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SITE CLOSEOUT REPORT FOR FORMER MELVILLE NORTH LANDFILL NS NEWPORT RI
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TETRA TECH NUS

SITE CLOSEOUT REPORT

for

Former Melville North Landfill

NAVSTA, Newport, Rhode Island

Naval Facilities Engineering Command Mid-Atlantic

Contract Number N62470-08-D-1001
Contract Task Order WE64

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SITE CLOSEOUT REPORT

FOR

FORMER MELVILLE NORTH LANDFILL

NAVSTA, NEWPORT, RHODE ISLAND

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command Mid-Atlantic
9742 Maryland Avenue
Norfolk, Virginia 23511-3095

Submitted by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406-1433

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PREPARED UNDER THE DIRECTION OF:

STEPHEN S. PARKER, LSP
PROJECT MANAGER
TETRA TECH NUS, INC.
WILMINGTON, MASSACHUSETTS

APPROVED FOR SUBMISSION BY:

JOHN J. TREPANOWSKI, P.E.
PROGRAM MANAGER
TETRA TECH NUS, INC.
KING OF PRUSSIA, PENNSYLVANIA

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List of Abbreviations and Acronyms

bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAP	Corrective Action Plan
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLEAN	Comprehensive Long Term Environmental Action Navy
CTO	Contract Task Order
DEC	Direct Exposure Criteria
DOD	Department of Defense
DRO	Diesel Range Organics
EEI	Envirodyne Engineers, Inc.
EPA	Environmental Protection Agency
FFA	Federal Facilities Agreement
FwEC	Foster Wheeler Environmental Corporation
GA	RIDEM groundwater classification
GRO	Gasoline Range Organics
IAS	Initial Assessment Study
ICDEC	Industrial/Commercial Direct Exposure Criteria
IR	Installation Restoration
mg/L	milligrams per liter
mg/Kg	milligrams per kilogram
MLW	Mean Low Water
NAVSTA	Naval Station
NETC	Naval Education and Training Center
NOV	Notice of Violation
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl

PCE	Tetrachloroethylene
ppm	part per million
RDEC	Residential Direct Exposure Criteria
RIDEM	Rhode Island Department of Environmental Management
RSL	Regional Screening Level
SI	Site Investigation
SVOC	Semi-Volatile Organic Compound
TPH	Total Petroleum Hydrocarbons
TtEC	Tetra Tech EC, Inc.
TtNUS	Tetra Tech NUS, Inc.
TVPH	Total Volatile Petroleum Hydrocarbons
µg/L	micrograms per liter
ug/Kg	micrograms per kilogram
UST	Underground Storage Tank
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This report has been prepared to support closeout of the former Melville North Landfill (the site) located at Naval Station (NAVSTA) Newport, in Portsmouth, Rhode Island, and previously owned by the Navy. The report was prepared at the request of the U.S. Department of Navy (Navy) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62470-08-D-1001, Contract Task Order (CTO) WE 64. The site is recommended for close-out because soil excavation activities were completed in accordance with the soil remediation cleanup goals, follow-up monitoring shows no exceedances of Rhode Island soil or groundwater criteria, and no measurable free product is present at the site.

E.1 SITE DESCRIPTION

The 10-acre site is located in the northwest portion of NAVSTA Newport on the shoreline of Narragansett Bay in the Town of Portsmouth. The site was used as a landfill for at least the period of time beginning after World War II until 1955. The landfill reportedly received a variety of waste materials, including spent acids, various waste oils (diesel, fuel, lube), solvents, waste paints, and possibly polychlorinated biphenyls (PCBs). Some of the original suspected and/or identified source areas at the site included two waste lagoons, two small possible impoundment areas, and mounds of oil-soaked soil, reportedly from disposal of oil sludge material that was generated while cleaning fuel supply tanks at the nearby tank farms, or from cleanup operations of various oil spills.

