Corrective Action Plan
Building 44 (Former Pump House)
Gould Island
Revision 2.0

Naval Station Newport
Newport, Rhode Island

Northern Division
Naval Facilities Engineering Command

Contract No. N62472-90-D-1298
Contract Task Order 0143

January 1999

TETRA TECH NUS, INC.

W5298203F

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Building 44 (Former Pump House)
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Naval Station Newport
Newport, Rhode Island

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION - NAVY (CLEAN) CONTRACT

Submitted to:
Northern Division
Environmental Branch, Code 1812BJH
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop No. 2
Lester, Pennsylvania 19113-2090

Submitted by:
Tetra Tech NUS, Inc.
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Contract No. N62472-90-D-1298
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January 1999

SUBMITTED BY:

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STATEMENT OF ACCURACY

As required by the Rhode Island Department of Environmental Management Regulations for Underground Storage Facilities used for Petroleum Products and Hazardous Materials (DEM DWM-UST05-93) Section 14.12 B) (1), effective December 30, 1993, the undersigned (author) certifies that information presented in this Underground Storage Tank (UST) Corrective Action Plan for the Building 44 (Former Pump House) UST Site, Gould Island, at Naval Station Newport, Newport, Rhode Island, is accurate to the degree specified in this report and the Site Investigation Report (Brown & Root Environmental 11/97).

James R. Forrelli
James R. Forrelli, P.E.
Project Manager
Tetra Tech NUS, Inc.

STATEMENT OF ACCURACY

As required by the Rhode Island Department of Environmental Management Regulations for Underground Storage Facilities used for Petroleum Products and Hazardous Materials (DEM DWM-UST05-93) Section 14.12 (B) (2), effective December 30, 1993, the undersigned (facility owner/operator representative) certifies that information presented in this Underground Storage Tank (UST) Corrective Action Plan for the Building 44 (Former Pump House) UST Site, Gould Island, at Naval Station Newport, Newport, Rhode Island, is accurate to the degree specified in this report and the Site Investigation Report (Brown & Root Environmental 11/97).

Peter R. Palmerino
Program Manager USTs
Naval Station Newport

As required by the Rhode Island Department of Environmental Management Regulations for Underground Storage Facilities used for Petroleum Products and Hazardous Materials (DEM DWM-UST05-93) Section 14.12 (B) (2), effective December 30, 1993, the undersigned (facility owner/operator representative) certifies that information presented in this Underground Storage Tank (UST) Corrective Action Plan for the Building 44 (Former Pump House) UST Site, Gould Island, at Naval Station Newport, Newport, Rhode Island, is accurate to the degree specified in this report and the Site Investigation Report (Brown & Root Environmental 11/97).

David D. Dorocz
Division Supervisor, Code 40-E
Environmental Division
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J. C. Wyman
Capt., USN
Public Works Officer
Naval Station Newport

In October 1998 the name of the Navy Education and Training Center (NETC) in Newport, Rhode Island was changed to Naval Station Newport. The text for this Corrective Action Plan was prepared prior to the name change.

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1.0 INTRODUCTION

This Corrective Action Plan (CAP) was prepared to address groundwater and soils contaminated by petroleum hydrocarbons at the former location of seven underground storage tanks (USTs). The USTs were located beneath Building 44 (Former Pump House) on Gould Island at the Naval Education and Training Center (NETC) in Newport, Rhode Island.

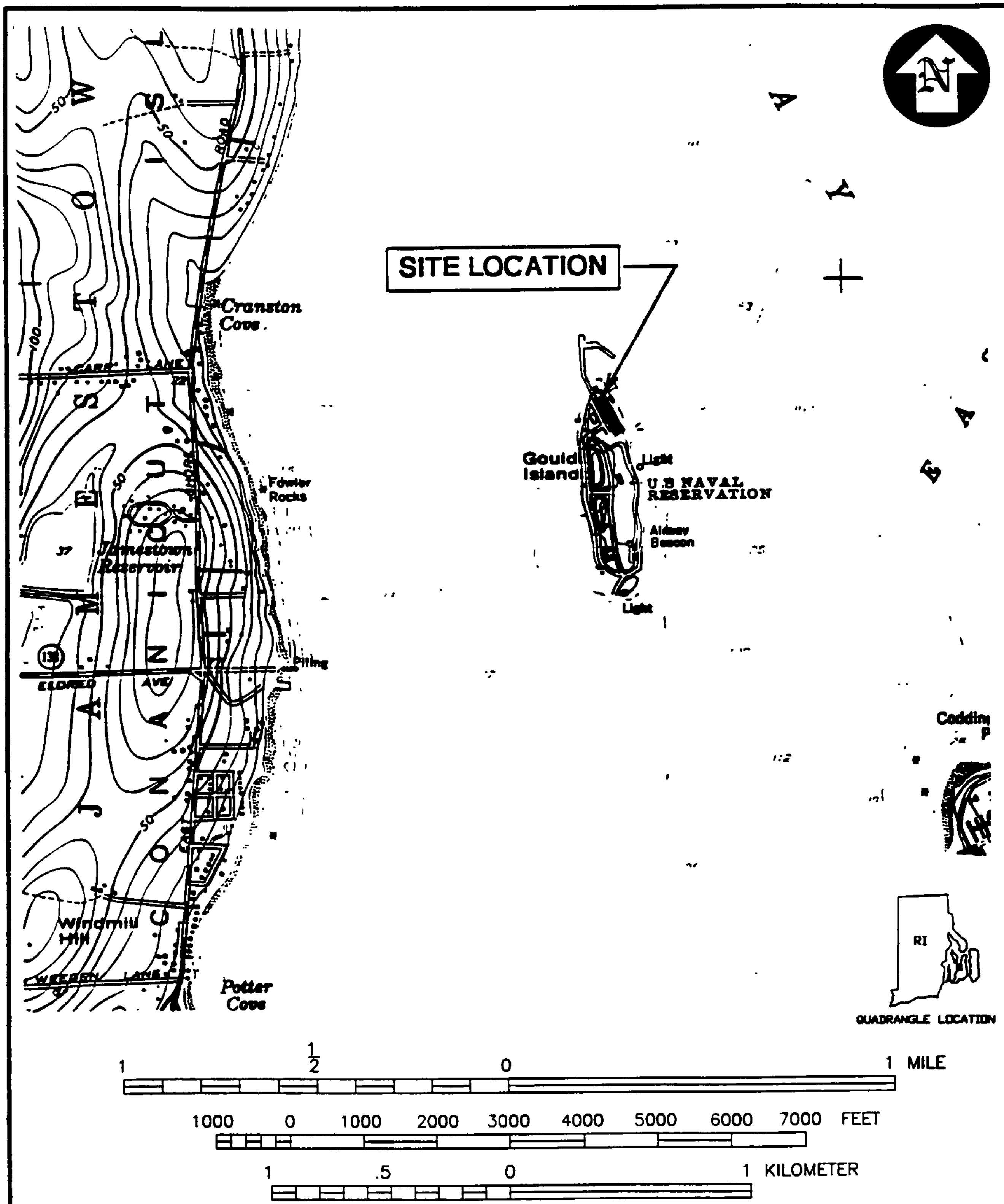
This CAP includes information to satisfy the requirements of the Rhode Island Department of Environmental Management (RIDEM) Underground Storage Tank Section Regulations (DEM-DWM-UST05-93, Sections 14.11 and 14.12).

A summary of findings of the site investigations is presented in Section 2.0. Section 3.0 presents a technology screening evaluation of remedial alternatives that could be used to achieve the Remedial Action Objectives (RAO) for the site. Section 4.0 presents a conceptual design of the selected remedial action. A summary of the interim groundwater monitoring program is discussed in Section 5.0. Section 6.0 provides a schedule of activities for this CAP.

1.1 SITE DESCRIPTION

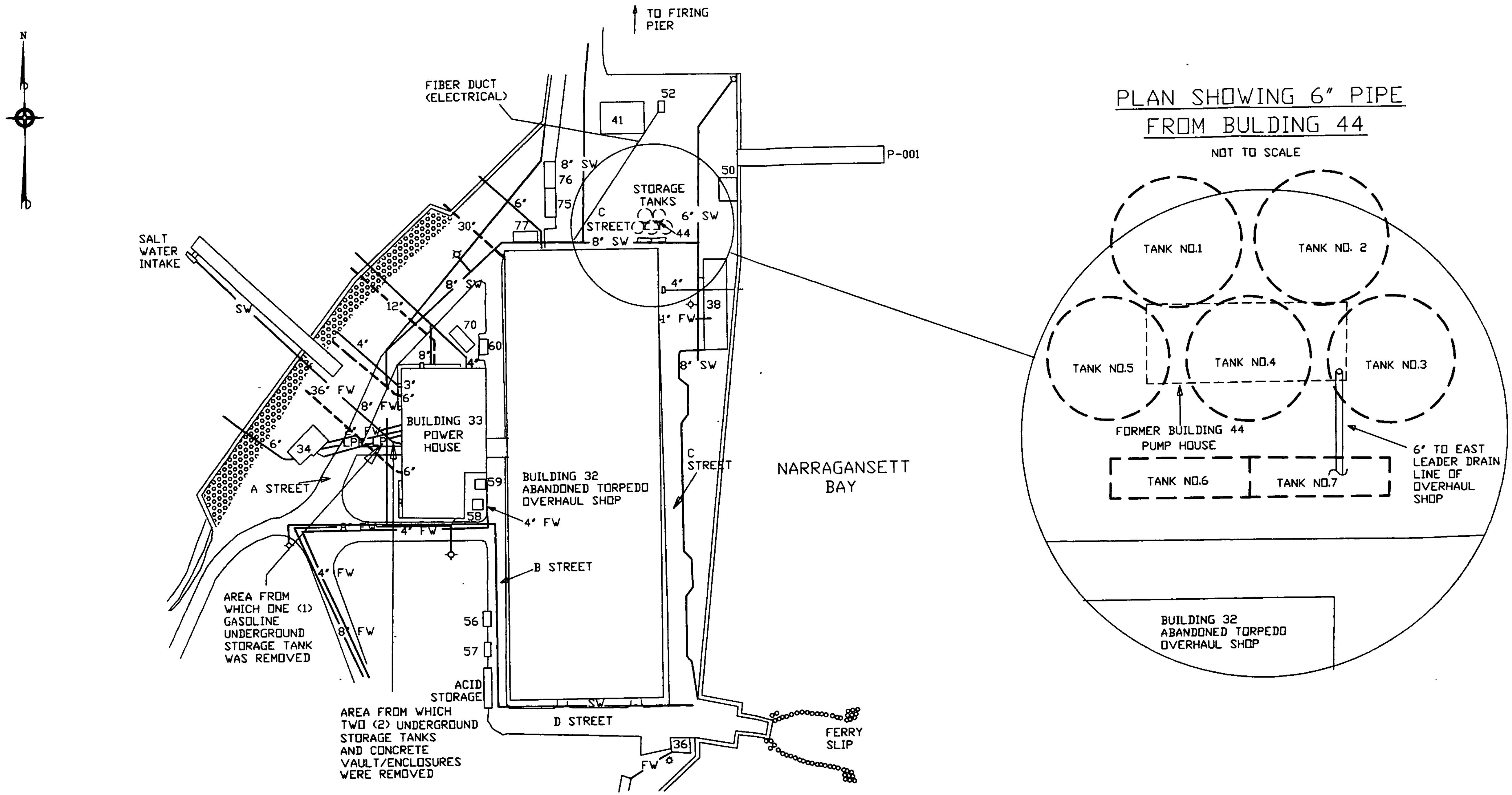
The site is located on the northern end of Gould Island, in the East Passage of Narragansett Bay, approximately 1.5 miles off the coast of Middletown, Rhode Island. Building 44 served as the pump house for seven USTs before it was demolished in 1989. A Navy torpedo testing range is located on the northern tip of the island and is still active. The remainder of the island is inactive. A site location map is presented as Figure 1-1.

The USTs consisted of two 5,000-gallon steel tanks and five 50,000-gallon concrete tanks. These USTs were installed in the 1940s to supply fuel to the power generation plant on Gould Island. The 50,000-gallon USTs were constructed of reinforced concrete and were cast in place. The dimensions of each tank were 10 feet deep by 30 feet across. The UST area is located north of Building 32, the abandoned torpedo overhaul facility. The locations of the former USTs and of Buildings 44 and 32 are shown on Figure 1-2.



SITE LOCATION MAP	FIGURE 1-1
BUILDING 44 (FORMER PUMP HOUSE)	TETRA TECH NUS, INC.
GOULD ISLAND - JAMESTOWN, RI	55 Jonspin Road (508)658-7899 Wilmington, MA 01887

DRAWN BY:	R. DEWSNAP	REV.:	0
CHECKED BY:	D. CONAN	DATE:	OCTOBER 29, 1998
SCALE:	AS SHOWN	PROJECT NO:	



NOTES:

GRAPHIC SCALE

0' 300' 600'

1 INCH = 300 FEET

SITE PLAN	FIGURE 1-2
BUILDING 44 (FORMER PUMP HOUSE)	TETRA TECH NUS, INC.
GOULD ISLAND – JAMESTOWN, RHODE ISLAND	55 Jonspin Road Wilmington, MA 01887 (978)658-7899

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	D. CONAN	DATE:	OCTOBER 29, 1998
SCALE:	1" = 300'	FILE NO.:	DWG\NETC\GOULD\CAP\FIG_1-2

1.2 SITE BACKGROUND

The UST Closure Assessment report prepared by Environmental Resource Associates, Incorporated (September 1994) indicates that three of the concrete tanks stored No. 5 fuel oil and two stored No. 2 fuel oil. One of the steel USTs stored No. 2 fuel oil and the other stored alcohol. In 1989, a contract was issued by NETC to close the USTs and demolish Building 44. As a result, the two 5,000-gallon USTs were emptied and removed from the site. The five 50,000-gallon USTs were emptied and cleaned, the tank covers (tops) were destroyed, and the tanks were backfilled with clean fill.

