-914 and MW-919 (Figure 2-5). The other three monitoring wells did not have detectable levels of arsenic. Cobalt was detected in all seven wells and at four wells above the RSL for tapwater (there is no MCL for cobalt). The four wells where cobalt was detected above the tapwater RSL includes MW-912, MW-913, MW-919 and MW-921. Six monitoring wells had concentrations of manganese above the tapwater RSL, there is no MCL for manganese in groundwater. The six wells include the four wells where arsenic was detected above screening levels and MW-920 and MW-921. MW-922 had a detectable concentration of manganese, but it was below the tapwater RSL. Iron was detected in all wells above screening criteria.

2.5.2.3 Evaluation of Sediment

Sediment samples were collected from 12 locations within Normans Brook and its associated wetlands and tributaries. Samples were analyzed for VOCs, SVOCs, dioxins, pesticides, PCBs and metals. The complete dataset is provided in the FS report (Tetra Tech, 2013). Results were compared to EPA RSLs for residential and industrial soil, and to ecological criteria as appropriate in a screening level ecological risk assessment. Based on this evaluation, sediment was not identified as a media of concern.

2.5.2.4 Evaluation of Surface Water

Surface water samples were collected from ten locations within Normans Brook and its associated wetlands and tributaries. These surface water samples were collocated with sediment samples, whenever surface water was present. Samples were analyzed for VOCs, SVOCs, pesticides, PCBs and metals. Sample results were compared to the EPA RSLs for tap water and the EPA MCLs, and to ecological criteria as appropriate in the screening level ecological risk assessment. The complete dataset is provided in the FS report (Tetra Tech, 2013). Based on this evaluation, surface water was not identified as a media of concern.

2.5.2.5 Fate and Transport

PAHs have low volatility, and are generally not very soluble. PAHs are likely to remain adsorbed to soil particles and are only gradually leached by precipitation or infiltration. For these compounds, biodegradation is possible, but is likely to be slow. Metals also tend to adsorb to soil particles, especially when there is high organic content, and become soluble under reducing conditions. Both classes of compounds are considered to be persistent in the environment. PAHs or metals adsorbed to the soil particles present at the ground surface could transported in runoff that occurs during precipitation events or through the wind erosion of soil. Such erosion is significantly reduced with the presence of a vegetative cover, as is the case at most portions of this site. Soluble metals may also be leached from the soils into groundwater by infiltration of precipitation and through the seasonal rise and fall of the water table. Once in groundwater, soluble metals will travel with groundwater flow. As groundwater migrates, some of the metals will undergo transformation processes that result in their return to an insoluble state. Reduction-oxidation, precipitation, and adsorption reactions can cause the dissolved phase ions to leave the aqueous phase.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

NAVSTA Newport is an active military training facility and is expected to remain active for the foreseeable future. Forty-two Naval and defense commands currently operate at NAVSTA Newport, which is one of the Navy's primary sites for training and educating officers, officer candidates, senior enlisted personnel, and midshipman candidates, and which is also used for conducting advanced undersea warfare and development systems activities. Tenant commands include the NUWC, Naval Warfare College, SWOS, Navy Warfare Development Command, Officer Training Command, Center for Service Support, Naval Academy Preparatory School, and Senior Enlisted Academy.

The NAVSTA Newport area has been used by the U.S. Navy since the Civil War era, with operations increasing during times of conflict and decreasing as Naval forces were reorganized. Between 1900 and the mid-1970s, the facility was also used as a fueling depot. The Shore Establishment Realignment Program reorganization in April 1973 resulted in reductions in personnel, and the Navy excessed a large portion of the acreage of the original facility. NETC was subsequently established. In the mid-1990s several new laboratories were constructed to provide research, development, testing, evaluation, engineering, and fleet support for submarines and underwater systems. In October 1998, NAVSTA Newport was established as the primary host command, taking over base operating support responsibilities from NETC.

The DU 4-1 portion of Site 12 is part of the NAVSTA located in Portsmouth, Rhode Island. Wetlands cover approximately one-third of the site's approximately 14 acres. DU 4-1 was used in the past as part of the TF4 drainage system; it is a topographic low point of TF4 and contained two former OWSs and associated discharge pipes and discharge areas. These structures have since been removed. Since the decommissioning and removal of the OWS and pipe system, the site has remained vacant.

The site is occasionally used for hunting by lottery selection during state-regulated deer hunting season. Portions of Tank Farm 4 are currently being evaluated for use by wind turbines. As such the current and planned future use is industrial and restricted recreational (hunting).

Groundwater underlying NAVSTA Newport is **not used for drinking water**. Drinking water for NAVSTA Newport and most of the residents of Newport and Middletown is supplied and managed by the Newport Water Department, which receives its water supply from a series of seven surface water reservoirs located on Aquidneck Island and two surface water reservoirs on the mainland. DU 4-1 is not within the watershed of any of the area supply reservoirs. Private wells located within 3 miles of NAVSTA Newport provide drinking water to approximately 4,800 of the estimated 10,000 people that live within 3 miles of the facility (Tetra Tech, 2004). Due to its near-coastal location, groundwater at DU 4-1 is downgradient of any potential or existing water sources.

RIDEM has established a state groundwater classification system to protect its groundwater resources, and under this system, DU 4-1 is within **RIDEM's GA groundwater classification area,** which designates it as presumed suitable for public or private drinking water use without treatment (RIDEM, 2010). However, per EPA groundwater remediation guidance, in states without an EPA-approved Comprehensive State Groundwater Protection Program (CSGWPP) such as Rhode Island, CERCLA groundwater remediation must meet federal drinking water standards (i.e., MCLs and non-zero Maximum Contaminant Level Goals ([MCLGs]) and risk-based standards, or more stringent state groundwater standards, unless the water is non-potable. Therefore, groundwater at DU 4-1 must meet the more stringent of federal drinking water standards, risk based standards and state groundwater standards.

2.7 SUMMARY OF SITE RISKS

This section of the ROD summarizes the results of the risk assessment for this site. The risks summarized in this section were those for **potential receptors** indicated in Table 2-3 which assumes an unrestricted use of the site. Some media and receptors were later eliminated after review of subsequent data collected (Section 2.7.3). Previously, lead has been found in soil associated with the boundary fence around Tank Farm 4 and a separate maintenance action will be conducted to address the fence and the associated soil.

The baseline risk assessment estimates the risks that a site poses if no action were to be taken. The risk assessment results provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action. A HHRA and a screening-level ERA were conducted as part of the DGA for DU 4-1 in 2012 (Tetra Tech, 2012).

2.7.1 Human Health Risk

The quantitative HHRA was conducted using chemical concentrations detected in soil, groundwater, surface water, and sediment. Key steps in the risk assessment process included identification of COPCs, exposure assessment, toxicity assessment, and risk characterization. Tables summarizing data used in the HHRA and the associated results are presented in Appendix C.

2.7.1.1 Identification of COPCs

The available validated data collected during the field investigations were used to identify COPCs for DU 4-1. Both federal and RIDEM criteria were used for COPC selection. Federal criteria include EPA RSLs, EPA MCLs, and EPA Groundwater Screening Levels for Evaluating the Vapor Intrusion into Indoor Air from Groundwater and Soils. RIDEM criteria included direct exposure criteria (DECs) for residential soil, RIDEM GA leachability criteria, and GA groundwater objectives.

Table C-1 in Appendix C presents exposure point concentrations (EPCs) for the **COPCs identified** during the HHRA for surface soil (0-1 foot), subsurface soil (2-4, 4-6, 6-8 or 8-10 feet), groundwater, surface water, and sediment. EPCs are the concentrations used in the risk assessment to estimate exposure and risk from each COPC. The following guidelines were used to calculate EPCs for Site 12 DU 4-1 COPCs during the HHRA:

- For soil, surface water, and sediment, 95-percent upper confidence limits (UCLs) on the arithmetic mean, which are based on the distribution of each data set, were selected as the EPCs. EPCs were calculated following EPA's Calculating UCL for EPCs at Hazardous Waste Sites and using EPA's ProUCL software Version 4.00.05 (USEPA, 2002 and 2010).

- For groundwater, in accordance with the EPA New England Risk Updates (1995), maximum groundwater concentrations were used as EPCs for the reasonable maximum exposure (RME) scenario and average groundwater concentrations were used as EPCs for the central tendency exposure (CTE) scenario.

- Non-detected values were evaluated in accordance with the ProUCL guidance. The results of duplicate samples were averaged for purposes of calculating EPCs for COPCs in environmental media at DU 4-1. In calculating averages, if a chemical was detected in only one sample of a duplicate pair, the average was calculated using the detected value and one-half of the detection limit.

2.7.1.2 Exposure Assessment

During the **exposure assessment** step of the HHRA, current and potential future exposure pathways through which humans might come into contact with the COPCs identified in the previous step were evaluated. The results of the exposure assessment for DU 4-1 were used to refine the CSM (Figure 2-2), which identifies potential contaminant sources, contaminant release mechanisms, transport routes, and receptors under current and future land use scenarios. Surface soil, subsurface soil, groundwater, surface water, and sediment were identified as the media for evaluation. The evaluated potential exposure routes include inhalation of air or volatiles from soil and groundwater (including vapor intrusion into buildings); dermal contact with soil, sediment, surface water, and groundwater; and ingestion of soil, sediment and groundwater. The HHRA considered receptor exposure under non-residential land use (restricted recreational use, construction and industrial uses, and visitation by trespassers) and hypothetical future residential and unrestricted recreational land use. Current and hypothetical future exposure pathways evaluated at DU 4-1 are summarized in Table 2-3. Potential exposures associated with current restricted recreational use of the property by hunters (restricted by season and selected by lottery) was assumed to be similar to exposures associated with industrial use. Exposure assumptions and other supporting information used in the HHRA are presented in Appendix C.

Table 2-3. Receptors and Exposure Routes Evaluated in HHRA

Receptor	Exposure Route
Construction Workers (future land use)	Soil incidental ingestion Soil dermal contact Inhalation of air/dust emissions Groundwater incidental ingestion (during excavation) Groundwater dermal contact (during excavation) Groundwater inhalation of volatile organics (during excavation)
Industrial Workers (and restricted recreational use – hunting by lottery selection) (current and future land use)	Soil incidental ingestion Soil dermal contact Inhalation of air/dust emissions
Adolescent Trespassers (current and future land use)	Soil incidental ingestion Soil dermal contact Inhalation of air/dust emissions Surface water dermal contact Sediment incidental ingestion Sediment dermal contact
Residents (Adults/Children) (hypothetical future land use)	Soil incidental ingestion Soil dermal contact Inhalation of air/dust emissions Direct ingestion of groundwater Groundwater dermal contact (residential use, i.e., showering/bathing) Inhalation of volatiles in groundwater (residential use, i.e., showering/bathing)
Unrestricted Recreational Users (Adults/Children) (hypothetical future land use)	Soil incidental ingestion Soil dermal contact Inhalation of air/dust emissions Surface water dermal contact Sediment incidental ingestion Sediment dermal contact

2.7.1.3 Toxicity Assessment

The objective of the toxicity assessment is to identify the potential adverse health effects in exposed populations. Quantitative estimates of the relationship between the magnitude and type of exposures and the severity or probability of human health effects are defined for the identified COPCs. Quantitative toxicity values determined during this component of the risk assessment are integrated with outputs of the exposure assessment to characterize the potential for the occurrence of adverse health effects for each receptor group.

The toxicity value used to evaluate non-carcinogenic health effects for ingestion and dermal exposures is the reference dose (RfD). The reference concentration (RfC) is used to evaluate non-carcinogenic health effects for inhalation exposures. RfDs and RfCs are estimates of the daily exposure level for the human population that are likely to be without appreciable risk during a portion or all of a lifetime. RfDs and RfCs are based on a review of available animal and/or human toxicity data, with adjustments for various uncertainties associated with the data. Carcinogenic effects are quantified using the cancer slope factor (CSF) for ingestion and dermal exposures and inhalation unit risk (IUR) for inhalation exposures, which is a plausible upper-bound estimate of the probability of development of cancer per unit intake of chemical over a lifetime. The potential carcinogenic effects are calculated using available dose-response data from human and/or animal studies.

Although toxicity criteria can be found in several toxicological sources, EPA's Integrated Risk Information System (IRIS) online database is the preferred source of toxicity values. This database is continuously updated, and the presented values have been verified by EPA. The toxicity criteria for the constituents selected as COPCs during the HHRA are presented in Appendix C.

2.7.1.4 Risk Characterization

During the risk characterization, the outputs of the exposure and toxicity assessments are combined to characterize the baseline risk (cancer risks and non-cancer hazards) at the site if no action was taken to address the contamination. Potential **cancer risks and non-cancer hazards** were calculated based on RME assumptions. The RME scenario assumes the maximum level of human exposure that could reasonably be expected to occur.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$\text{Cancer Risk} = \text{CDI} \times \text{SF}$$

where: Cancer Risk = a unitless probability (e.g., 2×10^{-5}) of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor ($[\text{mg/kg-day}]^{-1}$)

These calculated risks are probabilities that are usually expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk or incremental lifetime cancer risk (ILCR) of 1×10^{-6} under an RME scenario indicates that an individual experiencing the reasonable maximum exposure estimate has an “excess lifetime cancer risk” because it would be in addition to the risks of contracting cancer that individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. EPA’s generally acceptable risk range for site-related exposures to COCs is 1×10^{-4} (1 in 10,000) to 1×10^{-6} (1 in 1 million).

Table 2-4 provides RME cancer risk estimates from the DU 4-1 HHRA for the significant receptors and routes of exposure developed by taking into account various conservative assumptions about the frequency and duration of exposure for each receptor and also about the toxicity of the COCs. DU 4-1 COCs associated with carcinogenic risk includes arsenic and PAHs. Total risk estimates calculated for all applicable exposure routes range from 2×10^{-9} for inhalation of soil vapors for hypothetical child, resident to 9×10^{-4} for ingestion of surface soil by hypothetical lifelong residents. These risk levels indicate that if no cleanup action was taken, the increased probabilities of developing cancer as a result of site-related exposure would range from approximately 0 to 9 in 10,000.

No unacceptable cancer risks were estimated for exposures to surface water, or sediment at DU 4-1. The ILCRs for hypothetical future child, adult, and lifelong residents using groundwater at the site for domestic purposes exceeded the EPA target risk range. Arsenic was the major contributor to the ILCR for groundwater, although measured concentrations were below the MCL for this metal. The ILCRs for hypothetical future child, adult, and lifelong residents exposed to soil through residential use of the site also exceeded the EPA target risk range, primarily due to the presence of PAHs, and to a lesser extent, arsenic in soil.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., a lifetime) to an RfD derived for a similar exposure period. An RfD represents a level to which an individual may be exposed that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a Hazard Quotient (HQ). An HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic non-carcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all chemicals that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may be reasonably exposed. An HI of 1 or less indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

$$\text{Non-cancer HQ} = \text{CDI} / \text{RfD}$$

where: CDI = chronic daily intake (mg/kg-day)
RfD = reference dose (mg/kg-day)

CDIs and RFDs are expressed in the same units and represent the same exposure period (i.e., chronic, sub-chronic, or short-term).

Table 2-4 also provides RME non-cancer HQs for each receptor and route of exposure and total HIs for all routes of exposure. Total HIs for all applicable exposure routes range from 0.00002 for dermal contact with surface water by adolescent trespassers and adult recreational users to 29 for ingestion of groundwater by hypothetical future child residents.

No unacceptable non-cancer hazards were estimated for surface water or sediment at DU 4-1. HIs for all receptors exposed to site-related COPCs in surface and subsurface soil under the RME scenario were less than or equal to unity (1), with the exception of construction workers exposed to soil. Manganese in soil samples collected near former Ruin 1 was the major contributor to the HI for construction workers. HIs for hypothetical future lifelong residents using groundwater at DU 4-1 for domestic purposes exceeded unity (1). Arsenic, cobalt, iron, and manganese were the major contributors to the HI.

2.7.1.5 Summary of Human Health Risk

The HHRA evaluated receptor exposure under hypothetical residential and non-residential (industrial, trespassers and recreational) land use scenarios. At DU 4-1, PAHs, dioxins/furans, and metals were identified as COPCs in soil. Naphthalene and metals were identified as COPCs in groundwater. PAHs and metals were identified as COPCs in surface water and PAHs, dioxins/furans, and metals were identified as COPCs in sediment.

Quantitative estimates of non-carcinogenic and carcinogenic risks (HIs and ILCRs, respectively) were developed for potential human receptors. All receptors were evaluated for exposures to surface soil (0 to 1 foot bgs) and all soil (0 to 10 feet bgs). Construction workers and hypothetical residents were also evaluated for exposures to groundwater. Adolescent trespassers and recreational users were also evaluated for exposures to surface water and sediment.

If the risk assessment calculated total risk for a media that was below the EPA thresholds (cancer risk of 1E-4 or HI >1), those media were eliminated as media of concern for the remedy development. Accordingly, the HHRA for DU 4-1 indicates there are potential risks to some receptors from exposure to surface soil, all soil and groundwater. However, there are no risks above thresholds to any receptors for exposure to surface water or sediment. The following potential risks were identified, based upon the indicated COCs:

- Construction workers could be affected by exposure to manganese in all soil.
- Lifelong unrestricted recreational users could be affected by exposure to carcinogenic PAHs in surface soil.
- Child residents could be affected by exposure to carcinogenic PAHs and arsenic in soil, and arsenic, cobalt, iron, and manganese in groundwater.
- Child unrestricted recreational users could be affected by exposure to carcinogenic PAHs in surface soil.
- Adult residents could be affected by exposure to carcinogenic PAHs in soil and arsenic and manganese in groundwater used for residential purposes.
- Lifelong residents could be affected by exposure to carcinogenic PAHs and arsenic in soil and by exposure to arsenic in groundwater, in addition to the child and adult resident risks stated above.

Table 2-4 below presents the calculated risks for the receptors identified above.

TABLE 2-4. RECEPTORS AND CALCULATED RISK

RECEPTOR	MEDIUM	TOTAL CANCER RISK	TOTAL NON-CANCER HAZARD INDEX
Construction Workers	Soil (0 - 10 feet in depth) (inhalation of dust in excavations)	<1E-4	**3**
Unrestricted Recreational User	Surface Soil (0 - 1 foot) (ingestion, dermal contact)	**2E-04**	<1
Child Resident	Surface Soil (0 - 1 foot) (ingestion, dermal contact)	**1E-03**	**2**
	Surface and Subsurface Soil (0 - 10 feet) (ingestion, dermal contact)	**3E-04**	**3**
	Groundwater (ingestion, dermal contact)	<1E-4	**31**
Adult Resident	Surface Soil (0 - 1 foot) (ingestion, dermal contact)	**2E-04**	<1
	Groundwater (ingestion, dermal contact)	<1E-4	**10**
Lifelong Resident (Adults/Children)	Surface Soil (0 - 1 foot) (ingestion, dermal contact)	**1E-03**	NA
	Surface and Subsurface Soil (0 - 10 feet) (ingestion, dermal contact)	**3E-04**	NA
	Groundwater (ingestion, dermal contact)	**2E-04**	NA

BOLDED values indicate exceedance of EPA's target risk range or target hazard value.
NA – Not Applicable: non cancer risks are not additive for lifetime exposures.

Soil Risks

HIs for all receptors exposed to site-related COPCs in surface and subsurface soil under the RME scenario were less than or equal to unity (1), with the exception of construction workers exposed to soil. At DU 4-1, manganese in soil samples collected near former Ruin 1 was the major contributor to the HI for construction workers.

ILCR for receptors exposed to site related COPCs in surface and subsurface soil under the RME scenario were below threshold risk values, except for unrestricted recreational and residential users. The primary contributors to the cancer risk were PAHs and arsenic in soil, specifically associated with target areas (hot spots) at SB934 (PAHs) and SB943 (arsenic).

Groundwater Risks

HIs for lifelong residents hypothetically using the groundwater at DU 4-1 for domestic purposes exceeded unity (1). Arsenic, cobalt, iron, and manganese were the major contributors to the HI.

The ILCRs for child residents, adult residents, and lifelong residents hypothetically using the groundwater for domestic purposes exceed the USEPA target risk range. Arsenic was the major contributor to the ILCR though concentrations measured were below the MCL.

Risk Uncertainties

No major sources of uncertainty, other than those typically associated with risk assessment estimates, were identified for the Site 12 DU 4-1 HHRA.

2.7.2 Ecological Risk

A screening-level ecological risk assessment was performed to evaluate ecological risks to terrestrial and aquatic receptors exposed to contaminants associated with DU 4-1. This assessment was a screening assessment, to determine contaminants of potential ecological concern, and to assist in determining whether a baseline ecological risk assessment (BERA) should be conducted. Tables summarizing the “screening” ecological risk assessment and associated results are presented in Appendix D.

Based on the limited potential ecological risks, overall low concentrations of most COPCs, and the fact that most of those potential risks are due to PAHs at a single location at DU 4-1, it was concluded that no further evaluation of ecological risks was required and no remedial actions were necessary to address ecological exposure.

2.7.3 Basis for Action

Unacceptable human health risks were identified for current and future exposure of construction workers due to manganese in soil, for hypothetical future exposure of lifelong and child unrestricted recreational users and child residents due to PAHs and arsenic in soil, and for hypothetical future use of groundwater by child, adult, and lifetime residents due to arsenic, cobalt, iron and manganese in groundwater. Because unacceptable risks were identified under current and future land use scenarios, a response action is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment that may present an imminent and substantial endangerment to public health or welfare.

2.8 Remedial Action Objectives

RAOs are medium-specific goals that define the objective of conducting remedial actions to protect human health and the environment. RAOs specify the potential exposure routes and receptors, and acceptable concentrations (i.e., cleanup levels or RGs) for a site and provide a general description of what the cleanup will accomplish. RAOs typically serve as the design basis for the remedial alternatives described in Section 2.9.

The **RAOs for DU 4-1** are as follows:

- Prevent the ingestion of and direct contact with vadose zone soil containing site contaminants that pose unacceptable risk for residential and other unrestricted uses.

- Prevent exposure of construction workers to soils with site contaminants exceeding RGs.
- Prevent future migration of soil contaminants either to groundwater or adjacent wetlands/waterways.
- Prevent use of site groundwater until groundwater RGs have been achieved.
- Restore groundwater quality to its beneficial use.

These RAOs are based on current and reasonably anticipated future site use, which is industrial and restricted recreational use (bow hunting by permit/lottery selection). Although the site is not currently used for residential or unrestricted recreational purposes and there are no plans for such use of the property in the future, RGs for residential exposures also have been calculated to evaluate cleanup options that would allow for unrestricted use and unlimited exposure of the site and to determine whether institutional controls are needed to control these hypothetical future site uses.

Chemicals associated with unacceptable human health risk (ICLR greater than 1 x 10^{-4} or HI greater than 1) were identified as **COCs** that require remediation. No unacceptable ecological risks were identified, so no ecological COCs were identified. As agreed by the Navy, EPA and the State of Rhode Island, chemicals detected at concentrations exceeding RIDEM DECs were also identified as COCs for remediation.

Human health risk-based COCs were identified in soil and groundwater based on the results of the HHRA. COCs for soil were also identified based on chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs): RIDEM Direct exposure criteria were used to identify COCs for soil .

Preliminary Remediation Goals (PRGs) were developed during the FS as target cleanup goals for remedial actions that would reduce COC concentrations in DU 4-1 media of concern and if achieved, thereby mitigate risks to human health and the environment. PRGs were established for contaminants that were detected at the site at concentrations associated with unacceptable risks and also for CERCLA hazardous substances, pollutants or contaminants that were detected at concentrations exceeding RIDEM's soil DECs and or Leachability Criteria.

PRGs were developed for the identified COCs using a multi-step process that began by developing candidate (i.e., potential) remediation goals (RGs). Remediation goals (RGs) were determined based on the lowest value between the ARAR-based and risk-based PRGs. Background levels of contaminants at the site were then used to adjust the remediation goal values as appropriate. For COCs with an MCL, the MCL (or a similarly enforceable state standard) is used in place of the risk-based RG. This substitution is acceptable due to uncertainties inherent with calculation of risk-based PRGs. The final selected contaminant specific concentrations to direct remediation at the site were then retained as cleanup levels. This section presents this process and the resulting COCs and remediation goals.

Candidate remediation (cleanup) goals (RGs) were developed for soil and groundwater for the COCs that contributed significantly to the cancer risk above 10^{-4} and/or HI greater than 1 for each exposure pathway in a land use scenario for a receptor group. Chemicals were not considered as significant contributors to risk if their individual carcinogenic risk contribution was less than 1 x 10^{-6} and their non-carcinogenic HQ was less than 1 (Appendix C). Acceptable concentrations based on risk were calculated to meet an ILCR of 1E-6 and a HQ of 1, accordingly. These are identified as candidate risk-based remediation goals.

In accordance with the dispute resolutions dated January 12, 2012 and April 20, 2012, detected constituents that exceeded RIDEM direct exposure criteria (DEC) were also identified as COCs for the site, and the associated DECs were identified as candidate ARAR-based remediation goals. In accordance with these agreements, the lower of the two candidate values (risk-based remediation goal, or ARAR-based remediation goal) was selected for potential action at the site.

The candidate remediation goals were then compared to background concentrations if available. **Background concentrations of metals in the soils** at the site were developed in 2008 as described in

Section 2.5.1. The candidate soil remediation goals for metals that were present in background soil at higher concentrations were adjusted to meet the background concentration identified (Section 2.5.1 and Tetra Tech, 2008).

A final step was used to determine which chemicals were appropriate for selection of remediation goals in the FS. In this final step, site concentrations of each COC identified in the DGA report were compared to the candidate remediation goals and background concentrations, if available. The representative site concentration was selected as the 95-percent UCLs of the available data set for soil and maximum concentrations detected for groundwater. Those COCs with representative site concentrations greater than the selected remediation goals were identified as final COCs for remediation.

Appendix C, Tables C-13 and C-14 summarize the COPCs, COCs and development of RGs in the FS. Table 2-5 and 2-6 summarize the COCs and cleanup levels selected for remediation at the site.

The PRGs developed in the FS have been retained as **cleanup levels** in this ROD. Cleanup levels for soil at Site 12 DU 4-1 were selected for active remediation to support continued industrial and restricted recreational use of the site. Residential cleanup levels were used to help determine the extent of LUCs. As detailed above, for each COC, the calculated 10^{-6} cancer risk value, RIDEM DEC, the RIDEM Leachability Criterion, and background value were compared. The lesser of the calculated risk-based value, DEC, and Leachability Criterion was selected and compared to the background value. If greater than the background value, the selected value was used as the cleanup level. If the selected value was less than the background value, the background value was used as the cleanup level. Cleanup levels for soil were developed as PRGs in Appendix C, Table C-13, and are summarized in Table 2-5.

The cleanup levels for site groundwater were selected as the more stringent of the federal drinking water MCLs, federal risk – based standards or RIDEM GA criteria, as developed in Appendix C, Table C-14, and summarized in Table 2-6. For COCs with no published MCLs, federal risk-based standards, or RIDEM GA criteria, the more stringent of the cancer risk or non-cancer hazard was selected.

TABLE 2-5. CLEANUP LEVELS FOR SOIL

CHEMICAL OF CONCERN	SURFACE SOIL CLEANUP LEVEL (mg/kg)	BASIS FOR SELECTION	SUBSURFACE SOIL CLEANUP LEVEL (mg/kg)	BASIS FOR SELECTION
Residential Use Scenario				
SVOCs				
Benzo(a)anthracene	0.15	Cancer Risk[(a)]=10^{-6}	0.15	Cancer Risk[(a)]=10^{-6}
Benzo(a)pyrene	0.089[(b)]	Background[(b)]	0.015	Cancer Risk[(a)]=10^{-6}
Benzo(b)fluoranthene	0.15	Cancer Risk[(a)]=10^{-6}	0.15	Cancer Risk[(a)]=10^{-6}
Benzo(g,h,i)perylene	0.8	RIDEM DEC	0.8	RIDEM DEC
Benzo(k)fluoranthene	0.9	RIDEM DEC	0.9	RIDEM DEC
Chrysene	0.4	RIDEM DEC	0.4	RIDEM DEC
Dibenzo(a,h)anthracene	0.015	Cancer Risk[(a)]=10^{-6}	0.015	Cancer Risk[(a)]=10^{-6}
Fluoranthene	20	RIDEM DEC	NA[(c)]	NA
Indeno(1,2,3-cd)pyrene	0.15	Cancer Risk[(a)]=10^{-6}	0.15	Cancer Risk[(a)]=10^{-6}
Pyrene	13	RIDEM DEC	NA[(c)]	NA
Metals [(f)]				
Arsenic	19[(e)]	Background[(b)]	24[(e)]	Background[(b)]
Manganese	390	RIDEM DEC	1030	Background[(b)]

TABLE 2-5. CLEANUP LEVELS FOR SOIL (CONT.)				
CHEMICAL OF CONCERN	SURFACE SOIL CLEANUP LEVEL (MG/KG)	BASIS FOR SELECTION	SUBSURFACE SOIL CLEANUP LEVEL (MG/KG)	BASIS FOR SELECTION
Industrial Use Scenario				
SVOCs				
Benzo(a)anthracene	7.8	RIDEM DEC	NA(c)	NA
Benzo(a)pyrene	0.8	RIDEM DEC	0.8(d)	RIDEM DEC
Benzo(b)fluoranthene	7.8	RIDEM DEC	NA(c)	NA
Dibenzo(a,h)anthracene	0.8	RIDEM DEC	NA(c)	NA
Metals (f)				
Arsenic	19(b,e)	Background(b)	24(b,d,e)	Background(b)
Manganese	NA(c)	NA	1030(d)	Background(b)

a Risk-based cleanup level calculated for the risk-based COCs identified from the HHRA.
b Cleanup levels so noted are actually background 95-percent Upper Predictive Limits (UPLs) because the background values are above the risk based RG.
c Compound does not pose unacceptable risk in associated medium and was not detected in excess of any ARAR.
d Subsurface soil cleanup levels for industrial use are applicable only to the 0- to 2-foot interval if a LUC is applied.
e The target excavation at SB943 will address soil above 19 mg/kg (background) but will be excavated to a target concentration of 15 mg/kg in accordance with request from RIDEM.
f Lead has been found in soil associated with the boundary fence around TF4. A separate maintenance action will be conducted to address the fence and associated soil.
NA = Not applicable.
RG selection is provided in detail on Table 2-4 of the Final FS.

TABLE 2-6. CLEANUP LEVELS FOR GROUNDWATER		
CHEMICAL OF CONCERN	CLEANUP LEVEL (µg/L)	BASIS FOR SELECTION
Residential Use Scenario		
Total and Dissolved Metals		
Arsenic	10(a)	MCL
Cobalt	3.3	Non-Cancer Hazard Index=1(b)
Iron	10,900	Non-Cancer Hazard Index=1(b)
Manganese	300	EPA Health Advisory(c)

a Site concentrations of arsenic do not exceed the MCL, which is selected as the RG over the risk-based value.
b Risk-based cleanup level calculated for the risk-based COCs identified from the HHRA.
c The EPA health advisory is cited at EPA request.

2.9 DESCRIPTION OF ALTERNATIVES

To address potentially unacceptable human health risks associated with soil and groundwater at DU 4-1, a **preliminary technology screening** evaluation was conducted in the FS. A number of treatment technologies and process options for soil and groundwater were initially screened based on their potential effectiveness, Implementability, and cost, but most were eliminated based on the types, concentrations, and volumes of contaminants at the site.

The technologies and process options retained after the initial screening were assembled into various alternatives for soil and groundwater. Consistent with the NCP, the no action alternatives were evaluated as baselines for comparison with other alternatives during the comparative analysis. The remedial alternatives developed in the FS for soil and groundwater are presented in Sections 2.9.1 and 2.9.2, respectively.

2.9.1 Soil Alternatives

To address COCs in soil, a screening of General Response Actions, remedial technologies, and process options was conducted as part of the FS. The technologies and process options retained from the detailed screening were assembled into three remedial alternatives for soil at DU 4-1. Consistent with the NCP, the no action alternative was evaluated as a baseline for comparison with other alternatives during the comparative analysis. Table 2-7 summarizes the major components and provides estimated costs for each of the remedial alternatives developed for site soil.

TABLE 2-7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR SOIL

Alternative	Components	Details	Cost
No Action (Alternative SO1)	None	No further actions would be taken. Five-year reviews of the no action decision would be required and conducted as part of the facility-wide five-year review process.	**Capital**: $0 **Operation and Maintenance (O&M)**: $0* **Five-Year Reviews**: $0** **Total 30-Year Net Present Worth (NPW)**: $0
LUCs and Inspections, Groundwater Monitoring, Fencing and Signs (Alternative SO2)	LUCs and Inspections	The intent of LUCs is to ensure that land uses (industrial and restricted recreational) do not change and to ensure that contact with COCs at concentrations that would cause an unacceptable risk under more intensive uses is prevented for the life of the remedy. LUCs will also provide controls for adequate protection to workers who may conduct excavations at the site. LUCs would cover the area where COCs remain in soil at levels exceeding residential cleanup levels. Periodic inspections of the site would be conducted to verify continued compliance with and effectiveness of the LUCs.	**Capital**: $18,767*** **O&M**: $3,135* **Five-Year Reviews**: $25,300** every 5 years **Total 30-Year NPW**: $197,863
	Groundwater Monitoring	Groundwater monitoring would be conducted under this alternative to ensure that contaminants are not migrating. Specifically monitoring will be conducted to assure, that the COCs remaining in soil at concentrations exceeding cleanup levels are not leaching to groundwater at concentrations above federal drinking water standards and then migrating to downgradient surface water bodies.	
	Fencing and Signs	Fencing would restrict human access to areas where contaminants in surface soil are present at concentrations exceeding industrial cleanup levels. Although access to TF4 is currently partially restricted by gates and fencing, new fencing around specific areas would be installed under this alternative. Signage would consist of warning signs to alert possible entrants to the presence of contaminated soil and dig restrictions. Fencing and signage requirements and maintenance would be documented in the LUC Remedial Design (RD) prepared by the Navy.	
	Five-Year Reviews	Five-year reviews would be conducted by the Navy, EPA, and RIDEM until site conditions were restored to allow for unrestricted use and unlimited exposure.	

TABLE 2-7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR SOIL (CONT.)