The site was investigated in several stages between 1994 and 1997. The findings of the investigations are presented in the UST Closure Assessment Report (Environmental Resource Associates, Inc., September, 1994); Site Assessment Report (Quad Three Group (Q3G), May 1995); Phase I Environmental Assessment (Q3G, May 1996); Supplemental Site Investigation (Q3G, January, 1997); and Site Investigation (SI) Report (Brown & Root Environmental, November, 1997). In addition, supplemental groundwater lead sampling and product baildown tests were performed in March 1998. The results are presented in a letter report provided in Appendix A. A summary of the findings from the investigations is presented in Section 2.0.

1.3 ACTION LEVELS AND STANDARDS

Rhode Island regulatory requirements were reviewed to determine action levels for the Former Building 44 UST Site.

The Rhode Island <u>Regulations for Underground Storage Facilities Used for Petroleum Products and Hazardous Materials</u> establish procedures and requirements for assessing and remediating sites contaminated by releases associated with underground storage of petroleum products. Requirements for leak and spill response including free product removal, site investigations, and corrective action plans are provided under these regulations.

Under the Rhode Island <u>Rules and Regulations for Groundwater Quality</u> (August 1996), the groundwater at the site has been classified by RIDEM as class GA, suitable for public or private drinking water use without treatment. RIDEM has established numerical groundwater quality standards for specific substances to determine compliance with the GA groundwater classification. The 1997 SI groundwater analytical results were compared against the numerical class GA groundwater standards to determine standard exceedances.

Under the Rhode Island Water Quality Regulations (August 1996), RIDEM has assigned a surface water classification of SA to the portion of Narragansett Bay that surrounds Gould Island. Class SA waters are protected for the following uses: shellfish harvesting for direct human consumption, primary and secondary contact recreational activities, and fish and wildlife habitat. Class SA waters are suitable for aquaculture uses and navigation and industrial cooling, and shall have good aesthetic value. Under these regulations, no discharge of pollutants shall be allowed that violates any water quality criterion or interferes with the designated uses.

No action level for soils has been set by RIDEM for the Building 44 UST Site. Although not applicable to petroleum UST sites, the Rhode Island Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (August 1996) contain a Method 1 GA TPH Leachability Criteria of 500 ppm and a Method 1 Industrial Direct Exposure Criterion of 2,500 ppm. These criterion were used as action levels for the Building 44 UST Site based on the fact that the land use is non-residential, that access to the site is limited to workers temporarily visiting the site, and that no drinking water wells are present on Gould Island. RIDEM recently proposed a TPH standard of 2,500 mg/kg for UST sites. Corrective actions for the Building 44 UST Site will follow the TPH action level applicable at the time the plan is implemented.

2.0 SUMMARY OF FINDINGS

This section describes the data collected during the site investigations performed at Building 44 (Former Pump House) on Gould Island. These findings are fully described in the UST site investigation reports (see Section 1.2).

2.1 SOIL GAS SURVEY RESULTS

On September 18 and 19, 1996, a Gore-Sorber soil gas survey was conducted at the former Building 44 UST location. Sixty-nine modules were installed in a grid pattern on 25-foot centers to provide a preliminary delineation of site-related contaminants. The modules were installed in 3/4-inch-diameter, 2.5-feet deep pilot holes and were sealed with cork stoppers. The modules were left in place for 2 weeks before being removed and shipped off site for laboratory analysis.

The soil gas survey analytical results identified petroleum-related compounds throughout the study area. Benzene, toluene, ethylbenzene, and xylenes (BTEX) were identified at various concentrations in all 69 modules. TCE was also identified with some regularity throughout the study area.

In addition to the soil gas survey, seven soil samples were randomly collected from the Gore-Sorber survey grid area during the same time period. Analysis of the samples showed low concentrations of methyl t-butyl ether, BTEX, undecane, tridecane, pentadecane, and napthalene. Comparison of the soil sample results to the Gore-Sorber soil gas survey by Quad 3 Group concluded that the source of contaminants identified by the Gore-Sorber soil gas survey was contaminated groundwater, with no direct correlation to the contamination identified in the soil sampling.

2.2 SOIL AND GROUNDWATER SAMPLE RESULTS

During the site investigations conducted between 1995 and 1997, numerous soil and groundwater samples were collected in the vicinity of the former USTs associated with Building 44. The samples were analyzed for parameters such as TPH, diesel range organics (DRO), gasoline range organics (GRO), VOCs, SVOCs, and RCRA metals. Results of the sampling are presented in the following sections.

2.2.1 Test Pits

As part of the SI, on July 11, 1997 seven test pits were excavated in the vicinity of the former USTs. Four of the test pits were excavated to determine the exact tank locations and three were excavated to investigate anomalies identified during the geophysical survey performed during the January 1997 Supplemental SI. Of the three test pits excavated to investigate anomalies, floating product was observed in TP1 and TP3, and black-stained soil was observed in TP2. No observations were reported for the four test pits excavated to identify the tanks location.

2.2.2 Subsurface Soil Sample Analysis

Split-spoon soil samples were collected from the nine soil borings installed at the site from April 10 through 12, 1995. Samples were collected at 5-foot intervals during installation of the borings and were screened for the presence of purgeable volatile constituents with a photoionization detector (PID) before being sent off site for TPH-DRO analysis. Results of the soil sampling show TPH-DRO to be present in four of the nine soil borings at a depth of 10 to 12 feet below the ground surface. One of the nine soil samples detected TPH-DRO between 15 and 17 feet below the ground surface.

Soil samples were also collected in the vicinity of former Building 44 during September and October of 1996 as part of the SI. The seven random soil samples collected during this event were obtained with a hand auger at depths of from 2.5 to 3.0 feet below ground surface. Results from this sampling event detected low concentrations of methyl t-butyl ether (MTBE) (19.7 ppb), BTEX (227.3 ppb), undecane (94.6 ppb), tridecane (167 ppb), pentadecane (366 ppb), and naphthalene (12.2 ppb). Cadmium (3.4 ppm), chromium (171 ppm), and lead (93 ppm) were also detected in the soil samples. The presence of these metals was attributed to sources other than the former USTs. Total Recoverable Petroleum Hydrocarbons (TRPH) were detected in each of the seven samples, GRO were detected at low levels in two samples, and DRO were detected in one sample.

The SI Report indicates that ten subsurface soil samples collected in July 1997 were taken from nine of the borings that were installed and completed as monitoring wells. Analytical testing was performed for TPH, VOCs, SVOCs, and RCRA metals. TPH was detected in all of the samples except the one from SB14. Four SVOC compounds that exceed RIDEM criteria were identified in the soil sample collected from SB07. These include benzo(a)pyrene at 0.91 mg/kg, benzo(a)anthracene at 1.9 mg/kg, chrysene at 2 mg/kg, and benzo(k)fluoranthene at 0.94 mg/kg. One of the RCRA metals, arsenic, was detected in the soil sample collected at SB06 (2 mg/kg).

2.2.3 Groundwater Sample Analysis

Three groundwater samples were collected in April 1995 from the three wells that were installed during the Q3G site assessment. The samples were analyzed for TPH-DRO. A TPH fingerprint analysis and water level measurements in the wells were also performed. Results of the sampling indicate the presence of TPH-DRO in each of the three wells (MW001, MW002, and MW003). TPH fingerprint analysis identified the TPH constituent as degraded No. 2 fuel oil. The water level in the wells was measured between 5.4 and 6.5 feet below ground surface. Additionally, 0.8 feet of product was measured in MW002.

As part of the SI, in July 1997, thirteen groundwater samples were collected from the nine newly installed wells (MW 201 through MW 209), two duplicate samples, MW001, and MW003. The samples were analyzed for TPH, VOCs, SVOCs, and RCRA metals. Results of the sampling indicate the presence of TPH in MWs 201, 202, 203, and MW001. One VOC, methylene chloride, was detected in MW001, but was attributed to laboratory contamination. SVOC analysis detected only one compound, naphthalene, also present in MW001. Metals analysis detected various concentrations of lead in six of the wells that were sampled. The presence of lead in the groundwater was thought to be attributable to the sediment present in the samples, so field-filtered groundwater samples were collected in March 1998, and sent to the laboratory for lead analysis.

Dissolved (filtered) lead concentrations were much lower than the total, (unfiltered) concentrations reported from the August 1997 sampling results. These data support the statement in the SI Report, (B&RE, 1997, page 6-2) that the lead concentrations are related to turbidity in the samples.

During the 1997 investigation sampling, a layer of floating free product approximately 0.4 foot thick was observed in MW001. Free product was also observed in MW-205 during the March 1998 supplemental investigation, during which product baildown tests conducted to estimate recoverability and thickness of LNAPL in the formation. An analysis of baildown data gathered from MW-001 indicated that 0.15 feet of product was in the formation at MW-001. At MW-205, the product was so viscous that it became smeared along the inside of the well casing during removal and the thickness could not be determined.

Assuming the conditions at monitoring well MW-001 are representative of conditions across the site, and using observations made during the 1997 and 1998 SI and reported by previous investigators, a potential LNAPL area approximately 10,850 square feet is present at the site. Product thickness is assumed to be uniform at 0.15 feet. Also assuming that the formation in this area has a porosity of 25 percent, 407 cubic feet or 3,044 gallons of product may be present.

2.3 SUMMARY OF GEOLOGIC DATA

Surficial materials at the site primarily consist of silty sand and sand with silt and some gravel. These materials become more compacted with depth, grading into weathered bedrock or very compacted sand with increased gravel. The bedrock consists of phyllite, with depth to refusal ranging from 9 feet to 25 feet in the on-site borings. Borings SB05 and SB10 through SB13 were located within the abandoned tanks at the center of the site. Refusal at the bottom of these borings is believed to represent the bottom of the former tank pit; refusal was at 7 feet in SB13 and at 9 to 10 feet in the other tank pit borings. These borings, logged from drill cuttings, encountered fill material consisting of fine to coarse sand with various amounts of silt and fragments of cement, brick, phyllite, and construction debris.

Fill was encountered in the monitoring well borings (SB01-SB03, SB06-SB08) generally to a depth of approximately 7 feet. The fill consists of loose, silty, fine- to medium-grained sand with some gravel. Gravel is predominantly phyllite fragments with lesser clasts of brick, cement, and/or wood. Fill was not encountered in borings SB04 and SB14. These two borings were located near the northern end of Building 32; they contained dense silty sand with some gravel directly below the cement pavement. This dark brown to black unsorted material was densely packed with oxidation pits around gravel clasts (phyllite rock fragments). The material is believed to be natural material and is described in the logs as "till."

The same dense till material was observed at the lower half of the other borings surrounding the former tanks to the depth of refusal. Five- and four-feet thick sections of stratified sand with silt and gravel below the fill material and above the dense till were observed at borings SB-1 and SB-6, respectively, at the northeastern perimeter of the former tanks. Boring SB-3, at the western side of the former tanks, contained the same middle section of natural sand appearing at 6.0 feet to 7.5 feet depths.

The fill found inside the USTs consisted of sand and gravel, and concrete, brick, steel, and wood construction debris including steel rebar. Evidence of oil contamination, including free product, was found in the fill inside the USTs. Soils outside the USTs were a black, silty fine to medium sand with concrete and brick debris encountered in some areas. Evidence of oil contamination, including free product, was found in the soils surrounding the USTs.

2.4 SUMMARY OF HYDROGEOLOGIC DATA

The depth to groundwater depends on the topographic location, time of year, and character of subsurface deposits. Groundwater is obtained from the unconsolidated glacial deposits of till and drift, and from the underlying Pennsylvanian bedrock. Rainfall infiltration is the principal means of groundwater replenishment on the island; however, runoff is controlled over much of the study area and directed through storm drains into Narragansett Bay. During the late spring and summer, the water table usually declines as a result of evaporation and the uptake of water by plants, and rises during the autumn and following winter thaws. In addition, tidal influences can cause fluctuations in the groundwater table close to the shoreline.

Groundwater in the vicinity of the tank farm to the north of Building 44 was present at depths ranging from approximately 6.5 to 7.5 feet below ground surface. The relative elevation of each monitoring well was determined by a Rhode Island-registered land surveyor. Groundwater elevations were determined by converting the measured depths to groundwater elevations using the survey data and groundwater observations made in August 1997. From these data, approximate water-table contours were drawn and the groundwater flow direction was estimated. Groundwater elevations range from 1.11 feet above mean sea level (MSL) at MW204 to 0.51 feet below MSL at MW207. These data and data from previous studies indicate groundwater flows north, east, and west from the tank farm area toward Narragansett Bay. Test results indicate that the hydraulic conductivity of the aquifer ranges from about 1.17 feet/day at monitoring well MW203 to 4.88 feet/day at monitoring well MW207. Plotted recovery curve data are provided in Appendix C of the November 1997 SI Report. The results of the hydraulic conductivity testing indicate that the aquifer materials at the site have a low to moderate hydraulic conductivity. These results are consistent with the observations made during the SI. These observations include the high silt and clay content of the geologic materials and the density of the materials as indicated by the high blow counts recorded during sampling.

The results of the tidal study, included in the SI report, present the groundwater elevations in monitoring well MW201, piezometers PZ02 and PZ05, and the surface water elevation measured at the pier on Gould Island. A review of these hydrographs indicates that the groundwater elevation in the two USTs did not change significantly during the monitoring period. The slight apparent fluctuation is considered to be caused by the drift of the instrument and is not significant because of the random nature of the fluctuations and the small values (maximum change between readings was 0.03 feet for PZ05). The maximum observed change in groundwater elevation in monitoring well MW201 was 0.75 feet. This change is not significant when compared to an observed tidal range of approximately 4 feet. The tidal study hydrographs can be found in Appendix D of the November 1997 SI Report.

2.5 CONCLUSIONS OF THE INVESTIGATIONS

The site investigations have revealed that a portion of the soils and groundwater in and around the vicinity of the former USTs associated with Building 44 on Gould Island are contaminated at levels that exceed various RIDEM criteria. Evidence of petroleum-related subsurface soil staining and free product on groundwater was observed during soil boring/monitoring well installation and test pitting investigations both within the confines of tank walls and outside the tanks. TPH contamination in the subsurface soils was found to exceed 500 mg/kg in nearly all of the soil samples taken during the investigations. In addition to the soil and groundwater contamination, free product was identified in MW-001, MW-002, and MW205 during the various site investigations.