ALTERNATIVE	COMPONENTS	DETAILS	COST
Target Area Excavation, OffSite Landfill Disposal, Groundwater Monitoring, and LUCs and Inspections (Alternative SO3)	Removal of Target Soil Area	Soil containing PAHs above industrial cleanup levels will be excavated (SB934), and soil containing arsenic in surface soil at concentrations above industrial cleanup levels would be excavated SB943. Excavations would be designed after the completion of soil sampling around these target borings. Pre-design soil samples would be analyzed for PAHs and arsenic to bound the proposed excavations. Approximately 371 and 185 cubic yards (cy) of soil would be removed at the two target areas, respectively, but this estimate would be refined after the completion of the above-noted soil sampling. In addition, two potential areas identified by EPA and RIDEM request (a soil/debris berm near SB930 and the former test pits to the northwest of SB924) will also be evaluated for removal actions by regulatory request. Removal actions would be based on Pre-design evaluations conducted. At the "debris berm," the presence of solid waste would be determined, and if present, this berm would be removed. At the former test pit areas, soils would be sampled at regulatory request, and the presence of soils with COC concentrations exceeding cleanup levels would trigger a target area excavation in this area.	<u>**Capital**</u>: $646,632 <u>**O&M**</u>: $2,585*** <u>**Five-Year Reviews**</u>: $25,300** every 5 years <u>**Total 30-Year NPW**</u>: $813,409
	Offsite Landfill Disposal	Contaminated soil and debris excavated from target areas would be transported and disposed of at an off-base licensed landfill facility. As noted above, approximately 556 cy of soil would be excavated from the target areas and would require offsite disposal. It is assumed for costing purposes that any additional excavated soil from the debris berm and/or area of a former test pit west of SB924 can be disposed of in the same manner.	
	LUCs and Inspections	The intent of LUCs is to ensure that land uses (industrial and restricted recreational) do not change and to ensure that contact with COCs at concentrations that would cause an unacceptable risk under more intensive uses is prevented for the life of the remedy. LUCs will also provide controls for adequate protection to workers who may conduct excavations at the site. Periodic inspections of the site would be conducted to verify that surface soil is not disturbed where industrial remediation goals are exceeded in subsurface soil and to assure continued compliance with and effectiveness of the LUCs.	
	Groundwater Monitoring	Same as Alternative SO2.	
	Five-Year Reviews	Same as Alternative SO2.	

* For purposes of cost estimation, all O&M costs represent 30-year time frames, only. Actual total costs may be higher.
** Five-year reviews are conducted for the Newport facility, and the cost to include this site with a no action alternative, is considered negligible.
*** Cost for groundwater monitoring is included in the groundwater alternatives for the site.

Alternatives SO2 and SO3 could be implemented within 2 years of signing the ROD and would attain the RAOs pertaining to soil upon implementation. The RD and preparation of the construction work plan, LUC RD, and long-term monitoring/management plan would be completed within the first year, and construction activities would be expected to require several months after that, which could be impacted by access limitations at this site.

2.9.2 Groundwater Alternatives

To address COCs in groundwater, a screening of General Response Actions, remedial technologies, and process options was conducted as part of the FS. The technologies and process options retained from the detailed screening were assembled into three remedial alternatives for groundwater at the site. Consistent with the NCP, the no action alternative was evaluated as a baseline for comparison with other alternatives during the comparative analysis. Table 2-8 summarizes the major components and provides estimated costs for each of the remedial alternatives developed for Site 12 DU 4-1 groundwater.

TABLE 2-8. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR GROUNDWATER

ALTERNATIVE	COMPONENTS	DETAILS	COST
No Action (Alternative GW1)	None	No further actions would be taken. Five-year reviews of the no action decision would be required, and conducted as part of the facility-wide five year review process.	**Capital**: $0 **O&M**: $0 **Five-Year Reviews:** $0* **Total 30-Year NPW**: $0
MNA, LUCs, and Inspections (Alternative GW2)	MNA	Natural attenuation would rely on naturally occurring processes in the aquifer to reduce the toxicity, and mobility of COCs (metals) in groundwater. To demonstrate the effectiveness and provide documentation of such attenuation, a quarterly groundwater quality monitoring program would be implemented for the first 2 years to define seasonal trends, if any. After a trend in groundwater quality has been established, the Navy would request a change in monitoring frequency to an annual program. This program would allow confirmation of continued reduction in concentrations of COCs. MNA planning documents would be prepared with regulatory input to support implementation of the MNA program. Modeling has estimated the timeframe for MNA for overburden to be 45 years and for bedrock 26 years.	**Capital**: $82,281 **O&M**: $115,392 (Annual, Yrs 1&2) $30,787 (Annual, Yrs 3-30) **Annual Costs (Inspections):** $3,350 **Five-Year Reviews:** $25,300 every 5 years* **Total 30-Year NPW**: $1,065,021
	LUCs and Inspections	LUCs would be implemented to control exposure to COCs in groundwater and to protect human health during the interim period until cleanup goals have been achieved in groundwater. Groundwater LUCs would prohibit installation of groundwater supply wells, including public and private drinking water wells and residential irrigation wells, and would prohibit any use of groundwater for drinking water purposes. Regular site inspections would be performed to verify continued implementation of LUCs until groundwater RGs have been achieved.	
	Five-Year Reviews	Five-year reviews would be conducted by the Navy, EPA, and RIDEM until site conditions were restored to allow for unrestricted use and unlimited exposure.	

TABLE 2-8. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR GROUNDWATER (CONT).

ALTERNATIVE	COMPONENTS	DETAILS	COST
In-Situ Treatment, Long-Term Monitoring, and LUCs and Inspections (Alternative GW3)	In-Situ Treatment	An in-situ treatment process that encourages growth of sulfate reducing bacteria would be implemented to create a condition that will cause metals in groundwater to precipitate out of groundwater and become sequestered in the soil and bedrock and subsequently reduce concentrations of metals present in groundwater. Final treatment parameters would be determined based on a pilot study conducted during the design phase, but for costing purposes, it was assumed that treatment would involve precipitation of mobilized metals into insoluble metal sulfides via injection of a solution containing sulfate-reducing bacteria and appropriate nutrients into the subsurface in selected target treatment zones.	**Capital**: $1,634,927 **O&M**: $115,392 (Yr 1-3) $30,787 (Yrs 4 and after) **Five-Year Reviews**: $23,000 every5 years **Total 30-Year NPW**: $2,774,703
	Long-Term Monitoring	Initial monitoring is required to determine a baseline, and monitoring during treatment to confirm response and manage injections is also necessary. After COC concentrations are below cleanup levels via the in-situ treatment described above (time-frame estimated at 4+ years), continued quarterly monitoring for 1 additional year would be required to identify any rebound of COCs in groundwater, then annual monitoring may be appropriate for the long term to verify that concentrations remain less than cleanup levels (estimated at 24 years). Long-term monitoring plans would be required to support implementation of the monitoring program during and after the treatment process.	
	LUCs and Inspections	Same as Alternative GW2.	
	Five-Year Reviews	Same as Alternative GW2.	

* Five-year reviews are conducted for the Newport facility, and cost to include this site is considered negligible.

2.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

Tables 2-9 and 2-10 and subsequent text in this section summarize the comparison of the remedial alternatives with respect to the **nine CERCLA evaluation criteria** outlined in the NCP at 40 Code of Federal Regulations (CFR) 300.430(e)(9)(iii) and categorized as threshold, primary balancing, and modifying criteria. Further information on the detailed comparison of remedial alternatives is presented in the FS.

2.10.1 Comparative Analysis of Soil Alternatives

Table 2-9 and subsequent text in this section summarize the comparison of the soil remedial alternatives with respect to the nine CERCLA evaluation criteria.

TABLE 2-9. SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES

CERCLA Criterion	Alternative SO1 No Further Action	Alternative SO2 LUCs, Groundwater Monitoring, Fencing and Signs	Alternative SO3 Target Soil Removal and Offsite Disposal, LUCs, and Groundwater Monitoring
ESTIMATED TIME FRAME FOR CLEANUP (YEARS)			
Time to achieve cleanup goals	Not Applicable	<2	<2

TABLE 2-9. SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES (CONT.)

***CRITERIA ANALYSIS:* Threshold Criteria – Selected alternative must meet these criteria**			
Overall Protection of Human Health and the Environment	⊘	●	●
Compliance with ARARs	⊘	⊘	●
Primary Balancing Criteria – Used to differentiate between alternatives meeting threshold criteria			
Long-Term Effectiveness and Permanence	⊘	○	●
Reduction of Mobility, Toxicity, and Volume of Contaminants through Treatment	⊘	⊘	⊘
Short-Term Effectiveness	⊘	●	●
Implementability	●	●	●
Cost	●	●	○
Costs[a, b] Capital Costs O&M Costs Total Present Worth Cost	 $0 $0 $0	 $18,800 $171,500 $197,900	 $744,800 $166,800 $911,600
Modifying Criteria – May be used to modify recommended cleanup			
State Agency Acceptance	⊘	⊘	●
Community Acceptance	Not Applicable	Not Applicable	●

● Meets ○ Partially Meets ⊘ Does not Meet

a For purposes of cost estimation, all O&M costs represent 30-year time frames only. Actual total costs may be higher.
b The five-year reviews at this DU are a component of the Newport facility-wide year-year reviews.

2.10.1.1 Threshold Criteria

Overall Protection of Human Health and the Environment. The no action alternative would not achieve the RAOs and therefore does not protect human health and the environment. It will therefore not be considered further in this ROD. Alternative SO3 would be the most effective at protecting human health and the environment because surface soil with the greatest concentrations of contaminants (exceeding industrial cleanup levels) would be removed and transported off site for disposal. Alternative SO2 is less protective because it would rely on institutional controls and fencing to eliminate unacceptable risk. Both Alternatives SO2 and SO3 provide adequate protection of hypothetical future residents because both alternatives would prevent site uses associated with unacceptable exposure to soils as long as the institutional controls are managed properly for as long as soil COC concentrations exceed cleanup levels for unrestricted use.

Compliance with ARARs. ARARs include any federal or state standards, requirements, criteria, or limitations determined to be legally applicable or relevant and appropriate to the site or remedial action. Alternative SO3 meets chemical-specific, location-specific, and action-specific ARARs. Alternative SO1 would not comply with ARARs because it does not prevent exposure to contaminated soil containing COCs at concentrations exceeding cleanup levels. Alternative SO2 would not meet chemical – specific ARARs.

The Navy has determined that the Alternative SO3 is the "Least Environmentally Damaging Practicable Alternative," as defined in the Clean Water Act, to protect wetland resources, based on the Navy's assessment that the remedial action can be conducted in a manner to be protective of wetland and floodplain resources

2.10.1.2 Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Alternative SO3 would have the greatest long-term effectiveness due to the removal of the most contaminated soil from the site. However, Alternatives SO2 and SO3 use the same processes over the long term to provide the desired long-term effectiveness for the remainder of the soil managed by the LUCs. Alternative SO1 would not be effective or provide permanent protection from contaminants.

Reduction in Toxicity, Mobility, or Volume Through Treatment. None of the three soil alternatives involve reduction in toxicity, mobility, or volume through treatment.

Time To Achieve RAOs. Alternative SO1 is not expected to meet RAOs. Alternatives SO2 and SO3 are anticipated to meet RAOs within two years of the ROD. Alternative SO2 will meet the RAOs after construction of the fence areas, and the implementation of the LUCs. Alternative SO3 will meet the RAOs after completion of the target area excavations, and the implantation of the LUCs. Although excavation will be more complex than erection of a series of fence areas, it can be completed in the same time frame.

Short-Term Effectiveness. Alternative SO1 would not involve any major construction activities that would expose construction workers, the surrounding community, and the environment to COC exposure; however, alternative SO1 would not meet RAOs. Of the active alternatives, Alternative SO2 would have the least short-term risks because it would not involve excavated material being removed and transported through the surrounding community. Alternative SO3 would have the most short-term risks based on excavation and transportation of contaminated soil to which construction workers, the surrounding community, and the environment could be exposed.

Implementability. Alternative SO1 would be the easiest to implement because no action is required; however, it is not implementable in an administrative sense because it does not achieve the threshold criteria of protection of human health and the environment or achieving ARARs. Alternative SO2 would be more easily implemented than Alternative SO3 due to the complexities associated with excavation and offsite transportation of soil.

Cost. The estimated, 30-year, present worth cost for Alternative SO3 is $813,400, and the estimated, 30-year, present worth for Alternative SO2 is $197,400.

2.10.1.3 Modifying Criteria

State Acceptance. State involvement has been solicited throughout the CERCLA process. RIDEM, as the designated state support agency in Rhode Island, concurs with the Selected Remedy. RIDEM's concurrence letter is presented in Appendix A.

Community Acceptance. The public was notified of a formal public comment period, as described in Section 2.3, and was encouraged to participate in the process. No written comment letters were received during the formal public comment period (June 19 to July 19, 2013) for the Proposed Plan. The questions posed at the public meeting (informal session) on June 19, 2013, were general inquiries for informational purposes and were addressed at the public meeting. The formal public hearing, at which attendees were asked to state their comments for the record, took place immediately after the public meeting on June 19, 2013. These formal comments/questions and the Navy responses are summarized in Section 3.0. No oral or written comments were made by the public during the public comment period. No objections to the proposed remedial alternative were voiced or received by mail, facsimile, or by electronic mail. The transcript of the public hearing is provided in Appendix F of this Record of Decision.

2.10.2 Comparative Analysis of Groundwater Alternatives

Table 2-10 and subsequent text in this section summarize the comparison of the groundwater remedial alternatives with respect to the nine CERCLA evaluation criteria and categorized as threshold, primary balancing, and modifying criteria. Further information on the detailed comparison of remedial alternatives is presented in the FS.

TABLE 2-10. SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES

CERCLA Criterion	Alternative GW1 No Further Action	Alternative GW2 MNA and LUCs	Alternative GW3 In-Situ Bioprecipitation, Monitoring, and LUCs
ESTIMATED TIMEFRAMES FOR CLEANUP (YEARS)			
Time to achieve cleanup goals	Not Applicable	26-45	4 or more
***CRITERIA ANALYSIS:* Threshold Criteria – Selected alternative must meet these criteria**			
Overall Protection of Human Health	⦸	●	●
Compliance with ARARs	⦸	●	●
Primary Balancing Criteria – Used to differentiate between alternatives meeting threshold criteria			
Long-Term Effectiveness and Permanence	⦸	○	○
Reduction of Mobility, Toxicity, and Volume of Contaminants through Treatment	⦸	⦸	●
Short-Term Effectiveness	⦸	○	○
Implementability	●	●	○
Cost [a, b]	●	○	○
Capital Costs O&M Costs Total Present Worth Cost	$0 $0 $0	$82,300 $962,600 $1,044,900	$1,634,900 $1,127,000 $2,774,700
Modifying Criteria – May be used to modify recommended cleanup			
State Agency Acceptance	⦸	●	●
Community Acceptance	Not Applicable	●	Not Applicable

● Meets ○ Partially Meets ⦸ Does not Meet

a) For purposes of cost estimation, all O&M costs represent 30-year timeframes only. Actual total costs may be higher.
b) The 5-year reviews at this DU are a component of the Newport facility 5-year reviews.

2.10.2.1 Threshold Criteria

Overall Protection of Human Health and the Environment. Alternative GW2 would be protective of human health and the environment. Under this alternative, the levels of dissolved metals in the aquifer would be expected to attenuate as the attenuation of petroleum at or upgradient of the site concludes and the natural geochemistry of the aquifer rebalances. Until that time, no exposure would be occurring based on implementation and enforcement of LUCs.

Under Alternative GW2 and GW3, the RAO to prevent the use of site groundwater for residential purposes would be achieved immediately upon implementation of LUCs. Both alternatives would attain the RAO to restore groundwater quality to its beneficial use when COC concentrations reach the cleanup levels through treatment or natural attenuation. Use of GW2 would allow natural processes to reduce the COC concentrations to below the cleanup levels, while GW3 would accomplish the same thing through detailed and somewhat elaborate treatment processes. Treatment processes can impact the groundwater at and downgradient of the site in other ways and these unexpected impacts can be problematic.

The FS estimated that cleanup levels would be achieved in 25 to 45 years for Alternative GW2 and 4 years or more for Alternative GW3, though there is uncertainty in the ability of GW3 to be effective in the long term due to potential contaminant rebound in the groundwater after termination of the treatment, therefore 24 years of monitoring after treatment levels have been reached has been estimated. Groundwater currently is not used as a drinking water source, and there are no plans for such a use in the foreseeable future. Therefore there is not a specific need for implementing treatment to reduce COC concentrations quickly as would be the primary benefit of implementation of GW3.

Alternative GW1 could become protective of human health and the environment if natural attenuation reduced COC concentrations to less than cleanup levels; however, there would be no monitoring to verify this. Additionally, there would be no controls in place in the short term to prevent residential use of groundwater prior to reaching the cleanup levels.

Compliance with ARARs. ARARs include any federal or state standards, requirements, criteria, or limitations determined to be legally applicable or relevant and appropriate to the site or remedial action. Alternatives GW2 and GW3 would both comply with location- and action-specific ARARs and TBCs to the same general degree.

Enforceable standards identified in the FS are currently met in groundwater. The chemical-specific ARAR for manganese is the public health advisory, which is a criterion “to be considered,” although it becomes an enforceable standard for this site upon regulatory signature of this ROD. Although this criterion is not met under the current condition, it is expected that it could be met over time after the attenuation of petroleum is completed and the redox conditions in the aquifer subside. This attenuation would be predicted and documented in Alternative GW2, and although it could be met under Alternative GW1, the achievement would not be known since no monitoring would be conducted. Under Alternative GW3, treatment operations would artificially reduce manganese concentrations within the DU, but that may only be the case while the treatment system is operating.

2.10.2.2 Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Alternative GW2 would provide effectiveness through LUCs alone, but only permanence through natural attenuation. LUCs would be effective for preventing exposure to groundwater COCs as long as the LUCs remain in place.

Reduction in Toxicity, Mobility, or Volume Through Treatment. Neither Alternative GW1 nor GW2 provides reduction of toxicity, mobility, or volume of waste through treatment because no active treatment would be conducted. Reductions in COC mobility and toxicity in groundwater through natural attenuation anticipated over the long term; however, under Alternative GW1, this reduction would not be verified or quantified. Alternative GW3 would also reduce the toxicity, and mobility of COCs through in-situ bioprecipitation, more rapidly, as the conditions to precipitate out the metals would be augmented by the treatment process.

Short-Term Effectiveness. Implementation of Alternative GW1 would not result in risks to site workers or adversely impact the surrounding community or environment because no remedial activities would be performed.

Alternatives GW2 and GW3 would achieve the first groundwater RAO immediately upon implementation of LUCs. The second RAO for groundwater would be achieved after a maximum estimate of 45 years under Alternative GW2 and after 4 years or more under Alternative GW3, although there is uncertainty in the permanence of Alternative GW3, and additional treatment beyond that identified may be required under this alternative, based on actual behavior of the site geochemistry over time.

Implementability. Alternative GW1 would be easiest to implement in a technical sense because no action would be conducted.

Alternative GW2 would be the easiest of the active alternatives to implement because it would include only minimal, if any, construction effort (e.g., potential new monitoring wells) and because of the relative ease of conducting long-term monitoring. Administrative, management, and operational issues and coordination with other agencies or acquiring permits under this alternative would also be easily implemented.

Alternative GW3 would be the most difficult to implement because of the complexities involved in developing and implementing an in-situ treatment system. It is assumed that initial baseline tests would be required to refine groundwater flow nuances within the treatment area and detailed geochemical conditions at the site so that the treatment system can be properly designed and constructed for optimum operation.

Cost. The estimated, 30-year, present worth cost for Alternative GW3 is $2,762,000, and the estimated, 30-year, present worth cost for Alternative GW2 is $1,065,000.

2.10.2.3 Modifying Criteria

State Acceptance. State involvement has been solicited throughout the CERCLA process. RIDEM, as the designated state support agency in Rhode Island, concurs with the Selected Remedy. RIDEM's concurrence letter is presented in Appendix A.

Community Acceptance. As discussed in Section 2.10.1.3, the public was notified of a formal public comment period, as described in Section 2.3, and was encouraged to participate in the process. No written comment letters were received during the formal public comment period (June 19 to July 19, 2013) for the Proposed Plan. The questions posed at the public meeting (informal session) on June 19, 2013, were general inquiries for informational purposes and were addressed at the public meeting. The formal public hearing, at which attendees were asked to state their comments for the record, took place immediately after the public meeting on June 19, 2013. These formal comments/questions and the Navy responses are summarized in Section 3.0. No oral or written comments were made by during the public comment period. No objections to the proposed remedial alternative were voiced or received by mail, facsimile, or by electronic mail. The transcript of the public hearing is provided in Appendix F of this Record of Decision.

2.11 PRINCIPAL THREAT WASTE

The NCP at 40 CFR 300.430(a)(1)(iii)(A) establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or that would present a significant risk to human health or the environment should exposure occur. A source material is a material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure. At DU 4-1, the contaminant concentrations are not highly toxic or highly mobile; therefore, principal threat wastes are not present at the site.

2.12 SELECTED REMEDY

2.12.1 Rationale for Selected Remedy

The Selected Remedy for TF4, DU 4-1 is a combination of soil Alternative SO3 and groundwater Alternative GW2. This includes selective excavation with offsite disposal for targeted areas of site soil, MNA of metals in groundwater, long-term monitoring of groundwater, and LUCs to prevent unrestricted use of the property. This combination of alternatives was selected because it provides the best balance with respect to the nine evaluation criteria and will allow for continued industrial use of the property.

The principal factors in the selection of this remedy included the following:

- Alternative SO3 provides a reasonable maximum protectiveness, given the current and anticipated future industrial use. The (limited) excavation of target hot spot areas provides a better level of permanence than isolation with a fence (Alternative SO2), and disposal of excavated soils at an offsite landfill allows for long term management of these soils under an appropriate regulatory framework. LUCs and groundwater monitoring will provide continued protection of human health and the environment by ensuring protection of workers conducting excavations, and that the property is not used for residential or unrestricted recreational purposes. Alternative SO3 is preferred because it is the most permanently protective option for addressing the current and potential future risks posed by the COCs and is consistent with the continued industrial/restricted recreational use of the site.

- Alternative GW2 relies on MNA, which includes a long-term groundwater monitoring program to verify that natural attenuation processes are effectively reducing metals concentrations to the natural steady-state conditions. Alternative GW2 offers adequate protection and appropriate controls for the COCs that show relatively low toxicity at the concentrations measured, and it does not require elaborate manipulation of the site geochemistry through treatment, rather using the natural degradation process to be completed. Data typically required for an MNA remedy, showing a decreasing trend in contaminant concentrations has not been collected for this Site, ; however, MNA could be successful over time based on the evaluation of biodegradation parameters for this Site.There is uncertainty in the amount of time required. Such time is available since there are no downgradient receptors at risk and there is no plan for use of the groundwater at the site. The time required will be re-evaluated at each five-year cycle to ensure improvement of the groundwater conditions through MNA and that the remedy remains protective. The Navy will seek a change to the remedy for groundwater at the site if MNA proves to be ineffective. The five-year review will assess whether adequate reductions in concentrations of COCs are evident based on monitoring data.

- Implementing LUCs will also ensure the continued protection of human health and the environment by prohibiting future use scenarios associated with unacceptable risks posed by soil (residential and unrestricted recreational uses) and by establishing controls to protect potential future construction workers who may conduct excavations into the subsurface soil.

In accordance with Section 404 of the CWA, the Navy has determined that the combination of Alternatives SO3/GW2 is the Least Environmentally Damaging Practicable Alternative to protect wetland resources because it provides the best balance of addressing contaminated soil within and adjacent to wetlands and waterways while minimizing both temporary and permanent alteration of wetlands and aquatic habitats on site.

2.12.2 Description of Selected Remedy

The following sections provide a detailed description of the selected remedies for soil and groundwater. Remedies are depicted on Figures 2-6 and 2-7, respectively.

2.12.2.1 Description of Selected Soil Remedy

The Selected Soil Remedy includes the following components, described below:

- Design Steps to plan and refine target excavation areas.
- Excavation of target area soil (with verification sampling).
- Offsite disposal.
- Implementation of LUCs to prevent residential and unrestricted recreational uses of the site and inspections and to assure that clean surface soils (0-2 feet) are not disturbed, and that LUCs are in place and effective.
- Groundwater monitoring to confirm soil COCs present are not leaching into groundwater.
- Five year reviews.

Design Step

A design step will be conducted to plan and provide specifications for contract acquisition on the soil excavations. The design step will include refining the extent of each of the target areas for the removal action. The design step will include collecting additional soil samples surrounding target borings SB934 and SB943, with samples from the SB934 area analyzed for PAHs and samples from the SB943 area analyzed for arsenic. Soils near SB934 with PAH concentrations exceeding industrial cleanup levels will be removed, and soils near SB943 with arsenic concentrations exceeding 15 mg/kg in this target area will be removed, in accordance with a prior agreement with RIDEM.

In addition, two other areas (the soil/debris berm near SB930 and former test pits northwest of SB924) will be evaluated as potential target removal areas. The basis for action at these areas will be the makeup of the material and concentrations of COCs defined in this ROD. The debris berm will be evaluated and removed if solid waste is found within it, and a former test pit area west of SB924 will also be evaluated for the presence of solid waste. Solid waste will be defined by the presence of man-made material such as brick, concrete, tile etc. Both areas will be sampled in accordance with agreement between EPA, RIDEM and the Navy. Any portions of the berm containing solid waste will be removed and disposed of off-site. Soils in the former test pit area and any portions of the berm with that are comingled with COCs exceeding industrial cleanup levels as defined in this ROD will be removed using the industrial RGs to direct these actions.

Excavation and Offsite Disposal

The Navy will conduct selective soil excavation in the following target areas:

- Areas of soil at and around SB934 with concentrations of PAHs above industrial cleanup levels.
- Areas of soil at and around SB943 at depths of 0 to 2 feet with arsenic concentrations exceeding 15 mg/kg. The extent of this excavation will be determined in the design step, as described above.
- The potential debris berm located near SB930 may be excavated if debris is found within it that is co-mingled with COCs exceeding industrial cleanup levels.

- The former test pit area northwest of SB924 may be excavated if results of soil sampling indicate exceedences of industrial cleanup levels.

After completion of excavation, the excavated areas will be backfilled with clean fill to match approximate prior and surrounding surface elevations. It is assumed that an area 50 feet by 50 feet by 4 feet deep will be excavated at SB934, resulting in removal of approximately 370 cy of soil, and an area 50 feet by 50 feet by 2 feet deep will be excavated at SB943, resulting in removal of approximately 187 cy of soil. No less than two feet of backfill will be used to return the excavation to grade, so as to assure that a minimum of two feet of clean soil is placed over any subsurface soil remaining in excess of industrial cleanup levels after the excavation is completed. Actual quantities will be calculated following results of the evaluation step anticipated to be less, but will be determined during the design step as described above. Estimates of debris or soil volume at the two potential excavation areas (debris berm and former test pit area) have not been estimated.

Verification samples for laboratory analysis will be collected from the bottoms and sidewalls of the excavation areas, and results will be compared to industrial cleanup levels to verify that the proper extent of contaminated soil has been removed. If the results exceed the cleanup levels, the excavation will continue in the direction of the exceedence until subsequent verification samples meet cleanup levels or a limiting site feature is reached. The Navy will develop a Sampling and Analysis Plan (SAP) for the verification sampling that will identify the frequency of verification sample collection.

Contaminated soil excavated from target areas will be transported and disposed of at an off-base licensed landfill facility. It is assumed that approximately 557 cy of soil will be excavated from the target areas and would require offsite disposal. Possible additional excavated soil from the debris berm and/or from the area of a former test pit west of SB924 is not quantified at this time, but it is assumed that the material can be disposed of in the same manner if it is determined that this material needs to be removed.

<u>LUCs and Inspections</u>

LUCs will be established to assure that the site is not used for residential or unrestricted recreational purposes. They will also be used to assure that future construction workers are made aware of the potential hazards with excavations into the subsurface soil at the site. LUCs will be augmented by periodic inspections. Inspections will ensure that no change in land use is evident, and ensure that surface soil (0-2 feet) remains undisturbed in areas where COCs (manganese and arsenic) remain in subsurface soil above industrial cleanup levels. A full description of LUCs is provided in Section 2.12.2.3 below.

<u>Groundwater Monitoring</u>

Groundwater monitoring will be conducted under this alternative to ensure that COCs remaining in site soil at concentrations exceeding (unrestricted) cleanup levels are not leaching into the groundwater from the soil.

A long-term monitoring work plan and SAP will be prepared with input from RIDEM and USEPA. This annual groundwater monitoring program as part of the soil remedy will be implemented along with the groundwater remedy monitoring requirement. It would be conducted as a separate requirement so that if groundwater cleanup goals are met, monitoring could continue as part of the soil remedy if there is still potential leaching at levels of concern.

It is anticipated that the existing seven wells at the site and an additional seven wells installed as part of the remedy will be sampled at least annually. Samples will be analyzed for COCs identified in Table 2-4. Should there be repeated rounds of data that demonstrate no leaching of soil COCs is occurring, the Navy will petition EPA to discontinue groundwater monitoring under the soil remedy. At a minimum, data would be reviewed every 5 years to determine if the program needed to be continued.

5-Year Reviews

Five year reviews are required for the site since COCs will remain after the remedy is complete. A full description of the Five Year Review process and requirements is provided in Section 2.12.2.4, below.

2.12.2.2 Description of Selected Groundwater Remedy

The Selected Groundwater Remedy includes the following components, described below:

- MNA
- LUCs to prevent residential uses of the groundwater and inspections and to confirm LUCs are in place and effective.
- Five-Year Reviews

Monitored Natural Attenuation

This remedy has been developed based on the CSM indicating that past releases of petroleum to the subsurface at and upgradient of DU 4-1 are indirectly causing elevated concentrations of metals in groundwater. As the petroleum is degraded through natural bacterial action, a side effect is the creation of oxidation-reduction conditions in those release areas, which liberates some metals from their natural sequestration in soil and rock. Based on these conditions, the degradation of petroleum is providing a geochemical condition that promotes greater than normal concentrations of metals in groundwater.

MNA will be implemented in accordance with the (OSWER) Directive, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites, and other MNA guidance documents (USEPA, 1999). Natural attenuation would rely on naturally occurring processes including precipitation and adsorption within the aquifer to reduce the toxicity, and concentration of COCs (metals) in groundwater.

Based on site assessments, it is expected that the elevated concentrations of metals (manganese, iron, and cobalt) that exceed cleanup levels are determined to be present as an indirect result of the biodegradation of petroleum at or upgradient of DU 4-1. Although arsenic concentrations at the site have not exceeded the MCL, arsenic in groundwater contributes to risk to the residential receptor. Therefore, the MCL is retained as a de-facto cleanup concentration for arsenic.

It is expected that as the petroleum biodegradation concludes, much of these dissolved metals will come out of solution and become immobilized in their particulate form. Such attenuation can occur through sequestration by precipitation or adsorption under favorable geochemical conditions to immobilized and/or occluded forms that are inaccessible to persons, even during the residential use of groundwater.

To demonstrate the effectiveness of natural attenuation, a quarterly groundwater monitoring program will be implemented for the first 2 years to define seasonal trends, if any. After a trend in groundwater quality has been established, the Navy will request from EPA and RIDEM a change in monitoring frequency for review and approval to document continued decreases in the concentrations of COCs. The five-year review will evaluate the monitoring data to (1) evaluate whether MNA is continuing, (2) to determine whether cleanup levels continue to be exceeded, and (3) to determine whether continuation of the LUCs and monitoring program is appropriate based on the geochemical conditions. The required **time frame for the MNA process is currently estimated at 26 years (bedrock) and 45 years (overburden)** based on a the predicted time for three volumes of groundwater to fully flow through the site's saturated zone. It is also assumed that groundwater monitoring stations will be established to document 1) whether the groundwater conditions at Tank Farm 4 remain favorable for MNA, 2) that a trend indicating the success of MNA is established and ensured, and 3) that MNA remains the most viable groundwater remediation alternative for DU 4-1. Based on results and trends documented in the Five-Year Review Report, the monitoring frequency could be modified, the monitoring network could be adjusted or expanded, or the continued implementation of MNA could be reconsidered.

A long-term monitoring plan and MNA SAP will be prepared to identify the wells to be sampled, analyses to be performed, and need for any new monitoring wells. For planning and costing purposes, it is anticipated that up to 14 groundwater monitoring wells will be required, seven of which are currently present on site. Each monitoring event will include measurement of MNA parameters including, but not limited to: dissolved oxygen, oxidation-reduction potential, conductivity, ferrous iron, pH, hydrogen sulfide, sulfate, nitrite, nitrate, and the concentrations of the COCs (and total and dissolved arsenic, manganese, iron, and cobalt). Other MNA parameters (i.e. total organic carbon, ammonia, methane ethane, orthophosphate, etc.) will be identified during the development of the SAP and included in the program as appropriate.

LUCs and Inspections

LUCs will be established to assure that the site and the site groundwater are not used for residential purposes. LUCs will be augmented by periodic inspections. A full description of LUCs is provided in Section 2.12.2.3 below.

Five-Year Reviews

Five-year reviews are required for the site since COCs will remain after the remedy is complete. A full description of the Five Year Review process and requirements is provided in Section 2.12.2.4, below.

2.12.2.3 Description of Land Use Controls

As part of the Selected Remedy, the Navy will implement LUCs to prevent exposure to COCs in soil and groundwater and to protect human health during the interim time period until remedial actions have achieved RAOs across the site. LUCs will be maintained for as long as conditions do not allow for unrestricted use and unlimited exposure of the site. As depicted on Figure 2-6, the LUCs boundary is the perimeter of DU 4-1. Consistent with the RAOs developed for the site, the specific performance objectives for the LUCs are as follows:

- Prevent use of the groundwater at the property for any consumptive purpose, including for household use, drinking water supply, or residential irrigation. Non-consumptive industrial use of the groundwater is allowable because groundwater currently meets enforceable drinking water standards including MCLs and non-zero MCLGs.

- Prevent excavation or intrusive use of the ground, monitoring wells, and any other components of the remedy without proper engineering controls to prevent uncontrolled exposure of soil COCs that are present in the subsurface soil.

- Prevent residential or unrestricted recreational use of the site; assure that at least two feet of clean surface soil (0-2 feet) remains undisturbed in areas where remaining subsurface soil exceeds industrial cleanup levels.

- Establish requirements and conduct LUC compliance inspections described elsewhere in this section.

The LUC implementation actions including monitoring and enforcement requirements will be provided in a LUC RD that will be prepared by the Navy as the LUC component of the overall RD. Regular site inspections will be performed to verify the continued maintenance of LUCs until the cleanup levels have been achieved.

The LUCs will be established and implemented in accordance with the post-ROD LUC RD that will be prepared by the Navy as the LUC component of the remedy. Within 90 days of ROD signature, the Navy shall prepare and submit, for EPA and RIDEM review and approval, a LUC RD that shall contain LUC implementation actions, including maintenance, monitoring, and enforcement requirements that are consistent with the requirements under this ROD. LUCs will be developed in accordance with the Principles and Procedures for Specifying, Monitoring, and Enforcement of Land Use Controls and Other Post-ROD Actions, per letter dated January 16, 2004, from Alex A. Beehler, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), and the requirements of the NAVSTA Newport FFA. If the property is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the site's FFA, Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure that such controls remain in place. If the property is ever transferred to non-federal ownership, deed restrictions, meeting state property law standards, would be recorded that would incorporate the land use restrictions called for under this ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity. LUCs will be maintained until the concentration of hazardous substances in soil and groundwater are at levels that allow for unrestricted use and unlimited exposure.

2.12.2.4 Five-Year Reviews

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, in accordance with Section 121(c) of CERCLA and NCP §300.430(f)(5)(iii)(c), a statutory review will be conducted within 5 years of the initiation of remedial action, and every 5 years thereafter, to ensure that the remedy continues to be protective of human health and the environment. During such reviews, the Navy, EPA, and state will review site conditions and the LUC compliance inspection information and monitoring data to determine whether continued implementation of the Selected Remedy is appropriate. Five-year reviews will be conducted until DU 4-1 conditions are restored such that the site is suitable for unrestricted use and unlimited exposure in accordance with CERCLA.

2.12.3 Expected Outcomes of Selected Remedy

The current industrial/restricted recreational land use, which will be supported by the Selected Remedy, is expected to continue at DU 4-1, and there are no other planned land uses in the foreseeable future. Alternative SO3 would render the site suitable for the planned continued industrial and restricted recreational (hunting) use. Groundwater at the site is not used and is not expected to be used in the future, and the Selected Remedy will have no impact on current or future groundwater uses available at the site. However, as per EPA groundwater remediation guidance, in states without an EPA-approved CSGWPP such as Rhode Island, CERCLA groundwater remediation must meet federal MCLs and risk-based standards unless the water is non-potable. There are no socio-economic, community revitalization, or economic impacts or benefits associated with implementation of the Selected Remedy. RAOs for the site are anticipated to be achieved within approximately 1 year for soil and between 26 and 45 years for groundwater. Table 2-11 describes how the Selected Remedy mitigates risk and achieves RAOs for DU 4-1.

TABLE 2-11. HOW SELECTED REMEDY MITIGATES RISK AND ACHIEVES RAOS

RISK	RAO	COMMENTS
Direct exposure to and ingestion of contaminated soil	Prevent ingestion of and dermal contact with vadose zone soil containing site contaminants that pose unacceptable risk for residential and other unrestricted uses.	Selective excavation and off-site disposal of soil will prevent exposure to surface soil with COCs concentrations exceeding industrial cleanup levels. Implementing, enforcing, and inspecting LUCs will prevent exposure to COCs at concentrations exceeding industrial cleanup levels in subsurface soil and exceeding residential cleanup levels in surface and subsurface soil.
	Prevent exposure of construction workers and industrial workers to soils with site contaminants exceeding industrial cleanup levels.	Enforcing LUCs for construction workers at the site will ensure that they are informed and adopt adequate protection for any potential excavation work at the site.

TABLE 2-11. HOW SELECTED REMEDY MITIGATES RISK AND ACHIEVES RAOS (CONT.)		
RISK	RAO	COMMENTS
Migration of Contaminants to groundwater or surface water	Prevent future migration of soil contaminants either to groundwater or adjacent wetlands/waterways.	Selective excavation and off-site disposal of the most contaminated soil will reduce the potential for contaminants to migrate from soil to groundwater and surface water. LUCs and inspections will be implemented to assure that surface soil (0-2 feet) remains undisturbed. Long-term monitoring of groundwater will document any leaching of soil COCs into the groundwater
Use of groundwater for residential purposes	Prevent use of site groundwater until groundwater cleanup levels have been achieved.	LUCs will restrict the use of site groundwater until cleanup levels are achieved.
	Restore groundwater quality to its beneficial use.	MNA will allow decreases of COC concentrations to the natural steady state over time as natural degradation of petroleum upgradient concludes, and the area geochemistry rebalances. COC concentrations will be monitored at DU 4-1 to identify changes over time and to document when steady-state conditions are achieved.

The current industrial use of the site is expected to continue for the foreseeable future, it is not expected that modification or removal of the LUCs will be required. However, if proposed land use changes in the future and uses other than industrial/commercial and restricted recreational activities are expected, additional remedial approaches may be required. Any modifications to LUCs will be conducted in accordance with provisions in the TF4 DU 4-1 LUC RD, CERCLA, and the NCP.

2.13 STATUTORY DETERMINATIONS

In accordance with the NCP, the Selected Remedy meets the following statutory determinations:

- **Protection of Human Health and the Environment** – The Selected Remedy is needed to prevent unacceptable risks to human health associated with exposure to COCs in site soil and groundwater under current and future land use scenarios. The Selected Remedy will be protective of human health and the environment through prevention of exposure to the COCs remaining in soil and will be will be protective of human health and the environment through reductions in COC concentrations in site groundwater via MNA to achieve cleanup levels. The Selected Remedy includes LUCs that will ensure the long-term effectiveness of the remedy and that will prevent exposure to contaminated soil and groundwater until conditions are suitable for unlimited use and unrestricted exposure.

- **Compliance with ARARs** – The Navy has determined that the Selected Remedy is the Least Environmentally Damaging Practicable Alternative in compliance with the federal Clean Water Act. The Selected Remedy will attain all identified federal and state ARARs, as presented in Appendix E.

- **Cost-Effectiveness** – The Selected Remedy is a cost-effective alternative that allows for continued industrial use of the property. The costs are proportional to overall effectiveness by achieving an adequate amount of long-term effectiveness and permanence within a reasonable time frame. Detailed costs for the Selected Remedy are presented in Appendix B[1].

- **Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable** – The Selected Remedy does not include treatment.

- **Preference for Treatment Which Permanently and Significantly Reduces the Toxicity, Mobility, or Volume of the Hazardous Substances as a Principle Element** – The Selected Remedy includes excavation and offsite disposal of the most contaminated portions of soil at the Site.

[1] Cost estimates presented in Appendix B are based on the conceptual designs evaluated during the FS. Line item quantities and costs may vary based on the engineering designs developed during the RD phase.

- **Five-Year Review Requirement** – Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of remedial action and every 5 years thereafter to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

CERCLA Section 117(b) requires an explanation of significant changes from the Selected Remedy presented in the Proposed Plan that was published for public comment. No significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate. Formal comments received during the public comment period and the associated responses are provided in Section 3.0, Responsiveness Summary.

3.0 RESPONSIVENESS SUMMARY

3.1 STAKEHOLDER COMMENTS AND LEAD AGENCY RESPONSES

Participants in the public meeting (informal session) held on June 19, 2013, included RAB members and representatives of the Navy, EPA, and RIDEM. The questions raised at the public meeting were general inquiries for informational purposes and were addressed at the public meeting. A formal public hearing was held immediately following the public meeting. Oral comments received during the public hearing and written comments received during the public comment period are summarized in Table 3-1. The complete transcript of the public hearing is included in the Administrative Record for TF4 DU 4-1.

TABLE 3-1. SUMMARY OF QUESTIONS FROM PUBLIC COMMENT PERIOD

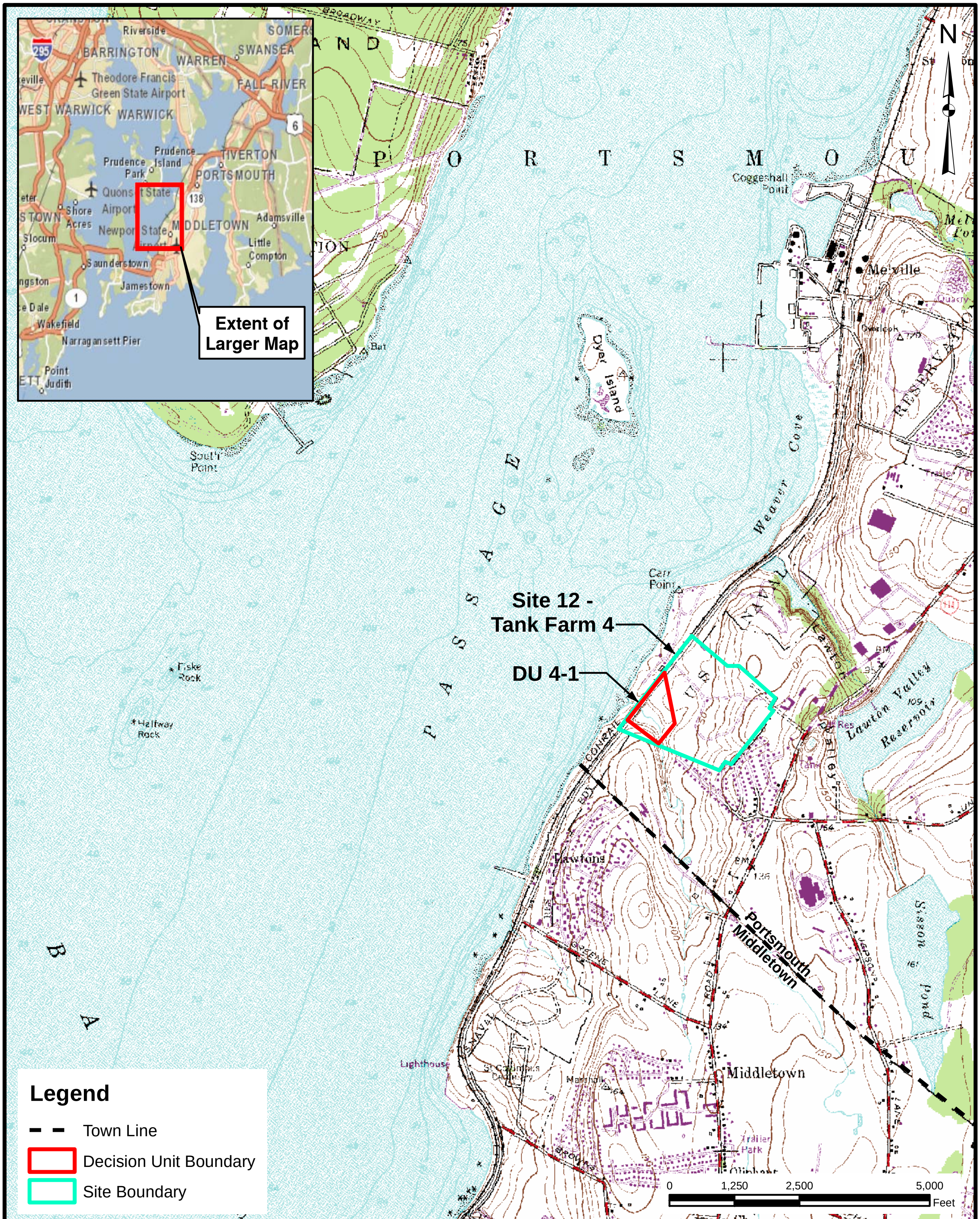
QUESTION/COMMENT	RESPONSE
Mr. Bob Berner, of Portsmouth, Rhode Island commented that he appreciated the level of detail in the proposed plan, and the fact that it seemed to be conservative. He said it was a job well done.	The comment is noted.
Mr. Dave Brown, a Newport RAB member, commented that he agreed with the SO3 remedy as long as the extra money being spent on this remedy did not take away from money to cleanup other Navy locations. He also commented that alternative SO3 would probably look more attractive and therefore be good for cyclist and tourism. Mr. Brown also noted that he understood alternatives GW2 and GW3 were pretty uncertain. He concluded with his support.	The funding for the cleanup is provided independently for each site, and independent of the investigatory efforts at sites that do not yet have remedial decisions associated with them so as to be sure that such funding is not impacted by other decisions. The comment is correct that there is high uncertainty as to the likely success of GW3 and this uncertainty balanced against the cost does not make it as attractive as Alternative GW2. As noted elsewhere in the documentation, the remedial decision is revisited every five years and if it is determined that the selected remedy is not protective, it can be changed through a new evaluation and with public input similar to this process being conducted now.
Ms. Margaret Kirschner of Newport, Rhode Island, commented on what the time-frame of 30-years might mean to the land becoming useful to the community again and how that factors into the cost when comparing alternatives.	The comment is noted, and the Navy shares Ms. Kirschner's appreciation for the consideration of cost, balanced against restrictions on future land use. It is noted that the proposed remedy will not permit recreational use of the site other than those restricted uses currently allowed.
Mr. Bob Berner commented on how the contaminated areas might impact the use of those areas for recreation.	The selected soil remedy for this site consists of excavation of contaminated soil, land use controls, inspections and monitoring to allow for restricted recreational usage of the site. Additionally, the Navy will review the site every five years and the inspections and monitoring data will be evaluated against the remedial action objectives that are set forth by this decision document to ensure protectiveness of the site.

3.2 TECHNICAL AND LEGAL ISSUES

No additional technical or legal issues associated with the TF4 DU 4-1 ROD were identified.

Figures

I:\02698\DD.ID.12\FINAL_ROD\TF4_DU4-1_SITE_LOCUS.MXD GJG/NEC 05/09/13



NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND

DECISION UNIT 4-1 LOCATION MAP

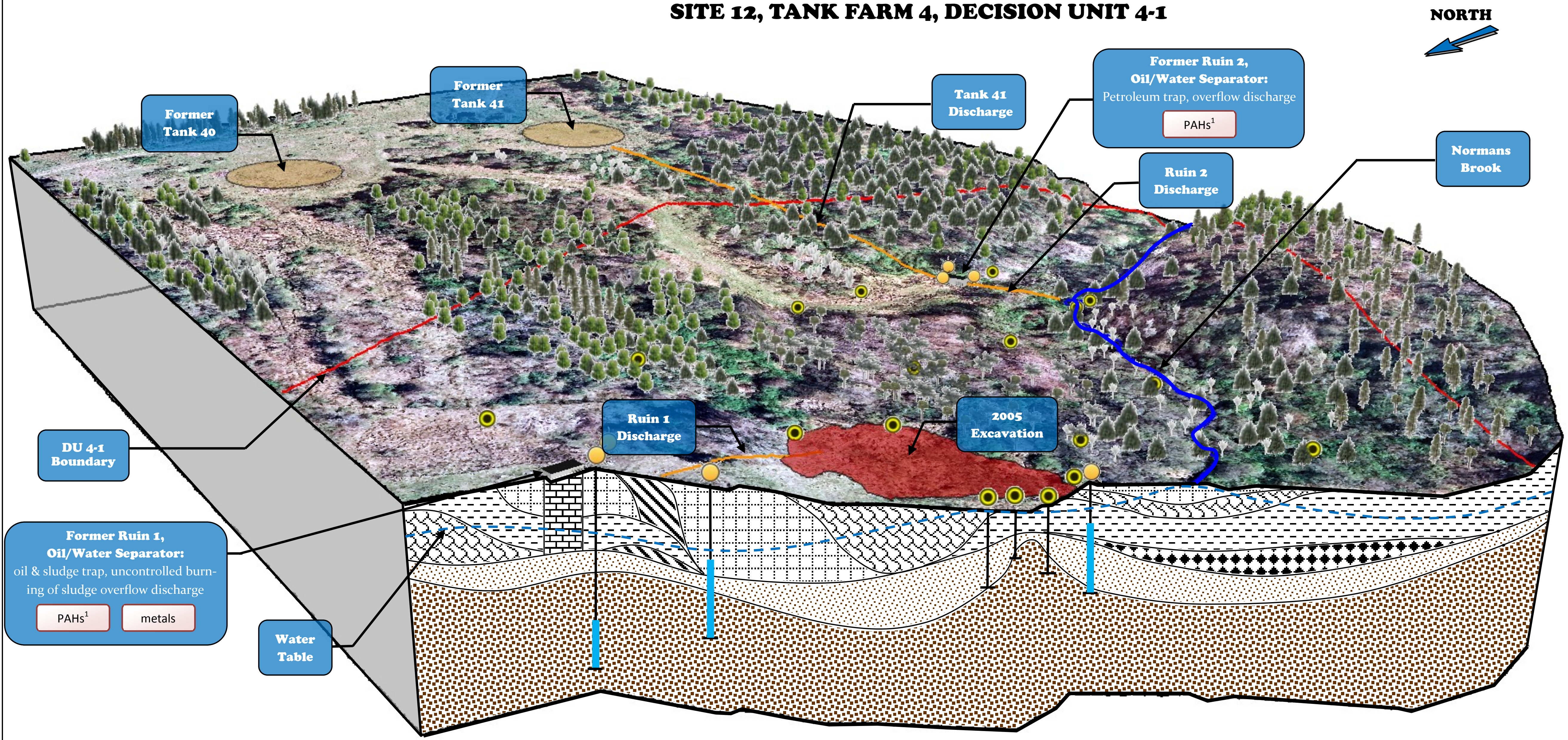
DECISION UNIT 4-1 - TANK FARM 4
RECORD OF DECISION

TETRA TECH

SCALE	PER SCALE BAR
FILE	I:\...\TF4_DU4-1_ SITE_LOCUS.MXD
REV 0	DATE 05/09/13
FIGURE NUMBER	2-1

NAVAL STATION NEWPORT

SITE 12, TANK FARM 4, DECISION UNIT 4-1



LEGEND

MONITORING WELL LOCATION
RISER PIPE
SCREENED INTERVAL
SOIL BORING LOCATION

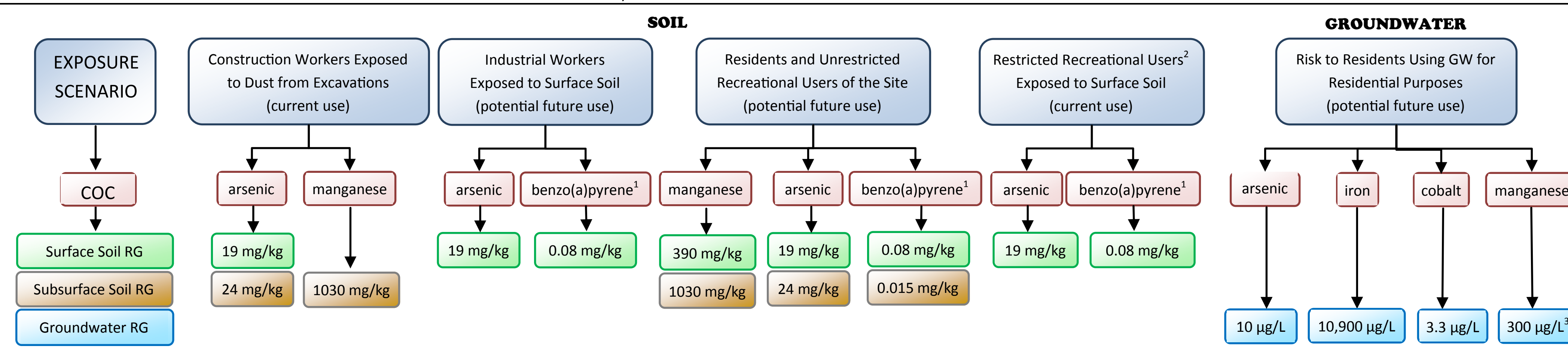
LITHOLOGY

- PHYLLITE
- WEATHERED PHYLLITE
- SILTY SAND
- SANDY SILT
- SILT WITH GRAVEL
- SANDY SILT WITH GRAVEL
- SILTY SAND WITH GRAVEL
- FILL

Notes:

- Not to scale.
- Not to be used for design.
- Vertical interpretation is exaggerated for presentation.
- Lithology interpreted from Figure 1-7 of the Feasibility Study report.

SITE RISKS* AND REMEDIATION * Risk includes ILCR > 10^{-6} and/or HI > 1



Notes:

1. Benzo(a)pyrene is presented for illustration only. Up to six carcinogenic PAHs contributed to risk and separate RGs are provided for each in Table 2-5 of the ROD.
2. Restricted Recreational User exposure is similar to Industrial.
3. Federal Health Advisory.

Acronyms

RG - Remediation Goal

TETRA TECH

Naval Station Newport
Middletown, Rhode Island

CONCEPTUAL SITE MODEL

Site 12, Tank Farm 4, Decision Unit 4-1
Record of Decision

File: O:\...Site 12\Category 1\ROD...	Scale: No Scale (perspective view)
Figure Number: 2-2	Date: 3/25/2013

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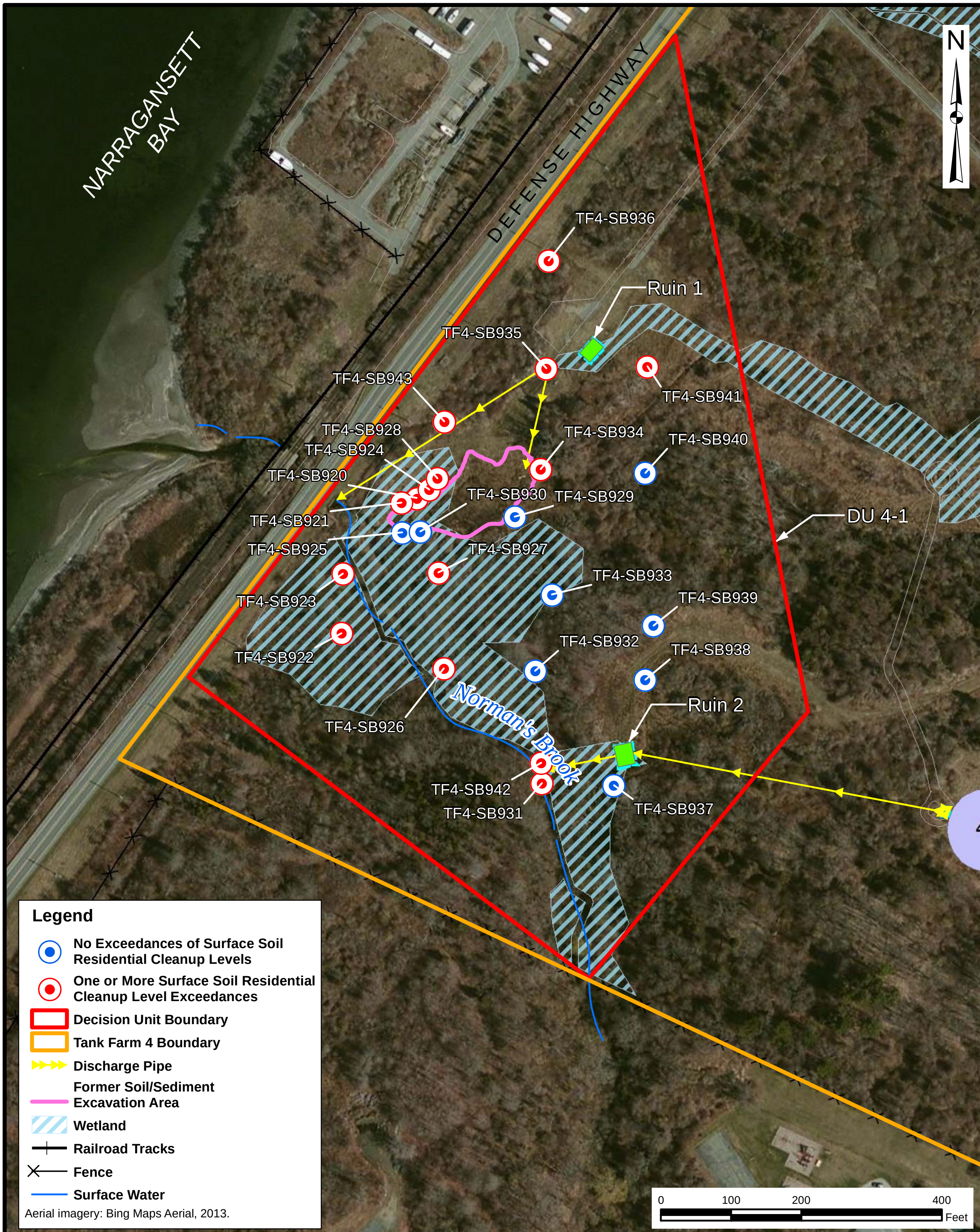

TETRA TECH

NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND

SURFACE SOIL EXCEEDANCES OF RESIDENTIAL CLEANUP LEVELS

DECISION UNIT 4-1 - TANK FARM 4
RECORD OF DECISION

SCALE	
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2-3A	

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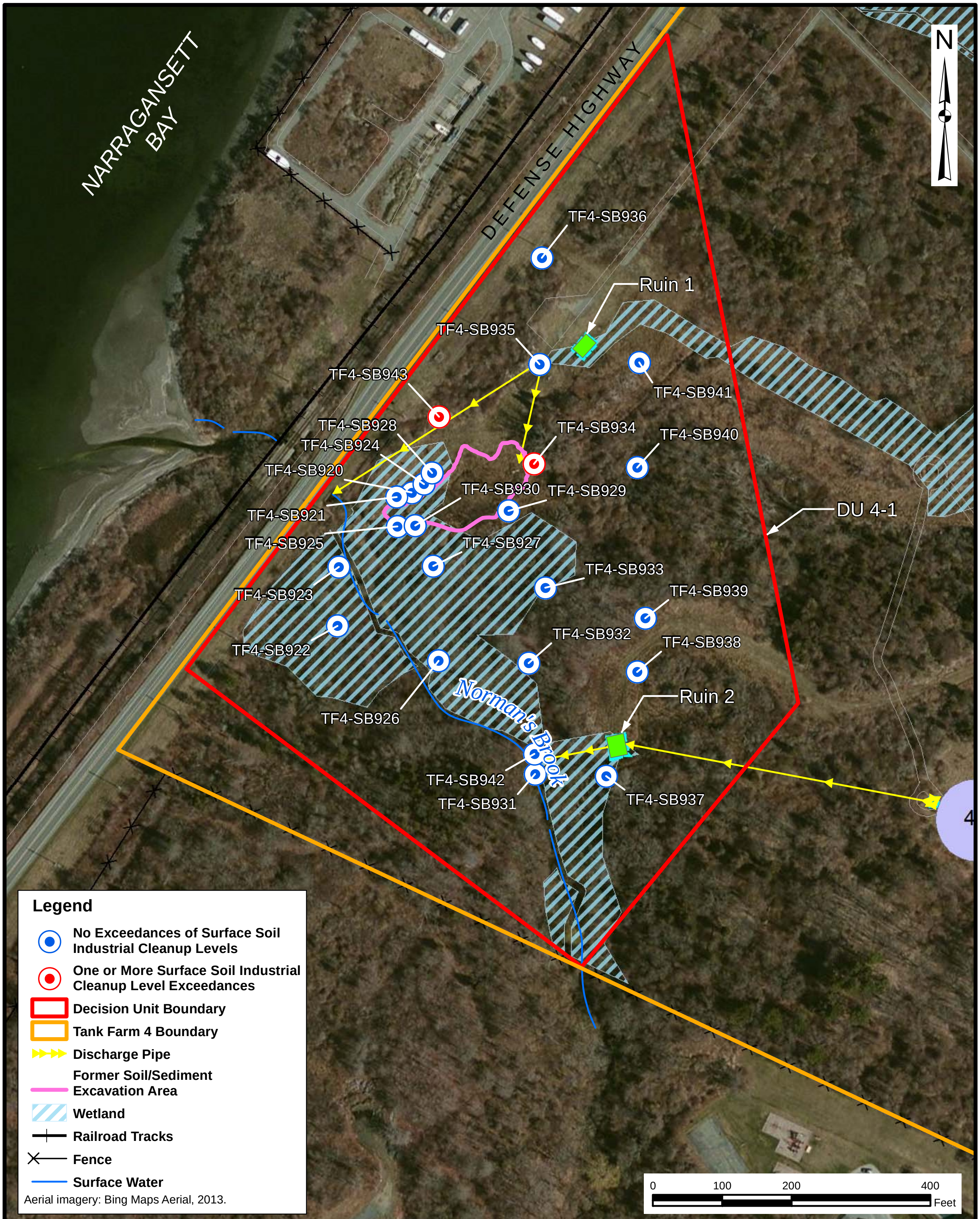

TETRA TECH

NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND

SURFACE SOIL EXCEEDANCES OF INDUSTRIAL CLEANUP LEVELS

DECISION UNIT 4-1 - TANK FARM 4
RECORD OF DECISION

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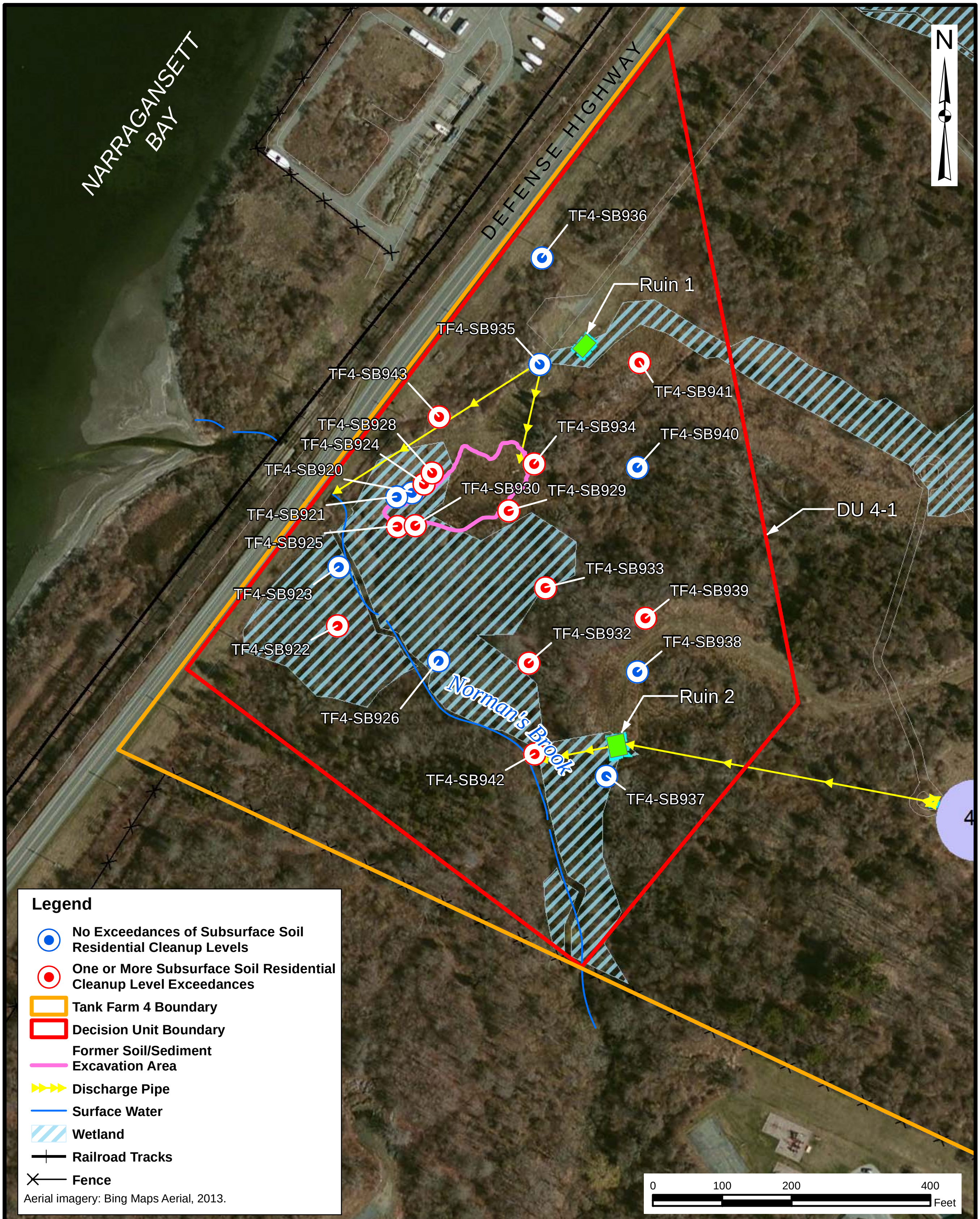
FIGURE NUMBER	2-3B



TETRA TECH

NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND

SUBSURFACE SOIL EXCEEDANCES OF RESIDENTIAL CLEANUP LEVELS

DECISION UNIT 4-1 - TANK FARM 4
RECORD OF DECISION

SCALE	PER SCALE BAR
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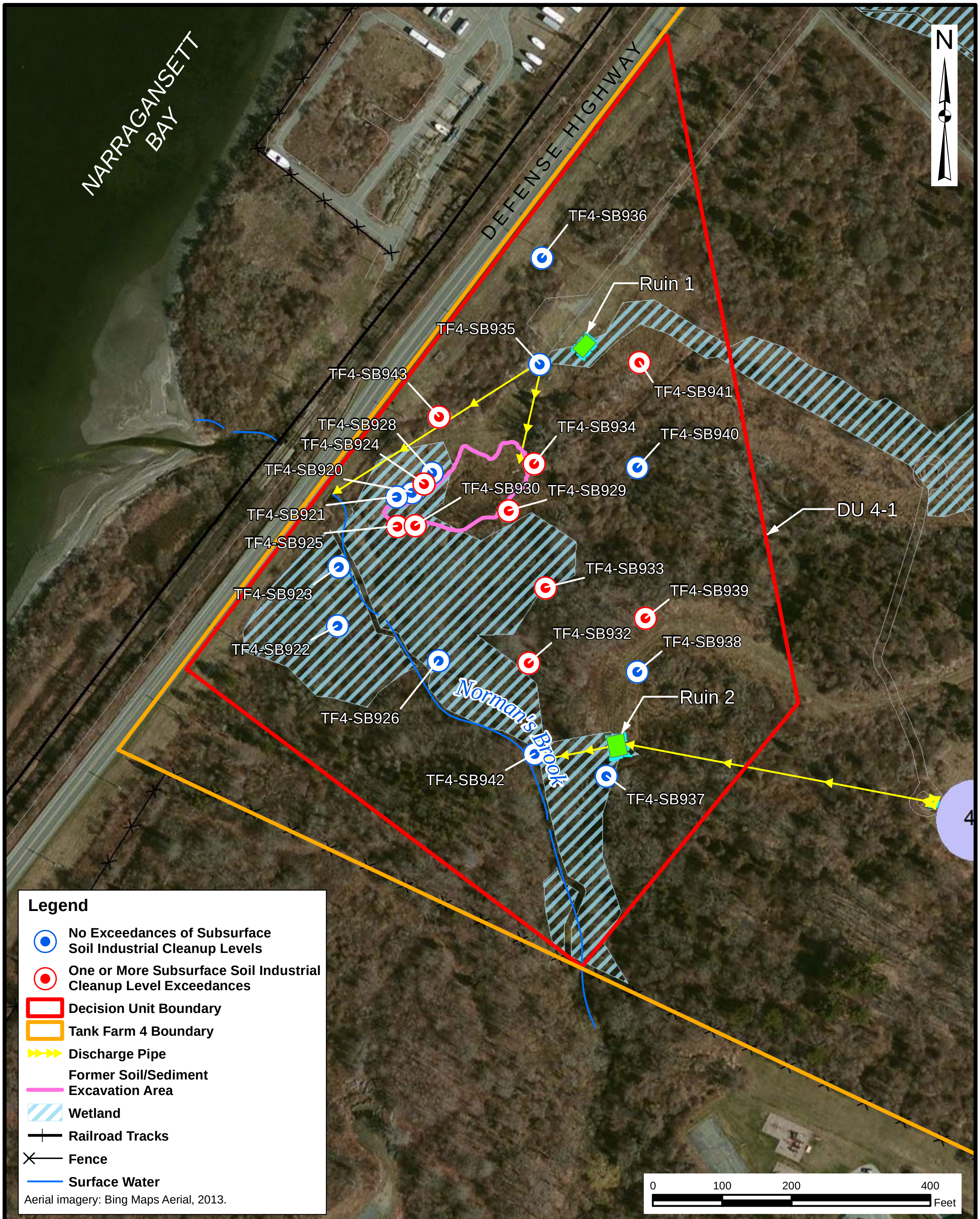
FIGURE NUMBER	2-4A