3.0 EVALUATION OF REMEDIAL ALTERNATIVES

A Remedial Methods Screening Evaluation was prepared to identify and screen potential remedial technologies and formulate remedial methods that could be employed to address contaminated soils and groundwater present at the former Building 44 UST Site. This screening evaluation was performed to comply with the State of Rhode Island Regulations for Underground Storage Facilities Used for Petroleum Products and Hazardous Materials (DEM-DWM-UST05-93), Section 14.12, which calls for the justification of chosen remedial method(s) to meet remediation objectives.

3.1 SUMMARY OF SELECTION PROCESS

The screening evaluation consisted of the following steps:

- Developing media-specific remedial action objectives (RAOs) that are protective of human health and the environment
- Identifying general response actions that define media-specific measures and address site-specific RAOs
- Developing initial estimates of areas or volumes of media to which the general response actions might be applied
- Identifying and screening the technologies applicable to each general response action

This evaluation screened remedial technologies for effectiveness, implementability, and cost in addressing contaminated environmental media. The technologies were evaluated relative to each other and preferred remedial method(s) were then recommended.

Applicable regulatory requirements and guidance were reviewed to aid in formulating RAOs.

A summary of RIDEM regulatory requirements and considerations to address releases from USTs is provided in Section 3.1.1. Section 3.1.2 presents the RAOs and the rationale for their formulation. Section 3.1.3 presents the general response actions that may be implemented at the site and the screening of soil remediation technologies. The screening of groundwater institutional controls is presented in Section 3.1.4. Section 3.2 provides the rationale for selecting the preferred remedial method and Section 3.3 provides the recommendations for implementation.

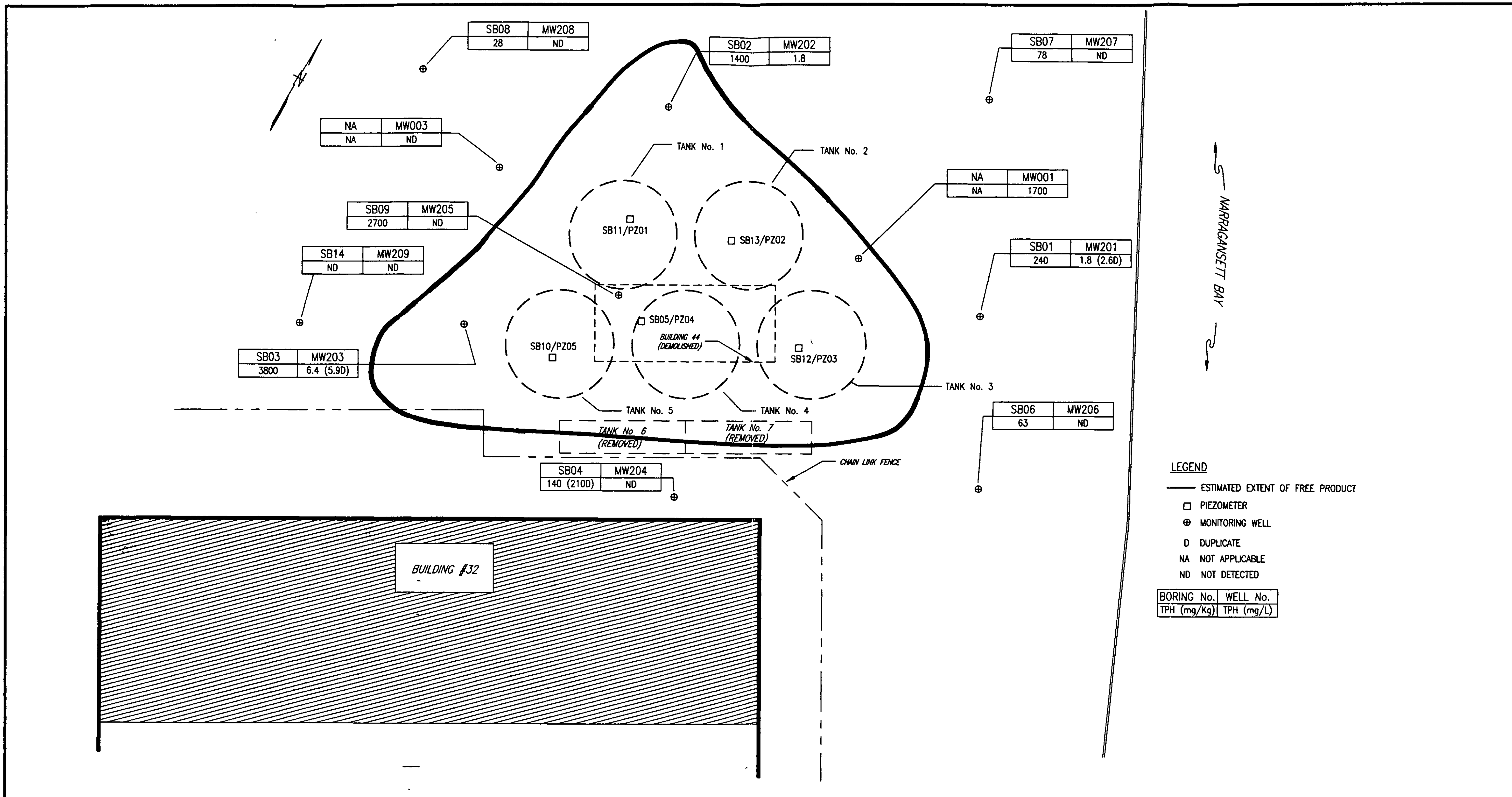
3.1.1 Regulatory Requirements and Considerations

The characterization and remediation of the former Building 44 UST Site are governed by the State of Rhode Island regulation DEM-DWM-UST-05-93 and supporting guidelines. The site characterization was conducted in conformance with these regulations.

Soils - The former Building 44 UST Site is situated in a sensitive area since the underlying aquifer is classified GA (indicating groundwater that is suitable for drinking without treatment), and ecologically sensitive areas (Narragansett Bay) that may be at risk are located less than 500 feet from this location. The volume of contaminated soil is estimated at 3,370 cubic yards, which is based on an areal extent of 13,000 square feet (see Figure 3-1), and an average thickness of 7 feet (approximate depth to groundwater).

Free Product - Free product was detected in MW-001 and MW-205. In addition, soil staining was observed during test pit operations. Free product removal is required by RIDEM's Regulations for Underground Storage Facilities Used for Petroleum Products and Hazardous Materials (DEM-DWM-UST05-93), Section 14.06, which calls for the recovery and disposal of free product. Product bail down tests were conducted in March 1998 on MW-001 and MW-205, as recommended in the SI report. Bail down test data was analyzed, indicating that 0.15 feet of product was in the formation at MW-001. However, the bail down test at MW-205 was not successful because the product in the well was so viscous that it smeared along the inside of the well casing during removal. The area of free product was estimated using the results of the bail down test at MW-001 and the field observations made during the SI and by product observation reported by previous investigators. This evaluation estimated that 407 cubic feet or 3,044 gallons of product may be present.

Typical recovery percentages range from 30 to 50 percent depending on the characteristics of the product and the formation. The evaluation of the data concluded that between 900 and 1500 gallons of recoverable product are present at the site (Figure 3-2). Results of the bail down test were presented in an April 1, 1998 letter (see Appendix A).



NOTES:

1. ALL LOCATIONS TO BE CONSIDERED APPROXIMATE.
2. PLAN NOT TO BE USED FOR DESIGN.

GRAPHIC SCALE

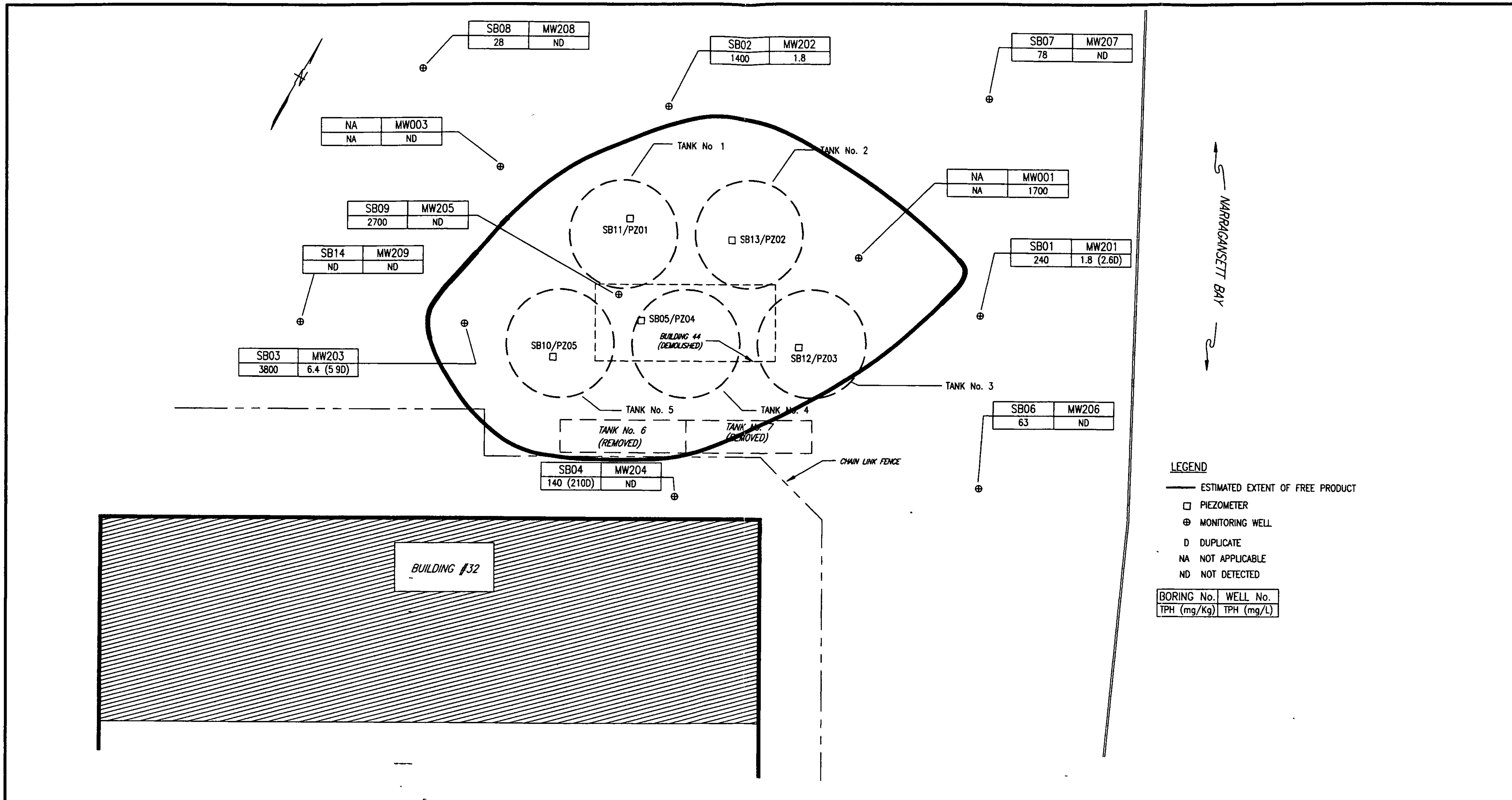
0' 30' 60'

1 INCH = 30 FEET

ESTIMATED EXTENT OF SOIL GREATER THAN 500 MG / KG			
CTO 143 – FORMER BLDG. 44 UST SITE, GOULD ISLAND CORRECTIVE ACTION PLAN			
NEWPORT, RHODE ISLAND			
DRAWN BY	R.G. DEWSNAP	REV.:	0
CHECKED BY	D.F. CONAN	DATE.	OCTOBER 29, 1998
SCALE:	1" = 30'	FILE NO	DWG\NETC\CTO143\SOIL_TPH.DWG

FIGURE 3–1

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658–7899



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1. ALL LOCATIONS TO BE CONSIDERED APPROXIMATE.
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GRAPHIC SCALE

0' 30' 60'

1 INCH = 30 FEET

ESTIMATED EXTENT OF FREE PRODUCT			
CTO 143 – FORMER BLDG. 44 UST SITE, GOULD ISLAND CORRECTIVE ACTION PLAN			
NEWPORT, RHODE ISLAND			
DRAWN BY:	R.G. DEWSNAP	REV	0
CHECKED BY:	D.F. CONAN	DATE	OCTOBER 29, 1998
SCALE.	1" = 30'	FILE NO	DWG\NETC\CTO143\FR_PROD.DWG

FIGURE 3–2

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899

Groundwater - The groundwater underlying the site is classified as Class GA (indicating groundwater that is suitable for drinking without treatment). Maximum concentrations detected during the SI were compared to RIDEM's Class GA aquifer groundwater quality standards, Rules and Regulations for Groundwater Quality (12-100-006, August 1996). Exceedances were noted for cadmium, chromium, lead, naphthalene, and methylene chloride. Filtered groundwater samples were collected during the product bail down test and analyzed for lead. The filtered (dissolved) concentrations were significantly lower than the total concentrations detected during the SI. All filtered lead concentrations were below RIDEM's GA objective of 15 ug/l. Therefore, metal exceedances documented in the SI report were attributed to sample turbidity.

The remaining VOC and SVOC exceedances were detected in MW-001, which exhibited free product. These detections were attributed to the presence of free product and determined not to be representative of the aquifer. Source removal and natural attenuation are expected to adequately address any groundwater contamination.

3.1.2 Remedial Action Objectives

Remedial action objectives (RAOs) are developed to protect human health and the environment, and to ensure that the selected remedial methods will address site-specific concerns. Based on the types of contaminants present, the media affected, and the contaminants' migration characteristics, RAOs were developed for site soils, free product, and groundwater. The RAO for the former Building 44 UST Site contaminated soils is:

- Minimize/eliminate leaching of petroleum hydrocarbons from soils to groundwater

Note that contamination was not detected in surface soils and therefore does not present an exposure hazard to humans from contaminated soils through ingestion, inhalation, and dermal contact.