TETRA TECH

NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND

SUBSURFACE SOIL EXCEEDANCES OF INDUSTRIAL CLEANUP LEVELS

DECISION UNIT 4-1 - TANK FARM 4
RECORD OF DECISION

SCALE	
PER SCALE BAR	
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REV	DATE
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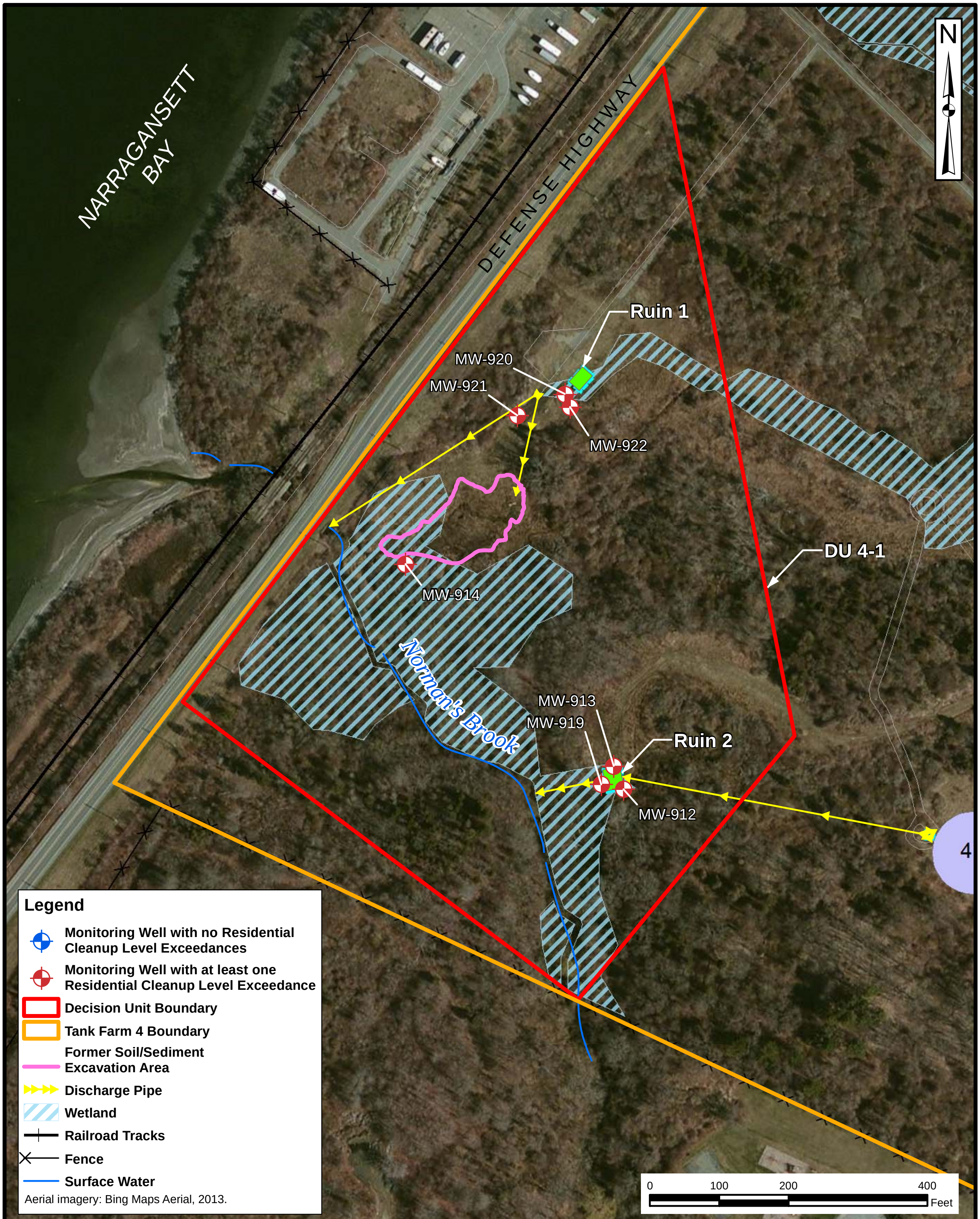
FIGURE NUMBER	
2-4B	



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TETRA TECH

NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND

GROUNDWATER EXCEEDANCES OF RESIDENTIAL CLEANUP LEVELS

DECISION UNIT 4-1 - TANK FARM 4
RECORD OF DECISION

SCALE	PER SCALE BAR
FILE	I:\...\TF4_DU4-1_MW_EXCEED_RES_PRG.MXD
REV 0	DATE 09/13/13
FIGURE NUMBER	2-5

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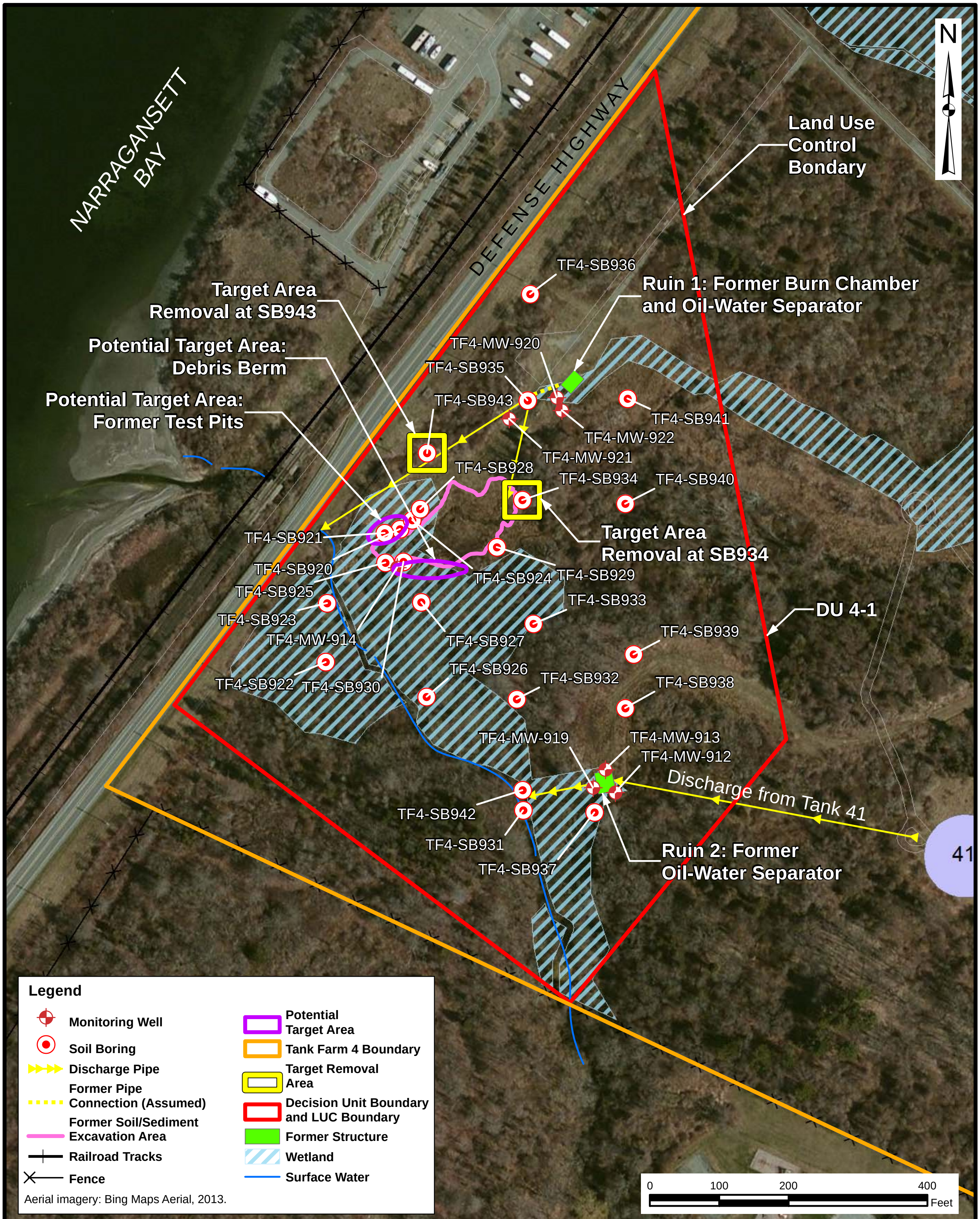
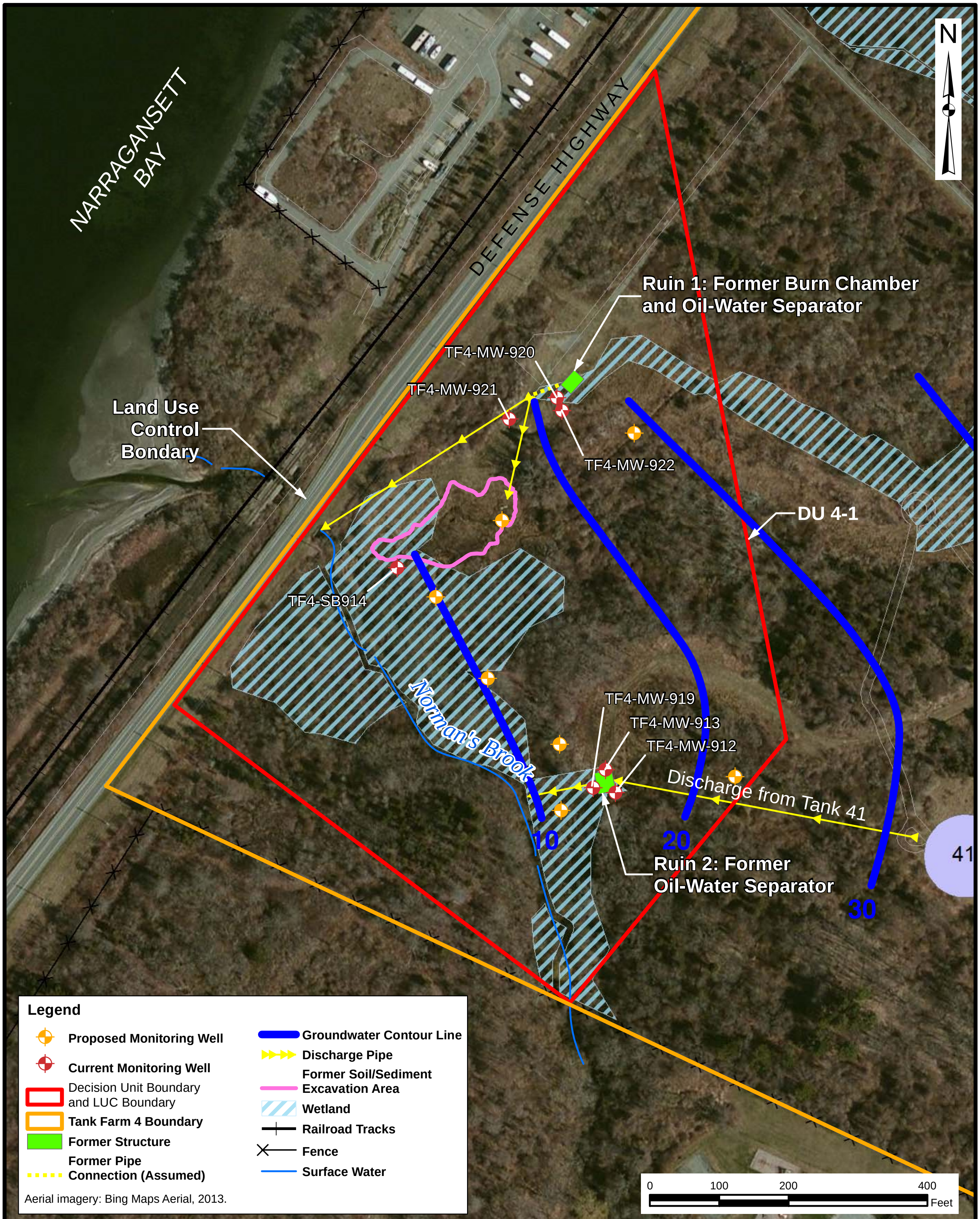


TETRA TECH	NAVAL STATION NEWPORT PORTSMOUTH, RHODE ISLAND **SUMMARY OF SOIL REMEDY (SO-3)** DECISION UNIT 4-1 - TANK FARM 4 RECORD OF DECISION	SCALE: PER SCALE BAR FILE: I:\...\TF4_DU4-1_ALT_SO3.MXD REV: 0 DATE: 09/12/13 FIGURE NUMBER: 2-6



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TETRA TECH

NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND

SUMMARY OF GROUNDWATER REMEDY (GW-2)

DECISION UNIT 4-1 - TANK FARM 4
RECORD OF DECISION

SCALE	
PER SCALE BAR	
FILE	
I:\...\TF4_DU4-1_ALT_GW_REMEDY.MXD	
REV	DATE
0	09/12/13
FIGURE NUMBER	
2-7	

Administrative Record Reference Table

DETAILED ADMINISTRATIVE RECORD REFERENCE TABLE

ITEM	REFERENCE PHRASE IN ROD	LOCATION IN ROD	LOCATION OF INFORMATION IN ADMINISTRATIVE RECORD
1	**Remedial Investigation**	Table 2-1	TRC. 1992. "Remedial Investigation, Naval Education and Training Center, Newport, Rhode Island". January.
2	**Demolished the underground tanks**	Table 2-1	Foster Wheeler Environmental Corporation, Final Tank Closure Assessment Reports, January 28, 1999. (11 reports)
3	**Site Investigation**	Table 2-1	Tetra Tech EC, 2007. Final Closeout Report for Sludge Disposal Trenches and Review Areas at Tank Farms 4 and 5, Naval Station Newport Portsmouth, Rhode Island. June 19.
4	**background soil investigation**	Table 2-1	Tetra Tech, 2008. Basewide Background Study Report for Naval Station Newport, Newport, Rhode Island. Tetra Tech, Inc., King of Prussia, Pennsylvania. July.
5	**Data Gaps Assessment (DGA)**	Table 2-1	Tetra Tech, 2012. Data Gaps Assessment Report for Installation Restoration Site 12 (Tank Farm 4) and 13 (Tank Farm 5) Category 1 Areas, Naval Station Newport, Newport RI. August.
6	**Baseline Human Health Risk Assessment (HHRA)**	Table 2-1	Tetra Tech, 2012.
7	**Screening Ecological Risk Assessment (ERA)**	Table 2-1	Tetra Tech, 2012.
8	**Remedial alternatives**	Table 2-1	Tetra Tech, 2013. Feasibility Study for DU 4-1 at Site 12 – Tank Farm 4, Naval Station Newport, Newport, Rhode Island. Final – June.
9	**Public notice**	Section 2.3	Newport Daily News June 17, 2013
10	**Groundwater flow**	Section 2.5.1	Tetra Tech, 2012.
11	**Burning of sludge**	Section 2.5.2	Envirodyne Engineers, Inc. 1983. Initial Assessment Study, Naval Education and Training Center, Newport, Rhode Island. March.
12	**Not used for drinking water**	Section 2.6	Envirodyne Engineers, Inc. 1983.
13	**RIDEM's GA and GB groundwater classification areas**	Section 2.6	RIDEM, 2010. Groundwater Quality Rules. State of Rhode Island and Providence Plantations Department of Environmental Management, Office of Water Resources. June.
14	**potential receptors**	Section 2.7	Tetra Tech, 2012.
15	**COPCs identified**	Section 2.7.1	Tetra Tech, 2012.
16	**Exposure assessment**	Section 2.7.1	Tetra Tech, 2012.
17	**cancer risks and non-cancer hazards**	Section 2.7.1	Tetra Tech, 2012.
18	**Refinement process**	Section 2.7.1	Tetra Tech, 2013.
19	**RAOs for DU 4-1**	Section 2.8	Tetra Tech, 2013.
20	**PRGs**	Section 2.8	Tetra Tech, 2012.
21	**preliminary technology screening**	Section 2.9	Tetra Tech, 2013.
22	**nine CERCLA evaluation criteria**	Section 2.10	Tetra Tech, 2013.

23	**Timeframe for this process is currently estimated at 26 years (bedrock) and 45 years (overburden)**	Section 2.12.2.2	Tetra Tech, 2013.

ADDITIONAL REFERENCES

Tetra Tech, 2004. Five-Year Review for Naval Station Newport, Naval Station Newport, Newport, Rhode Island. Tetra Tech NUS, Inc., King of Prussia, Pennsylvania. December.

USEPA, 1995. New England Risk-Based Priority Setting Project Risk Identification Work Group Final Report. September.

USEPA, 1999. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Office of Solid Waste and Emergency Response. OSWER Directive 9200.4-17P. April 21.

USEPA, 2002. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10. December

USEPA, 2010. ProUCL Version 4.00.05 User Guide. Office of Research and Development, Washington, D.C. EPA/600/R 07/038, May.

Appendix A
Rhode Island Department of Environmental Management Concurrence Letter

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
235 Promenade Street, Providence, RI 02908-5767 TDD 401-222-4462

26 September 2013

Mr. James T. Owens, III, Director
U.S. EPA – New England Region
Office of Site Remediation and Restoration
5 Post Office Square
Suite 100 (OSRR 07-3)
Boston, MA 02109-3912

RE: Record of Decision for Decision Unit 4-1 at Site 12 - Tank Farm 4 (OU11)
Naval Station Newport, RI

Dear Mr. Owens:

On 23 March 1992 the State of Rhode Island entered into a Federal Facilities Agreement (FFA) with the Department of the Navy and the Environmental Protection Agency. One of the primary goals of the FFA is to ensure that the environmental impacts associated with past activities at Naval Station Newport located in Newport, Rhode Island are thoroughly investigated and that appropriate actions are taken to protect human health and the environment.

In accordance with the FFA, the Department of Environmental Management (Department) has completed its review of the Record of Decision (ROD) for Decision Unit 4-1 at Site 12 – Tank Farm 4 (OU11) dated September 2013 at Naval Station Newport, RI. The Department of the Navy's selected alternative for the Site, as presented in the ROD, is the following: excavation and offsite disposal of selected soil from two target areas along with the investigation and potential offsite disposal of wastes and soils from two additional target areas; monitored natural attenuation (MNA) of metals in groundwater until groundwater cleanup standards are achieved; and implementation of land use controls (LUCs) to ensure that future use of the property is limited to industrial activities, to ensure that subsurface soils are not disturbed without appropriate safety precautions, and to prohibit groundwater use until groundwater cleanup goals are achieved.

The Department has worked on this Site with the Department of the Navy and the Environmental Protection Agency from the early stages up through this current decision milestone. Based upon this Department's review of this ROD and the results of the remedial investigation activities conducted to date, we offer our concurrence on the decision.

The Department wishes to emphasize the following aspects of the ROD:

- The Navy will conduct a pre-design investigation (PDI) which will include soil sampling and analysis to identify the extent of soils for the removal action in the two target areas: soil containing PAHs above industrial cleanup levels at and around SB934 and soil containing arsenic in surface soil at concentrations above industrial cleanup levels and background concentrations at and around SB943. In addition, two additional suspect areas of potential soil contamination (the soil/debris berm near SB930 and former test pit area northwest of SB924) will be investigated as part of the PDI to determine if soil/debris removal in these areas is necessary. At the debris berm, the presence of solid waste will be determined, and if present, this berm will be removed. At the former test pit area, if concentrations of COCs are found to exceed cleanup levels, a target excavation will be conducted in this area.

- If, after an appropriate amount of data has been collected, MNA is determined to be an ineffective remedy for the Site, the Navy will seek a change to the remedial action for groundwater, using an additional public notification and ROD amendment or ESD;
- The Navy will implement groundwater use restrictions and a long-term monitoring plan for the Site;
- The Navy will implement land use controls (LUCs) to prevent residential and unrestricted recreational uses of the Site; and
- The Navy will conduct five-year reviews to ensure that the remedial actions for the Site continue to provide adequate protection of human health and the environment.

Thank you for providing us with an opportunity to review and concur with this important ROD.

Sincerely,

Janet Coit
Director

cc: Terrence Gray, RIDEM
Leo Hellested, RIDEM
Matthew DeStefano, RIDEM
Pamela Crump, RIDEM
Bryan Olson, USEPA
Kymberlee Keckler, USEPA
Roberto Pagtalunan, Navy

Appendix B
Cost Estimates

TABLE C1-7
Cost Backup - Capital Costs
Soil Alternative SO3: Hot Spot Excavation, Off-Site Disposal, LUCs, and Inspections
Site 12, Tank Farm 4, DU 4-1
NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI

			Unit Cost				Extended Cost				
Item	Quantity	Unit	Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	Subtotal
1 DOUMENTS AND CONSTRUCTION PLANNING											
1.1 Prepare RAWP, HASP, Specs,	300	hr			$37.00		$0	$0	$11,100	$0	$11,100
1.2 Weltand restoration plan	75	hr			$37.00		$0	$0	$2,775	$0	$2,775
1.3 LUC RD	1	LS	$9,100.00				$9,100	$0	$0	$0	$9,100
2 PRE-DESIGN INVESTIGATION (see basis sheet)											
2.1 SAP preparation	1	ls			$17,140.00		$0	$0	$17,140	$0	$17,140
2.2 Sampling labor and materials	1	ls	$850.00	$4,000.00	$26,450.00		$850	$4,000	$26,450	$0	$31,300
2.3 Analytical analysis of soil samples	1	ls	$47,040.00				$47,040	$0	$0	$0	$47,040
2.4 Drilling subcontractor	1	ls	$29,900.00				$29,900	$0	$0	$0	$29,900
3 MOBILIZATION AND DEMOBILIZATION											
3.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
3.2 Equipment Mobilization/Demobilization	4	ea			$177.00	$610.00	$0	$0	$708	$2,440	$3,148
4 FIELD SUPPORT AND SITE ACCESS											
4.1 Office Trailer	1	mo				$360.00	$0	$0	$0	$360	$360
4.2 Field Office Equipment, Utilities, & Support	1	mo		$470.00			$0	$470	$0	$0	$470
4.3 Storage Trailer	1	mo				$92.50	$0	$0	$0	$93	$93
4.4 Survey Support	2	day	$1,075.00				$2,150	$0	$0	$0	$2,150
4.5 Site Superintendent	14	day		$206.00	$384.64		$0	$2,884	$5,385	$0	$8,269
4.6 Site Health & Safety and QA/QC	14	day		$206.00	$307.68		$0	$2,884	$4,308	$0	$7,192
4.7 Underground Utility Clearance	1	ls	$10,525.00				$10,525	$0	$0	$0	$10,525
5 DECONTAMINATION											
5.1 Decontamination Services	1.0	mo		$1,220.00	$2,245.00	$1,550.00	$0	$1,220	$2,245	$1,550	$5,015
5.2 Equipment Decon Pad	1	ls		$4,500.00	$3,000.00	$725.00	$0	$4,500	$3,000	$725	$8,225
5.3 Decon Water	3,000	gal		$0.20			$0	$600	$0	$0	$600
5.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$771.00	$0	$0	$0	$771	$771
5.5 Clean Water Storage Tank, 6,000 gallon	1	mo				$771.00	$0	$0	$0	$771	$771
5.6 Disposal of Decon Waste (liquid & solid)	1	mo	$985.00				$985	$0	$0	$0	$985
6 SITE PREPARATION											
5.1 Excavator, 2.5 cy	3	day			$355.20	$1,784.00	$0	$0	$1,066	$5,352	$6,418
6.2 Skid-Steer	3	day			$333.40	$291.00	$0	$0	$1,000	$873	$1,873
6.3 Site Labor, (3 laborers)	7	day			$264.80		$0	$0	$1,854	$0	$1,854
6.4 Clear & Chip Trees	4	day			$333.40	$689.60	$0	$0	$1,334	$2,758	$4,092
6.5 Grub Stumps and Chip	4	day				$190.90	$0	$0	$0	$764	$764
6.6 Off-Site Disposal of Chipped Trees	50	ton	$45.00				$2,250	$0	$0	$0	$2,250
7 EXCAVATION, DISPOSAL											
7.1 Excavator, 2.5 cy	7	day			$355.20	$1,784.00	$0	$0	$2,486	$12,488	$14,974
7.2 Skid-Steer	7	day			$333.40	$291.00	$0	$0	$2,334	$2,037	$4,371
7.3 Site Labor, (3 laborers)	7	day			$264.80		$0	$0	$1,854	$0	$1,854
7.4 Verification Samples, PAHs, metals	30	ea	$360.00	$20.00	$50.00	$20.00	$10,800	$600	$1,500	$600	$13,500
7.5 T & D of Excavated Soil-debris, non-hazardous	917	ton	$85.00				$77,945	$0	$0	$0	$77,945
7.6 Waste Disposal Characterization / Analytical	4	ea	$850.00	$30.00	$50.00	$30.00	$3,400	$120	$200	$120	$3,840
8 SITE RESTORATION											
8.1 Backfill, common fill	306	cy		$17.96			$0	$5,496	$0	$0	$5,496
8.2 Backfill, vegetative soil	127	cy		$27.67			$0	$3,514	$0	$0	$3,514
8.3 Revegetation, seed	10.0	msf	$77.50				$775	$0	$0	$0	$775
8.4 Dozer, 300 hp	4	day			$343.90	$1,592.00	$0	$0	$1,376	$6,368	$7,744
8.5 Compactor, 120 hp	4	day			$343.90	$560.60	$0	$0	$1,376	$2,242	$3,618
8.6 Skid-Steer	4	day			$333.40	$291.00	$0	$0	$1,334	$1,164	$2,498
8.7 Site Labor (3 laborers) (cover)	6	day			$264.80		$0	$0	$1,589	$0	$1,589
9 POST CONSTRUCTION COST											
9.1 Contractor Completion Report	150	hr			$37.00		$0	$0	$5,550	$0	$5,550
9.2 Remedial Action Closeout Report	200	hr			$37.00		$0	$0	$7,400	$0	$7,400
Subtotal							$195,720	$27,288	$105,361	$44,976	$373,345

continued next page

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Overhead on Labor Cost @ 30%									$31,608		$31,608
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$19,572	$2,729	$10,536	$4,498	$37,334
Tax on Materials and Equipment Cost @ 7.0%								$1,910		$3,148	$5,058
Total Direct Cost							$215,292	$31,927	$147,505	$52,622	$447,346
Indirects on Total Direct Cost @ 25%	(excluding transportation and disposal cost)										$92,104
Profit on Total Direct Cost @ 10%											$44,735
Subtotal											$584,184
Health & Safety Monitoring @ 2%											$11,684
Total Field Cost											$595,868
Engineering on Total Field Cost @ 5%											$29,793
Contingency on Total Field Cost @ 20%											$119,174
TOTAL CAPITAL COST											**$744,835**

TABLE C1-8
Cost Backup - Annual and Five - Year Costs
Soil Alternative SO3: Hot Spot Excavation, Off-Site Disposal, LUCs, and Inspections
Site 12, Tank Farm 4, DU 4-1
NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI

5/1/2013 2:56 PM

Item	Item Cost years 1 - 30	Item Cost years 1-5	Item Cost every 5 years	Notes
LUCs Inspection & Report	$2,350			One-day visit to verify LUCs with Report
Groundwater Monitoring	$0			Annual monitoring is required, but assumed to be conducted under the groundwater remedial alternative.
Five -Year Review			$23,000	Assumes that this is a component of the NAVSTA Newport IRP Five Year Reievew
Subtotal	$2,350	$0	$23,000	
Contingency @ 10%	$235	$0	$2,300	Cost with contingency is used for Present Worth Analysis.
TOTAL	**$2,585**	**$0**	**$25,300**	

TABLE C1-9
Cost Backup - Present Worth Analysis
Soil Alternative SO3: Hot Spot Excavation, Off-Site Disposal, LUCs, and Inspections
Site 12, Tank Farm 4, DU 4-1
NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$744,835		$744,835	1.000	$744,835
1		$2,585	$2,585	0.980	$2,534
2		$2,585	$2,585	0.961	$2,485
3		$2,585	$2,585	0.942	$2,436
4		$2,585	$2,585	0.924	$2,388
5		$27,885	$27,885	0.906	$25,256
6		$2,585	$2,585	0.888	$2,295
7		$2,585	$2,585	0.871	$2,250
8		$2,585	$2,585	0.853	$2,206
9		$2,585	$2,585	0.837	$2,163
10		$27,885	$27,885	0.820	$22,875
11		$2,585	$2,585	0.804	$2,079
12		$2,585	$2,585	0.788	$2,038
13		$2,585	$2,585	0.773	$1,998
14		$2,585	$2,585	0.758	$1,959
15		$27,885	$27,885	0.743	$20,719
16		$2,585	$2,585	0.728	$1,883
17		$2,585	$2,585	0.714	$1,846
18		$2,585	$2,585	0.700	$1,810
19		$2,585	$2,585	0.686	$1,774
20		$27,885	$27,885	0.673	$18,766
21		$2,585	$2,585	0.660	$1,706
22		$2,585	$2,585	0.647	$1,672
23		$2,585	$2,585	0.634	$1,639
24		$2,585	$2,585	0.622	$1,607
25		$27,885	$27,885	0.610	$16,997
26		$2,585	$2,585	0.598	$1,545
27		$2,585	$2,585	0.586	$1,514
28		$2,585	$2,585	0.574	$1,485
29		$2,585	$2,585	0.563	$1,456
30		$27,885	$27,885	0.552	$15,394
				TOTAL PRESENT WORTH	**$911,613**

TABLE C2-4
Cost Backup: Capital Cost
Groundwater Alternative 2 - LUCs & MNA
Site 12 - Tank Farm 4, DU 4-1
NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 Capital Costs											
1.1 LUCs	1	ea			$9,100.00		$0	$0	$9,100	$0	$9,100
1.2 MNA Work Plan											
planning meeting (2 people)	16	hr			$85.00		$0	$0	$1,360	$0	$1,360
analytical specs	16	hr			$105.00		$0	$0	$1,680	$0	$1,680
SAP preperation (Draft/Final)	160	hr			$85.00		$0	$0	$13,600	$0	$13,600
misc supplies, equipment, copying etc.	1	ea		$500.00			$0	$500	$0	$0	$500
1.3 Drilling Subcontractor											
well installation oversight	30	hr			$85.00		$0	$0	$2,550	$0	$2,550
misc supplies, equipment, copying etc.	1	ea		$1,000.00		$1,500.00	$0	$1,000	$0	$1,500	$2,500
drilling subcontractor	3	day	$7,550.00				$22,650	$0	$0	$0	$22,650
. **Subtotal**							$22,650	$1,500	$28,290	$1,500	$53,940
Overhead on Labor Cost @ 30%									$8,487		$8,487
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$2,265	$150	$2,829	$150	$5,394
Tax on Materials and Equipment Cost @ 6%								$90		$90	$180
Total Direct Cost							$2,265	$240	$11,316	$240	$68,001
Indirects on Total Direct Cost @ 0%											$0
Profit on Total Direct Cost @ 10%											$6,800
Subtotal											$74,801
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$74,801
Contingency on Total Field Costs @ 10%											$7,480
Engineering on Total Field Cost @ 0%											$0
TOTAL CAPITAL COST											**$82,281**

TABLE C2-5
Cost Backup: Annual and Five Year Costs
Groundwater Alternative 2 - LUCs & MNA
Site 12 - Tank Farm 4, DU 4-1
NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI

Item	Item Cost Years 1-2	Item Cost Years 3-30	Item Cost every 5 years	Notes
Annual Site Inspection & Report, Years 1-30	$2,350	$2,350		Labor and supplies once a year to inspect Land Use Controls with report
Groundwater Sampling, Analysis and Report (Years 1-2)	$102,552			LUCs and Monitoring at 14 monitoring wells, Quarterly
Groundwater Sampling, Analysis and Report (Years 3-30)		$25,638		LUCs and Monitoring at 14 monitoring wells (annually)
Five Year Review			$23,000	Assumes five year review is a component of the Newport Five Year Review
Subtotal	$104,902	$27,988	$23,000	
Contingency @ 10%	$10,490	$2,799	$2,300	
TOTAL	**$115,392**	**$30,787**	**$25,300**	