The RAO for former Building 44 UST Site free product is:

- Recover mobile free product

The RAO for contaminated groundwater is:

Monitor only to confirm contamination is not entering groundwater.

3.1.3 General Response Actions and Technology Screening

General response actions are categories of actions that will satisfy the remedial action objectives. Based on site-specific conditions, the general response actions identified for contaminated soils include: excavation and treatment; excavation and disposal; and in-situ treatment. General response actions for contaminated groundwater include natural attenuation and in-situ treatment.

Based on the soils general response actions, the following technologies were selected for evaluation: thermal desorption (excavation and on-site treatment), landfilling (excavation, transportation, and off-site disposal), and bioremediation (in-situ and ex-situ). Thermal desorption, ex-situ bioremediation, and off-site landfilling would require soils excavation. In-situ bioremediation involves subsurface biodegradation of petroleum hydrocarbons, in place. To effectively implement any of the treatment technologies, treatability studies and pilot-scale studies are required to optimize the remediation processes.

These options allow for considering remedies ranging from minimal action to aggressive removal or treatment actions that mitigate contaminated soils. A limited number of potential remedial technologies were selected and screened to evaluate their effectiveness, implementability, and relative order-of-magnitude costs.

3.1.3.1 Excavation and On-Site Treatment (Thermal Desorption)

The contaminated soils underlying the site would be excavated to allow subsequent treatment. Common construction equipment (backhoe, hydraulic excavators, etc.) would be used. All heavy equipment and supplies would have to be mobilized to the site via barge and tugboat. It is anticipated that all contaminated soils residing above the mean low water table (approximately 3,370 cubic yards) would be excavated. During excavation, additional sample collection and analyses would be required to define the areas and depths of contamination in excess of the TPH action level. The excavation would be backfilled with the treated soils. During closure activities, the USTs were backfilled with a combination of soil and construction debris. The tank contents could pose a problem during remediation and potentially increase cleanup costs.

Because contaminated soils would be excavated under this remedial method, personal protective equipment would likely be necessary during excavation to protect remediation workers. Depending on the soil moisture content, dust suppressants might also be needed to control fugitive dust emissions.

Thermal desorption is an ex-situ treatment process that uses heat and physical agitation to volatilize organic contaminants from soils; the resulting organic vapor stream is subsequently collected or destroyed. A typical thermal desorption system consists of a rotary drum thermal processor equipped with heat transfer surfaces, and a vapor treatment system. Direct-fired and indirectly heated systems (generally heated by circulating hot oil) are available. Temperatures used in the thermal processor are contaminant- and matrix-specific, with a range of approximately 150 degrees F to 800 degrees F. Most units incorporate mechanical agitation during treatment to facilitate complete desorption of organics. An induced air flow conveys the volatilized organics through a gas treatment system for capture (carbon adsorption or condensation) or destruction (thermal oxidation). The treated air stream is then discharged through a stack to the atmosphere. Thermal desorption is a well-demonstrated technology for industrial sludge and product drying applications. While the use for soils remediation is less demonstrated, thermal desorption is steadily becoming more prevalent as a means for treating organics-contaminated soils. At lower temperatures, this process is most effective on VOCs, but units operating at higher temperatures are also capable of treating semi-volatile and non-volatile organics.

Effectiveness of Excavation and On-Site Treatment (Thermal Desorption)

Thermal desorption should be capable of removing the site soil contaminants since VOCs and TPH (including SVOCs) are present; the process would also be capable of accommodating the volume of contaminated site soils present. Site conditions are favorable for thermal desorption since soils are predominantly permeable sands. Thermal desorption at relatively low or moderate temperatures would be expected to reduce TPH to less than the action level.

The effectiveness of thermal desorption depends primarily on the boiling point of the contaminant. For volatile organics such as benzene, toluene, ethylbenzene, and xylenes that have relatively low boiling points, nearly complete removal from the soils would be expected at relatively low operating temperatures.

No long-term impacts to human health and the environment would be anticipated for excavation and thermal desorption. In the short-term during implementation, engineering controls would be used to mitigate fugitive VOCs and dusts, and air emissions from the thermal treatment unit would need to be captured or destroyed.

Implementability of Excavation and On-Site Treatment (Thermal Desorption)

On-site thermal desorption is readily implementable. The equipment and resources necessary to treat the soils on site are available, with several vendors capable of performing this work. No operational difficulties are anticipated for either excavation or thermal desorption. Air emissions from the thermal treatment unit would have to meet Rhode Island air emission standards and regulations; permits could be required. If the vapor control system consisted of a collection system (condensation, activated carbon), then off-site disposal of the residuals at a treatment, storage, or disposal (TSD) facility would be required. If the vapor control system was destructive treatment (oxidation, incineration), then off-site disposal might not be required. TSD facilities would be available for disposing of treatment residuals. Numerous contractors would be available with heavy equipment and trained operators to perform contaminated soils excavation. The dust and vapor control equipment and materials would be available and could be implemented at the site. The presence of construction debris in the USTs and the need to barge equipment/supplies to and from the island could complicate implementation.

Treatability testing would be required to optimize operating parameters such as temperature, retention times, air flow, and air emissions controls. Soil samples with contaminants of interest would be collected and sent to a laboratory for thermal treatment testing.

Cost of Excavation and On-Site Treatment (Thermal Desorption)

The relative capital costs for thermal desorption are anticipated to be high. Most of the capital cost would arise from equipment mobilization (barges would be required to ferry equipment to the island), demobilization, and operation. For relatively small volumes of contaminated soils, thermal desorption might not be cost effective in comparison with other treatment technologies. The estimated capital cost for the excavation and on-site treatment alternative is $1.401,987, with the cost of post-remedial groundwater monitoring estimated at $80,359. The total cost of this alternative is $1,482,347. The present worth cost of the excavation and on-site treatment alternative is $1,477,284. Should fugitive VOCs and dust control be required, the costs could increase.

Conclusion

Thermal desorption is an effective and implementable technology for removing VOCs and TPH from contaminated site soils. However, implementation of this remedial method would require extensive excavation and would require numerous precautions to prevent fugitive emissions or accidental exposures. The desorbed contaminants would have to be disposed of off site at a TSD facility. The costs for implementing excavation and thermal desorption are anticipated to be high.

3.1.3.2 Excavation, Transportation, and Off-Site Disposal (Landfill)

Under this remedial method, contaminated soils underlying the site in excess of the TPH action level would be excavated and transported off site for disposal at a landfill. The removal of contaminated soils would minimize further contaminant leaching into groundwater.

As described for excavation and thermal desorption, common construction equipment (backhoes, hydraulic excavators, etc.) would be used. It is anticipated that all contaminated soils residing above the mean low water table (approximately 3,370 cubic yards) would be excavated. During excavation, additional sample collection and analyses would be required to define the areas and depths of contamination in excess of the TPH action level.

Soil samples should be tested using the toxicity characteristic leaching procedure (TCLP) (EPA Method SW-846-1311) to determine whether the soils are considered hazardous by regulatory definitions. If TCLP results indicate that site soils are hazardous by characteristic, then disposal in a hazardous waste landfill would be warranted. Even if the soils are not considered hazardous by characteristic, disposal in a landfill might be required.

Contaminated soils may be disposed of in hazardous waste or industrial waste landfills. The principal differences between these landfills are the administrative requirements and the degree of leachate control provided; summaries of these landfills are as follows:

Hazardous Waste Landfill - Hazardous waste landfills are regulated by the landfill and post-closure requirements of RCRA (40 CFR 264 and 265, Subparts G and N), the Toxic Substances Control Act (TSCA) for PCBs, and state and local laws. Among the requirements are foundations, double liner systems, leak detection systems, leachate collection and treatment systems, capping, post-closure inspections and maintenance of the landfill (30-year period), and post-closure groundwater monitoring (30-year period).

Industrial Landfill - Industrial landfills include some residual waste landfills and construction/demolition waste landfills. Design and operating practices are typically similar to hazardous waste landfills; however, the permitting requirements are not nearly as stringent. These landfills may be used for wastes that are not classified as hazardous but may still significantly contaminate groundwater.

The excavation would be backfilled with clean, imported material.

Effectiveness of Excavation, Transportation, and Off-Site Disposal (Landfill)

Landfilling would achieve the RAOs by preventing the leaching of contaminated soils to the groundwater. The options available include a secure hazardous waste landfill or an industrial landfill. The selection of one landfill over another would depend on the relative toxicity of the soils and the risks associated with their disposal. Soils containing contaminants restricted under RCRA land disposal restrictions (LDRs) regulations and not already "placed" would have to be treated to acceptable levels prior to landfilling. In addition to these RCRA-mandated LDRs, pre-treatment requirements are typically established by individual landfill operators to comply with their respective permit conditions. A hazardous waste landfill may be appropriate for disposal of the most contaminated soils, while an industrial landfill may be appropriate for disposal of the moderately contaminated soils.

Off-site landfills would be capable of handling the volume of contaminated soils (approximately 3,370 cubic yards). Landfilling alone would achieve the remediation objectives for prevention of contaminant migration into groundwater. Off-site landfills are available to accept the contaminated soils.

The short-term risks of off-site disposal to human health and the environment would be from implementing on-site excavation and transporting the material to an off-site facility. However, these risks could be mitigated through the use of appropriate engineering controls to prevent fugitive dust and VOCs migration; application of industrial safety procedures during the excavation, loading, and transportation of contaminated soils to protect workers; and implementation of health and safety measures to protect remedial workers from exposure to contaminated soils and VOC gases. In the long term, risk to human health and the environment would be eliminated.

While off-site disposal would eliminate the source of continued groundwater contamination at the former Building 44 UST Site, this remedial method may not be a permanent action. If the contaminated soils are untreated prior to disposal in a landfill, and the landfill should fail, then the Navy might still be liable for potential environmental damages in the future. If contaminated soils were sent to a TSD facility that treats the soils to remove or destroy the petroleum hydrocarbons prior to landfilling, then future liabilities for soils disposal may be eliminated.

Implementability of Excavation, Transportation, and Off-Site Disposal (Landfill)

Off-site disposal is implementable. For off-site disposal, permits would be required to transport the various types of wastes from the former Building 44 UST Site. Treatment of the wastes in compliance with RCRA LDRs prior to off-site landfilling might be required for some soils. Off-site TSD facilities are available to receive this waste. Numerous companies are readily available that have trained personnel, equipment, and resources to excavate or transport the soils off site. The presence of construction debris in the USTs and the need to barge equipment/supplies to and from the island might complicate implementation.

Treatability studies would not be required to implement this alternative. However, soils would need to be adequately characterized (through chemical analyses and TCLP leaching tests) so that a landfill could determine whether the soils could be accepted for disposal.

Cost of Excavation, Transportation, and Off-Site Disposal

The relative cost of excavation and off-site disposal is low. The estimated capital cost for the excavation and off-site disposal alternative is $703,246, with the cost of post-remedial groundwater monitoring estimated at $80,359. The total cost of this alternative is $783,605. The present worth cost of the excavation and off-site disposal alternative is $778,542.

Conclusion

Landfilling is an effective and implementable disposal option for the contaminated soils. Depending on regulatory requirements and whether the site's contaminated soils are deemed hazardous by characteristic, the excavated materials could be sent to either a hazardous waste or industrial waste landfill. If the soils did not require treatment at the disposal facility and the contaminants were not destroyed or removed, the possibility for long-term liability would exist should the landfill fail.

3.1.3.3 In-Situ Bioremediation

In-situ bioremediation is the application of biological treatment to contaminants present in the subsurface. Petroleum hydrocarbons (particularly aromatics) can be biodegraded (metabolized) by aerobic microorganisms into innocuous compounds such as carbon dioxide and water. Microorganisms require a carbon food source (organic contaminant), and nutrients such as nitrogen, phosphorus, and oxygen (to support aerobic activity). Natural communities of microorganisms present in the subsurface can carry out biodegradation in many different types of habitats and environments, under aerobic and anaerobic conditions. Understanding the biological principles of microbial metabolism, and the effect of environmental conditions on the bacteria is necessary for optimizing bioremediation. The biological mechanism of this treatment process is sometimes stimulated by the addition of nutrients or heat, or the ex-situ stimulation and reinjection of the indigenous contaminant-degrading organisms.

Designing a bioremediation system would include collecting samples to perform plate counts on the bacteria, identifying and counting indigenous petroleum degraders, and determining background nutrient (nitrogen and phosphorous) and soil pH levels. Parameters that would limit the effectiveness of bioremediation would be identified, and a system implemented to adjust those limiting factors.

For purposes of evaluating this alternative, a remediation time of 24 months was assumed, however, the time required to remediate the site cannot be projected with certainty.

Effectiveness of In-situ Bioremediation

In-situ bioremediation would be capable of treating VOCs and non-volatile TPH contamination in the unsaturated soils at the site. Bioremediation would likely achieve the soil TPH action level. This alternative uses biodegradation to address subsurface organic contamination. Solutions of oxygenated water, nutrients, and possibly microbes would be applied to the site to enhance the natural biodegradation of non-volatile organic compounds (SVOCs and non-volatile TPH) by microbial populations. Oxygenated water would be used to introduce oxygen to the subsurface since an air sparging system would require significantly more power. Electrical power is not available on the island; power would have to be provided by an on-site generator.