TABLE C2-6
Cost Backup: Present Worth Cost
Groundwater Alternative 2 - LUCs & MNA
Site 12 - Tank Farm 4, DU 4-1
NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$82,281	$0	$82,281	1.000	$82,281
1		$115,392	$115,392	0.980	$113,130
2		$115,392	$115,392	0.961	$110,911
3		$30,787	$30,787	0.942	$29,011
4		$30,787	$30,787	0.924	$28,442
5		$56,087	$56,087	0.906	$50,800
6		$30,787	$30,787	0.888	$27,338
7		$30,787	$30,787	0.871	$26,802
8		$30,787	$30,787	0.853	$26,276
9		$30,787	$30,787	0.837	$25,761
10		$56,087	$56,087	0.820	$46,011
11		$30,787	$30,787	0.804	$24,761
12		$30,787	$30,787	0.788	$24,275
13		$30,787	$30,787	0.773	$23,799
14		$30,787	$30,787	0.758	$23,333
15		$56,087	$56,087	0.743	$41,673
16		$30,787	$30,787	0.728	$22,427
17		$30,787	$30,787	0.714	$21,987
18		$30,787	$30,787	0.700	$21,556
19		$30,787	$30,787	0.686	$21,133
20		$56,087	$56,087	0.673	$37,745
21		$30,787	$30,787	0.660	$20,312
22		$30,787	$30,787	0.647	$19,914
23		$30,787	$30,787	0.634	$19,524
24		$30,787	$30,787	0.622	$19,141
25		$56,087	$56,087	0.610	$34,187
26		$30,787	$30,787	0.598	$18,398
27		$30,787	$30,787	0.586	$18,037
28		$30,787	$30,787	0.574	$17,683
29		$30,787	$30,787	0.563	$17,336
30		$56,087	$56,087	0.552	$30,964
				TOTAL PRESENT WORTH	**$1,044,946**

Appendix C
Human Health Risk Assessment Summary Tables

TABLE C-1
EXPOSURE POINT CONCENTRATIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Parameter	Tank Farm 4					
	Surface Soil (0 - 1 feet) (mg/kg)	Surface/ Subsurface (mg/kg)	Groundwater		Surface Water (ug/L)	Sediment (mg/kg)
			RME (ug/L)	CTE (ug/L)		
Volatile Organic Compounds						
Benzene	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds						
Benzo(a)anthracene	24.7(2)	6(3)	NA	NA	0.17(1)	0.01(4)
Benzo(a)pyrene	11(2)	2.7(3)	NA	NA	NA	0.11(4)
Benzo(b)fluoranthene	22.4(2)	5.5(3)	NA	NA	NA	0.127(4)
Benzo(g,h,i)perylene	3.9(2)	0.96(3)	NA	NA	NA	NA
Benzo(k)fluoranthene	8.7(2)	2.1(3)	NA	NA	NA	NA
Chrysene	2.7(2)	6.6(3)	NA	NA	NA	NA
Dibenzo(a,h)anthracene	1.8(2)	0.19(5)	NA	NA	NA	0.028(4)
Fluoranthene	38(2)	9.2(3)	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	3.9(2)	0.72(8)	NA	NA	NA	NA
Naphthalene	NA	NA	0.19(1)	0.19(1)	NA	NA
Pyrene	39.4(2)	9.5(3)	NA	NA	NA	NA
Pesticides/PCBs						
Endrin Aldehyde	NA	NA	6.52(1)	6.52(1)	NA	NA
Dioxins/Furans						
2,3,7,8-TCDD TEQs	0.0000031(4)	0.0000027(4)	NA	NA	NA	0.0000041(7)
Inorganics						
Aluminum	NA	NA	253(1)	253(1)	NA	10,190(7)
Arsenic	15.8(7)	19.2(9)	6.3(1)	2.4(10)	0.36(6)	21.5(7)
Beryllium	0.42(7)	0.39(4)	NA	NA	NA	0.52(7)
Chromium	NA	NA	NA	NA	NA	18.6(7)
Cobalt	13.3(7)	19.1(4)	12.6(1)	9(10)	NA	43.3(9)
Iron	33,452(7)	41,025(7)	17,100(1)	9,133(10)	426(7)	84,620(9)
Manganese	453(7)	1,065(9)	5,030(1)	1,512(10)	NA	2,204(9)
Thallium	NA	2.2(6)	NA	NA	NA	6.7(8)

Notes:
NA - Not applicable. Not a COPC for this media.
RME - Reasonable maximum exposures
CTE - Central Tendency exposures
1 - Maximum Detected Concentration
2 - 99% KM (Chebyshev)
3 - 97.5% KM (Chebyshev)
4 - 95% Approximate Gamma
5 - 95% KM (BCA)
6 - 95% KM (t)
7 - 95% Student's-t
8 - 95% KM (Chebyshev)
9 - 95% Chebyshev(Mean, Sd)
10 - Average Concentration
11 - 95% Modified-t
12 - 95% H-UCL

TABLE C-2
SUMMARY OF EXPOSURE INPUT PARAMETERS
REASONABLE MAXIMUM EXPOSURES
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Exposure Parameter	Construction Worker	Industrial Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	Child Resident	Adult Resident
All Exposures							
ED (years)	1(1)	25(2,3)	12(4)	6(2)	24(2)	6(2,3)	24(2,3)
BW (kg)	70(2)	70(2,3)	50(2)	15(2)	70(2)	15(2,3)	70(2,3)
AT_n (days)	365(5)	9,125(3,5)	4,380(5)	2,190(5)	8,760(5)	2,190(3,5)	8,760(3,5)
AT_c (days)	25,550(5)	25,550(3,5)	25,550(5)	25,550(5)	25,550(5)	25,550(3,5)	25,550(3,5)
Incidental Ingestion/Dermal Contact with Soil							
C_{soil} (mg/kg)	Maximum or 95% UCL(6)	Maximum or 95% UCL(6)	Maximum or 95% UCL(6)	Maximum or 95% UCL(6)	Maximum or 95% UCL(6)	Maximum or 95% UCL(6)	Maximum or 95% UCL(6)
IR (mg/day)	330(2)	100(2)	100(2)	200(2)	100(2)	200(2,3)	100(2,3)
EF-Soil (days/year)	130(7)	250(3,8)	48(9)	48(9)	48(9)	350(3,10)	350(3,10)
FI (unitless)	1	1	1	1	1	1	1
SA (cm^2/day)	3,300(8)	3,300(8)	4,050(11)	2,800(8)	5,700(8)	2,800(8)	5,700(8)
AF (mg/cm^2)	0.3(8)	0.2(8)	0.4(8)	0.2(8)	0.07(8)	0.2(8)	0.07(8)
ABS (unitless)	chemical-specific(8)	chemical-specific(8)	chemical-specific(8)	chemical-specific(8)	chemical-specific(8)	chemical-specific(8)	chemical-specific(8)
CF (kg/mg)	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06
Inhalation Fugitive Dust/Volatile Emissions from Soil							
C_{air} (mg/m^3)	calculated(1)	calculated(1)	calculated(1)	calculated(1)	calculated(1)	calculated(1)	calculated(1)
ET (hours/day)	8(7)	8(12)	8(9)	8(9)	8(9)	24	24
EF-Soil (days/year)	130(7)	250(8)	48(9)	48(9)	48(9)	350(3,10)	350(3,10)
PEF (m^3/kg)	1.4E+06(1)	1.1E+10(13)	1.1E+10(13)	1.1E+10(13)	1.1E+10(13)	1.1E+10(13)	1.1E+10(13)
Ingestion/Dermal Contact with Groundwater							
C_{gw} (µg/L)	Maximun	NA	NA	NA	NA	Maximun	Maximun
IR_{gw} (L/day)	0.05(14)	NA	NA	NA	NA	1.29(2)	2.0(2)
EF (days/year)	130(7)	NA	NA	NA	NA	350(10)	350(10)
ET (hours/day) and t_{event} (hours/event)	8(7)	NA	NA	NA	NA	1.0(8)	0.58(8)
EV (events/day)	1(14)	NA	NA	NA	NA	1(14)	1(14)
A (cm^2/day)	3,300(8)	NA	NA	NA	NA	6,600(8)	18,000(8)
Kp (cm/hour), t* (hour/event), τ (hour), and B (unitless)	chemical-specific(8)	NA	NA	NA	NA	chemical-specific(8)	chemical-specific(8)

TABLE C-2
SUMMARY OF EXPOSURE INPUT PARAMETERS
REASONABLE MAXIMUM EXPOSURES
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Exposure Parameter	Construction Worker	Industrial Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	Child Resident	Adult Resident
Inhalation of Volatile Emissions from Groundwater							
C_{air} (mg/m^3)	calculated[15]	NA	NA	NA	NA	NA	NA
ET (hours/day)	8[7]	NA	NA	NA	NA	NA	NA
EF (days/year)	130[7]	NA	NA	NA	NA	NA	NA
Dermal Contact with Surface Water							
C_{sw} (µg/L)	NA	NA	Maximum or 95% UCL[6]	Maximum or 95% UCL[6]	Maximum or 95% UCL[6]	NA	NA
EF (days/year)	NA	NA	48[9]	48[9]	48[9]	NA	NA
ET (hours/day) and t_{event} (hours/event)	NA	NA	1[14]	1[14]	1[14]	NA	NA
EV (events/day)	NA	NA	1[14]	1[14]	1[14]	NA	NA
A (cm^2/day)	NA	NA	4,050[11]	2,800[8]	6,880[16]	NA	NA
K_p (cm/hour)	NA	NA	chemical-specific[8]	chemical-specific[8]	chemical-specific[8]	NA	NA
t* (hour/event), τ (hour), and B (unitless)	NA	NA	chemical-specific[8]	chemical-specific[8]	chemical-specific[8]	NA	NA
CF (L/cm^3)	NA	NA	1E-03	1E-03	1E-03	NA	NA
Incidental Ingestion/Dermal Contact with Sediment							
C_{sed} (mg/kg)	NA	NA	Maximum or 95% UCL[6]	Maximum or 95% UCL[6]	Maximum or 95% UCL[6]	NA	NA
IR (mg/day)	NA	NA	100[2]	200[2]	100[2]	NA	NA
EF-Sediment (days/year)	NA	NA	48[9]	48[9]	48[9]	NA	NA
FI (unitless)	NA	NA	1	1	1	NA	NA
SA (cm^2/day)	NA	NA	4,050[11]	2,800[8]	6,880[16]	NA	NA
AF (mg/cm^2)	NA	NA	1[8]	0.2[8]	0.07[8]	NA	NA
ABS (unitless)	NA	NA	chemical-specific[8]	chemical-specific[8]	chemical-specific[8]	NA	NA
CF (kg/mg)	NA	NA	1E-06	1E-06	1E-06	NA	NA

TABLE C-2
SUMMARY OF EXPOSURE INPUT PARAMETERS
REASONABLE MAXIMUM EXPOSURES
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Exposure Parameter	Construction Worker	Industrial Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	Child Resident	Adult Resident

Notes:

A	Skin surface area available for contact	ED	Exposure duration
ABS	Absorption factor	EF	Exposure frequency
AF	Soil-to-skin adherence factor	ET	Exposure time
AT_c	Averaging time for carcinogenic effects	EV	Event frequency
AT_n	Averaging time for noncarcinogenic effects	FI	Fraction ingested from contaminated source
B	Bunge Model partitioning coefficient	IR	Ingestion rate (soil or groundwater)
BW	Body weight	K_p	Permeability coefficient from water through skin
CF	Conversion factor	SA	Skin surface area available for contact
CR	Contact rate	PEF	Particulate emission factor
$C_{soil/sed}$	Exposure concentration for soil/sediment	τ	Lag time
$C_{gw/sw}$	Exposure concentration for groundwater/surface water	t*	Time it takes to reach steady-state conditions
C_{air}	Exposure concentration for air	t_{event}	Duration of event

1 - USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9365.4-24.
2 - USEPA, 1997: Exposure Factors Handbook. EPA/600/8-95/002FA.
3 - Rhode Island Department of Environmental Management, DEM-DSR-01-93, February 2004.
4 - Adolescent ages 7 to 18 years old.
5 - USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A.
6 - USEPA, 2002. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10.
7 - Assumes a 26 week construction project over a course of one year.
8 - USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. PA/540/R/99/005.
9 - Assumes 4 days a week for 12 weeks.
10 - Although USEPA Region 1 Risk Update No. 2 August 1994 recommends an exposure frequency of 150 days/year, this RI will follow national guidance per USEPA Region I direction September 28, 2006.
11 - Assumes 31 percent of the average total surface area of 1.31 m2 for females and males, ages 7 through 17 years (USEPA, 1997).
12 - Length of a typical work day.
13 - USEPA, 2010: Soil Screening Guidance calculation Internet site at http://risk.lsd.ornl.gov/calc_start.htm. Site-specific values for Hartford, Connecticut.
14 - Professional judgment.
15 - VDEQ September 2004. Virginia Department of Environmental Quality (VDEQ, online -http://www.deq.state.va.us/brownfieldweb/vrp.html).
16 - Assumes 38 percent of the total body surface area.

TABLE C-3
INTERMEDIATE VARIABLES FOR CALCULATING DERMAL ABSORPTION
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical of Potential Concern	Media	Dermal Absorption Fraction (soil)	FA	Kp		T(event)		Tau		T*		B
			Value	Value	Units	Value	Units	Value	Units	Value	Units	Value
Volatile Organic Compounds												
Benzene	Groundwater	NA	1	1.5E-02	cm/hr	(1)	hr	2.9E-01	hr	7.0E-01	hr	5.1E-02
Chloroform	Surface Water	NA	1	6.8E-03	cm/hr	(1)	hr	5.0E-01	hr	1.2E+00	hr	2.9E-02
Semivolatile Organic Compounds												
Benzo(a)anthracene	Soil, Surface Water, Sediment	0.13	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)
Benzo(a)pyrene	Soil, Surface Water, Sediment	0.13	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)
Benzo(b)fluoranthene	Soil, Surface Water, Sediment	0.13	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)
Benzo(g,h,i)perylene	Soil	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	Soil	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	Soil, Sediment	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	Soil, Sediment	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	Soil	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	Soil, Surface Water, Sediment	0.13	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)
Naphthalene	Groundwater, Surface Water	0.13	1	4.7E-02	cm/hr	(1)	hr	5.6E-01	hr	1.3E+00	hr	2.0E-01
Pyrene	Soil	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs												
Aroclor-1254	Soil	0.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Aldehyde	Groundwater	NA	0.8	5.1E-03	cm/hr	(1)	hr	1.4E+01	hr	3.4E+01	hr	3.8E-02
Dioxins/Furans												
2,3,7,8-TCDD Equivalents	Soil, Sediment	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics												
Aluminum	Soil, Groundwater, Surface Water, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Arsenic	Soil, Groundwater, Surface Water, Sediment	0.03	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Beryllium	Soil, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Chromium	Soil, Sediment	0	1	2.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Cobalt	Soil, Groundwater, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Iron	Soil, Groundwater, Surface Water, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Manganese	Soil, Groundwater, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Thallium	Soil, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA

TABLE C-3
INTERMEDIATE VARIABLES FOR CALCULATING DERMAL ABSORPTION
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical of Potential Concern	Media	Dermal Absorption Fraction (soil)	FA	Kp		T(event)		Tau		T*		B
			Value	Value	Units	Value	Units	Value	Units	Value	Units	Value

Notes:
All values from EPA's Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final, July 2004.
1 - T(event) is 8 hrs for RME and 4 hrs for CTE for the construction worker; 1 hr for RME and 0.33 hrs for hypothetical child residents; and 0.58 hrs for RME and 0.25 hr for CTE for hypothetical adult residents.
2 - RAGS Part E recommends not attempting to quantify risk because contaminants are outside the effective predictive domain of the model.
FA = Fraction Absorbed Water
Kp = Dermal Permeability Coefficient of Compound in Water
T(event) = Event Duration
Tau = Lag Time
T* = Time to Reach Steady-State
B = Dimensionless Ratio of the Permeability Coefficient of a Compound Through the Stratum Corneum Relative to its Permeability Coefficient Across the Viable Epidermis
NA = Not applicable.

TABLE C-4
CHEMICAL PROPERTIES FOR VOLATILIZATION FROM SOIL/GROUNDWATER TO OUTDOOR AIR MODELS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical	Molecular Weight (g/mole)	Organic Carbon Partition Coefficient (cm^3/g)	Air Diffusivity (cm^2/sec)	Water Diffusivity (cm^2/sec)	Solubility Limit (mg/L)	Henry's Law Constant (Dimensionless)	Henry's Law Constant ($atm\text{-}m^3/mol$)
Benzene	7.81E+01	1.46E+02	9.00E-02	1.00E-05	1.79E+03	2.30E-01	5.55E-03
Chloroform	1.19E+02	3.18E+01	7.70E-02	1.10E-05	7.95E+03	1.50E-01	3.67E-03
Naphthalene	1.28E+02	1.54E+03	6.00E-02	8.40E-06	3.10E+01	1.80E-02	4.40E-04

Source:
USEPA 2010: USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites, May 2010.

TABLE C-5
INPUT PARAMETERS FOR CALCULATION OF THE
VOLATILIZATION FROM SOIL TO OUTDOOR AIR MODELS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Parameter	Definition	Value	Reference
Q/C	Inverse of mean concentration at center of source (g/m^2-s per kg/m^3).	73.95045	USEPA, 2010
T	Exposure interval (seconds).	9.5E+08	USEPA, 2002
pb	Dry soil bulk density (g/cm^3).	1.5	USEPA, 2002
ps	Soil particle density (g/cm^3).	2.65	USEPA, 2002
θw	Water-filled soil porosity (L_{pore}/L_{soil}).	0.15	USEPA, 2002
n	Total soil porosity (L_{pore}/L_{soil}).	0.434	USEPA, 2002
Di	Diffusivity in air (cm^2/sec).	Chemical specific	USEPA, 2002
H'	Dimensionless Henry's Law Constant.	Chemical specific	USEPA, 2002
S	Solubility limit (mg/L)	Chemical specific	USEPA, 2002
Dw	Diffusivity in water (cm^2/sec).	Chemical specific	USEPA, 2002
Koc	Soil organic carbon partition coefficient (cm^3/g).	Chemical specific	USEPA, 2002
foc	Fraction organic carbon in soil (g/g).	0.006	USEPA, 2002

Notes:
Chemical specific values are presented in Table 6-26.
USEPA 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.
USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/epa/ssl1.shtml.
Site-specific values for Hartford, Connecticut.

TABLE C-6
NON-CANCER TOXICITY DATA - ORAL/DERMAL
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal[1]	Absorbed RfD for Dermal[2]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds										
Benzene	Chronic	4.0E-03	mg/kg/day	1	4.0E-03	mg/kg/day	Blood	300/1	IRIS	1/14/2011
Chloroform	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	100/1	IRS	1/14/2011
Semivolatile Organic Compounds										
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene[3]	Chronic	3.0E-02	mg/kg/day	1	3.0E-02	mg/kg/day	Kidney	3000/1	IRIS	1/14/2011
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	Chronic	4.0E-02	mg/kg/day	1	4.0E-02	mg/kg/day	Liver	3000/1	IRIS	1/14/2011
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	Chronic	2.0E-02	mg/kg/day	1	2.0E-02	mg/kg/day	Body Weight	3000/1	IRIS	1/14/2011
Pyrene	Chronic	3.0E-02	mg/kg/day	1	3.0E-02	mg/kg/day	Kidney	3000/1	IRIS	1/14/2011
Pesticides/PCBs										
Aroclor-1254	Chronic	2.0E-05	mg/kg/day	1	2.0E-05	mg/kg/day	Autoimmune	300/1	IRIS	1/14/2011
Endrin Aldehyde[4]	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Liver	100/1	IRIS	1/14/2011
Dioxins/Furans										
2,3,7,8-TCDD	Chronic	1.0E-09	mg/kg/day	1	1.0E-09	mg/kg/day	Developmental	NA	ATSDR	12/1998
Inorganics										
Aluminum	Chronic	1.0E+00	mg/kg/day	1	1.0E+00	mg/kg/day	CNS	100	PPRTV	10/23/2006
Arsenic	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Skin, CVS	3/1	IRIS	1/14/2011
Beryllium	Chronic	2.0E-03	mg/kg/day	0.007	1.4E-05	mg/kg/day	GS	300/1	IRIS	1/14/2011
Hexavalent Chromium	Chronic	3.0E-03	mg/kg/day	0.025	7.5E-05	mg/kg/day	Fetotoxicity, GS, Bone	300/3	IRIS	1/14/2011
Cobalt	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Blood	NA	PPRTV	8/25/2008
Iron	Chronic	7.0E-01	mg/kg/day	1	7.0E-01	mg/kg/day	GS	1.5	PPRTV	9/11/2006
Manganese (soil)[3]	Chronic	7.0E-02	mg/kg/day	0.04	2.8E-03	mg/kg/day	CNS	1/1	IRIS	1/14/2011
Manganese (water)[3]	Chronic	2.4E-02	mg/kg/day	0.04	9.6E-04	mg/kg/day	CNS	1/3	IRIS	1/14/2011
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
1 - U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.
2 - Adjusted dermal RfD = Oral RfD x Oral Absorption Efficiency for Dermal.
3 - Adjusted IRIS value in accordance with USEPA Region I Risk Update Number 4, November 1996.
4 - Values are for Enrdin.

Definitions:
ATSDR = Agency for Toxic Substances and Disease Registry.
CNS = Central Nervous System
CVS = Cardiovascular system
GS = Gastrointestinal
IRIS = Integrated Risk Information System
NA = Not Available.
PPRTV = Provisional Peer Reviewed Toxicity Value.

TABLE C-7
NON-CANCER TOXICITY DATA - INHALATION
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD[1]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds									
Benzene	Chronic	3.0E-02	mg/m^3	8.6E-03	(mg/kg/day)	Blood	300/1	IRIS	1/14/2011
Chloroform	Chronic	9.8E-02	mg/m^3	2.8E-02	(mg/kg/day)	Liver	NA	ATSDR	9/1997
Semivolatile Organic Compounds									
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	Chronic	3.0E-03	mg/m^3	8.6E-04	(mg/kg/day)	Nasal	3000/1	IRIS	1/14/2011
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs									
Aroclor-1254	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endrin Aldehyde	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxins/Furans									
2,3,7,8-TCDD	Chronic	4.0E-08	mg/m3	1.1E-08	(mg/kg/day)	Liver, Respiratory, Developmental	NA	Cal EPA	9/2009
Inorganics									
Aluminum	Chronic	5.0E-03	mg/m3	1.4E-03	(mg/kg/day)	CNS	300	PPRTV	10/23/2006
Arsenic	Chronic	1.5E-05	mg/m3	4.3E-06	(mg/kg/day)	NA	NA	Cal EPA	9/2009
Beryllium	Chronic	2.0E-05	mg/m3	5.7E-06	(mg/kg/day)	Lungs	10/1	IRIS	1/14/2011
Hexavalent Chromium	Chronic	1.0E-04	mg/m^3	2.9E-05	(mg/kg/day)	Lungs	300/1	IRIS	1/14/2011
Cobalt	Chronic	6.0E-06	mg/m^3	1.7E-06	(mg/kg/day)	Lungs	NA	PPRTV	8/25/2008
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	Chronic	5.0E-05	mg/m^3	1.4E-05	(mg/kg/day)	CNS	1000/1	IRIS	1/14/2011
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
1 - Extrapolated RfD = RfC *$20m^3$/day / 70 kg

Definitions:
CNS = Central Nervous System
IRIS = Integrated Risk Information System
NA = Not Applicable
ATSDR = Agency for Toxic Substances and Disease Registry.
Cal EPA = California Environmental Protection Agency, Technical Support Document for Describing Available Cancer Slope Factors, September 2009.
PPRTV = Provisional Peer Reviewed Toxicity Value.

TABLE C-8
CANCER TOXICITY DATA - ORAL/DERMAL
SITE 12 - TANK FARM 4, DU 4-1
NAVASTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal[1]	Absorbed Cancer Slope Factor for Dermal[2]		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds								
Benzene	5.5E-02	$(mg/kg/day)^{-1}$	1	5.5E-02	$(mg/kg/day)^{-1}$	A / Known human carcinogen	IRIS	1/14/2011
Chloroform	3.1E-02	$(mg/kg/day)^{-1}$	1	3.1E-02	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	Cal EPA	9/2009
Semivolatile Organic Compounds								
Benzo(a)anthracene[3]	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Benzo(a)pyrene[3]	7.3E+00	$(mg/kg/day)^{-1}$	1	7.3E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	1/14/2011
Benzo(b)fluoranthene[3]	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	D (Not classifiable as to human carcinogenicity)	IRIS	1/14/2011
Benzo(k)fluoranthene[3]	7.3E-02	$(mg/kg/day)^{-1}$	1	7.3E-02	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Chrysene[3]	7.3E-03	$(mg/kg/day)^{-1}$	1	7.3E-03	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Dibenzo(a,h)anthracene[3]	7.3E+00	$(mg/kg/day)^{-1}$	1	7.3E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Fluoranthene	NA	NA	NA	NA	NA	D (Not classifiable as to human carcinogenicity)	IRIS	1/14/2011
Indeno(1,2,3-cd)pyrene[3]	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Naphthalene	NA	NA	NA	NA	NA	C / Inadequate data of carcinogenicity in humans	IRIS	1/14/2011
Pyrene	NA	NA	NA	NA	NA	D (Not classifiable as to human carcinogenicity)	IRIS	1/14/2011
Pesticides/PCBs								
Aroclor-1254	2.0E+00	$(mg/kg/day)^{-1}$	1	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(2)	9/1996
Endrin Aldehyde	NA	NA	NA	NA	NA	NA	NA	NA
Dioxins/Furans								
2,3,7,8-TCDD	1.3E+05	$(mg/kg/day)^{-1}$	1	1.3E+05	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	Cal EPA	9/2009
Inorganics								
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	1.5E+00	$(mg/kg/day)^{-1}$	1	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	1/14/2011
Beryllium	NA	NA	NA	NA	NA	Carcinogenic potential cannot be determined	IRIS	1/14/2011
Hexavalent Chromium[3]	5.0E-01	$(mg/kg/day)^{-1}$	0.025	2.0E+01	$(mg/kg/day)^{-1}$	A / Known human carcinogen	NJDEP	4/8/2009
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	D (Not classifiable as to human carcinogenicity)	IRIS	1/14/2011
Thallium	NA	NA	NA	NA	NA	Inadequate information to assess carcinogenic potential	IRIS	1/14/2011

TABLE C-8
CANCER TOXICITY DATA - ORAL/DERMAL
SITE 12 - TANK FARM 4, DU 4-1
NAVASTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal[1]	Absorbed Cancer Slope Factor for Dermal[2]		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)

Notes:

1 - USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.

2 - Adjusted cancer slope factor for dermal = Oral cancer slope factor / Oral Absorption Efficiency for Dermal.

3 - The carcinogenic PAHs and hexavalent chromium are considered to act via the mutagenic mode of action. These chemicals are evaluated in accordance with USEPA's Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (2005).

IRIS = Integrated Risk Information System.

NA = Not Available.

Cal EPA = California Environmental Protection Agency, Technical Support Document for Describing Available Cancer Slope Factors, September 2009.

NJDEP = New Jersey Department of Environmental Protection, Derivation of Ingestion-Based Soil Remediation Criterion for Cr^{+6} Based on the NTP Chronic Bioassay Data for Sodium Dichromate Dihydrate, April 8, 2009.

USEPA(1) = OSWER Directive No.9285.7-75.

USEPA(2) = USEPA, PCBs: Cancer Dose-Response Assessment and Applications to Environmental Mixtures, September 1996, EPA/600/P-96/001F.

TABLE C-9
CANCER TOXICITY DATA - INHALATION
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor[1]		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds							
Benzene	7.8E-06	$(ug/m^3)^{-1}$	2.7E-02	$(mg/kg/day)^{-1}$	A / Known human carcinogen	IRIS	1/14/2011
Chloroform	2.3E-05	$(ug/m^3)^{-1}$	8.1E-02	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	1/14/2011
Semivolatile Organic Compounds							
Benzo(a)anthracene[2]	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	NA	Cal EPA(1)	9/2009
Benzo(a)pyrene[2]	1.1E-03	$(ug/m^3)^{-1}$	3.9E+00	$(mg/kg/day)^{-1}$	NA	Cal EPA(1)	9/2009
Benzo(b)fluoranthene[2]	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	NA	Cal EPA(1)	9/2009
Benzo(g,h,i)perylene	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	1/14/2011
Benzo(k)fluoranthene[2]	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	NA	Cal EPA(1)	9/2009
Chrysene[2]	1.1E-05	$(ug/m^3)^{-1}$	3.9E-02	$(mg/kg/day)^{-1}$	NA	Cal EPA(1)	9/2009
Dibenzo(a,h)anthracene[2]	1.2E-03	$(ug/m^3)^{-1}$	4.2E+00	$(mg/kg/day)^{-1}$	NA	Cal EPA(1)	9/2009
Fluoranthene	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	1/14/2011
Indeno(1,2,3-cd)pyrene[2]	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	NA	Cal EPA(1)	9/2009
Naphthalene	3.4E-05	$(ug/m3)^{-1}$	1.2E-01	$(mg/kg/day)^{-1}$	C/ Possible Human Carcinogen	Cal EPA(2)	8/2004
Pyrene	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	1/14/2011
Pesticides/PCBs							
Aroclor-1254	5.7E-04	$(ug/m^3)^{-1}$	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(2)	9/1996
Endrin Aldehyde	NA	NA	NA	NA	NA	NA	NA
Dioxins/Furans							
2,3,7,8-TCDD	3.8E+01	$(ug/m^3)^{-1}$	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	Cal EPA(1)	9/2009
Inorganics							
Aluminum	NA	NA	NA	NA	NA	NA	NA
Arsenic	4.3E-03	$(ug/m^3)^{-1}$	1.5E+01	$(mg/kg/day)^{-1}$	A / Known human carcinogen	IRIS	1/14/2011
Beryllium	2.4E-03	$(ug/m^3)^{-1}$	8.4E+00	$(mg/kg/day)^{-1}$	B1 / Probable human carcinogen	IRIS	1/14/2011
Hexavalent Chromium[2]	8.4E-02	$(ug/m^3)^{-1}$	2.9E+02	$(mg/kg/day)^{-1}$	A / Known human carcinogen	IRIS	1/14/2011
Cobalt	9.0E-03	$(ug/m^3)^{-1}$	3.2E+01	$(mg/kg/day)^{-1}$	NA	PPRTV	8/25/2008
Iron	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	1/14/2011
Thallium	NA	NA	NA	NA	Inadequate information to assess carcinogenic potential	IRIS	1/14/2011

TABLE C-9
CANCER TOXICITY DATA - INHALATION
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor(1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)

Notes:

1 - Inhalation CSF = Unit Risk * 70 kg / 20m^3/day.

2 - The carcinogenic PAHs and hexavalent chromium are considered to act via the mutagenic mode of action. These chemicals are evaluated in accordance with USEPA's Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (2005).

Definitions:

Cal EPA = California Environmental Protection Agency.

IRIS = Integrated Risk Information System.

NA = Not Available.

USEPA(1) = OSWER Directive No.9285.7-75.

USEPA(2) = USEPA, PCBs: Cancer Dose-Response Assessment and Applications to Environmental Mixtures, September 1996, EPA/600/P-96/001F.

Cal EPA(1) = California Environmental Protection Agency, Technical Support Document for Describing Available Cancer Slope Factors, September 2009.

Cal EPA(2) = Adoption of Unit Risk Values for Naphthalene, August 2004.

PPRTV = Provisional Peer Reviewed Toxicity Value.