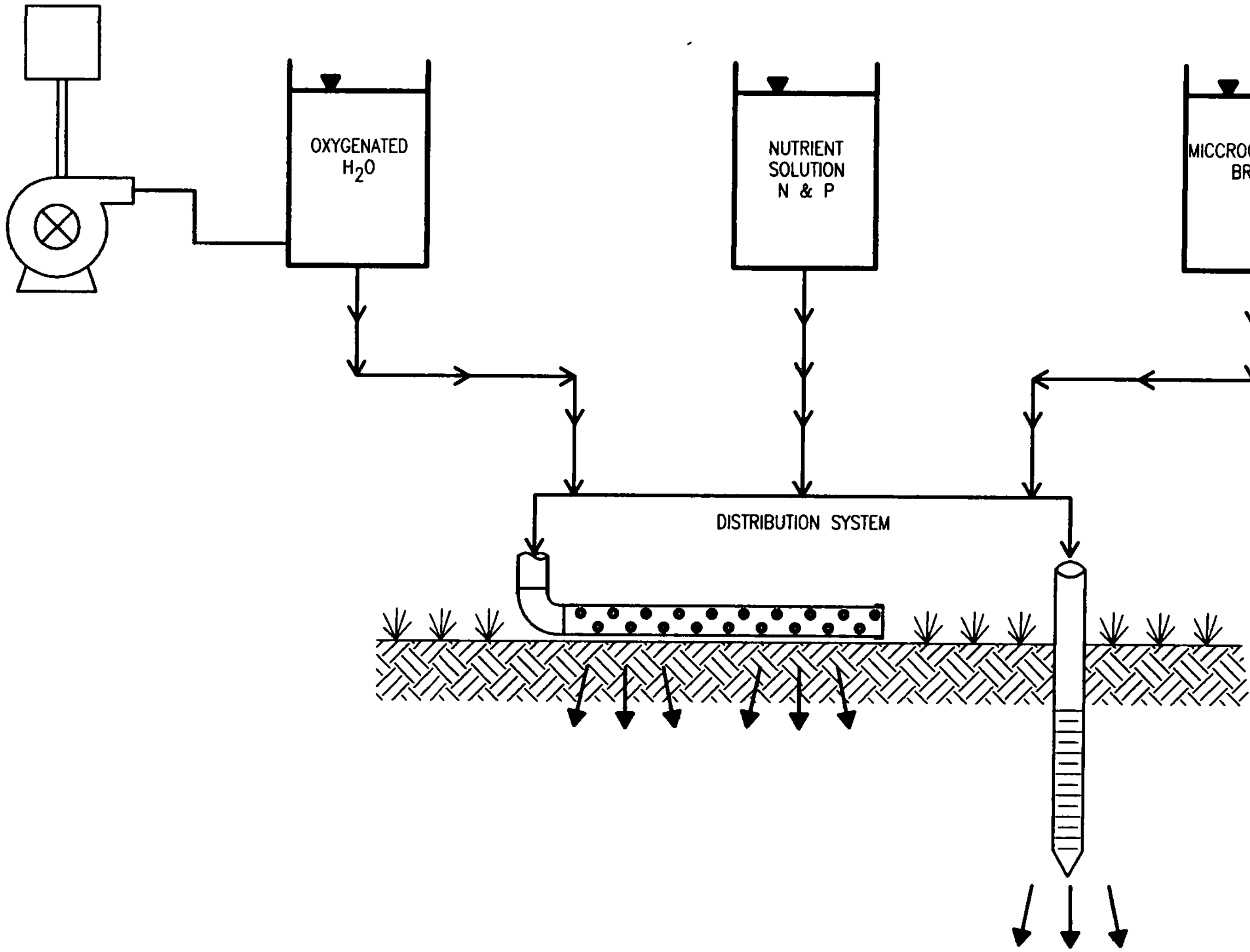
Implementability of In-situ Bioremediation

In-situ bioremediation is implementable at the site. The bioremediation system would include three vessels for distributing oxygenated water, nutrient solution, and potentially cultured petroleum degraders. Existing monitoring wells and perforated pipe or hose laid on grade would be used to distribute the solutions. Relatively small quantities of nutrients and microbes would be required to initiate the biodegradation process. A continuing source of oxygenated water would be required to sustain the aerobic metabolism. A flow diagram depicting the in-situ bioremediation process is included as Figure 3-3.

Treatability tests would be performed to determine whether biodegradation requires enhancement through oxygen or nutrient enrichment. Soil samples would be collected and sent to a laboratory for testing.

Cost

The relative cost of in-situ bioremediation is low. The estimated capital cost for the in-situ bioremediation alternative is $365,644 with the operation and maintenance cost estimated at $236,037. The cost of post-remedial groundwater monitoring is estimated at $80,359. The total cost of this alternative is $682,040. The present worth cost of the in-situ bioremediation alternative is $726,504.



IN-SITU BIOREMEDIATION PROCESS FLOW DIAGRAM

CTO 143 – FORMER BLDG. 44 UST SITE, GOULD ISLAND
CORRECTIVE ACTION PLAN

NEWPORT, RHODE ISLAND

DRAWN BY	R G DEWSNAP	REV..	0
CHECKED BY·	D F CONAN	DATE:	OCTOBER 29, 1998
SCALE	NONE	FILE NO.:	DWG\NETC\CTO143\BIO_REM DWG

FIGURE 3–3

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658–7899

Conclusions

In-situ bioremediation is an effective remedial method for this site based on the types of contaminants (petroleum hydrocarbons) and subsurface soil conditions (permeable sandy soils). The in-situ bioremediation alternative relies on increasing the oxygen content to stimulate the biodegradation of VOCs and TPH by soil microbes. Because no excavation would be necessary to address the contaminated soils, the implementation of this remedial method would likely have a low impact on workers and the environment. Treatability testing would be warranted to optimize the treatment processes.

3.1.3.4 Ex-Situ Bioremediation (Biopiles)

Ex-situ bioremediation in the form of biopiles involves placing excavated contaminated soil into piles and then enhancing the aerobic degradation of contaminants by microbial activity. Biopiles are constructed by placing contaminated soil in lifts with aeration piping between the lifts. Moisture and nutrients are also added to the soil to provide optimum conditions for microbial growth and activity. An impermeable liner, sand or wood berms, and possibly a leachate collection system is used to prevent leachate from the biopile from contaminating underlying soil and groundwater. A cover is placed over the biopile to prevent erosion, to prohibit precipitation from entering the soil, and to prevent contact with humans. Since volatile compounds have been detected in the soils at low concentrations, a vapor treatment system should not be required.

As described for excavation and thermal desorption, common construction equipment (backhoes, hydraulic excavators, bulldozers, etc.) would be used. The area required to contain the estimated 3,400 cubic yards of excavated soil would be approximately 23,000 square feet. Soils contaminated in excess of the TPH action level would be excavated and placed in lifts on the impermeable biopile liner. The sides of the biopile would have a one to three slope, which would produce a biopile height of approximately 7.5 feet. Some segregation of construction debris (concrete, wood, steel, etc.) from soil might be required before placement in the biopile. After lifts are complete, aeration piping would be laid down and connected by manifold piping to a blower. A plastic cover would be placed over the biopile.

The design of the biopile would depend on the evaluation of laboratory treatability studies, expected climatic conditions, and soil characteristics. Soil samples would be analyzed for parameters such as heterotrophic bacteria populations, soil pH, and moisture content. Treatability studies on these soil samples would evaluate the parameters required for optimal rate of biodegradation. The toxicity of organic and inorganic chemicals in the soil to the petroleum degrading bacteria would also be determined. The soil TPH and total metal concentrations evaluated in the SI are well below 50,000 mg/kg and 2,500 mg/kg respectively, the concentrations that are generally considered toxic to the soil bacteria.

Microbial populations, soil pH, and moisture content would be maintained in the biopile at the optimal levels determined by the treatability studies. Microbes appropriate for the degradation of the target compounds and the nutrients required for their growth would be supplied by the laboratory conducting the treatability studies. The microbes and nutrients would then be added to the biopile as needed. Soil pH would be measured and adjusted if necessary to a value between 6.8 and 7.0 by mixing the contaminated soil with lime or sulfate. Moisture content would be measured periodically by soil moisture probes and adjusted to a value between 12 and 30 percent by weight by the addition of water. The water would be delivered by barge or extracted from site wells containing uncontaminated groundwater.

Effectiveness of Ex-Situ Bioremediation (Biopiles)

Bioremediation of contaminants within the biopile should be effective in reducing TPH soil concentrations to below the action level. Biodegradation of heavier petroleum hydrocarbons such as fuel oil is generally a slower process than the degradation of lighter petroleum products such as gasoline, kerosene, and diesel fuel. The time required to remediate the soils is expected to be approximately 12 months. A better estimate of the time required to remediate the soil could be developed based on treatability study testing. The ambient temperature required for biopile operation is between 10 degrees C and 45 degrees C, which would limit the effectiveness of the biopile during several winter months.

Both in-situ and ex-situ bioremediation has been successfully used at several sites containing soils contaminated with fuel oil. An advantage of ex-situ bioremediation is that conditions within the biopile can be more easily maintained and enhanced for optimal degradation than for in-situ bioremediation.

Implementability of Ex-Situ Bioremediation (Biopiles)

Bioremediation through the use of a biopile is implementable. The required land area for the biopile footprint is available. A generator and fuel tank would have to be located at the site to facilitate the use of an extraction blower to aerate the biopile. Circulation of air through the biopile may cause the soil to dry out. To maintain ideal soil moisture content, water would have to be added to the soil. Depending on the rate at which the soils dry, the necessary volume of extracted groundwater could be quite large, e.g., 70,000 gallons.

Cost

The relative cost of ex-situ bioremediation is high. The estimated capital cost for the ex-situ bioremediation alternative is $1,168,250 with the operation and maintenance cost estimated at $138,482. The cost of post-remedial groundwater monitoring is estimated at $80,359. The total cost of this alternative is $1,387,091. The present worth cost of the in-situ bioremediation alternative is $1,371,819.

Conclusions

Ex-situ bioremediation through the use of a biopile would be an effective remedial method based on the types of contaminants present and the ability to enhance the biopile conditions for optimal biodegradation.

Since remediated soils would be backfilled into the excavation, there would be no chance of future liability as would be the case with the excavation and off-site disposal option.

3.1.4 Free Product

As discussed in Section 3.1.1, free product was detected in MW-001 and MW-205; in addition soil staining was observed during test pit operations. Free product recovery is required by RIDEM. Product bail down tests were conducted in March 1998 on MW-001 and MW-205, as recommended in the SI report. Results of the bail down test were presented in an April 1, 1998 letter (see Appendix A). The test concluded that approximately 900 to 1,500 gallons of recoverable product are present at the site (Figure 3-2).

Free product recovery methods would be selected in conjunction with the soil remediation alternative. With the exception of in situ bioremediation, the remedial alternative under evaluation involve excavation of the contaminated soil, that would allow free product recovery from the open excavation. If in situ bioremediation is implemented, product recovery wells would be used.

3.1.5 Groundwater

As discussed in Section 3.1.1, contaminant detections in the groundwater are attributed to sample turbidity (metals), and the presence of free product (VOCs and SVOCs). Groundwater remediation is not proposed in this CAP. A groundwater monitoring plan would be implemented in conjunction with soil remediation and free product recovery. The plan would include three rounds of semi-annual groundwater monitoring events. Five wells would be sampled for TPH, SVOCs, VOCs, and dissolved and total metals.

3.1.6 Comparison of Soil Remedial Technologies

Using the screening criteria of effectiveness, implementability, and relative cost, several remedial technologies were evaluated to determine whether they can achieve the RAOs and meet the soil TPH action level.

For the on-site treatment of contaminated soils, thermal desorption, and in-situ and ex-situ bioremediation would achieve the RAOs and reduce TPH to below the 500 kg/mg action level. Excavation and on-site handling of contaminated materials pose some difficulties and short-term risks to on-site workers, but can safely be implemented by following proper industrial and hazardous waste site protocols. In the long-term, no further threats to human health and the environment are anticipated.

Since thermal desorption is not a destructive method, the desorbed VOCs would have to be subsequently captured and destroyed or disposed. Thermal desorption is costly due to the high costs of equipment mobilization. The site would be suitable for future use upon completion of remediation. Excavation of 3,370 cubic yards of soils would require engineering controls and safeguards. Treated soil would be used for backfilling the excavation. Expansion of soils due to increased porosity after excavation could result in approximately 5,100 cubic yards of soils that require handling and treatment.

Off-site disposal of contaminated soils would achieve the RAOs and reduce VOCs sufficiently to reduce TPH to below the action level. Excavation and on-site handling of contaminated materials pose some difficulties and short-term risks to on-site workers, but can be safely implemented by following proper industrial and hazardous waste site protocols. The excavated 3,370 cubic yards of soils could expand to approximately 5,100 cubic yards due to increased porosity; these soils would require handling and treatment. Transportation to off-site TSD facilities could pose some risks from accidents and spills. In the long term, no further threats are anticipated for site contamination to human health and the environment. The cost for off-site disposal is the most expensive alternative. The remedial technology may be permanent if contaminated soils are treated at the TSD facility; if untreated, the soils may pose a long-term liability issue. Once excavation, off-site disposal, and backfill with clean material have been completed, the site would be suitable for future use.

The in-situ bioremediation remedial technology would be the most easily implemented alternative since no major on-site activities would be required. It would, however, require more time to achieve action levels compared to the other alternatives. The time to remediate the site using in-situ bioremediation cannot be projected with certainty until after treatability test have been conducted. This remedial technology is effective in preventing the continued contaminant leaching to groundwater, and would be the least expensive alternative.

Ex-situ bioremediation is also effective in preventing the continued contaminant leaching to groundwater. As with thermal desorption and off-site disposal, contaminated soil must be handled during construction of the biopile. This poses some difficulties and short-term risks to on-site workers, but can safely be achieved following proper industrial and hazardous waste site protocols. Ex-situ bioremediation is estimated to take between approximately 12 months, however treatability study testing would be required to determine the treatment this timeframe.

Estimated costs and length of remediation for the four evaluated alternatives are summarized in Table 3-1. Detailed costs estimates are included in Appendix B.

TABLE 3-1
ALTERNATIVE COST ESTIMATE SUMMARY
CORRECTIVE ACTION PLAN
FORMER BUILDING 44 UST SITE (GOULD ISLAND)
NETC-NEWPORT, RHODE ISLAND

Remedial Alternative - Soil	Description	Duration (months)	Costs ($)			
			Capital	Total O&M/ Monitoring	Total [a]	Present Worth
1	Excavation and On-Site Treatment (Thermal Desorption)	3	1,401,987	80,359	1,482,347	1,477,284
2	Excavation, Transportation and Off-Site Disposal (Landfill)	3	703,246	80,359	783,605	778,542
3	In-Situ Bioremediation	24	365,644	316,396	682,040	726,504
4	Ex-situ Bioremediation (Biopile)	12	1,168,250	218,841	1,387,091	1,371,819

Note: (a) - Total cost includes capital, total operation and maintenance (O&M) costs, contingency, general and administrative costs (G&A), profit, and engineering fees.

3.2 RECOMMENDED REMEDIAL METHOD

The present worth costs of the excavation and off-site disposal alternative at $778,542, and the in-situ bioremediation alternative at $726,504, are comparable. Although the least expensive alternative is in-situ bioremediation, the time required to achieve the clean-up level of the site cannot be accurately projected. If the duration is longer than the 24 months used in this evaluation, the cost will be higher. Therefore, the recommended remedial method for the former Building 44 UST Site is excavation, transportation, and off-site disposal (landfill) for the source area soils. This remedial method is capable of achieving the soil TPH action levels and can be completed within a relatively short time frame, less than 3 months.

Based on the comparison of four remedial alternatives, the excavation, transportation, and off site disposal alternative offers the most advantages for addressing petroleum hydrocarbon contamination at the former Building 44 UST Site. Excavation and landfilling has been demonstrated to be effective at sites with gasoline or fuel spills and where subsurface VOCs and TPH presence posed threats to human health and the environment.

If necessary, free product recovery would be implemented during the excavation phase. The contaminated soil would be excavated to the water table, exposing the top few inches of the aquifer and any floating product. Product skimmer pumps would be used to collect the bulk of the product. The remaining sheen would be "sponged" with hydro-phobic oil absorbent mats. Free product would be disposed of in accordance with all applicable regulations.

As discussed in Section 3.1.1, no groundwater remediation is anticipated as part of the remedial action. Groundwater contamination will be addressed through some removal and natural attenuation.

4.0 CONCEPTUAL DESIGN

The conceptual design for the excavation, transportation, and off-site disposal remedy for the former Building 44 UST Site is presented in this section. The volume of soil to be excavated was estimated on the basis of the action level used for this CAP as specified in Section 3.1.1. The soil volume will be reevaluated based on the action levels applicable at the time of the plan implementation.

4.1 REMEDIAL OBJECTIVE

The objectives for the proposed excavation, transportation, and off-site disposal remedy at the former Building 44 UST Site are:

- Minimize/eliminate leaching of petroleum hydrocarbons from soils to groundwater by removing the source (soils that exceed the TPH action level throughout the site vadose zone).
- Monitor groundwater to confirm contamination is not entering the surficial aquifer.
- Recover mobile free product, if detected.

The remedy will be conducted in accordance with the Rhode Island UST Regulations and other applicable regulations, as listed in Section 4.3.

4.2 PROCESS DESIGN

The general process design for the soil, groundwater, and free product components of the remedy are presented below.

4.2.1 Soil Excavation, Transportation, and Disposal

The proposed remedy includes excavating up to approximately 3,370 cubic yards (cy) of contaminated soil, transporting the contaminated soil from Gould Island, and disposing the soil at an approved off-site landfill. Any debris removed during the excavation activities will be segregated for disposal at an approved off-site landfill. The contaminated soil area is identified in Figure 3-1.

4.2.1.1 Contaminated Soil Excavation

Contaminated soil will be excavated with a backhoe or excavator using the open cut method, and placed in a staging area. The soil will be transferred from the staging area to a barge using a front-bucket loader. Initial excavation will be conducted to a predetermined depth based on analytical data collected from soil borings and test pit excavations during the SI. The side slopes will be excavated in accordance with OSHA regulations. Protection of the excavation is will be accomplished through bench cuts, sloping sidewalls, trench boxes, or engineered shoring and bracing structures such as sheet piling. Excavation will proceed until the remedial objectives are met at the excavation boundaries. Sampling and analysis will be conducted, as described below, to confirm that the boundaries of the excavation areas meet the remedial objectives. Erosion, dust, and odor control measures will be implemented, as necessary.

Field screening will be conducted during soil removal activities to determine the lateral and vertical extent of excavation, and to minimize the number of confirmatory samples submitted for laboratory analysis. Field screening activities may include headspace analysis using a FID, TPH analysis using a field test kit approved by RIDEM (PetroFLAG by Dexsil), as well as both visual and olfactory observations. In addition, grab samples will be collected for field screening prior to transport and stockpiling.

Once the field screening results indicate approximate completion of excavation and no visible petroleum contamination or odors remain, the boundaries of the excavation area will be sampled, both laterally and vertically, to ensure that the excavation efforts were successful in removing the contaminated soil. The confirmatory samples will be submitted to a Navy-approved and RIDEM-certified laboratory. All samples will be analyzed for TPH (EPA Method 8100M). In addition, the excavation will be evaluated to ensure that no NAPLs remain in any soil or groundwater and that no physical evidence of petroleum-based contamination remains following excavation.

Compliance with the soil remedial objectives will be demonstrated by confirming that the analytical data for each excavation area meet all the following criteria:

- No single sample result exceeds any soil remedial objective by a factor of five

- No more than 10 percent of the individual sample results exceed any soil remedial objectives

- No single sample is identified as containing NAPLs

If the analytical results indicate that contamination extends beyond the excavated limits, additional soil will be excavated using field screening to determine the extent of soil removal until confirmation sampling and analysis demonstrate the action level has been achieved.

Once the analytical results from the perimeter sampling confirm that the remedial objectives have been met, backfilling operations will begin. Backfill, consisting of clean imported materials and/or surplus clean surface soils, will be placed and compacted. The site will then be finished with topsoil, and seeded, and mulched.

No on-site treatment of excavated soil other than dewatering will be required to prepare the material for off-site transportation and disposal. Excavated soil that requires dewatering may be temporarily staged adjacent to the excavation for a day to allow the water to drain.

Following removal of the stockpiles, the former stockpile areas will be graded to match surrounding contours and all disturbed areas will be seeded, and mulched, as necessary. All equipment and materials will be decontaminated as necessary and removed from the site. All wastes generated from construction activities (including the construction entrance, support zone(s), silt fence, and miscellaneous construction debris) will be disassembled and disposed of as appropriate.

4.2.1.2 Contaminated Soil Transportation

The contaminated soil will be transported from the island to the mainland pier where it will be transferred to dump trailers, weighed, and transported to an approved landfill. Empty dump trailer/roll-off trucks will be scaled for tare weight upon arrival at the pier and scaled for loaded weight at departure from the pier. The use of portable scales will allow maximizing the volume of soil shipped without overloading the vehicles.

4.2.1.3 Contaminated Soil Disposal

After reviewing confirmatory analytical results, the soil will be transported to an appropriate landfill based on the analytical results and disposal costs. A report will be submitted to RIDEM summarizing the soil excavation, transportation, and disposal activities and the associated analytical data demonstrating compliance with the soil remedial objectives at excavation boundaries.

4.2.2 Groundwater Monitoring

No remediation of groundwater is anticipated as part of this remedial action. Source removal and natural attenuation are expected to address the groundwater contamination, as discussed in Section 3.1.1. A groundwater monitoring program will be conducted to monitor for hydrocarbon migration, as presented in Section 5.0.

4.2.3 Free Product Removal

The groundwater at the base of the excavation will be screened visually to determine the presence of NAPLs. When the water table is encountered, the soil will be removed to approximately 6 inches below the water table surface. Recoverable free product, if encountered, will be pumped from the excavation and properly disposed of off site.

4.3 OTHER REQUIREMENTS

Other requirements and guidance specific to the remedial activities planned for the impacted area include:

- Rhode Island Hazardous Waste Management Act of 1978 (RIGL 23-19.1 et seq.) - Hazardous Waste Management Rules and Regulations

- Rhode Island Groundwater Protection Act (RIGL 46-13.1) - Protection of Groundwater

- Rhode Island Water Pollution Control Act - Rhode Island Water Quality Regulations (RIGL 46-12, et seq.)

- Rhode Island Pollutant Discharge Elimination Systems (RIGL 46-12, et seq.)

- Rhode Island Coastal Resources Management Law (RIGL, Title 46, Chapter 23) and Regulations

- RCRA: (40 CFR 262) - Generator Requirements for Manifesting Waste for Off-Site Disposal; (40 CFR 263) - Transporter Requirements for Off-Site Disposal; (40 CFR 264.90-254.101, Subpart F) - Groundwater Protection; (40 CFR.110-118, Subpart G) - Closure/Post Closure Requirements

- Federal Hazardous Materials Transportation Act (40 CFR 170, 171) - Rules for Transportation of Hazardous Materials

- Federal Land Disposal Restrictions (40 CFR 268)

- Federal Toxic Substances Control Act (40 CFR 761.125)

- Federal Clean Water Act: (40 CFR 121) - Ambient Water Quality Standards; (40 CFR 122-125) - National Pollutant Discharge Elimination (NPDES) Permit Requirements; (40 CFR 410.15) - Effluent Discharge Limitations

- Federal Executive Order 11990 - Statement on Proceedings of Floodplain Management (40 CFR 6, Appendix A)

- Federal Coastal Zone Management Act (16 USC Section 1451 et seq.)

5.0 PROPOSED LONG-TERM GROUNDWATER MONITORING

The groundwater monitoring program will monitor for hydrocarbon contamination migration at the site over a 1-1/2 year period. Every 6 months, designated existing wells will be sampled and groundwater levels will be measured in all site monitoring wells using an electronic oil/water interface probe. Thickness of free product, if present, will be recorded. Samples will be collected from five monitoring wells, including one source area monitoring well and four down gradient wells. Each sampling event will be completed within a 24-hour period. Samples will be analyzed for TPH (Method 8015) to determine if residual petroleum products in the subsurface soils are being released to the groundwater. Samples will also be analyzed for VOCs, SVOCs, and dissolved and total metals.

An evaluation of all the data will be performed to determine if:

- The existing groundwater monitoring well network is adequate to monitor contaminant migration

- Any free product observed in the monitoring wells represents a recoverable quantity of product.

In addition, an overburden groundwater map will be prepared each quarter.

Ninety days after the third (final) sampling event, a corrective action groundwater monitoring report will be submitted to RIDEM. The report will include a summary of the analytical results and free product observations organized by monitoring event. This report will also present an evaluation of the data, conclusions, and recommendations. Complete analytical results will be provided in an appendix.

If a recoverable volume of product is determined to be present, recommendations regarding evaluation of additional potential remedial measures will be presented.

6.0 PROPOSED SCHEDULE

Table 6-1 presents a proposed schedule for implementing the selected remedial action and related activities. This schedule assumes a 30-day cycle for RIDEM review of deliverable and interim documents.

This schedule indicates that groundwater monitoring will be performed semi annually, and begin when remediation is at or near completion.

TABLE 6-1
EXCAVATION, TRANSPORTATION, AND OFF-SITE DISPOSAL
PROJECT SCHEDULE
FORMER BUILDING 44 UST SITE GOULD ISLAND
NETC-NEWPORT, RHODE ISLAND

Activity	Duration (Days)
RIDEM Review - Building 44 UST Site CAP	30
Workplan Preparation/Subcontractor Procurement	107
Mobilization	16
Soil Excavation	39
Free Product Recovery (concurrent with Soil Excavation)	39
Confirmation Sampling and Analysis	8
Backfill Excavation with Clean Fill	3
Soil Transportation and Disposal (landfilling)	12
Install/Develop Replacement Monitoring Wells	14
Remediation Report Preparation	48
Groundwater Monitoring (1½ years)	420
Groundwater Monitoring Report	48

Note: Sum of activity duration is greater than project duration due to activity overlapping

REFERENCES

Bioscreen, Natural Attenuation Decision Support System, Users Manual Version 1.3, EPA/600/R-96/087, August 1996.

Brown & Root Environmental, November 1997. UST Site Investigation Report, Building 44 (Former Pump House) Gould Island. Contract Task Order 0143 Northern Division, NAVFAC, Contract No. N62472-90-D-1298.

Brown & Root Environmental, May 1997. Work Plan Addendum No. 7, Contract Task Order 0143 Northern Division, NAVFAC, Contract No. N62472-90-D-1298.

ERA (Environmental Resource Associates, Inc.), September 1994. UST Closure Assessment, NETC Building 44, Gould Island, Portsmouth, Rhode Island, Facility ID#211.

Quad Three Group, Incorporated, May 1996. Phase I Environmental Assessment, Building 44 (former Pump House) - Gould Island. Quad Three Group, Wilkes Barre, Pennsylvania.

Quad Three Group, Incorporated, January 1997. Supplemental Site Investigation. Building 44 - Gould Island. Quad Three Group, Wilkes Barre, Pennsylvania.

Rhode Island Department of Environmental Management, 1993. Regulations for Underground Storage Facilities Used for Petroleum Products and Hazardous Materials. Underground Storage Tank Section, Providence, Rhode Island.

Rhode Island Department of Environmental Management, 1996. Rules and Regulations for Groundwater Quality. Division of Groundwater and Individual Sewage Disposal Systems, Providence, Rhode Island.

Rhode Island Department of Environmental Management, 1997. Water Quality Regulations. Division of Water Resources, Providence, Rhode Island.

Rhode Island Department of Environmental Management, 1993, Amended, 1996. Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases. Division of Site Remediation, Providence, Rhode Island.

Suthersan, S. S., Remediation Engineering Design Concepts, CRC Press Inc., 1997.

APPENDIX A
GROUNDWATER LEAD SAMPLING ANALYTICAL RESULTS AND PRODUCT BAILDOWN TEST RESULTS

Brown & Root Services

55 Jonspin Road / Wilmington, MA 01887-1020 / 978-658-7899 / Fax: 978-658-7870

C-NAVY-4-98-1150W

Project Number 0288

April 1, 1998

Mr. Brian Helland
Remedial Project Manager
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, Pennsylvania 19113

Reference: Contract No. N62472-90-D-1298, Navy (CLEAN), Contract Task Order No. 143, Tank Farms 4 and 5, NETC, Newport, Rhode Island

Subject: Transmittal of Former Building 44 UST Site, Gould Island Groundwater Lead Sampling Analytical Results and Product Baildown Test Results

Dear Mr. Helland:

Enclosed for submittal are three copies of the Former Building 44 UST Site, Gould Island Gr undwater Lead Sampling Analytical Results and Product Baildown Test Results.