TABLE C-10
SUMMARY OF CANCER RISKS AND HAZARD INDICES
REASONABLE MAXIMUM EXPOSURES
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Construction Workers	Surface Soil (0 - 1 Feet)	Incidental Ingestion	4E-06	--	--	Benzo(a)pyrene	0.3	--
		Dermal Contact	1E-06	--	--	--	0.01	--
		Inhalation	3E-07	--	--	--	1	--
		Total	5E-06	--	--	Benzo(a)pyrene	1	--
	All Soil (0 - 10 Feet)	Incidental Ingestion	1E-06	--	--	--	0.3	--
		Dermal Contact	3E-07	--	--	--	0.01	--
		Inhalation	3E-07	--	--	--	2	Manganese
		Total	2E-06	--	--	--	3	Manganese
	Groundwater	Incidental Ingestion	3E-08	--	--	--	0.1	--
		Dermal Contact	2E-08	--	--	--	0.8	--
		Inhalation	3E-10	--	--	--	0.0002	--
		Total	5E-08	--	--	--	0.8	--
	Total Surface Soil and Groundwater		5E-06				2	
	Total All Soil and Groundwater		2E-06				3	
Industrial Workers	Surface Soil (0 - 1 Feet)	Incidental Ingestion	5E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.2	--
		Dermal Contact	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.01	--
		Inhalation	2E-09	--	--	--	0.0003	--
		Total	1E-04	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.2	--
	All Soil (0 - 10 Feet)	Incidental Ingestion	2E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Arsenic	0.2	--
		Dermal Contact	1E-05	--	--	Benzo(a)pyrene, Arsenic	0.02	--
		Inhalation	2E-09	--	--	--	0.0005	--
		Total	3E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Arsenic	0.2	--

TABLE C-10
SUMMARY OF CANCER RISKS AND HAZARD INDICES
REASONABLE MAXIMUM EXPOSURES
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Adolescent Trespassers	Surface Soil (0 - 1 Feet)	Incidental Ingestion	2E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	0.04	--
		Dermal Contact	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	0.008	--
		Inhalation	2E-10	--	--	--	0.00005	--
		Total	6E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.05	--
	All Soil (0 - 10 Feet)	Incidental Ingestion	5E-06	--	--	Benzo(a)pyrene	0.05	--
		Dermal Contact	9E-06	--	--	Benzo(a)pyrene	0.01	--
		Inhalation	2E-10	--	--	--	0.0001	--
		Total	1E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Arsenic	0.07	--
	Surface Water	Dermal Contact	1E-09	--	--	--	0.00002	--
		Total	1E-09	--	--	--	0.00002	--
	Sediment	Incidental Ingestion	2E-06	--	--	--	0.10	--
		Dermal Contact	3E-06	--	--	Arsenic	0.02	--
		Total	5E-06	--	--	Arsenic	0.1	--
	Total Surface Soil, Surface Water, and Sediment		5E-06				0.2	
	Total All Soil, Surface Water, and Sediment		2E-05				0.2	
Child Recreational Users	Surface Soil (0 - 1 Feet)	Incidental Ingestion	1E-04	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.3	--
		Dermal Contact	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	0.010	--
		Inhalation	1E-10	--	--	--	0.00005	--
		Total	1E-04	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene	Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.3	--
	All Soil (0 - 10 Feet)	Incidental Ingestion	3E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Arsenic	0.4	--
		Dermal Contact	9E-06	--	--	Benzo(a)pyrene	0.01	--
		Inhalation	1E-10	--	--	--	0.0001	--
		Total	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.4	--
	Surface Water	Dermal Contact	1E-09	--	--	--	0.00004	--
		Total	1E-09	--	--	--	0.00004	--
	Sediment	Incidental Ingestion	7E-06	--	--	Arsenic	0.7	--
		Dermal Contact	7E-07	--	--	--	0.01	--
		Total	8E-06	--	--	Arsenic	0.7	--
	Total Surface Soil, Surface Water, and Sediment		2E-04				0.9	
	Total All Soil, Surface Water, and Sediment		5E-05				1	

TABLE C-10
SUMMARY OF CANCER RISKS AND HAZARD INDICES
REASONABLE MAXIMUM EXPOSURES
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Adult Recreational Users	Surface Soil (0 - 1 Feet)	Incidental Ingestion	2E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.03	--
		Dermal Contact	8E-06	--	--	Benzo(a)pyrene	0.001	--
		Inhalation	3E-10	--	--	--	0.00005	--
		Total	3E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.03	--
	All Soil (0 - 10 Feet)	Incidental Ingestion	5E-06	--	--	Benzo(a)pyrene, Arsenic	0.04	--
		Dermal Contact	2E-06	--	--	--	0.002	--
		Inhalation	4E-10	--	--	--	0.0001	--
		Total	8E-06	--	--	Benzo(a)pyrene, Arsenic	0.04	--
	Surface Water	Dermal Contact	2E-09	--	--	--	0.00002	--
		Total	2E-09	--	--	--	0.00002	--
	Sediment	Incidental Ingestion	3E-06	--	--	Arsenic	0.07	--
		Dermal Contact	4E-07	--	--	--	0.002	--
		Total	3E-06	--	--	Arsenic	0.07	--
	Total Surface Soil, Surface Water, and Sediment		3E-05				0.1	
	Total All Soil, Surface Water, and Sediment		1E-05				0.1	
Lifelong Recreational Users (Child and Adults)	Surface Soil (0 - 1 Feet)	Incidental Ingestion	1E-04	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene	Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	NA	- -
		Dermal Contact	5E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	NA	- -
		Inhalation	4E-10	- -	- -	- -	NA	- -
		Total	2E-04	- -	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Indeno(1,2,3-cd)pyrene, Arsenic	NA	- -
	All Soil (0 - 10 Feet)	Incidental Ingestion	3E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Arsenic	NA	- -
		Dermal Contact	1E-05	- -	- -	Benzo(a)anthracene, Benzo(a)pyrene	NA	- -
		Inhalation	5E-10	- -	- -	- -	NA	- -
		Total	5E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	NA	- -
	Surface Water	Dermal Contact	4E-09	- -	- -	- -	NA	- -
		Total	4E-09	- -	- -	- -	NA	- -
	Sediment	Incidental Ingestion	1E-05	- -	- -	Arsenic, Chromium	NA	- -
		Dermal Contact	1E-06	- -	- -	- -	NA	- -
		Total	1E-05	- -	- -	Arsenic, Chromium	NA	- -
	Total Surface Soil, Surface Water, and Sediment		2E-04				NA	
	Total All Soil, Surface Water, and Sediment		6E-05				NA	

TABLE C-10
SUMMARY OF CANCER RISKS AND HAZARD INDICES
REASONABLE MAXIMUM EXPOSURES
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Child Residents	Surface Soil (0 - 1 Feet)	Ingestion	8E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	Benzo(k)fluoranthene	2	Target Organs HI < 1
		Dermal Contact	3E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Indeno(1,2,3-cd)pyrene, Arsenic	0.07	--
		Inhalation	2E-09	--	--	--	0.001	--
		Total	1E-03	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	Benzo(k)fluoranthene	2	Target Organs HI < 1
	All Soil (0 - 10 Feet)	Ingestion	2E-04	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Arsenic	Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	3	Target Organs HI < 1
		Dermal Contact	7E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.10	--
		Inhalation	2E-09	--	--	--	0.002	--
		Total	3E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Arsenic	Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	3	Target Organs HI < 1
	Groundwater	Ingestion	7E-05	--	Arsenic	--	29	Cobalt, Manganese, Arsenic, Iron, Endrin Aldehyde
		Dermal Contact	3E-07	--	--	--	3	Manganese
		Inhalation	0E+00	--	--	--	0.0009	--
		Total	7E-05	--	Arsenic	--	31	Cobalt, Manganese, Arsenic, Iron, Endrin Aldehyde
	Total Surface Soil and Groundwater		1E-03				33	
	Total All Soil and Groundwater		3E-04				34	

TABLE C-10
SUMMARY OF CANCER RISKS AND HAZARD INDICES
REASONABLE MAXIMUM EXPOSURES
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Adult Residents	Surface Soil (0 - 1 Feet)	Ingestion	1E-04	--	Benzo(a)anthracene, Benzo(a)pyrene	Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.2	--
		Dermal Contact	6E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	0.01	--
		Inhalation	7E-09	--	--	--	0.001	--
		Total	2E-04	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Indeno(1,2,3-cd)pyrene, Arsenic	0.2	--
	All Soil (0 - 10 Feet)	Ingestion	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Arsenic	0.3	--
		Dermal Contact	2E-05	--	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Arsenic	0.02	--
		Inhalation	8E-09	--	--	--	0.002	--
		Total	6E-05	--	Benzo(a)pyrene, Arsenic	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	0.3	--
	Groundwater	Ingestion	9E-05	--	Arsenic	--	9	Manganese
		Dermal Contact	5E-07	--	--	--	0.9	--
		Inhalation	0E+00	--	--	--	0.0003	--
		Total	9E-05	--	Arsenic	--	10	Manganese
	Total Surface Soil and Groundwater		3E-04				10	
	Total All Soil and Groundwater		1E-04				10	

TABLE C-10
SUMMARY OF CANCER RISKS AND HAZARD INDICES
REASONABLE MAXIMUM EXPOSURES
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Lifelong Residents (Child and Adults)	Surface Soil (0 - 1 Feet)	Ingestion	9E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	Benzo(k)fluoranthene	NA	- -
		Dermal Contact	3E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Arsenic	NA	- -
		Inhalation	9E-09	--	--	--	NA	
		Total	1E-03	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene	Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	Benzo(k)fluoranthene	NA	- -
	All Soil (0 - 10 Feet)	Ingestion	2E-04	--	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Arsenic	Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	NA	- -
		Dermal Contact	8E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	NA	- -
		Inhalation	1E-08	--	--	--	NA	- -
		Total	3E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Arsenic	Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	NA	- -
	Groundwater	Ingestion	2E-04	Arsenic	--	--	NA	- -
		Dermal Contact	8E-07	--	--	--	NA	- -
		Inhalation	0E+00	--	--	--	NA	- -
		Total	2E-04	Arsenic	--	--	NA	- -
	Total Surface Soil and Groundwater		1E-03				NA	
	Total All Soil and Groundwater		5E-04				NA	

Notes:
NA - Not applicable.
A bolded chemical name indicates that chemical is present at naturally occurring levels.

TABLE C-11
RISKS ASSOCIATED WITH NATURALLY OCCURRING CHEMICALS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Receptor	Reasonable Maximum Exposures		Central Tendency Exposure	
	ILCR	HI	ILCR	HI
CONSTRUCTION WORKERS				
Surface Soil				
Site Risk(1)	5E-06	1	2E-06	0.3
Background Risk(2)	1E-06	0.2	6E-07	0.09
Site + Background Risk(3)	7E-06	1	2E-06	0.4
All Soil				
Site Risk	2E-06	3	7E-07	0.6
Background Risk	1E-06	0.2	6E-07	0.07
Site + Background Risk	4E-06	3	1E-06	0.6
Groundwater	5E-08	0.8	6E-09	0.2
Site Totals				
Total Surface Soil and Groundwater	5E-06	2	2E-06	0.5
Total All Soil and Groundwater	2E-06	4	7E-07	0.8
Site and Background Totals				
Total Surface Soil and Groundwater	7E-06	3	2E-06	0.6
Total All Soil and Groundwater	4E-06	4	1E-06	0.8

INDUSTRIAL WORKERS				
Surface Soil				
Site Risk	1E-04	0.2	1E-05	0.07
Background Risk	2E-06	0.01	4E-07	0.006
Site + Background Risk	1E-04	0.2	1E-05	0.07
All Soil				
Site Risk	3E-05	0.2	4E-06	0.09
Background Risk	2E-06	0.01	4E-07	0.006
Site + Background Risk	3E-05	0.2	4E-06	0.09

ADOLESCENT TRESPASSERS				
Surface Soil				
Site Risk	6E-05	0.05	3E-06	0.01
Background Risk	3E-07	0.004	4E-08	0.001
Site + Background Risk	6E-05	0.05	3E-06	0.01
All Soil				
Site Risk	1E-05	0.07	9E-07	0.01
Background Risk	3E-07	0.003	4E-08	0.0009
Site + Background Risk	1E-05	0.07	9E-07	0.01
Surface Water	1E-09	0.00002	1E-10	0.000005
Sediment	5E-06	0.1	9E-07	0.04
Site Totals				
Total Surface Soil, Surface Water and Sediment	6E-05	0.2	4E-06	0.05
Total All Soil, Surface Water and Sediment	2E-05	0.2	2E-06	0.05
Site and Background Totals				
Total Surface Soil, Surface Water and Sediment	6E-05	0.2	4E-06	0.05
Total All Soil, Surface Water and Sediment	2E-05	0.2	2E-06	0.05

TABLE C-11
RISKS ASSOCIATED WITH NATURALLY OCCURRING CHEMICALS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Receptor	Reasonable Maximum Exposures		Central Tendency Exposure	
	ILCR	HI	ILCR	HI
CHILD RECREATIONAL USERS				
Surface Soil				
Site Risk	1E-04	0.3	1E-05	0.07
Background Risk	1E-06	0.03	8E-08	0.007
Site + Background Risk	1E-04	0.3	1E-05	0.07
All Soil				
Site Risk	4E-05	0.4	3E-06	0.09
Background Risk	1E-06	0.02	8E-08	0.006
Site + Background Risk	4E-05	0.4	3E-06	0.1
Surface Water	1E-09	0.00004	9E-11	0.00001
Sediment	8E-06	0.7	6E-07	0.2
Site Totals				
Total Surface Soil, Surface Water and Sediment	2E-04	0.9	1E-05	0.2
Total All Soil, Surface Water and Sediment	5E-05	1	4E-06	0.3
Site and Background Totals				
Total Surface Soil, Surface Water and Sediment	2E-04	1.0	1E-05	0.2
Total All Soil, Surface Water and Sediment	5E-05	1	4E-06	0.3

ADULT RECREATIONAL USERS				
Surface Soil				
Site Risk	3E-05	0.03	1E-06	0.007
Background Risk	4E-07	0.003	3E-08	0.0007
Site + Background Risk	3E-05	0.03	1E-06	0.008
All Soil				
Site Risk	8E-06	0.04	4E-07	0.01
Background Risk	4E-07	0.002	3E-08	0.0006
Site + Background Risk	8E-06	0.04	4E-07	0.01
Surface Water	2E-09	0.00002	2E-10	0.000006
Sediment	3E-06	0.07	2E-07	0.02
Site Totals				
Total Surface Soil, Surface Water and Sediment	3E-05	0.1	1E-06	0.03
Total All Soil, Surface Water and Sediment	1E-05	0.1	6E-07	0.03
Site and Background Totals				
Total Surface Soil, Surface Water and Sediment	3E-05	0.1	1E-06	0.03
Total All Soil, Surface Water and Sediment	1E-05	0.1	7E-07	0.03

TABLE C-11
RISKS ASSOCIATED WITH NATURALLY OCCURRING CHEMICALS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Receptor	Reasonable Maximum Exposures		Central Tendency Exposure	
	ILCR	HI	ILCR	HI
LIFELONG RECREATIONAL USERS				
Surface Soil				
Site Risk	2E-04	NA	1E-05	NA
Background Risk	1E-06	NA	1E-07	NA
Site + Background Risk	2E-04	NA	1E-05	NA
All Soil				
Site Risk	5E-05	NA	4E-06	NA
Background Risk	1E-06	NA	1E-07	NA
Site + Background Risk	5E-05	NA	4E-06	NA
Surface Water	4E-09	NA	3E-10	NA
Sediment	1E-05	NA	9E-07	NA
Site Totals				
Total Surface Soil, Surface Water and Sediment	2E-04	NA	1E-05	NA
Total All Soil, Surface Water and Sediment	6E-05	NA	4E-06	NA
Site and Background Totals				
Total Surface Soil, Surface Water and Sediment	2E-04	NA	1E-05	NA
Total All Soil, Surface Water and Sediment	6E-05	NA	5E-06	NA

CHILD RESIDENTS				
Surface Soil				
Site Risk	1E-03	2	1E-04	0.7
Background Risk	7E-06	0.2	8E-07	0.06
Site + Background Risk	1E-03	2	1E-04	0.7
All Soil				
Site Risk	3E-04	3	3E-05	0.9
Background Risk	7E-06	0.2	8E-07	0.06
Site + Background Risk	3E-04	3	3E-05	0.9
Groundwater	7E-05	31	5E-06	6
Site Totals				
Total Surface Soil and Groundwater	1E-03	33	1E-04	7
Total All Soil and Groundwater	4E-04	34	4E-05	7
Site and Background Totals				
Total Surface Soil and Groundwater	1E-03	33	1E-04	7
Total All Soil and Groundwater	4E-04	34	4E-05	7

TABLE C-11
RISKS ASSOCIATED WITH NATURALLY OCCURRING CHEMICALS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Receptor	Reasonable Maximum Exposures		Central Tendency Exposure	
	ILCR	HI	ILCR	HI
ADULT RESIDENTS				
Surface Soil				
Site Risk	2E-04	0.2	1E-05	0.07
Background Risk	3E-06	0.02	3E-07	0.007
Site + Background Risk	2E-04	0.2	1E-05	0.08
All Soil				
Site Risk	6E-05	0.3	4E-06	0.1
Background Risk	3E-06	0.02	3E-07	0.006
Site + Background Risk	6E-05	0.3	4E-06	0.1
Groundwater	9E-05	10	6E-06	3
Site Totals				
Total Surface Soil and Groundwater	3E-04	10	2E-05	3
Total All Soil and Groundwater	2E-04	10	1E-05	3
Site and Background Totals				
Total Surface Soil and Groundwater	3E-04	10	2E-05	3
Total All Soil and Groundwater	2E-04	10	1E-05	3

LIFELONG RESIDENTS				
Surface Soil				
Site Risk	1E-03	NA	1E-04	NA
Background Risk	1E-05	NA	1E-06	NA
Site + Background Risk	1E-03	NA	1E-04	NA
All Soil				
Site Risk	3E-04	NA	4E-05	NA
Background Risk	1E-05	NA	1E-06	NA
Site + Background Risk	3E-04	NA	4E-05	NA
Groundwater	2E-04	NA	1E-05	NA
Site Totals				
Total Surface Soil and Groundwater	1E-03	NA	2E-04	NA
Total All Soil and Groundwater	5E-04	NA	5E-05	NA
Site and Background Totals				
Total Surface Soil and Groundwater	1E-03	NA	1E-04	NA
Total All Soil and Groundwater	5E-04	NA	5E-05	NA

Notes:
ILCR = Incremental Lifetime Cancer Risk
HI = Hazard Index
1 - Cancer risk or hazard index from only site-related chemicals detected at concentrations exceeding screening levels.
2 - Cancer risk or hazard index from only chemicals present at naturally ocurring levels detected at concentrations exceeding screening levels. Aluminum and chromium were within background levels in surface soil and subsurface soil
No background samples are available for groundwater, surface water, and sediment.
3 - Cancer risk or hazard index from all chemicals detected at concentrations exceeding screening levels.

TABLE C-12
CHEMICALS RETAINED AS CHEMICALS OF CONCERN[1]
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical	Receptor								
	Construction Workers	Industrial Workers	Adolescent Trespassers	Child Recreational Users	Adult Recreational Users	Lifelong Recreational Users	Child Residents	Adult Residents	Lifelong Residents
Surface Soil									
Carcinogenic PAHs						X	X	X	X
Arsenic							X	X	X
All Soil									
Carcinogenic PAHs							X	X	X
Arsenic							X	X	X
Manganese	X								
Groundwater									
Endrin Aldehyde[2]							X		
Arsenic							X	X	
Cobalt							X		
Iron							X		
Manganese							X	X	
Surface Water									
No COCs identified for surface water.									
Sediment									
No COCs identified for sediment.									

(1) A chemical is retained as a COC if it contributed to a total cancer risk greater than 1×10^{-4} or to a target organ hazard index greater than 1 (Table C-10).
(2) Endrin aldehyde was later determined to be a laboratory contaminant, and was eliminated as a COC.

SELECTION OF PRGs
DU 4-1 AT SITE 12 - TANK FARM 4, FEASIBILITY STUDY
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Contaminant of Potential Concern (COPC) (mg/kg)	Site Data [1]				Candidate PRGs					Background [3]		Surface Soil		Subsurface Soil	
	Surface Soil (0-1 foot)		All Soil (0-10 feet)		Risk-Based PRGs [2]		ARAR-Based PRGs					Selected PRGs	Comment	Selected PRGs	Comment
	Concentration	FOD	Concentration	FOD	Cancer	Non-Cancer	RIDEM DEC	RIDEM LC	EPA	Surface Soil	Subsurface Soil				
Residential Use Scenario															
benzo(a)anthracene	24.7	21/24	6	36/66	0.15	NA	0.9	NA	NA	0.077	NA	0.15		0.15	
benzo(a)pyrene	11	21/24	2.7	35/66	0.015	NA	0.4	240	NA	0.089	NA	0.089	5	0.015	
benzo(b)fluoranthene	22.4	22/24	5.5	37/66	0.15	NA	0.9	NA	NA	0.122	NA	0.15		0.15	
benzo(g,h,i)perylene	3.9	21/24	0.96	33/66	NA	NA	0.8	NA	NA	0.097	NA	0.8		0.8	
benzo(k)fluoranthene	8.7	21/24	2.1	34/66	1.5	NA	0.9	NA	NA	0.098	NA	0.9		0.9	
chrysene	2.7	21/24	6.6	36/66	NA	NA	0.4	NA	NA	0.113	NA	0.4		0.4	
dibenzo(a,h)anthracene	1.8	14/24	0.19	20/66	0.015	NA	0.4	NA	NA	NA	NA	0.015		0.015	
fluoranthene	38	22/24	9.2	38/66	NA	NA	20	NA	NA	0.156	NA	20		NA	6
indeno(1,2,3-cd)pyrene	3.9	21/24	0.72	32/66	0.15	NA	0.9	NA	NA	0.111	NA	0.15		0.15	
pyrene	39.4	22/24	9.5	37/66	NA	NA	13	NA	NA	0.142	NA	13		NA	6
benzo(a)pyrene equivalents	NA	22/24	NA	38/66	NA	NA	NA	NA	NA	NA	NA	NA	6	NA	6
1,2,3,4,6,7,8,9-OCDD	NA [4]	24/24	NA [4]	47/47	NA	NA	NA	NA	NA	NA	NA	NA	6	NA	6
2,3,7,8-TCDD TEQs	0.0000031	24/24	0.0000027	47/47	NA	NA	NA	NA	NA	NA	NA	NA	6	NA	4,6
arsenic	15.8	24/24	19.2	66/66	0.39	22	7	NA	NA	19	24	19	5	24	5
beryllium	0.42	24/24	0.39	66/66	NA	NA	1.5	0.6 [9]	NA	0.58	0.63	NA	6	NA	6
cobalt	13.3	24/24	19.1	66/66	NA	NA	NA	NA	NA	9.6	17	NA	6	NA	6
iron	33452	24/24	41025	66/66	NA	NA	NA	NA	NA	24500	38600	NA	6	NA	6
manganese	453	24/24	1065	66/66	NA	NA	390	NA	NA	360	1030	390		1030	5
thallium	3.3	6/24	2.2	16/66	NA	NA	5.5	0.1 [9]	NA	NA	NA	NA	6,9	NA	6
Extractable Petroleum Hydrocarbons	NA	13/18	NA	22/48	NA	NA	500 [7]	NA	NA	NA	NA	NA	7	NA	7
Industrial Use Scenario															
benzo(a)anthracene	24.7	21/24	6	36/66	NA	NA	7.8	NA	NA	0.077	NA	7.8		NA	6
benzo(a)pyrene	11	21/24	2.7	35/66	NA	NA	0.8	240	NA	0.089	NA	0.8		0.8	
benzo(b)fluoranthene	22.4	22/24	5.5	37/66	NA	NA	7.8	NA	NA	0.122	NA	7.8		NA	6
benzo(g,h,i)perylene	3.9	21/24	0.96	33/66	NA	NA	10000	NA	NA	0.097	NA	NA	6	NA	6
benzo(k)fluoranthene	8.7	21/24	2.1	34/66	NA	NA	78	NA	NA	0.098	NA	NA	6	NA	6
chrysene	2.7	21/24	6.6	36/66	NA	NA	780	NA	NA	0.113	NA	NA	6	NA	6
dibenzo(a,h)anthracene	1.8	14/24	0.19	20/66	NA	NA	0.8	NA	NA	NA	NA	0.8		NA	6
fluoranthene	38	22/24	9.2	38/66	NA	NA	10000	NA	NA	0.156	NA	NA	6	NA	6
indeno(1,2,3-cd)pyrene	3.9	21/24	0.72	32/66	NA	NA	7.8	NA	NA	0.111	NA	NA	6	NA	6
pyrene	39.4	22/24	9.5	37/66	NA	NA	10000	NA	NA	0.142	NA	NA	6	NA	6
benzo(a)pyrene equivalents	NA	22/24	NA	38/66	NA	NA	NA	NA	NA	NA	NA	NA	6	NA	6
1,2,3,4,6,7,8,9-OCDD	NA [4]	24/24	NA [4]	47/47	NA	NA	NA	NA	NA	NA	NA	NA	6	NA	6
2,3,7,8-TCDD TEQs	0.0000031	24/24	0.0000027	47/47	NA	NA	NA	NA	NA	NA	NA	NA	4,6	NA	4,6
arsenic	16	24/24	19.2	66/66	NA	NA	7	NA	NA	19	24	19	5	24	5
beryllium	0.42	24/24	0.39	66/66	NA	NA	1.5	0.6 [9]	NA	0.58	0.63	NA	6	NA	6
cobalt	13	24/24	19.1	66/66	NA	NA	NA	NA	NA	9.6	17	NA	6	NA	6
iron	33452	24/24	41025	66/66	NA	NA	NA	NA	NA	24500	38600	NA	6	NA	6
manganese	453	24/24	1065	66/66	NA	585	10000	NA	NA	360	1030	NA	6	1030	5
thallium	3.3	6/24	2.2	16/66	NA	NA	140	0.1 [9]	NA	NA	NA	NA	6	NA	6
Extractable Petroleum Hydrocarbons	NA	13/18	NA	22/48	NA	NA	2500 [7]	NA	NA	NA	NA	NA	7	NA	7

SELECTION OF PRGs
DU 4-1 AT SITE 12 - TANK FARM 4, FEASIBILITY STUDY
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

PRG Selection was conducted as follows: The lowest candidate PRG value was compared to the Site concentration (surface and subsurface); if the Site concentration exceeded the lowest candidate PRG, that value was selected as the PRG and then adjusted to background, if background data was available.

Bold - parameters are COPCs that were retained as COCs through the HHRA in the Data Gaps Assessment Report. Other COCs were identified as exceeding State Criteria, or included in this evaluation by regulatory request.

FOD - Frequency of Detection

DEC - RIDEM Direct Exposure Criteria

LC - RIDEM Leachability Critieria

NA - not applicable

(1) EPCs used to represent Site data are presented in Tables 3.1 (Surface Soil) and 3.2 (All Soil) [RME] of Appendix H-2 of the Data Gaps Assessment Report. Site Concentration is 95% UCLs calculated in the Data Gaps Assessment Report.

(2) Risk-based PRGs are calculated and presented in Appendix B of this FS report.

(3) Background data 95% UPLs are presented for combined background soils, refer to Appendix B, Attachment B2

(4) Dioxin-like congeners are evaluated together as a toxicity equivalency quotient (TEQ)

(5) PRG adjusted based on background

(6) Compound does not pose risk* (see * below) and does not exceed any ARAR.

(7) PRGs are not calculated for TPH under CERCLA

(8) Subsurface Soil PRGs for industrial use soil are applicable only to the 0-2 foot interval

(9) Leachability criteria for metals in soil are minimum concentrations that could provide an exceedance of the aqueous criteria provided in RIDEM Regulations; they do not reflect actual conditions.

* Risk: Cancer risk exceeding 1E-6, or non-cancer risk exceeding hazard quotient of 1

SELECTION OF PRGs - GROUNDWATER
DU 4-1 AT SITE 12 - TANK FARM 4, FEASIBILITY STUDY
NAVSTA NEWPORT, NEWPORT RHODE ISLAND

Contaminant of Potential Concern (COPC)	Site Data [1]		Candidate PRGs (µg/L)				Selected PRGs (µg/L)	Comment
	Groundwater		Risk-Based PRGs [2]		ARAR-Based PRGs			
	Concentration (µg/L)	FOD	Cancer	Non-Cancer	RIDEM GA	EPA MCL		
Residential Use Scenario								
naphthalene	0.19	1/7	NA	NA	100	NA	100	(3)
aluminum	253	2/7	NA	NA	NA	NA	NA	(3)
arsenic	6.3	4/7	0.039	3.3	10	10	10	(4)
cobalt	12.6	7/7	NA	3.3	NA	NA	3.3	
iron	17100	7/7	NA	10900	NA	NA	10900	
manganese	5030	7/7	NA	320	NA	300[5]	300	
Industrial Use Scenario								
None	NA	NA	NA	NA	NA	NA	NA	NA

Bold - COPCs that were retained as Contaminants of Concern (COCs) through the Human Health Risk Assessment in the Data Gaps Assessment Report
Non bold COPCs were detected above screening levels but not retained as COCs after the risk assessment.
µg/L - microgram per liter
FOD - Frequency of Detection
PRG - Preliminary Remediation Goal
MCL - EPA's Maximum Contaminant Level for drinking water
NA - not applicable

(1) The maximum concentration is cited (no 95% Upper Concentration Limit [UCL] is available)
(2) Risk-based PRGs are calculated and presented in Appendix B of this FS report
(3) Compound does not pose risk* (see below) and does not exceed any PRG
(4) Site concentration does not exceed the MCL, which is selected as the PRG over the risk-based value
(5) The EPA health advisory is presented in lieu of an enforacable standard.

* risk: Compound-specific cancer risk exceeding 1E-6, or non-cancer risk exceeding hazard quotient of 1

Appendix D
Ecological Risk Assessment Summary Tables

TABLE D-1
SURFACE SOIL COPC SELECTION
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample of Maximum Concentration(1)	95% UCL	Average of Positive Results(1)	Ecological Effects Quotient(2)				Rationale for Invertebrate/Plant Deletion or Selection	Retain for Food Chain Modeling?
							Invertebrates(3)	Plants(3)	Avian(4)	Mammals(4)		
Volatile Organics (ug/kg)												
2-BUTANONE	6/24	3 J	150	TF4-SB-927-0001	22	35.1	NA	NA	NA	NA	NSL	YES
ACETONE	15/24	3.5 J	160 J	TF4-SB-928-0001	38	34.8	NA	NA	NA	0.06	NSL	YES
M+P-XYLENES	4/24	1.3 J	2.5 J	TF4-SB-939-0001	2.3	1.9	2.6E-05	2.6E-05	6.8E-07	6.8E-07	BSL	NO
TOLUENE	3/24	1.2 J	2	TF4-SB-923-0001, TF4-SB-926-0001	2	1.73	2.7E-05	2.7E-05	1.4E-06	1.4E-06	BSL	NO
TOTAL XYLENES	7/24	0.87 J	2.6 J	TF4-SB-931-0001	2.3	1.87	2.7E-05	2.7E-05	7.0E-07	7E-07	BSL	NO
Semivolatile Organics (ug/kg)												
2,4-DIMETHYLPHENOL	1/24	39 J	39 J	TF4-SB-934-0001	NA	39	NA	3.9	NA	NA	NSL/ASL	YES
2-CHLOROPHENOL	5/24	5.4	8	TF4-SB-939-0001	6.6	6.58	0.8	0.8	NA	0.03	BSL	YES
2-METHYLNAPHTHALENE	4/24	4.7 J	47	TF4-SB-934-0001	20	18.3	0.002	NA	NA	0.0005	BSL/NSL	YES
2-METHYLPHENOL	2/24	4.5	30	TF4-SB-934-0001	30	17.2	0.6	0.6	NA	0.0007	ASL	YES
4-METHYLPHENOL	3/24	5	81	TF4-SB-934-0001	18	47.3	1.6	1.6	NA	0.0005	ASL	YES
ACENAPHTHENE	5/24	6.2	100	TF4-SB-934-0001	100	25.4	0.003	0.005	NA	0.001	BSL	YES
ACENAPHTHYLENE	15/24	4	2500	TF4-SB-934-0001	773	185	0.09	NA	NA	0.03	BSL/NSL	YES
ANTHRACENE	16/24	4.3	8800	TF4-SB-934-0001	4065	573	0.3	3.52	NA	0.09	BSL/ASL	YES
BENZO(A)ANTHRACENE	21/24	8.2	54000	TF4-SB-934-0001	24740	2640	3	NA	NA	49	ASL/NSL	YES
BENZO(A)PYRENE	21/24	8.5	24000	TF4-SB-934-0001	11016	1210	1.3	1.2	NA	22	ASL	YES
BENZO(B)FLUORANTHENE	22/24	4.3 J	49000	TF4-SB-934-0001	22449	2330	2.7	NA	NA	45	ASL/NSL	YES
BENZO(G,H,I)PERYLENE	21/24	6	8500	TF4-SB-934-0001	3916	456	0.5	NA	NA	7.7	BSL/NSL	YES
BENZO(K)FLUORANTHENE	21/24	7.4 J	19000	TF4-SB-934-0001	8730	974	1.1	NA	NA	17	ASL/NSL	YES
BIS(2-ETHYLHEXYL)PHTHALATE	6/24	36 J	320 J	TF4-SB-931-0001	197	126	3.2	3.2	NA	0.3	ASL	YES
CARBAZOLE	1/24	740 J	740 J	TF4-SB-934-0001	NA	740	NA	NA	NA	NA	NSL	YES
CHRYSENE	21/24	12	59000	TF4-SB-934-0001	27035	2890	3.3	NA	NA	54	ASL/NSL	YES
DI-N-BUTYL PHTHALATE	1/24	78 J	78 J	TF4-SB-925-0001	NA	78	0.78	0.0004	NA	0.5	BSL	YES
DIBENZO(A,H)ANTHRACENE	14/24	3.8	3900 J	TF4-SB-934-0001	1813	300	0.2	NA	NA	3.5	BSL/NSL	YES
FLUORANTHENE	22/24	5.1	83000	TF4-SB-934-0001	37997	3890	2.9	1.66	NA	0.8	ASL	YES
FLUORENE	9/24	6.6	470	TF4-SB-934-0001	85	61.8	0.02	NA	NA	0.005	BSL/NSL	YES
INDENO(1,2,3-CD)PYRENE	21/24	5.7 J	8500	TF4-SB-934-0001	3913	450	0.5	NA	NA	7.7	BSL/NSL	YES
NAPHTHALENE	5/24	4.5	21	TF4-SB-931-0001	7.445	8.7	0.001	NA	NA	0.0002	BSL/NSL	YES
PHENANTHRENE	21/24	5.6	440	TF4-SB-934-0001	182	70	0.02	NA	NA	0.004	BSL/NSL	YES
PHENOL	8/24	7.1	68	TF4-SB-934-0001	31	34.1	0.02	0.02	NA	0.0006	BSL	YES
PYRENE	22/24	4.4	86000	TF4-SB-934-0001	39359	4010	4.8	NA	NA	78	ASL/NSL	YES
TOTAL PAHS	22/24	13.8 J	407000 J	TF4-SB-934-0001	186433	19300	NA	NA	NA	NA	NA	NA
Pesticides (ug/kg)												
4,4'-DDD	4/24	6	49	TF4-SB-934-0001	37	24.1	0.004	0.004	0.5	2.3	BSL	YES
4,4'-DDE	3/24	5.1 J	10 J	TF4-SB-921-0001	6.1	8.33	0.0008	0.0008	0.1	0.5	BSL	NO
4,4'-DDT	1/24	10 J	10 J	TF4-SB-934-0001	NA	10	0.0008	0.0008	0.1	0.5	BSL	NO
BETA-BHC	2/24	6.1 J	14	TF4-SB-931-0001	7.2	10	1.6	3.5	NA	NA	ASL	YES
DELTA-BHC	1/24	3.9	3.9	TF4-SB-942-0001	NA	3.9	0.39	0.39	NA	0.0004	BSL	YES
ENDOSULFAN I	1/24	2.5	2.5	TF4-SB-942-0001	NA	2.5	250	250	NA	0.02	ASL	YES
ENDOSULFAN SULFATE	2/24	4.8 J	22 J	TF4-SB-934-0001	22	13.4	2200	2200	NA	0.6	ASL	YES
ENDRIN	1/24	7.9 J	7.9 J	TF4-SB-934-0001	NA	7.9	198	198	NA	0.8	ASL	YES
ENDRIN ALDEHYDE	1/24	35 J	35 J	TF4-SB-934-0001	NA	35	875	875	NA	3.3	ASL	YES
ENDRIN KETONE	2/24	3.7 J	69	TF4-SB-934-0001	44	36.4	1725	1725	NA	6.8	ASL	YES
GAMMA-BHC (LINDANE)	1/24	3.4 J	3.4 J	TF4-SB-931-0001	NA	3.4	68	0.7	NA	0.03	ASL/BSL	YES

TABLE D-1
SURFACE SOIL COPC SELECTION
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample of Maximum Concentration[1]	95% UCL	Average of Positive Results[1]	Ecological Effects Quotient[2]				Rationale for Invertebrate/Plant Deletion or Selection	Retain for Food Chain Modeling?
							Invertebrates[3]	Plants[3]	Avian[4]	Mammals[4]		
TOTAL DDD/DDE/DDT	6/24	5.1 J	59 J	TF4-SB-934-0001	16	21.9	0.005	0.005	0.6	2.8	BSL	YES
TOXAPHENE	1/24	240 J	240 J	TF4-SB-928-0001	NA	240	NA	NA	NA	2.0	NSL	YES
Dioxins (ng/kg)												
TEQ BIRD	24/24	0.301 J	2.76 J	TF5-SB-976-0204	1.6	1.05	NA	NA	NA	NA	NSL	YES
TEQ MAMMAL	24/24	0.842 J	7.18 J	TF5-SB-976-0204	3.0	3.43	NA	NA	NA	NA	NSL	YES
Inorganics (mg/kg)												
ALUMINUM	24/24	4850	15200	TF4-SB-927-0001	10539	9660	NA	pH	NA	NA	NSL/ASL	YES
ARSENIC	24/24	4.2 J	59.5	TF4-SB-943-0001	16	11.8	0.99	3.3	1.4	1.3	BSL/ASL	YES
BARIUM	24/24	13.1	56.7	TF4-SB-927-0001	33	29.6	0.2	0.1	NA	0.03	BSL	YES
BERYLLIUM	24/24	0.096 J	0.7 J	TF4-SB-941-0001	0.42	0.361	0.02	0.07	NA	0.03	BSL	YES
CADMIUM	21/24	0.027 J	0.48	TF4-SB-931-0001	0.23	0.208	0.003	0.02	0.6	1.3	BSL	YES
CALCIUM	21/24	101 J	1900 J	TF4-SB-943-0001	726	599	NA	NA	NA	NA	NUT	NO
CHROMIUM	24/24	8.4 J	20.8	TF4-SB-927-0001	13	12.1	0.3	0.3	0.8	0.6	BSL	NO
COBALT	24/24	4.9 J	20.5 J	TF4-SB-936-0001	13	11.8	NA	1.6	0.2	0.09	NSL/ASL	NO
COPPER	24/24	5.4	25.2	TF4-SB-923-0001	17	14.9	0.3	0.4	0.9	0.5	BSL	NO
IRON	24/24	18000	53200	TF4-SB-936-0001	33452	30200	NA	pH	NA	NA	NSL/BSL	YES
LEAD	24/24	6.9 J	63.5 J	TF4-SB-923-0001	26	21.8	0.04	0.5	5.8	1.1	BSL	YES
MAGNESIUM	24/24	1110 J	3040	TF4-SB-927-0001	2106	1910	NA	NA	NA	NA	NUT	NO
MANGANESE	24/24	144	818	TF4-SB-943-0001	453	391	1.8	3.7	0.2	0.2	ASL	NO
MERCURY	19/24	0.031 J	0.14	TF4-SB-923-0001	0.07	0.063	0.01	0.01	NA	0.09	BSL	YES
NICKEL	24/24	11.5	37.1	TF4-SB-943-0001	25	22.6	0.1	0.98	0.2	0.3	BSL	NO
POTASSIUM	24/24	187 J	545 J	TF4-SB-935-0001	352	318	NA	NA	NA	NA	NUT	NO
SELENIUM	14/24	0.82 J	3.5	TF4-SB-935-0001	1.5	1.39	0.9	6.7	2.9	5.6	BSL/ASL	YES
SILVER	1/24	0.068 J	0.068 J	TF4-SB-935-0001	NA	0.068	NA	0.0001	0.02	0.005	NSL/BSL	NO
SODIUM	21/24	21 J	137 J	TF4-SB-923-0001	57	50.5	NA	NA	NA	NA	NUT	NO
THALLIUM	6/24	2.6	5.3	TF4-SB-943-0001	3.3	3.58	3.8	3.8	NA	93	ASL	YES
VANADIUM	24/24	12.6 J	37.6	TF4-SB-927-0001	23	20.8	0.3	0.3	4.8	0.1	BSL	YES
ZINC	24/24	27.8	125	TF4-SB-936-0001	78	67.6	1.0	0.8	2.7	1.6	ASL/BSL	YES
Miscellaneous Parameters												
pH	1/1	5.1	5.1	TF4-SB-934-0001	NA	5.1	NA	NA	NA	NA	NA	NA

NA = Not Applicable/Value not able to be calculated

1 - Sample and duplicate were averaged for the minimum, maximum, and average concentrations.
2 - Ecological effects quotients were calculated by dividing the maximum detected concentration by the COPC screening level. Values are unitless. The screening levels are provided in Appendix I Table titled "Soil Ecological Screening Levels" in the Data Gaps Assessment Report.
3 - Cells are shaded if the chemical was retained as a COPC for that receptor.
4 - Shading for wildlife receptors indicates that the chemical was retained for food chain modeling. If a screening level was not available for a wildlife receptor or the chemical was retained for the other wildlife receptor, the chemical was retained for food chain modeling .

Associated Samples:

TF4-SB-920-0001
TF4-SB-921-0001
TF4-SB-922-0001
TF4-SB-923-0001
TF4-SB-924-0001
TF4-SB-925-0001
TF4-SB-926-0001
TF4-SB-927-0001
TF4-SB-928-0001
TF4-SB-929-0001
TF4-SB-930-0001
TF4-SB-931-0001
TF4-SB-932-0001
TF4-SB-933-0001
TF4-SB-934-0001
TF4-SB-935-0001
TF4-SB-936-0001
TF4-SB-937-0001
TF4-SB-938-0001
TF4-SB-939-0001
TF4-SB-940-0001
TF4-SB-941-0001
TF4-SB-942-0001
TF4-SB-943-0001

Rationale Codes
For Selection as a COPC:
ASL = Above COPC screening level
NSL = No screening level
For Elimination as a COPC:
BSL = Below COPC screening level
NUT = Essential nutrient

TABLE D-2
SEDIMENT COPC SELECTION
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical	Frequency of Detection	Minimum Concentration[1]	Maximum Concentration[1]	Sample of Maximum Concentration[1]	95% UCL	Average of Positive Results[1]	Ecological Screening Level	Source of Screening Level[2]	Ecological Effects Quotient[3]	Rationale for COPC Selection/ Deletion	Retain for Food Chain Modeling?
Volatile Organics (µg/kg)											
ACETONE	9/12	16	240 J	TF4-SD-907-0006	111	93.4	8.7	SCV[4]	27.6	ASL	YES
CARBON DISULFIDE	2/12	1.9 J	15 J	TF4-SD-912-0006	15	8.45	0.85	SCV	17.6	ASL	YES
Semivolatile Organics (µg/kg)											
2-METHYLNAPHTHALENE	4/12	2.68	10	TF4-SD-903-0006	5.78	5.38	20.2	NOAA[5]	0.5	BSL	YES
2-METHYLPHENOL	2/12	10 J	12 J	TF4-SD-912-0006	10.6	11	12	SCV	1.0	BSL	YES
4-METHYLPHENOL	5/12	3.68	16	TF4-SD-904-0006	8.67	8.12	NA	NA	NA	NSL	YES
ACENAPHTHENE	4/12	5.82 J	19	TF4-SD-905-0006	10.9	10.1	290	NOAA	0.1	BSL	YES
ACENAPHTHYLENE	8/12	4.5	28	TF4-SD-903-0006	11.1	8.54	160	NOAA	0.2	BSL	YES
ANTHRACENE	12/12	6.1	120	TF4-SD-903-0006	52.3	25.3	57.2	TEC	2.1	ASL	YES
BENZALDEHYDE	4/12	64 J	182 J	TF4-SD-911-0006-AVG	178	144	NA	NA	NA	NSL	YES
BENZO(A)ANTHRACENE	12/12	26 J	200 J	TF4-SD-903-0006	99.9	67.5	108	TEC	1.9	ASL	YES
BENZO(A)PYRENE	12/12	23.5 J	210	TF4-SD-903-0006	111	77.5	150	TEC	1.4	ASL	YES
BENZO(B)FLUORANTHENE	12/12	25 J	240 J	TF4-SD-903-0006	127	88.7	1800	NOAA[6]	0.1	BSL	YES
BENZO(G,H,I)PERYLENE	12/12	19.5	150	TF4-SD-903-0006	87.6	61	170	OMOE	0.9	BSL	YES
BENZO(K)FLUORANTHENE	12/12	33 J	200	TF4-SD-903-0006, TF4-SD-907-0006	126	87.6	240	OMOE	0.8	BSL	YES
BIS(2-ETHYLHEXYL)PHTHALATE	8/12	35 J	220 J	TF4-SD-907-0006	171	124	750	NOAA	0.3	BSL	YES
CHRYSENE	12/12	35.5 J	290 J	TF4-SD-903-0006	135	93.1	166	TEC	1.7	ASL	YES
DIBENZO(A,H)ANTHRACENE	12/12	6.6 J	53	TF4-SD-903-0006	27.9	19.4	33	TEC	1.6	ASL	YES
FLUORANTHENE	12/12	49.5 J	330	TF4-SD-903-0006	192	137	423	TEC	0.8	BSL	YES
FLUORENE	8/12	3.9	24	TF4-SD-905-0006	10.1	8.35	77.4	TEC	0.3	BSL	YES
INDENO(1,2,3-CD)PYRENE	12/12	16.5 J	120	TF4-SD-903-0006	72.9	50.9	200	OMOE	0.6	BSL	YES
NAPHTHALENE	8/12	4.1	6	TF4-SD-903-0006	5.2	5.04	176	TEC	0.0	BSL	YES
PHENANTHRENE	12/12	27	190	TF4-SD-905-0006	115	77.8	204	TEC	0.9	BSL	YES
PHENOL	3/12	3.52	15	TF4-SD-905-0006	6.6	7.77	48	NOAA	0.3	BSL	YES
PYRENE	12/12	41.5	260	TF4-SD-903-0006	153	110	195	TEC	1.3	ASL	YES
TOTAL PAHS	12/12	322 J	2400 J	TF4-SD-903-0006	1316	916	1610	TEC	1.5	ASL	YES
Pesticides (ug/kg)											
4,4'-DDD	1/12	3.4	3.4	TF4-SD-910-0006	NA	3.4	4.88	TEC	0.7	BSL	YES
4,4'-DDE	1/12	15 J	15 J	TF4-SD-910-0006	NA	15	3.16	TEC	4.7	ASL	YES
4,4'-DDT	1/12	6.7	6.7	TF4-SD-910-0006	NA	6.7	4.16	TEC	1.6	ASL	YES
ENDRIN ALDEHYDE	1/12	2.72	2.72	TF4-SD-911-0006-AVG	NA	2.72	2.22	TEC	1.2	ASL	YES
ENDRIN KETONE	1/12	20.8 J	20.8 J	TF4-SD-902-0006-AVG	NA	20.8	2.22	TEC	9.4	ASL	YES
TOTAL DDD/DDE/DDT	1/12	25.1 J	25.1 J	TF4-SD-910-0006	NA	25.1	5.28	TEC	4.8	ASL	YES
Dioxins (ng/kg)											
TEQ FISH	12/12	0.376 J	4.26 J	TF4-SD-910-0006	2.68	1.68	NA	NA	NA	NSL	YES
Inorganics (mg/kg)											
ALUMINUM	12/12	4730	12900	TF4-SD-910-0006	10186	8850	25500	NOAA	0.5	BSL	YES
ARSENIC	12/12	9.2	46.6 J	TF4-SD-906-0006	21.1	15.8	9.79	TEC	4.8	ASL	YES
BARIUM	12/12	16.6 J	64.7 J	TF4-SD-906-0006	42.7	33.9	48	NOAA[6]	1.3	ASL	YES
BERYLLIUM	12/12	0.21 J	0.68 J	TF4-SD-910-0006	0.516	0.445	NA	NA	NA	NSL	YES

TABLE D-2
SEDIMENT COPC SELECTION
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
PAGE 2 OF 2

Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample of Maximum Concentration(1)	95% UCL	Average of Positive Results(1)	Ecological Screening Level	Source of Screening Level(2)	Ecological Effects Quotient(3)	Rationale for COPC Selection/ Deletion	Retain for Food Chain Modeling?
CADMIUM	12/12	0.13 J	1.2	TF4-SD-906-0006	0.58	0.415	0.99	TEC	1.2	ASL	YES
CALCIUM	12/12	494 J	1220 J	TF4-SD-911-0006-AVG	952	811	NA	NA	NA	NUT	NO
CHROMIUM	12/12	7.3 J	29.2 J	TF4-SD-902-0006-AVG	18.6	15.4	43.4	TEC	0.7	BSL	YES
COBALT	12/12	9.4	76.2	TF4-SD-906-0006	43.3	19.2	50	NOAA	1.5	ASL	YES
COPPER	12/12	9.8	24.9	TF4-SD-910-0006	19.3	16.8	31.6	TEC	0.8	BSL	YES
IRON	12/12	21700	145000	TF4-SD-906-0006	84616	42300	20000	OMOE	7.3	ASL	YES
LEAD	12/12	6.3 J	96.2 J	TF4-SD-902-0006-AVG	52.8	39.7	35.8	TEC	2.7	ASL	YES
MAGNESIUM	12/12	1370	4160	TF4-SD-906-0006	2813	2440	NA	NA	NA	NUT	NO
MANGANESE	12/12	171	3440	TF4-SD-903-0006	2204	854	460	OMOE	7.5	ASL	YES
MERCURY	12/12	0.019 J	0.17	TF4-SD-909-0006	0.0905	0.0696	0.18	TEC	0.9	BSL	YES
NICKEL	12/12	16.3	132	TF4-SD-906-0006	73.6	32.6	22.7	TEC	5.8	ASL	YES
POTASSIUM	12/12	155 J	583	TF4-SD-910-0006	357	290	NA	NA	NA	NUT	NO
SILVER	1/12	0.12 J	0.12 J	TF4-SD-903-0006	NA	0.12	0.5	OMOE	0.2	BSL	YES
SODIUM	12/12	23.9 J	558	TF4-SD-911-0006-AVG	379	142	NA	NA	NA	NUT	NO
THALLIUM	10/12	0.45 J	11.5	TF4-SD-903-0006	6.68	2.82	NA	NA	NA	NSL	YES
VANADIUM	12/12	9.6	27.2	TF4-SD-910-0006	20.6	17.6	57	NOAA(6)	0.5	BSL	YES
ZINC	12/12	59	199	TF4-SD-906-0006	121	96.8	121	TEC	1.6	ASL	YES
Miscellaneous Parameters											
PH	12/12	4.9	6.6	TF4-SD-911-0006-AVG	NA	5.81	NA	NA	NA	NA	NA
TOTAL ORGANIC CARBON	12/12	15000	50000	TF4-SD-912-0006	NA	30900	NA	NA	NA	NA	NA

NA = Not Applicable/Value not able to be calculated

1 - Sample and duplicate were averaged for the minimum, maximum, and average concentrations.
2 - The sources for the ecological screening levels in order of preference is as follows:
TEC- MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicology. Vol. 39, pp. 20-31.
OMOE - OMOE 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ministry of Environment and Energy. August.
NOAA - Buchman, M. F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration. http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html
SCV - Jones, D.S., G.W. Suter II, and R.N. Hull. 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision. Oak Ridge National Laboratory. ES/ER/TM-95/R4. November.
3 - Ecological effects quotients were calculated by dividing the maximum detected concentration by the COPC screening level. Values are unitless. Cells are shaded if the chemical was retained as a COPC.
4 - Polar nonionic chemical for which the secondary chronic value is likely to be conservative.
5 - Saltwater TEL value.
6 - Saltwater AET value.

Associated Samples:

TF4-SD-901-0006	TF4-SD-904-0006	TF4-SD-907-0006	TF4-SD-910-0006
TF4-SD-902-0006-AVG	TF4-SD-905-0006	TF4-SD-908-0006	TF4-SD-911-0006-AVG
TF4-SD-903-0006	TF4-SD-906-0006	TF4-SD-909-0006	TF4-SD-912-0006

<u>Rationale Codes</u>
For Selection as a COPC:
ASL = Above COPC screening level
NSL = No screening level
For Elimination as a COPC:
BSL = Below COPC screening level
NUT = Essential nutrient

TABLE D-3
SURFACE WATER COPC SELECTION
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Sample of Maximum Concentration(1)	Average of Positive Results(1)	Ecological Screening Level	Source of Screening Level(2)	Ecological Effects Quotient(3)	Rationale for COPC Selection/ Deletion
Semivolatile Organics (ug/L)									
BENZO(A)ANTHRACENE	2/10	0.1 J	0.17 J	TF4-SW-903-0310	0.135	0.027	SCV	6.3	ASL
CHRYSENE	1/10	0.11	0.11	TF4-SW-903-0310	0.11	30	NOAA(4)	0.004	BSL
FLUORANTHENE	1/10	0.16	0.16	TF4-SW-903-0310	0.16	4.4	RIDEM	0.04	BSL
PHENANTHRENE	1/10	0.12	0.12	TF4-SW-903-0310	0.12	6.3	SCV	0.02	BSL
PHENOL	1/10	0.1	0.1	TF4-SW-902-0310-AV	0.1	5.6	RIDEM	0.02	BSL
PYRENE	1/10	0.23	0.23	TF4-SW-903-0310	0.23	0.025	NOAA	9.20	ASL
TOTAL PAHS	2/10	0.1 J	0.79 J	TF4-SW-903-0310	0.445	30	NOAA(4)	0.03	BSL
Inorganics (ug/L)									
ARSENIC	4/10	0.19 J	0.473 J	TF4-SW-901-0310	0.397	150	NRWQC	0.003	BSL
BARIUM	10/10	5.2	10.4	TF4-SW-906-0310	9.28	4	SCV	2.6	ASL
CALCIUM	10/10	10400	15800	TF4-SW-903-0310	14200	NA	NA	NA	NUT
COBALT	10/10	0.297 J	0.931 J	TF4-SW-907-0310	0.453	23	SCV	0.04	BSL
COPPER	10/10	0.807 J	3.7	TF4-SW-901-0310	1.86	9	NRWQC	0.4	BSL
IRON	10/10	270	545	TF4-SW-905-0310	372	1000	NRWQC	0.5	BSL
LEAD	8/10	0.191 J	0.928 J	TF4-SW-907-0310	0.382	2.5	NRWQC	0.4	BSL
MAGNESIUM	10/10	3480	16900	TF4-SW-903-0310	6760	NA	NA	NA	NUT
NICKEL	10/10	1.4	3.5	TF4-SW-907-0310	2.29	52	NRWQC	0.07	BSL
POTASSIUM	10/10	1440	3070	TF4-SW-908-0310	2660	NA	NA	NA	NUT
SELENIUM	9/10	0.154 J	0.231 J	TF4-SW-908-0310	0.199	5	NRWQC	0.05	BSL
SODIUM	10/10	23400	30600	TF4-SW-908-0310	28000	NA	NA	NA	NUT

NA = Not Applicable/Value not able to be calculated
1 - Sample and duplicate were averaged for the minimum, maximum, and average concentrations.
2 - The sources for the ecological screening levels in order of preference is as follows:
NRWQC - USEPA, 2009. National Recommended Water Quality Criteria: 2009. Office of Water.
RIDEM - Rhode Island Deprtment of Environmental Management (RIDEM) 2006. Ambient Water Quality Criteria and Guidelines. Water Resources Division. July.
SCV - Suter, G.W. II. and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Constituents of Concern for Effects on Aquatic Biota:1996 Revision. Environmental Sciences Division, Oak Ridge National Laboratory. ES/ER/TM-96/R2.
NOAA - Buchman, M. F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle, WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration.
3 - Ecological effects quotients were calculated by dividing the maximum detected concentration by the COPC screening level. Values are unitless. Cells are shaded if the chemical was retained as a COPC.
4 - Value is based on the Acute Saltwater value, which was divided by a factor of ten for a chronic value conversion.

Associated Samples:
TF4-SW-901-0310
TF4-SW-902-0310-AVG
TF4-SW-903-0310
TF4-SW-904-0310
TF4-SW-905-0310
TF4-SW-906-0310
TF4-SW-907-0310
TF4-SW-908-0310
TF4-SW-911-0310-AVG
TF4-SW-912-0310

Rationale Codes
For Selection as a COPC:
ASL = Above COPC screening level
NSL = No screening level
For Elimination as a COPC:
BSL = Below COPC screening level
NUT = Essential nutrient

TABLE D-4
TERRESTRIAL FOOD CHAIN MODEL - CONSERVATIVE SCENARIO
INVERTIVOROUS AND HERBIVOROUS RECEPTORS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

	Herbivorous Receptors EEQs				Invertivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		American Robin		Short-Tailed Shrew	
Chemical	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Volatile Organics								
2-BUTANONE	NV	NV	9.7E-06	3.7E-06	NV	NV	9.3E-06	3.6E-06
ACETONE	4.5E-06	4.5E-07	9.2E-03	1.8E-03	1.5E-06	1.5E-07	1.8E-03	3.5E-04
Semivolatile Organics								
2,4-DIMETHYLPHENOL	NV	NV	1.5E-03	3.1E-04	NV	NV	8.6E-04	1.7E-04
2-CHLOROPHENOL	NV	NV	3.6E-03	3.6E-04	NV	NV	1.8E-03	1.8E-04
2-METHYLNAPHTHALENE	3.9E-03	3.9E-04	1.1E-04	2.1E-05	1.2E-02	1.2E-03	2.3E-04	4.3E-05
2-METHYLPHENOL	NV	NV	2.0E-03	6.7E-04	NV	NV	6.6E-04	2.2E-04
4-METHYLPHENOL	NV	NV	NV	NV	NV	NV	NV	NV
ACENAPHTHENE	2.2E-03	2.2E-04	5.2E-05	9.5E-06	1.3E-02	1.3E-03	2.4E-04	4.5E-05
ACENAPHTHYLENE	5.3E-02	5.3E-03	1.2E-03	2.3E-04	4.7E+00	4.7E-01	9.3E-02	1.7E-02
ANTHRACENE	1.7E-01	1.7E-02	3.9E-03	7.1E-04	1.8E+00	1.8E-01	3.5E-02	6.5E-03
BENZO(A)ANTHRACENE	4.3E-01	4.3E-02	4.4E-01	7.0E-03	7.6E+00	7.6E-01	1.5E+01	2.4E-01
BENZO(A)PYRENE	3.3E-01	3.3E-02	6.4E-01	1.0E-02	2.9E+00	2.9E-01	5.7E+00	9.1E-02
BENZO(B)FLUORANTHENE	1.2E+00	1.2E-01	3.0E+00	4.8E-02	1.1E+01	1.1E+00	2.2E+01	3.6E-01
BENZO(G,H,I)PERYLENE	3.2E-01	3.2E-02	9.4E-01	1.5E-02	2.1E+00	2.1E-01	4.4E+00	7.0E-02
BENZO(K)FLUORANTHENE	2.2E-01	2.2E-02	3.7E-01	5.9E-03	4.2E+00	4.2E-01	8.7E+00	1.4E-01
BIS(2-ETHYLHEXYL)PHTHALATE	5.9E-03	5.9E-04	1.7E-04	1.7E-05	5.4E-02	5.4E-03	1.9E-03	1.9E-04
CARBAZOLE	1.5E-02	1.5E-03	3.4E-04	6.2E-05	7.0E-02	7.0E-03	1.2E-03	2.3E-04
CHRYSENE	4.7E-01	4.7E-02	4.7E-01	7.6E-03	1.2E+01	1.2E+00	2.4E+01	3.8E-01
DI-N-BUTYL PHTHALATE	5.1E-02	5.1E-03	9.1E-06	2.7E-06	1.3E-01	1.3E-02	1.6E-05	4.7E-06
DIBENZO(A,H)ANTHRACENE	5.5E-02	5.5E-03	1.1E-01	1.8E-03	7.8E-01	7.8E-02	1.6E+00	2.5E-02
FLUORANTHENE	2.8E+00	2.8E-01	7.4E-02	1.4E-02	2.1E+01	2.1E+00	4.1E-01	7.6E-02
FLUORENE	3.8E-03	3.8E-04	3.8E-05	6.9E-06	3.7E-01	3.7E-02	7.3E-03	1.4E-03
INDENO(1,2,3-CD)PYRENE	1.1E-01	1.1E-02	2.2E-01	3.5E-03	2.1E+00	2.1E-01	4.3E+00	6.8E-02
NAPHTHALENE	1.4E-02	1.4E-03	4.3E-04	8.0E-05	7.7E-03	7.7E-04	1.5E-04	2.8E-05
PHENANTHRENE	3.0E-02	3.0E-03	8.8E-04	1.6E-04	6.7E-02	6.7E-03	1.3E-03	2.3E-04
PHENOL	NV	NV	4.2E-04	2.5E-04	NV	NV	8.1E-05	4.8E-05
PYRENE	3.9E+00	3.9E-01	1.2E+01	1.9E-01	1.3E+01	1.3E+00	2.7E+01	4.3E-01
Pesticides/PCBs								
4,4'-DDD	7.1E-03	6.0E-04	7.5E-03	2.0E-04	2.8E-01	2.4E-02	2.8E-01	7.5E-03
BETA-BHC	8.4E-04	2.1E-04	8.2E-04	1.6E-04	2.1E-02	5.2E-03	1.9E-02	3.8E-03
DELTA-BHC	7.7E-04	1.9E-04	2.9E-02	2.9E-03	5.8E-03	1.4E-03	1.5E-01	1.5E-02
ENDOSULFAN I	1.2E-05	1.2E-06	6.7E-04	6.7E-05	4.7E-05	4.7E-06	1.8E-03	1.8E-04
ENDOSULFAN SULFATE	1.1E-04	1.1E-05	5.9E-03	5.9E-04	4.1E-04	4.1E-05	1.6E-02	1.6E-03
ENDRIN	1.8E-02	1.8E-03	1.1E-03	1.1E-04	4.6E-01	4.6E-02	3.3E-02	3.3E-03
ENDRIN ALDEHYDE	8.2E-02	8.2E-03	4.8E-03	4.8E-04	2.1E+00	2.1E-01	1.5E-01	1.5E-02
ENDRIN KETONE	1.6E-01	1.6E-02	9.4E-03	9.4E-04	4.2E+00	4.2E-01	2.9E-01	2.9E-02
GAMMA-BHC (LINDANE)	7.4E-05	7.4E-06	1.4E-05	1.4E-06	1.4E-03	1.4E-04	2.3E-04	2.3E-05
TOTAL DDD/DDE/DDT	8.3E-03	7.0E-04	8.7E-03	2.3E-04	4.8E-01	4.0E-02	4.8E-01	1.3E-02
TOXAPHENE	NV	NV	4.9E-04	4.9E-05	NV	NV	3.3E-03	3.3E-04
Dioxins								
TEQ BIRD	3.0E-03	3.0E-04	NV	NV	7.1E-01	7.1E-02	NV	NV
TEQ MAMMAL	NV	NV	2.9E-02	2.9E-03	NV	NV	1.7E+01	1.7E+00
Inorganics								
ALUMINUM	2.1E+00	2.1E-01	3.2E+01	3.2E+00	6.3E+00	6.3E-01	1.2E+02	1.2E+01
ARSENIC	5.0E-01	2.5E-01	4.4E-01	1.0E-01	1.0E+00	5.0E-01	6.3E-01	1.4E-01
BARIUM	8.5E-02	4.2E-02	2.3E-02	1.4E-02	1.1E-01	5.6E-02	1.4E-02	8.9E-03
BERYLLIUM	NV	NV	9.8E-02	7.8E-02	NV	NV	1.1E-02	8.3E-03
CADMIUM	3.5E-02	8.0E-03	6.2E-02	6.9E-03	5.2E-01	1.2E-01	6.4E-01	7.2E-02
COBALT	4.2E-02	1.7E-02	1.2E-02	4.8E-03	1.2E-01	5.2E-02	4.5E-02	1.8E-02
COPPER	2.7E-01	3.2E-02	1.5E-01	1.0E-02	6.8E-01	7.9E-02	2.6E-01	1.8E-02
IRON	8.4E+00	8.4E-01	4.9E+00	4.9E-01	2.1E+01	2.1E+00	1.2E+01	1.2E+00
LEAD	7.5E-01	2.7E-02	1.1E-01	2.8E-03	3.3E+00	1.2E-01	5.6E-01	1.4E-02
MERCURY	1.2E+01	1.2E+00	2.4E+00	4.9E-01	1.5E+01	1.5E+00	1.9E+00	3.7E-01
NICKEL	1.1E-01	3.9E-02	1.8E-01	2.1E-02	1.1E+00	3.9E-01	2.5E+00	2.9E-01
SELENIUM	9.2E-01	3.2E-01	1.7E+00	3.6E-01	1.6E+00	5.7E-01	1.8E+00	3.9E-01
THALLIUM	NV	NV	2.8E+00	2.8E-01	NV	NV	7.9E+01	7.9E+00
VANADIUM	1.7E+00	3.4E-01	3.7E-02	1.6E-02	3.6E+00	7.4E-01	6.9E-02	3.1E-02
ZINC	1.4E-01	5.4E-02	1.1E-01	2.8E-02	1.1E+00	4.1E-01	6.0E-01	1.5E-01

TABLE D-4
TERRESTRIAL FOOD CHAIN MODEL - CONSERVATIVE SCENARIO
INVERTIVOROUS AND HERBIVOROUS RECEPTORS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

	Herbivorous Receptors EEQs				Invertivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		American Robin		Short-Tailed Shrew	
Chemical	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL

Cells are shaded if the value is greater than 1.0
NV- Value Not Available/Not Able to be Calculated
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
EEQ - Ecological Effects Quotient

TABLE D-5
TERRESTRIAL FOOD CHAIN MODEL - CONSERVATIVE SCENARIO
PISCIVOROUS RECEPTORS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

	Piscivorous Receptor EEQs			
	Green Heron		Mink	
Chemical	NOAEL	LOAEL	NOAEL	LOAEL
Volatile Organics				
ACETONE	8.7E-06	8.7E-07	1.3E-02	2.5E-03
CARBON DISULFIDE	NV	NV	6.2E-04	3.1E-04
Semivolatile Organics				
2-METHYLNAPHTHALENE	3.7E-03	3.7E-04	8.0E-05	1.5E-05
2-METHYLPHENOL	NV	NV	1.3E-03	4.2E-04
4-METHYLPHENOL	NV	NV	NV	NV
ACENAPHTHENE	2.1E-03	2.1E-04	4.6E-05	8.5E-06
ACENAPHTHYLENE	3.0E-03	3.0E-04	6.8E-05	1.3E-05
ANTHRACENE	1.3E-02	1.3E-03	2.9E-04	5.4E-05
BENZALDEHYDE	NV	NV	4.8E-03	2.4E-03
BENZO(A)ANTHRACENE	2.2E-02	2.2E-03	5.2E-02	8.3E-04
BENZO(A)PYRENE	2.3E-02	2.3E-03	5.4E-02	8.7E-04
BENZO(B)FLUORANTHENE	2.6E-02	2.6E-03	6.2E-02	1.0E-03
BENZO(G,H,I)PERYLENE	1.6E-02	1.6E-03	3.9E-02	6.2E-04
BENZO(K)FLUORANTHENE	2.2E-02	2.2E-03	5.2E-02	8.3E-04
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E-01	1.4E-02	6.3E-03	6.3E-04
CHRYSENE	3.2E-02	3.2E-03	7.5E-02	1.2E-03
DIBENZO(A,H)ANTHRACENE	5.8E-03	5.8E-04	1.4E-02	2.2E-04
FLUORANTHENE	3.6E-02	3.6E-03	8.0E-04	1.5E-04
FLUORENE	2.6E-03	2.6E-04	5.8E-05	1.1E-05
INDENO(1,2,3-CD)PYRENE	1.3E-02	1.3E-03	3.1E-02	5.0E-04
NAPHTHALENE	6.5E-04	6.5E-05	1.5E-05	2.7E-06
PHENANTHRENE	2.1E-02	2.1E-03	4.6E-04	8.5E-05
PHENOL	NV	NV	8.5E-05	5.0E-05
PYRENE	2.8E-02	2.8E-03	6.7E-02	1.1E-03
Pesticides/PCBs				
4,4'-DDD	3.1E-03	2.6E-04	3.6E-03	9.4E-05
4,4'-DDE	3.7E-01	3.1E-02	4.0E-01	1.1E-02
4,4'-DDT	3.6E-02	3.0E-03	4.0E-02	1.0E-03
ENDRIN ALDEHYDE	3.6E-01	3.6E-02	2.8E-02	2.8E-03
ENDRIN KETONE	2.7E+00	2.7E-01	2.1E-01	2.1E-02
TOTAL DDD/DDE/DDT	6.2E-01	5.2E-02	6.8E-01	1.8E-02
Dioxins				
TEQ FISH	7.9E-03	7.9E-04	9.9E-02	9.9E-03
Inorganics				
ALUMINUM	1.9E+01	1.9E+00	8.1E+02	8.1E+01
ARSENIC	2.4E+00	1.2E+00	3.9E+00	8.9E-01
BARIUM	5.1E-01	2.5E-01	1.5E-01	9.4E-02
BERYLLIUM	NV	NV	1.5E-01	1.2E-01
CADMIUM	1.0E+00	2.4E-01	1.4E+00	1.6E-01
CHROMIUM	8.8E-01	1.5E-01	7.5E-01	3.1E-02
COBALT	1.6E+00	6.8E-01	1.3E+00	4.9E-01
COPPER	5.1E+00	5.9E-01	2.6E+00	1.8E-01
IRON	2.4E+02	2.4E+01	3.5E+02	3.5E+01
LEAD	6.0E+00	2.2E-01	1.6E+00	4.0E-02
MANGANESE	3.1E+00	1.5E+00	8.1E+00	2.8E+00
MERCURY	1.2E+01	1.2E+00	1.7E+00	3.5E-01
NICKEL	7.2E+00	2.6E+00	2.1E+01	2.4E+00
SILVER	9.7E-03	3.2E-04	2.4E-03	1.2E-04
THALLIUM	NV	NV	1.9E+02	1.9E+01
VANADIUM	1.3E+01	2.6E+00	7.9E-01	3.5E-01
ZINC	3.5E+00	1.4E+00	2.2E+00	5.6E-01

Cells are shaded if the value is greater than 1.0
NV- Value Not Available/Not Able to be Calculated
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
EEQ - Ecological Effects Quotient

TABLE D-6
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
INVERTIVOROUS AND HERBIVOROUS RECEPTORS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