Gr undwater Lead Sampling Analytical Results

Field-filtered groundwater samples were collected on March 3, 1998 from 11 wells listed below to accurately determine the level of dissolved lead concentrations in groundwater.

MW-201	MW-205	MW-209
MW-202	MW-206	MW-001
MW-203	MW-207	MW-003
MW-204	MW-208	

Samples were analyzed for lead by a subcontractor analytical laboratory located in Rhode Island. A minimum level data review of the analytical results was performed by B&R Environmental. A summary analytical data table is enclosed along with the analytical data. Lead was identified in 5 of the 11 wells sampled. Positive detections ranged from 1.0 ug/l in MW-208 to 1.9 ug/l in MW-206, all below the RIDEM Groundwater Objective for GA areas of 15.0 ug/l. These dissolved, (filtered) concentrations are much lower than the total, (unfiltered) concentrations reported from the August 1997 sampling results. These data support the statement in the Site Investigation Report (B&RE, 1997, page 6-2) that the lead concentrations are related to turbidity in the samples.

Product Baildown Tests

Product baildown tests were made to estimate recoverability and thickness of LNAPL in the formation. Groundwater levels were measured, and NAPL or product accumulation was checked in all site monitoring wells using an electronic oil/water interface probe. Groundwater elevations and LNAPL thickness observations/measurements are presented in the attached table. Product baildown tests were conducted in MW-001 and MW-205 to determine if product recovery rates are measurable.

Product thickness in the aquifer formation was estimated using a "Bail Down Test" as presented by Hughes, John P., Clay R. Sullivan, and Ronald E. Zinner in Techniques for Estimating the Thickness of Petroleum Product in the Subsurface, (National Ground Water Association, 1992). This method involves bailing the free product from the monitoring well and measuring the rate of pr duct accumulation in the well. These data are then plotted on graph paper and the inflection point in the data curve is determined and the product thickness in the formation is calculated.

Baildown data gathered from MW-001 and MW-205 were analyzed. This analysis indicated that 0.15 feet of product was in the formation at MW-001 (see attached data and graph). However, the bail down test at MW-205 was not successful because the product in this well was so viscous that it became smeared along the inside of the well casing during removal. The smeared pr duct prevented the rapid insertion of the probe in the well resulting in inconsistent depth to product measurements. In addition, the smeared product recharged the well along with the formation product. When product recovery occurs from both inside the well casing and from the formation, it is not possible to separate how much product is received from each source and the test is invalid.

The area of free product was estimated using observations made during the B&RE site investigation and by product observation reported by previous investigators. Observations made during test pit excavation indicate the presence of potential product in the vicinity of the USTs (sheen or immissible liquid floating on the water in the test pits). Similarly, the southern extent of the free product is assumed to be between monitoring well MW-002 where free product has been reported and monitoring well MW-204 where free product was not observed (MW-002 could not be located during the SI). Based on these observations, a potential LNAPL area of about 10,850 square feet (ft^2) is present at the site. Product thickness is assumed to be uniform at 0.15 feet. It is also assumed that the formation in this area has a porosity of 25 percent. This indicates that potentially 407 cubic feet (ft^3) or 3,044 gallons of product may be present. This estimate assumes that the conditions at monitoring well MW-001 are representative of conditions across the site.

The percentage of the total volume of product that can be removed varies depending on the capillary forces, the size of the formation pores, and the characteristics of the product.

Therefore, the amount of recoverable product is expected to vary across the potential LNAPL area. Typical recovery percentages range from 30 percent to 50 percent depending of the characteristics of the product and the formation. Therefore, it is estimated that between 900 and 1500 gallons of recoverable product is present at the Former Building 44 UST Site. The actual volume can only be determined through monitoring during recovery.

If you have any comments or questions on this transmittal, please contact me.

Very truly yours,

Michael S. Mealey for
James R. Forrelli, P.E.
Project Manager

JRF/rt

Enclosures

c: R. Roberge, NETC-Newport, Code 40E (w/enc. - 2)
J. Trepanowski/G. Glenn, B&R Environmental (w/enc.)
File 0288-3.2 w/o enc./0288-8.0 (w/enc.)

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-NAVY-3-98-1148W

Date: March 31, 1998

cc: File 0288-D-4.10

To: James Forrelli

From: Maureen Parker MP

Subject: Data Review, Project No. 0288, SDG No. SMW203
Celmic Corporation
CTO 143, NETC Building 44 (Gould Island) Site, Newport, RI

Filtered Lead:14 Groundwaters/ G44S-MW-001, G44S-MW201, G44S-MW-202, G44S-MW-203, G44S-MW-204, G44S-MW-205, G44S-MW-206, G44S-MW-207, G44S-MW-208, G44S-MW-209, G44S-MW-3, G44S-MW-DUP1, G44S-MW-DUP2

Rinsate Blank: 1 water/ G44S-MW-RB1

A cursory data review was performed on the inorganic data associated with the groundwater samples collected at the NETC Building 44 (Gould Island) site on March 3,1998. The samples were analyzed for lead by USEPA SW-846 Method 3005A/6010A.

The data package was checked for completeness. The laboratory was contacted on March 30, 1998 to request a Quality Assurance Review form that was required but not included in the data package. The form was faxed to B&RE on March 31, 1998.

The data package was checked for blank contamination and laboratory and field precision. No blank contaminants were found and the laboratory and field duplicate analyses met quality control criteria.

The review included a check for major non-compliances in the quality control summary forms and data summary forms. No major non-compliances were found. The summary table results should be used with caution since the sample data have not been validated.

APPENDIX B
ALTERNATIVE COST ESTIMATE SUMMARY

Remedial Alternative Cost Estimate Summary
Corrective Action plan
Former Building 44 UST Site, Gould Island
NETC-Newort, Rhode Island
CTO143

Alternative	Duration (months)	Costs					
		Capital Cost	Annual O&M Cost	Total O&M Cost	Annual Groundwater Monitoring Cost	Total Groundwater Monitoring Cost	Total Capital, O&M, and Monitoring Cost
1 Excavation and On-Site Treatment (Thermal Desorption)	3	$1,401,987	$0	$0	$53,573	$80,359	$1,482,347
2. Excavation, Transportation and Off-Site Disposal (Landfill)	3	$703,246	$0	$0	$53,573	$80,359	$783,605
3 In-Situ Bioremediation	24	$365,644	$157,358	$236,037	$53,573	$80,359	$682,040
4 Ex-Situ Bioremediation (Biopiles)	12	$1,168,250	$138,482	$138,482	$53,573	$80,359	$1,387,091

Remedial Alternative Present W rth Analysis
Corrective Action plan
Former Building 44 UST Site, G uld Island
NETC-Newort, Rhode Island
CTO143

Alternative	Year					Total Present Worth
	0	1	2	3	4	
1 Excavation and On-Site Treatment (Thermal Desorption)						
Capital Cost	$1,401,987					
O&M/Monitoring Cost		$53,573	$26,786 38			
Annual Cost	$1,401,987	$53,573	$26,786			
Interest Factor (Annual Discount Rate 5 %)	1 00	0 952	0 907	0 864	0 823	
Present Worth	1,401,987	$51,001	$24,295	$0	$0	$1,477,284
2 Excavation, Transportation and Off-Site Disposal (Landfill)						
Capital Cost	$703,246					
O&M/Monitoring Cost		$53,573	$26,786			
Annual Cost	$703,246	$53,573	$26,786			
Interest Factor (Annual Discount Rate 5 %)	1 00	0 952	0 907	0 864	0.823	
Present Worth	$703,246	$51,001	$24,295	$0	$0	$778,542
3 In-Situ Bioremediation						
Capital Cost	$365,644					
O&M/Monitoring Cost	$0	$157,358	$157,358	$53,573	$26,786	
Annual Cost	$365,644	$157,358	$157,358	$53,573	$26,786	
Interest Factor (Annual Discount Rate 5 %)	1 00	0 952	0 907	0 864	0 823	
Present Worth	$365,644	$149,805	$142,724	$46,287	$22,045	$726,504
4 Ex-Situ Bioremediation (Biopiles)						
Capital Cost	$1,168,250					
O&M/Monitoring Cost		$138,482	$53,573	$53,573		
Annual Cost	$1,168,250	$138,482	$53,573	$26,786		
Interest Factor (Annual Discount Rate 5 %)	1 00	0 952	0 907	0 864	0 823	
Present Worth	$1,168,250	$131,835	$48,590	$23,143	$0	$1,371,819

Cost Estimate
Alternative 1 - Excavation and On-Site Treatment (Thermal Desorption)
Corrective Action Plan
Former Building 44 UST Site (Gould Island)
NETC-Newport, Rhode Island
CTO143

Item	Quantity	Unit	Unit Cost	Subtotal Cost
Capital Costs				
1) General				
Mobilization/Demob via Barge(a)	1	ls	$50,000	$50,000
Eng. and Site Controls	1	ls	$2,500	$2,500
Mobile Office	3	mo	$550	$1,650
Portable Sanitary Facilities	3	mo	$85	$255
Portable Generator & Fuel	1	ls	$20,000	$20,000
Benchscale Test	1	ea	$5,000	$5,000
2) Excavation & Thermal Desorption (a)				
Excavate contaminated Soil	5,000	ton	$5	$25,000
Screen Construction Debris	1	ls	$25,000	$25,000
Stockpile/Stage Soil	5,000	ton	$2	$10,000
Thermally process contaminated soil	5,000	ton	$120	$600,000
Sampling & Analysis of Treated Soil	10	sample	$500	$5,000
3) Backfill Treated Soil				
Stockpile/Stage Soil	5,000	ton	$5	$25,000
Backfill Excavation (in 1' lifts)	5,000	ton	$2	$10,000
			General subtotal	$779,405
4) Monitoring Well Replacement				
Mob/Demob	1	ls	$10,000	$10,000
Overburden Drilling	70	ft	$65	$4,550
Well Casing & Screen	70	ft	$16	$1,120
Well Development	10	hr	$155	$1,550
IDW Disposal (Liquid)	275	gal	$2	$550
Loader	5	day	$250	$1,250
IDW Disposal (Bulk)	5	ton	$450	$2,250
Decontamination	5	ea	$250	$1,250
Frame & cover w/ concrete pad	5	ea	$350	$1,750
			Well subtotal	$24,270
5) Free Product Removal				
Skimmer Pump	1	pump	$6,500	$6,500
NAPL Collection	1	ls	$7,500	$7,500
NAPL disposal	1,500	gal	$10	$15,000
			Free Product Subtotal	$29,000

Cost Estimate
Alternative 1 - Excavation and On-Site Treatment (Thermal Desorption)
Corrective Action Plan
Former Building 44 UST Site (Gould Island)
NETC-Newport, Rhode Island
CTO143

6) Construction Management	15%	ls	$832,675	$124,901
			Capital Cost Subtotal	$957,576
			G&A 10% -	$95,758
			Total Direct Capital Cost	$1,053,334
			Profit 10% of Total Direct Cost -	$105,333
				$1,158,667
			Engineering 6% -	$69,520 04
			Contingency 15% -	$173,800 09
			Total Capital Cost	$1,401,987
7) Groundwater Monitoring (b)				
Annual O&M				
Mobilization to the island	2	events	$1,000	$2,000
Technicians (Labor)	2	events	$4,500	$9,000
Sample Analysis (b)	10	samples	$2,500	$25,000
Project Management	1 0	year	$2,500	$2,500
			Annual Groundwater Monitoring Cost Subtotal	$38,500
			G&A 10% -	$3,850
			Annual Total Direct Groundwater Monitoring Cost	$42,350
			Profit 10% of Total Annual Direct Groundwater Monitoring Cost -	$4,235
				$46,585
			Contingency 15% -	$6,988
			Total Annual Groundwater Monitoring Cost	$53,573
			Groundwater Monitoring Duration (years)	1 5
			Total Groundwater Monitoring Costs	$80,359
			Total Estimated Project Costs	**$1,482,347**

Notes
(a) Does not include air permitting, and building/operating permits
(b) 3 semi-annual sampling events -
5 wells sampled each event for TPH, SVOCs, VOCs, dissolved and filtered metals

Cost Estimate
Alternative 2 -Excavation, Transportation and Off-Site Disposal (Landfill)
Corrective Action Plan
Former Building 44 UST Site (Gould Island)
NETC-Newport, Rhode Island
CTO143

Item	Quantity	Unit	Unit Cost	Subtotal Cost
1) General				
Mobilization/Demob via Barge(a)	1	ls	$50,000	$50,000
Eng. and Site Controls	1	ls	$2,500	$2,500
Mobile Office	3	mo	$550	$1,650
Portable Sanitary Facilities	3	mo	$85	$255
Portable Generator & Fuel	1	ls	$0	$0
2) Excavation, Transport & Disposal (Landfill)				
Excavate contaminated Soil	5,000	ton	$5	$25,000
Screen Construction Debris	1	ls	$25,000	$25,000
Stockpile/Stage Soil	5,000	ton	$2	$10,000
T&D contaminated soil	5,000	ton	$35	$175,000
Confirmation Sampling & Analysis	10	sample	$500	$5,000
3) Backfill w/ Imported, Clean Soil				
Transport/barge soil to island	5,000	ton	$5	$25,000
Provide/Stage Soil	5,000	ton	$7	$35,000
Backfill Excavation (in 1' lifts)	5,000	ton	$2	$10,000
			General subtotal	$364,405
4) Monitoring Well Replacement				
Mob/Demob	1	ls	$10,000	$10,000
Overburden Drilling	70	ft	$65	$4,550
Well Casing & Screen	70	ft	$16	$1,120
Well Development	10	hr	$155	$1,550
IDW Disposal (Liquid)	275	gal	$2	$550
Loader	5	day	$250	$1,250
IDW Disposal (Bulk)	5	ton	$450	$2,250
Decontamination	5	ea	$250	$1,250
Frame & cover w/ concrete pad	5	ea	$350	$1,750
			Well subtotal	$24,270
5) Free Product Removal				
Skimmer Pump	1	pump	$6,500	$6,500
NAPL Collection	1	ls	$7,500	$7,500
NAPL disposal	1,500	gal	$10	$15,000
			Free Product Subtotal	$29,000

6) Construction Management	15%	ls	$417,675	$62,651
			Capital Subtotal·	$480,326
			G&A 10% -	$48,033
			Total Direct Capital Cost	$528,359
			Profit 10% of Total Direct Cost -	$52,835 89
				$581,195
			Engineering 6% -	$34,871 69
			Contingency 15% -	$87,179 21
			Total Capital Cost	$703,246
7) Groundwater Monitoring (b)				
<u>Annual O&M</u>				
Mobilization to the island	2	trip	$1,000	$2,000
Technicians (Labor)	2	trip	$4,500	$9,000
Groundwater Sampling (b)	10	samples	$2,500	$25,000
Project Management	1 0	year	$2,500	$2,500
			Annual Groundwater Monitoring Cost Subtotal	$38,500
			G&A 10% -	$3,850
			Annual Total Direct Groundwater Monitoring Cost	$42,350
			Profit 10% of Total Annual Direct Groundwater Monitoring Cost -	$4,235
				$46,585
			Contingency 15% -	$6,988
			Total Annual Groundwater Monitoring Cost	$53,573
			Groundwater Monitoring Duration (years)	1 5
			Total Groundwater Monitoring Costs	$80,359
			Total Estimated Project Costs	**$783,605**

Notes
(a) Does not include air permitting, and building/operating permits
(b) 3 semi-annual sampling events -
5 wells sampled each event for TPH, SVOCs, VOCs, dissolved and filtered metals

Cost Estimate
Alternative 3 - In-Situ Bioremediation
Corrective Action Plan
Former Building 44 UST Site (Gould Island)
NETC-Newport, Rhode Island
CTO143

Item	Quantity	Unit	Unit Cost	ubtotal Cost
1) General				
Mobilization/Demob via Barge(a)	1	ls	$50,000	$50,000
Eng. and Site Controls	1	ls	$2,500	$2,500
Mobile Office	3	mo	$550	$1,650
Portable Sanitary Facilities	3	mo	$85	$255
Portable Generator & Fuel	1	ls	$0	$0
Transport to/from island (Tt NUS)	3	mo	$1,000	$3,000
2) Treatability Study				
Collect Soil & GW samples	1	ea	$5,000	$5,000
Benchscale Lab-study	1	ea	$25,000	$25,000
Prepare TS Report	1	ea	$12,500	$12,500
3) Full-Scale Implementation				
Install Equipment Enclosure	1	ls	$10,000	$10,000
Air Compressor	1	ea	$7,500	$7,500
Solution Vessels (Poly Drums)	3	ea	$800	$2,400
Perforated Hosing	500	lf	$9	$4,500
Generator	1	ea	$25,000	$25,000
Fuel Tank for Generator	1	ea	$8,000	$8,000
			General subtotal	$157,305
4) Additional Well Installation				
Mob/Demob	1	ls	$15,000	$15,000
Overburden Drilling	150	ft	$65	$9,750
Well Casing & Screen	150	ft	$16	$2,400
Well Development	150	hr	$155	$23,250
IDW Disposal (Liquid)	330	gal	$2	$660
Loader	10	day	$250	$2,500
IDW Disposal (Bulk)	6	ton	$450	$2,700
Decontamination	6	ea	$250	$1,500
Frame & cover 2/ concrete pad	6	ea	$350	$2,100
			Site work subtotal	$59,860

5) Construction Management	15%	ls	$217,165	$32,575
			Capital Subtotal.	$249,740
			G&A 10% -	$24,974
			Total Direct Capital Cost	$274,714
			Profit 10% of Total Direct Cost -	$27,471
				$302,185
			Engineering 6% -	$18,131 11
			Contingency 15% -	$45,327.76
			Total Capital Cost	$365,644

6) Operation & Maintenance

Mobilization to the island	12	trip	$1,000	$12,000
Microbes	4	dosing	$500	$2,000
Nutrients	4	dosing	$500	$2,000
Technicians	12	mo	$4,500	$54,000
Maintenance (a)	4	mo	$500	$2,000
Generator Fuel	12	mo	$1,750	$21,000
Portable Sanitary Facilities	1	mo	$85	$85
NAPL disposal	750	gal	$10	$7,500
Project Management	1	mo	$2,500	$2,500
Groundwater Sampling (b)	4	quarter	$2,500	$10,000
			Annual O&M Cost Subtotal:	$113,085
			G&A 10% -	$11,309
			Annual Total Direct O&M Cost	$124,394
			Profit 10% of Total Annual Direct O&M Cost -	$12,439
				$136,833
			Contingency 15% -	$20,525
			Total Annual O&M Cost	$157,358
			O&M Duration (years)	2
			Total O&M Costs	$236,037

7) Groundwater Monitoring ©

<u>Annual Groundwater Monitoring</u>

Mobilization to the island	2	event	$1,000	$2,000
Technicians (Labor)	2	event	$4,500	$9,000
Groundwater Sampling (b)	10	samples	$2,500	$25,000
Project Management	1 0	year	$2,500	$2,500
			Annual Groundwater Monitoring Cost Subtotal	$38,500
			G&A 10% -	$3,850
			Annual Total Direct Groundwater Monitoring Cost	$42,350
			Profit 10% of Total Annual Direct Groundwater Monitoring Cost -	$4,235
				$46,585
			Contingency 15% -	$6,987 75
			Total Annual Groundwater Monitoring Cost	$53,573
			Groundwater Monitoring Duration (years)	$2
			Total Groundwater Monitoring Costs	$80,359
			Total Estimated Project Costs	**$682,040**

Notes

(a) Includes replacement parts required for preventive maintenance

(b) Lab fees to analyze vapor, NAPL and water samples for disposal.

(c) 3 semi-annual sampling events -

5 wells sampled each event for TPH, SVOCs, VOCs, dissolved and filtered metals

Cost Estimate
Alternative 4 - Ex-Situ Bioremediation (Biopiles)
Corrective Action Plan
Former Building 44 UST Site (Gould Island)
NETC-Newport, Rhode Island
CTO143

Item	Quantity	Unit	Unit Cost	Subtotal Cost
1) General				
Mobilization/Demob	1	ls	$10,000	$10,000
Eng and Site Controls	1	ls	$2,500	$2,500
Mobile Office	12	mo	$550	$6,600
Portable Sanitary Facilities	12	mo	$85	$1,020
Transport. to/from island (Tt NUS)	12	mo	$1,000	$12,000
2) Treatability Study				
Collect Soil & GW samples	1	ea	$5,000	$5,000
Benchscale Lab-study	1	ea	$25,000	$25,000
Prepare TS Report	1	ea	$12,500	$12,500
3) Excavation				
Excavate contaminated Soil	5,000	ton	$15	$75,000
Screen Construction Debris	1	ls	$25,000	$25,000
Stockpile/Stage Soil	5,000	ton	$5	$25,000
Confirmation Sampling & Analysis	25	sample	$500	$12,500
4) Free Product Removal				
Skimmer Pump	1	pump	$6,500	$6,500
NAPL Collection	1	ls	$7,500	$7,500
NAPL disposal	1,500	gal	$10	$15,000
5) Biopile Construction				
Bulldozer (w/ operator)	3	mo	$16,278 40	$48,835
Wheel Loader (2, w/ operators)	6	mo	$12,278 40	$73,670
Sand Berm (a)	30	cy	$41 50	$1,245
40 mil Polyethylene Liner (a)	25,000	sf	$1 09	$27,250
Crushed Stone Layer (a)	250	cy	$18 47	$4,618
4" Slotted PVC Pipe (a)	6,200	lf	$7 22	$44,764
4" PVC Manifold Pipe (a)	400	lf	$9 48	$3,792
Soil Moisture Content Analyses	5	ea	$100	$500
20 mil PVC Cove(a)	31,000	sf	$0 22	$6,820
15 HP Blower	1	ea	$4,870	$4,870
Elec Panel	1	ea	$3,000	$3,000
Solution Vessels (Poly Drums)	3	ea	$800	$2,400
Shed for Blower and Solution Vessels	1	ea	$3,500	$3,500
Perforated Hosing	2,000	lf	$9	$18,000
Pump for Solution Vessels	2	ea	$400	$800
Pump for GW Extraction	2	ea	$400	$800
Generator	1	ea	$25,000	$25,000
Fuel Tank for Generator	1	ea	$8,000	$8,000
6) Backfill Excavation				
Mobilization/Demob	1	ls	$10,000	$10,000
Bulldozer (w/ operator)	3	hr	$10,678 40	$32,035
Wheel Loader (2, w/ operator)	6	hr	$7,667 20	$46,003
Dismantle piping and equipment	1	ls	$10,000	$10,000
Dispose of piping, liner, and cover	6	tons	$80	$480
			General Subtotal	$617,503
7) Monitoring Well Replacement				
Mob/Demob	1	ls	$15,000	$15,000
Overburden Drilling	200	ft	$65	$13,000
Well Casing & Screen	200	ft	$16	$3,200
Well Development	200	hr	$155	$31,000
IDW Disposal (Liquid)	825	gal	$2	$1,650
Loader	14	day	$250	$3 500
Decontamination	15	ea	$250	$3,750
Frame & cover w/ concrete pad	15	ea	$350	$5,250
			Well subtotal	$76,350

Cost Estimate
Alternative 4 - Ex-Situ Bioremediation (Biopiles)
Corrective Action Plan
Former Building 44 UST Site (Gould Island)
NETC-Newport, Rhode Island
CTO143

Item	Quantity	Unit	Unit Cost	Subtotal Cost
8) Construction Management	15%	ls	$693,853	$104,078
			Capital Subtotal	$797,930
			G&A 10% -	$79,793 04
			Total Direct Capital Cost	$877,723
			Profit 10% of Total Direct Cost -	$87,772
				$965,496
			Engineering 6% -	$57,930
			Contingency 15% -	$144,824
			Total Capital Cost	$1,168,250
9) Operation & Maintenance (12 months)				
Mobilization to the island	24	trip	$200	$4,800
Microbes	4	dosing	$500	$2,000
Nutrients	4	dosing	$500	$2,000
Technicians (2 @ 2 days/month)	12	mo	$4,500	$54,000
Maintenance (b)	12	mo	$200	$2,400
Generator Fuel	12	mo	$1,750	$21,000
Portable Sanitary Facilities	12	mo	$85	$1,020
Project Management	1	mo	$2,500	$2,500
Biopile O_2/CO_2 Monitoring	12	event	$150	$1,800
Biopile Soil Sampling (5 samples)	4	event	$2,000	$8,000
			Annual O&M Cost Subtotal	$99,520
			G&A 10% -	$9,952
			Annual Total Direct O&M Cost	$109,472
			Profit 10% of Total Annual Direct O&M Cost -	$10,947
				$120,419
			Contingency 15% -	$18,062 88
			Total Annual O&M Cost	$138,482
			O&M Duration (years)	1
			Total O&M Cost	$138,482
10) Groundwater Monitoring (d)				
Annual Groundwater Monitoring				
Mobilization to the island	2	trip	$1,000	$2,000
Technicians (Labor)	2	trip	$4,500	$9,000
Groundwater Sampling (b)	10	samples	$2,500	$25,000
Project Management	1 0	year	$2,500	$2,500
			Annual Groundwater Monitoring Cost Subtotal	$38,500
			G&A 10% -	$3,850
			Annual Total Direct Groundwater Monitoring Cost	$42,350
			Profit 10% of Total Annual Direct Groundwater Monitoring Cost -	$4,235
				$46,585
			Contingency 15% -	$6,987 75
			Total Annual Groundwater Monitoring Cost	$53,573
			Groundwater Monitoring Duration (years)	1 5
			Total Groundwater Monitoring Costs	$80,359
			Total Estimated Project Costs	**1,387,091**

Notes
(a) Includes cost for installation
(b) Includes replacement parts required for preventive maintenance
(c) Lab fees to analyze vapor NAPL and water samples for disposal
(d) 3 semi-annual sampling events -
5 wells sampled each event for TPH SVOCs, VOCs, dissolved and filtered metals

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Project Number N0288

COPY

January 5, 1999

Mr. Peter Palmerino
Program Manager USTs
Code 40E
Naval Station Newport
One Simonpietri Drive - Building One
Newport, Rhode Island 02841-1711

Reference: Contract No. N62472-90-D-1298, Navy (CLEAN), Contract Task Order No. 143, Tank Farms 4 and 5, NSN, Newport, Rhode Island

Subject: Transmittal of Statement of Accuracy page and Review Copy of Revised Final Building 44 (former Pump House) UST Site (Gould Island) Corrective Action Plan (Revision 2.0)

Dear Mr. Palmerino:

As requested, enclosed are a owner's statement of accuracy page for signature and review copy of the Revised Final Former Building 44 UST Site Corrective Action Plan (CAP) (Revision 2.0). As requested in Mr. Brian Helland's December 16, 1998 e-mail, paragraph 4.2.3 was revised to state that if free product is encountered in the excavation it would be pumped from the excavation and disposed of off site. In addition the Statement of Accuracy was revised to be consistent with the Statement of Accuracy included in the Tank Farm Five CAP. Also, the cover and title page (signature page) reflect the change in the base's name to Naval Station Newport (NSN). The report text still refers to NETC; a statement is included following the Statement of Accuracy to inform the reader of the change.

The owner's statement of accuracy provides signatures by you, Mr. David Dorocz, and Capt. J. C. Wyman. After the original signed owner's statement of accuracy page is returned to me, the final document will be reproduced and distributed to NSN and NORTHDIV.

If you have any comments or questions on this transmittal, please contact me.

Very truly yours,

James R. Forrelli

James R. Forrelli, P.E.
Project Manager

JRF/rt

Enclosures

c: B. Helland, NORTHDIV (w/enc.)
J. Trepanowski/G. Glenn, TtNUS (w/enc.)
File N0288-3.2 w/o enc./N0288-D-8.0 (w/enc.)
D