	Herbivorous Receptors EEQs				Invertivorous Receptors EEQs			
	Bobwhite Quail		Meadow Vole		American Robin		Short-Tailed Shrew	
Chemical	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Semivolatile Organics								
ACENAPHTHYLENE	1.2E-02	1.2E-03	2.0E-04	3.7E-05	1.3E+00	1.3E-01	2.4E-02	4.4E-03
ANTHRACENE	5.3E-02	5.3E-03	8.6E-04	1.6E-04	7.5E-01	7.5E-02	1.3E-02	2.5E-03
BENZO(A)ANTHRACENE	7.6E-02	7.6E-03	5.9E-02	9.5E-04	3.0E+00	3.0E-01	5.7E+00	9.2E-02
BENZO(A)PYRENE	7.7E-02	7.7E-03	1.2E-01	1.8E-03	1.1E+00	1.1E-01	2.1E+00	3.4E-02
BENZO(B)FLUORANTHENE	3.2E-01	3.2E-02	5.7E-01	9.2E-03	4.4E+00	4.4E-01	8.5E+00	1.4E-01
BENZO(G,H,I)PERYLENE	8.6E-02	8.6E-03	1.6E-01	2.6E-03	8.7E-01	8.7E-02	1.7E+00	2.7E-02
BENZO(K)FLUORANTHENE	5.0E-02	5.0E-03	6.7E-02	1.1E-03	1.7E+00	1.7E-01	3.3E+00	5.3E-02
CHRYSENE	8.3E-02	8.3E-03	6.3E-02	1.0E-03	4.7E+00	4.7E-01	9.0E+00	1.4E-01
DIBENZO(A,H)ANTHRACENE	1.3E-02	1.3E-03	2.0E-02	3.3E-04	3.2E-01	3.2E-02	6.1E-01	9.7E-03
FLUORANTHENE	8.3E-01	8.3E-02	1.4E-02	2.7E-03	8.7E+00	8.7E-01	1.6E-01	2.9E-02
INDENO(1,2,3-CD)PYRENE	2.6E-02	2.6E-03	3.8E-02	6.1E-04	8.5E-01	8.5E-02	1.6E+00	2.6E-02
PYRENE	1.2E+00	1.2E-01	2.3E+00	3.7E-02	5.3E+00	5.3E-01	1.0E+01	1.6E-01
Pesticides/PCBs								
ENDRIN ALDEHYDE	3.9E-02	3.9E-03	1.7E-03	1.7E-04	1.9E+00	1.9E-01	1.2E-01	1.2E-02
ENDRIN KETONE	4.9E-02	4.9E-03	2.2E-03	2.2E-04	2.4E+00	2.4E-01	1.5E-01	1.5E-02
Dioxins								
TEQ MAMMAL	NV	NV	2.4E-03	2.4E-04	NV	NV	2.9E+00	2.9E-01
Inorganics								
IRON	1.7E+00	1.7E-01	5.3E-01	5.3E-02	4.9E+00	4.9E-01	2.7E+00	2.7E-01
LEAD	1.6E-01	5.7E-03	2.0E-02	5.1E-04	1.2E+00	4.3E-02	2.2E-01	5.5E-03
MERCURY	5.8E-01	5.8E-02	6.8E-02	1.4E-02	1.0E+01	1.0E+00	1.2E+00	2.4E-01
NICKEL	3.2E-02	1.2E-02	4.4E-02	5.0E-03	6.3E-01	2.3E-01	1.4E+00	1.6E-01
SELENIUM	2.4E-01	8.4E-02	2.8E-01	6.0E-02	6.9E-01	2.4E-01	7.9E-01	1.7E-01
THALLIUM	NV	NV	3.5E-01	3.5E-02	NV	NV	4.0E+01	4.0E+00
VANADIUM	3.4E-01	6.9E-02	4.5E-03	2.0E-03	1.0E+00	2.1E-01	2.5E-02	1.1E-02
ZINC	6.9E-02	2.7E-02	3.5E-02	9.0E-03	8.1E-01	3.1E-01	4.2E-01	1.1E-01

Cells are shaded if the value is greater than 1.0
Only chemicals with EEQs > 1.0 in the conservative food chain model are presented in this table.
NV- Value Not Available/Not Able to be Calculated
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
EEQ - Ecological Effects Quotient

TABLE D-7
TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
PISCIVOROUS RECEPTORS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Chemical	Piscivorous Receptor EEQs			
	Green Heron		Mink	
	NOAEL	LOAEL	NOAEL	LOAEL
Pesticides/PCBs				
ENDRIN KETONE	2.5E+00	2.5E-01	7.8E-02	7.8E-03
Inorganics				
ALUMINUM	1.4E+01	1.4E+00	2.4E+02	2.4E+01
ARSENIC	2.6E-01	1.3E-01	2.0E-01	4.5E-02
CADMIUM	3.6E-02	8.4E-03	2.1E-02	2.4E-03
COBALT	8.5E-01	3.5E-01	2.6E-01	1.0E-01
COPPER	1.1E+00	1.3E-01	2.3E-01	1.6E-02
IRON	1.3E+02	1.3E+01	7.6E+01	7.6E+00
LEAD	5.5E-01	2.0E-02	7.6E-02	1.9E-03
MANGANESE	1.8E+00	8.7E-01	1.9E+00	6.8E-01
MERCURY	2.4E+00	2.4E-01	1.4E-01	2.8E-02
NICKEL	8.3E-01	3.0E-01	1.0E+00	1.2E-01
THALLIUM	NV	NV	4.0E+01	4.0E+00
VANADIUM	8.9E+00	1.8E+00	2.2E-01	9.7E-02
ZINC	5.1E-01	2.0E-01	1.3E-01	3.4E-02

Cells are shaded if the value is greater than 1.0
NV- Value Not Available/Not Able to be Calculated
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
EEQ - Ecological Effects Quotient

TABLE D-8
SUMMARY OF COPCS FOR ECOLOGICAL RISKS RETAINED AFTER STEP 3A
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Assessment Endpoint	Tank Farm 4
Soil Invertebrates	benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and pyrene
Terrestrial Plants	None
Sediment Invertebrates	Manganese
Aquatic Organisms	None
Herbivorous Mammals	None
Herbivorous Birds	None
Invertivorous Mammals	benzo(a)anthracene, benzo(b)fluoranthene, chrysene, and pyrene
Invertivorous Birds	benzo(b)fluoranthene, chrysene, fluoranthene, and pyrene
Piscivorous Mammals	None
Piscivorous Birds	None

Appendix E
ARARs and To Be Considered Guidance

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Federal				
Environmental Protection Agency (EPA) Human Health Assessment Cancer Slope Factors (CSFs)	None	TBC	These are guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	Used to compute the individual incremental cancer risk resulting from exposure to carcinogenic contaminants in site media. Target area removal and Land Use Controls (LUCs) will prevent exposure to Site contaminants exceeding remediation goals (RGs).
Reference Dose (RfD)	None	TBC	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media.	Used to calculate potential non-carcinogenic hazards caused by exposure to contaminants. Target area removal and LUCs will prevent exposure to site contaminants exceeding RGs.
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	TBC	Guidance for assessing cancer risk.	Used to calculate potential carcinogenic risks caused by exposure to contaminants. Target area removal and LUCs will prevent exposure to Site contaminants exceeding RGs.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (March 2005)	TBC	Guidance of assessing cancer risks to children.	Used to calculate potential carcinogenic risks to children caused by exposure to contaminants. Target area removal and LUCs will prevent exposure to Site contaminants exceeding RGs.

TABLE E-1
ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – TARGET AREA EXCAVATION, OFFSITE LANDFILL DISPOSAL, AND LUCS AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
State				
State of Rhode Island Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Short Title: Remediation Regulations)	CRIR 12-180-001, DEM-DSR-01-93, Section 8.02, and 8.03 (with the exception of 8.02A(iv)-TPH)	ARAR - Applicable	These regulations set remediation standards for contaminated media. These standards are applicable to a CERCLA remedy when they are more stringent than federal standards. Establish criteria for groundwater and both direct contact and leachability of contaminants in soil.	Target area removal and LUCs will prevent exposure to site contaminant concentrations exceeding these standards.

TABLE E-2
ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 - TARGET AREA EXCAVATION, OFFSITE LANDFILL DISPOSAL, AND LUCS AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Federal				
Floodplain Management and Protection of Wetlands	44 Code of Federal Regulations (CFR) 9	Relevant and Appropriate	Federal Emergency Management Agency (FEMA) regulations that set forth the policy, procedure, and responsibilities to implement and enforce Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands.	Remedial activities conducted within the 100-year floodplain or within federal jurisdictional wetlands and aquatic habitats will be implemented in compliance with these standards. During the remedial design stage, the effects of soil remedial actions on federal jurisdictional wetlands will be evaluated. All practicable means will be used to minimize harm to the wetlands. Wetlands disturbed by soil remediation will be mitigated in accordance with requirements. Remedial activities will take place in or near floodplains. Target area removal will not affect the floodplain. Public comment has been sought, see responsiveness summary.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Federal (continued)				
Clean Water Act	Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material, 40 CFR 230	Applicable	These regulations outline the requirements for the discharge of dredged or fill materials into surface waters including federal jurisdictional wetlands. No activity that impacts waters of the United States shall be permitted if a practicable alternative that has less adverse impact exists. If there is no other practicable alternative, the impacts must be mitigated.	The Selected Remedy may involve discharge of dredged material and/or excavation. Soil remediation or other remedial actions that include dredging or filling wetlands will meet these requirements, including mitigation of altered wetland/aquatic resources as required. The Navy has determined that this alternative is the Least Environmentally Damaging Practicable Alternative to protect wetland resources because it provides the best balance of addressing contaminated soil within and adjacent to wetlands and waterways with minimizing both temporary and permanent alteration of wetlands and aquatic habitats on site. The Navy solicited public comment on its determination in the Proposed Plan and received no negative public comments.

TABLE E-2
ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 - TARGET AREA EXCAVATION, OFFSITE LANDFILL DISPOSAL, AND LUCS AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
State				
Fresh Water Wetlands Act; DEM Rules And Regulations Governing the Administration and Enforcement of the Fresh Water Wetlands Act (December 2010)	RIGL 2-1,Sections 2-1-18 through 2-1-20.2; Rules 4.00 and 5.00	Applicable	Rules and regulations governing the administration and enforcement of the Fresh Water Wetlands Act. Defines and establishes provisions for the protection of swamps, marshes, and other freshwater wetlands in the state. Actions are required to prevent the undesirable drainage, excavation, filling, alteration, encroachment or any other form of disturbance or destruction of a wetland. Also establishes standards for land within 50 feet of the edge of state-regulated wetlands.	Any excavation and backfill/cover activities will be conducted to minimize the disturbance of state jurisdictional wetland and perimeter wetland.

TABLE E-3
ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 - TARGET AREA EXCAVATION, OFFSITE LANDFILL DISPOSAL, AND LUCS AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Federal				
CWA National Recommended Water Quality Criteria (NRWQC)	40 C.F.R. §122.44	Applicable	Federal NRWQC are health-based and ecologically based criteria developed for carcinogenic and non-carcinogenic compounds.	Water quality standards will be used to develop monitoring standards for remedial work within and adjacent to wetlands/ waterways.
Clean Water Act – National Pollutant Discharge Elimination System (NPDES)	40 C.F.R. Parts 122 and 125	Applicable	Standards for discharge to surface waters.	If work within or adjacent to wetlands requires treating of water before discharge to surface waters, these standards will be met.
Management of Undesirable Plants on Federal Lands	7 U.S.C. §2814	Relevant and Appropriate	Requires federal agencies to establish integrated management systems to control or contain undesirable plant species on federal lands.	Measures will be taken to control invasive plants during the remedial response. An invasive species control plan will be developed and included in the remedial action work plan. The long term maintenance will be transitioned to NAVSTA after the remedy is in place, for inclusion into a base-wide program for controlling undesirable plants.
State				
Clean Air Act - Fugitive Dust Control	RIGL 23-23 *et seq.*; CRIR 12-31-05	Applicable	Requires that reasonable precaution be taken to prevent particulate matter from becoming airborne.	Removal and temporary storage of soil during the implementation of alternative will be conducted in a manner to prevent material from becoming airborne, through use of engineering controls such as water sprays.

TABLE E-3
ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 - TARGET AREA EXCAVATION, OFFSITE LANDFILL DISPOSAL, AND LUCS AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
State (continued)				
Clean Air Act - Emissions Detrimental to Persons or Property	RIGL 23-23 *et seq.*; CRIR 12-31-07	Applicable	Prohibits emissions of contaminants that may be injurious to humans, plant or animal life, or cause damage to property, or that reasonably interferes with the enjoyment of life and property.	Removal and temporary storage of soil during the implementation of alternative will be conducted in a manner to prevent material from becoming airborne. Monitoring of air emissions during removal will be used to assess compliance with the standard.
Soil Erosion and Sediment Control Handbook, 1989	-	To Be Considered	Identifies soil erosion and sediment control (E & SC) requirements for construction activities involving land-disturbance activities.	E & SCs will be used during soil disturbance activities such as excavation.
Standards for Identification and Listing of Hazardous Waste	Rules and Regulations for Hazardous Waste Management, Code of Rhode Island Rules (CRIR), 12-030-003, Rule 5.8	Applicable	Rhode Island is delegated to administer the federal Resource Conservation and Recovery Act (RCRA) statute through its state regulations. Defines the listed and characteristic hazardous wastes.	These regulations apply to all waste generated during actions at the site, such as excavated soil. The cited regulation will be used when determining whether or not a solid waste is hazardous. The soil is not expected to be hazardous.
Standards for Generators of Hazardous Waste	Rules and Regulations for Hazardous Waste Management, CRIR 12-030-003, Rule 5.2, 5.3, and 5.4	Applicable	Establishes accumulation, manifesting, and pre-transport requirements for hazardous waste.	These regulations would apply to any waste generated at the site that is determined to be hazardous, such as excavated soil. The soil is not expected to be hazardous.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
State (continued)				
Rules and Regulations for Groundwater Quality (Well Standards)	RIGL Ch. 46-12, Section 46-12-2; Ch. 46-13.1, Ch. 23-18.9, Sec. 23-18-9.1; Appendix 1	Applicable	Identifies the standards and specifications that must be followed for the installation or abandonment of monitoring wells.	Applies to the abandonment of unused monitoring wells, after they are no longer needed, and if it is necessary to do so.
Rhode Island Solid Waste Regulations – Closure	DEM OWMSW0401, 1.7.14(b)	Relevant and Appropriate	Regulation requires implementation of an approved closure plan	If the remedial action includes removal of solid waste comingled with CERCLA contaminants from the Site, the area will be closed under the substantive provisions of these standards.
Rhode Island Solid Waste Regulations – Dust Control	DEM OWMSW0401, 1.7.10	Relevant and Appropriate	Requires dust control.	Dust will be controlled at the site during removal of solid waste.
Rhode Island Solid Waste Regulations – Sedimentation and Erosion Control	DEM OWMSW0401, 2.1.04	Relevant and Appropriate	Requires development of a “Sedimentation and Erosion Control Plan.”	Sedimentation and erosion controls will be implemented as part of the removal of solid waste.

TABLE E-4
ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs:
GROUNDWATER ALTERNATIVE GW2 – MONITORED NATURAL ATTENUATION, LUCs AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Federal				
EPA Human Health Assessment Cancer Slope Factors (CSFs)	None	TBC	Guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	Used to compute the individual incremental cancer risk resulting from exposure to carcinogenic contaminants in site media. Land Use Controls (LUCs) will temporarily prevent exposure to contaminants in groundwater exceeding risk levels, and MNA will attain cleanup levels within a reasonable time frame.
Reference Dose (RfD)	None	TBC	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media.	Used to calculate potential non-carcinogenic hazards caused by exposure to contaminants. LUCs will temporarily prevent exposure to contaminants in groundwater exceeding risk levels, and MNA will attain cleanup levels within a reasonable time frame.
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	TBC	Guidance for assessing cancer risks.	Used to calculate potential carcinogenic risks caused by exposure to contaminants. LUCs will temporarily prevent exposure to contaminants in groundwater exceeding risk levels, and MNA will attain cleanup levels within a reasonable time frame.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (March 2005)	TBC	Guidance for assessing cancer risks to children.	Used to calculate potential carcinogenic risks to children caused by exposure to contaminants. LUCs will temporarily prevent exposure to contaminants in groundwater exceeding risk levels, and MNA will attain cleanup levels within a reasonable time frame.

TABLE E-4
ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs:
GROUNDWATER ALTERNATIVE GW2 – MONITORED NATURAL ATTENUATION, LUCs AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Federal (continued)				
Safe Drinking Water Act, National Primary Drinking Water Regulations - Maximum Contaminant Levels (MCLs)	42 U.S.C. §300f et seq.; 40 C.F.R. Part 141, Subparts B and G	Relevant and Appropriate	Establishes MCLs for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	Concentrations of contaminants are currently less than MCLs. LUCs will prevent residential use of groundwater. The MCLs will be used as groundwater monitoring standards. Groundwater monitoring may continue after the groundwater RGs are achieved because of the presence subsurface soil contamination. If contamination levels in soil and groundwater are reduced such that no unacceptable risk remains, groundwater monitoring can stop.
Safe Drinking Water Act; National Primary Drinking Water Regulations - Maximum Contaminant Level Goals (MCLGs)	42 U.S.C. §300f et seq.; 40 C.F.R. Part 141, Subpart F	Relevant and Appropriate	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	Concentrations of contaminants are currently less than non-zero MCLGs. The MCLGs will be used as groundwater monitoring standards. LUCs will prevent residential use of groundwater. Groundwater monitoring may continue after the groundwater RGs are achieved because of the presence subsurface soil contamination. Monitoring will verify that non-zero MCLGs are not exceeded. (The MCLG for arsenic is zero.) If contamination levels in soil and groundwater are reduced such that no unacceptable risk remains, groundwater monitoring can stop.
Health Advisories (EPA Office of Drinking Water)		To Be Considered	Health Advisories are estimates of risk from consumption of contaminated drinking water and consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water. The risk-based standard for manganese is 0.3 mg/L.	The Health Advisory standards will be used as groundwater monitoring standards. Groundwater monitoring may continue after the groundwater RGs are achieved because of the presence subsurface soil contamination. If contamination levels in soil and groundwater are reduced such that no unacceptable risk remains, groundwater monitoring can stop.

TABLE E-4
ASSESSMENT OF CHEMICAL-SPECIFIC ARARs AND TBCs:
GROUNDWATER ALTERNATIVE GW2 – MONITORED NATURAL ATTENUATION, LUCs AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
State				
Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Short Title: Remediation Regulations)	Code of Rhode Island Rules (CRIR) 12-180-001, DEM-DSR-01-93, Section 8.02, and 8.03 (with the exception of 8.02A(iv)-TPH)	Applicable	These regulations set remediation standards for contaminated media. These standards are applicable to a CERCLA remedy when they are more stringent than federal standards, though for this site, no COCs are identified for which state standards are more stringent than federal standards.	Concentrations of COCs are already less than State GA Groundwater Objectives. LUCs will temporarily prevent exposure to contaminants in groundwater exceeding risk levels and MNA will attain cleanup levels in a reasonable time frame. Periodic monitoring to be conducted as part of MNA will verify that Groundwater Objectives are not exceeded.

TABLE E-5
ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs:
GROUNDWATER ALTERNATIVE GW2 – MONITORED NATURAL ATTENUATION, LUCs AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Federal				
Floodplain Management and Protection of Wetlands	44 Code of Federal Regulations (CFR) 9	Relevant and Appropriate	Federal Emergency Management Agency (FEMA) regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands.	Remedial activities (such as construction of groundwater monitoring wells) conducted within the 100-year floodplain or within federal jurisdictional wetlands and aquatic habitats will be implemented in compliance with these standards. During the remedial design stage, the effects of MNA on federal jurisdictional wetlands will be evaluated. All practicable means will be used to minimize harm to the wetlands. Wetlands disturbed by MNA activities will be mitigated in accordance with requirements. Remedial activities will take place in or near floodplains. Public comment has been solicited, refer to the responsiveness summary.

TABLE E-5
ASSESSMENT OF LOCATION-SPECIFIC ARARs AND TBCs:
GROUNDWATER ALTERNATIVE GW2 – MONITORED NATURAL ATTENUATION, LUCs AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND

Requirement	Citation	Status	Requirement	Citation
State				
Fresh Water Wetlands Act; DEM Rules and Regulations Governing the Administration and Enforcement of the Fresh Water Wetlands Act (December 2010)	RIGL 2-1, Sections 2-1-18 through 2-1-20.2; Rules 4.00 and 5.00	Applicable	Rules and regulations governing the administration and enforcement of the Fresh Water Wetlands Act. Defines and establishes provisions for the protection of swamps, marshes and other fresh water wetlands in the state. Actions are required to prevent the undesirable drainage, excavation, filling, alteration, encroachment or any other form of disturbance or destruction of a wetland. Also establishes standards for land within 50 feet of the edge of state-regulated wetlands.	Any installation or maintenance of monitoring wells will be conducted to minimize the disturbance of state jurisdictional wetland and perimeter wetland.

TABLE E-6
ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs:
GROUNDWATER ALTERNATIVE GW2 – MONITORED NATURAL ATTENUATION, LUCs AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Federal				
EPA Groundwater Protection Strategy	August 1984; NCP Preamble, Vol. 55, No. 46, March 8, 1990, 40 CFR 300, p. 8733); Guidelines for Ground-Water Classification (November 1986)	TBC	The Groundwater Protection Strategy provides a common reference for preserving clean groundwater and protecting the public health against the effects of past contamination. Guidelines for consistency in groundwater protection programs focus on the highest beneficial use of a groundwater aquifer.	Risk-based standards will be met through MNA within the time frame identified in the text. LUCs will be maintained throughout this period to prevent groundwater use until the cleanup levels are met, and monitoring will confirm that concentrations remain below cleanup levels over time.
Use of Monitored Natural Attenuation (MNA) at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites	OSWER Directive 9200.4-17P (April 21, 1999)	TBC	EPA guidance regarding the use of monitored natural attenuation for the cleanup of contaminated soil and groundwater. In particular, the guidance explains that a reasonable time frame for achieving cleanup standard through monitored attenuation would be comparable to that which could be achieved through active restoration.	MNA is expected to take approximately 45 years to achieve groundwater cleanup standards. Although this is significantly longer that the GW-3 treatment alternative, there are a number of technical issues regarding GW-3 that may alter its effectiveness. If after five years a trend showing MNA cannot be confirmed, an alternative remedy will be considered and after ten years without sufficient contaminant reductions a treatment remedy may be implemented.

TABLE E-6
ASSESSMENT OF ACTION-SPECIFIC ARARs AND TBCs:
GROUNDWATER ALTERNATIVE GW2 – MONITORED NATURAL ATTENUATION, LUCs AND INSPECTIONS
SITE 12 - TANK FARM 4, DU 4-1
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
State				
Standards for Identification and Listing of Hazardous Waste	Rules and Regulations for Hazardous Waste Management, Code of Rhode Island Rules (CRIR), 12-030-003, Rule 5.8	Applicable	Rhode Island is delegated to administer the federal RCRA statute through its state regulations. Defines the listed and characteristic hazardous wastes.	These regulations apply to all waste generated during actions at the site, such as investigation-derived waste (IDW) from monitoring. Will be used when determining whether or not a solid waste is hazardous. IDW is not expected to be hazardous.
Standards for Generators of Hazardous Waste	Rules and Regulations for Hazardous Waste Management, CRIR 12-030-003, Rule 5.2, 5.3, and 5.4	Applicable	Establishes accumulation, manifesting, and pre-transport requirements for hazardous waste.	These regulations would apply to any waste generated at the site that is determined to be hazardous, such as investigation-derived waste (IDW) from monitoring. IDW is not expected to be hazardous.
Drilling of Drinking Water Wells; Rules and Regulations Governing the Enforcement of Chapter 46-13.2 Relating to the Drilling of Drinking Water Wells	Rule 7.01	Applicable	Prohibits installing drinking water wells near pollution sources or potential contamination sources.	LUCs would prevent the installation of residential groundwater wells near pollution sources or potential contamination sources.
Rules and Regulations for Groundwater Quality (Well Standards)	RIGL Ch. 46-12, Section 46-12-2; Ch. 46-13.1, Ch. 23-18.9, Sec. 23-18-9.1; Appendix 1	Applicable	Identifies the standards and specification that must be followed for the installation or abandonment of monitoring wells.	Applies to the abandonment of existing monitoring wells.
Soil Erosion and Sediment Control Handbook, 1989	-	TBC	Identifies soil erosion and sediment control (E & SC) requirements for construction activities involving land-disturbance activities.	E & SCs will be used during soil disturbance activities, such as excavation.

Appendix F
Public Hearing Transcript and Response to Public Comments

RESPONSIVENESS SUMMARY
PROPOSED PLAN
DU 4-1 at Site 12, Tank Farm 4
NAVAL STATION NEWPORT, RHODE ISLAND
COMMENTS RECORDED JUNE 19, 2013

The U.S. Navy (Navy) is pleased to provide the Public with responses to the June 19, 2013 comments on the Proposed Plan for DU 4-1 at Site 12, Tank Farm 4, which is part of Naval Station (NAVSTA) Newport in Newport, Rhode Island. Comments are presented first (italics font), followed by the Navy's responses.

1. My name is Bob Berner, B E R N E R, at 227 Rolling Hill Road in Portsmouth, Rhode Island. What I wanted to comment on was while I am not, I'm new to this subject and this is my second meeting on environmental activities on these tank farms, and I am a resident between Tank Farm 3 and 4, so I have some personal interest. I think I can rest easily because I think the detailed work that is in just these two documents here alone is proven to me at least that we're not playing around. We're sticking to the rules, and the conservatism shown here, I think, I don't think anybody can find any fault with it. So I think that is a job well done. Thank you very much.

Response: The comment is noted.

2. Dave Brown on Newport, RAB member and also have been on the Island Planning Commission and the initial West Side Master Plan. So I too like what you're recommending because it's based on solid analysis. I think your going on the soil from SO2 to SO3 makes good sense assuming that the extra money going to that is not, excuse me, I'm sorry, going from the SO2 to SO3 makes good sense assuming the extra money for that doesn't take money away from other cleanup on the base or on other sites here in the northeast region that might be more important. So the added benefits aren't lost. One plus from the community point of view of going to SO3 seems to me has to do with less need for signs and fencing, and from the community point of view there has been a lot of concern about having Burma Road be for bicycles and be attractive and realize tourism and recreation. So from that point of view it would seem a benefit that is not possible put in your calculation but from the community it would be a plus maybe. And I understand on the water clean up GW2 GW3 may be because it may be pretty uncertain. So again supportive of what you're proposing to do.

Response: The funding for the cleanup is provided independently for each site, and independent of the investigatory efforts at sites that do not yet have remedial decisions associated with them so as to be sure that such funding is not impacted by other decisions. The comment is correct that there is high uncertainty as to the likely success of GW3 and this uncertainty balanced against the cost does not make it as attractive as Alternative GW2. As noted elsewhere in the documentation, the remedial decision is revisited every five years and if it is determined that the selected remedy is not protective, it can be changed through a new evaluation and with public input similar to this process being conducted now.

3. Margaret Kirschner. I'm from Newport. I hoped to comment more extensively, but I would like to state preliminarily thank you very much for your presentation and for all the work that it represents. I am concerned about the expectations of the community that I have seen in the Aquidneck Island Planning Commission plan for the use of that area. And I don't think it pertains to the Navy's property specifically. I think there is a general expectation that people will be fishing and boating and the time period of the attenuation puts that way out into the future. So comes in as the cost savings of the alternative that you're proposing. You're proposing the middle alternative, is that correct?

I think for the cost difference of the two alternatives considering the years of remediation, I don't think we can appreciate what 30 years might mean for the use of the property. I don't think that I can *quantify what 30 years of use might mean for this cost difference. So it's just something that I hope to think about over the next 30 days, and if I can come up with some questions or comments I will. I'm just very aware that with the space and the view and the recreation that usable land that is safe as a goal is something that is hard to quantify cost-wise. Thank you.*

Response: To clarify, the third alternative for soil (SO3), and the second alternative for groundwater (GW2) are proposed. The comment is noted, and the Navy shares Ms. Kirschner's appreciation for the consideration of cost, balanced against restrictions on future land use.

4. (Bob Berner – previously stated)The comment I would make is that I agree with, possibly with the concern, but I haven't heard anything -- based on the remediation that was done at the target range, I haven't heard or seen any other sites along the shoreline in let's say 50 yards from the railroad track to the east. I haven't seen any of those areas being included in any superfund sites or contaminated areas that are going to greatly impact the use of those areas for recreation. I mean I, when I could access the Burma Road, I biked down there everyday. So just my review of the superfund sites, I didn't see anything. So while I understand the concern, I'm not so sure you're going to find anything that is going to deter the development, the planned development of that waterfront or the highway or the bike paths which in all likelihood are going to be a number of years away in any case. But still. I guess I'm agreeing but I haven't seen anything that said there is an issue there.

Response: The selected soil remedy for this site consists of excavation of contaminated soil, land use controls, inspections and monitoring to allow for restricted recreational usage of the site. Additionally, the Navy will review the site every five years and the inspections and monitoring data will be evaluated against the remedial action objectives that are set forth by this decision document to ensure protectiveness of the site.

Proposed Plan
Decision Unit 4-1 at Site 12 - Tank Farm 4
Operable Unit 11
Naval Station (NAVSTA) Newport
Portsmouth, Rhode Island

Public Hearing
Wednesday, June 19, 2013
8:24 p.m.

P R O C E E D I N G S

MR. PARKER: We'll start the hearing. This is the public hearing for the proposed remedial action plan for Decision Unit 4-1 at Site 12 which is Tank Farm 4, at the Naval Station Newport, Portsmouth, Rhode Island.

The purpose of the hearing is to solicit input from the community on this proposed plan. Your comments, if you choose to make comments verbally, will be taken down by the stenographer. They'll be recorded into the record. There will be a response issued by the Navy in a document called Responsiveness Summary. It will be reproduced into the Record of Decision as a record of both the solicitation of your input and our response.

If you choose not to comment verbally, you're welcome to write your comment down on the comment sheet that is on the back of the proposed plan and mail it to Lisa Rama who is the public affairs officer at the Naval Station, Newport. If you would rather email, you can just send an email to Lisa, and her email address is listed in the proposed plan. And if you would like to comment any

other way, we'll take them any other way.

But tonight's effort is intended to allow you to provide verbal comments if you so choose. If you have a comment, I am not going to answer you tonight. As I said, we'll respond in writing.

So I'll open it to the floor and ask anybody to say whatever they like. If you do have a comment, make sure you identify yourself by name and the town that you represent.

Do we have any comments?

MR. BERNER: My name is Bob Berner, B E R N E R, at 227 Rolling Hill Road in Portsmouth, Rhode Island. What I wanted to comment on was while I am not, I'm new to this subject and this is my second meeting on environmental activities on these tank farms, and I am a resident between Tank Farm 3 and 4, so I have some personal interest.

I think I can rest easily because I think the detailed work that is in just these two documents here alone is proven to me at least that we're not playing around. We're sticking to the rules, and the conservatism shown here, I think, I

don't think anybody can find any fault with it. So I think that is a job well done. Thank you very much.

MR. PARKER: Thank you. Do we have anything else?

MR. BROWN: Dave Brown on Newport, RAB member and also have been on the Island Planning Commission and the initial West Side Master Plan. So I too like what you're recommending because it's based on solid analysis.

I think your going on the soil from SO2 to SO3 makes good sense assuming that the extra money going to that is not, excuse me, I'm sorry, going from the SO2 to SO3 makes good sense assuming the extra money for that doesn't take money away from other cleanup on the base or on other sites here in the northeast region that might be more important. So the added benefits aren't lost.

One plus from the community point of view of going to SO3 seems to me has to do with less need for signs and fencing, and from the community point of view there has been a lot of concern about having Burma Road be for bicycles and be attractive and realize tourism and recreation. So from that point of view it would seem a benefit that is not possible put in your calculation but from the community it would be a plus maybe.

And I understand on the water clean up GW2 GW3 may be because it may be pretty uncertain. So again supportive of what you're proposing to do.

MR. PARKER: Thank you. Anything else? If there is nothing else, I'll just say that the comment period extends 30 days starting today. We'll take comments by mail or by fax or by email up until July 19th. That's 30 days. And feel free to provide that input, and we'll be happy to receive those comments.

Is there anything else? Does anybody wants to add?

MS. KIRSCHNER: Margaret Kirschner. I'm from Newport. I hoped to comment more extensively, but I would like to state preliminarily thank you very much for your presentation and for all the work that it represents. I am concerned about the expectations of the community that I have seen in the Aquidneck Island Planning Commission

plan for the use of that area. And I don't think it pertains to the Navy's property specifically. I think there is a general expectation that people will be fishing and boating and the time period of the attenuation puts that way out into the future. So comes in as the cost savings of the alternative that you're proposing. You're proposing the middle alternative, is that correct?

MR. PARKER: Groundwater alternative 2, yes. Combined with soil alternative 3.

MS. KIRSCHNER: I think for the cost difference of the two alternatives considering the years of remediation, I don't think we can appreciate what 30 years might mean for the use of the property. I don't think that I can quantify what 30 years of use might mean for this cost difference.

So it's just something that I hope to think about over the next 30 days, and if I can come up with some questions or comments I will. I'm just very aware that with the space and the view and the recreation that usable land that is safe as a goal is something that is hard to quantify cost-wise.

Thank you.

MR. PARKER: Good. Anything else.

MR. BERNER: Can I have a follow on question to that for a clarification?

MR. PARKER: If you want to ask her a question, that's probably --

MR. BERNER: I'm asking you.

MR. PARKER: I'm not going to answer.

MR. BERNER: That's right.

MR. PARKER: If you want to publicly, we'll talk after if you have a specific question. But if you want to make a comment for the record that you disagree or something like that, that's up to you.

MR. BERNER: The comment I would make is that I agree with, possibly with the concern, but I haven't heard anything -- based on the remediation that was done at the target range, I haven't heard or seen any other sites along the shoreline in let's say 50 yards from the railroad track to the east. I haven't seen any of those areas being included in any superfund sites or contaminated areas that are going to greatly impact the use of those areas for

recreation. I mean I, when I could access the Burma Road, I biked down there everyday. So just my review of the superfund sites, I didn't see anything. So while I understand the concern, I'm not so sure you're going to find anything that is going to deter the development, the planned development of that waterfront or the highway or the bike paths which in all likelihood are going to be a number of years away in any case. But still. I guess I'm agreeing but I haven't seen anything that said there is an issue there.

MR. PARKER: Okay. Well if there is nothing else, we'll close the hearing. I want to thank everybody for coming. I want to thank the Navy and EPA for representing their agencies, and I'll be around for questions, specific questions afterwards.

Thank you.

(The proceedings adjourned at 8:35 p.m.)

CERTIFICATE

I hereby certify that the foregoing __8__ pages contain a full, true and correct transcription of all my stenographic notes to the best of my ability taken in the above-captioned matter at said time and place.

____

Carol DiFazio
Registered Professional Reporter