The site was transferred from the Navy to the State of Rhode Island in September 1983; six months later, the property was sold to its current owner, Melville Marine Industries. However, the Navy retained responsibility for environmental concerns from previous use of the site as a landfill. The former Melville North Landfill was transferred to the State prior to NAVSTA Newport being placed on the National Priorities List (NPL), and it was agreed with EPA and Rhode Island that the Navy would not be required to follow the CERCLA process for this site. Rather, environmental investigations at the site would be conducted according to the Rhode Island Remediation Regulations.

Removal actions were conducted in 1993 and 1995, including the removal of oily soil piles from the northern end of the site (approximately 800 cubic yards of soil and 100 cubic yards of railroad timbers) and an estimated 8,946 cubic yards of soil and debris. The Navy then conducted a Site Investigation (SI) in accordance with the Rhode Island Department of Environmental Management (RIDEM) Remediation Regulations. Although the SI did not identify risks to current (industrial) receptors, the Navy agreed to conduct another removal action as a final remedy for the site. The removal action was conducted between April 1999 and May 2000.

Post-soil-removal groundwater monitoring ensued to evaluate groundwater quality at the site as requested by RIDEM. This work was conducted according to the *Work Plan for Groundwater Monitoring* (Tetra Tech, 2003). Three monitoring wells were installed and three groundwater monitoring events (Rounds 1 through 3) were conducted in August 2003, April 2004, and August 2004.

Soil samples were collected during the installation of the new monitoring wells. There were no exceedances of corresponding RIDEM criteria. Analytical results of groundwater samples collected using the low flow purge technique during the three rounds showed no exceedances of corresponding RIDEM criteria. No measurable free product was detected during the three rounds.

Therefore, as a result of the removal actions conducted at the former Melville North Landfill, and based on the post-soil-removal soil and groundwater results, no further action is needed at this site. The former Melville North Landfill is recommended for close-out under the RIDEM Remediation Regulations.

1.0 INTRODUCTION

The purpose of this report is to provide documentation to support the closeout of the former Melville North Landfill (the site), located at Naval Station (NAVSTA) Newport, in Portsmouth, Rhode Island, and previously owned by the Navy. This report was prepared at the request of the U.S. Department of Navy (Navy) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62470-08-D-1001, Contract Task Order (CTO) WE 64.

Four report sections are included. Section 1 is the introduction and presents a description of the site and a summary of background information pertinent to this closeout report, including site history, findings of the 1996 – 1997 Site Investigation (SI), including site geology and hydrogeology as evaluated during the SI, and results of estimated risks to human health. Additional site information is provided in the final SI Report for Melville North Landfill (Brown & Root Environmental [B&R Environmental], 1997). Section 2 presents a description of the remedial (or removal) actions conducted at the site between 1993 and 2000. Section 3 presents a summary of the post-soil-removal groundwater monitoring conducted in 2003 and 2004, and Section 4 presents conclusions and recommendations.

1.1 SITE LOCATION AND DESCRIPTION

NAVSTA Newport (formerly the Naval Education and Training Center [NETC]) is located in the City of Newport and the Towns of Middletown and Portsmouth, Rhode Island, on the western shore of Aquidneck Island facing the east passage of Narragansett Bay. The Melville North Landfill Site is located in the northwest portion of NAVSTA Newport on the shoreline of Narragansett Bay in the Town of Portsmouth (Figure 1-1).

Access to the Melville North Landfill Site is gained from the east via Defense Highway. The site is approximately 10 acres in size and is bounded to the west by Narragansett Bay, to the east by the Penn Central railroad tracks and Defense Highway beyond, to the north by vegetated wetlands (salt marsh), and to the south by a wooded upland area. The topography of the site is relatively flat, with a decrease in elevation between 5 and 10 feet along the shoreline to the west, and an increase in elevation between 5 and 10 feet along Defense Highway to the east. Ground elevations at the site rise from approximately mean sea level (msl) along the western margin of the site to approximately 22 feet along the eastern margin of the site, along a ridge adjacent to the railroad tracks. Across the relatively flat interior of the site, ground elevations generally vary between 10 and 20 feet above msl. A thin, elongated swale is adjacent to the railroad tracks in the central portion of the site, and runs northward toward the low-lying salt marsh, north of the site (Figure 1-2).

1.2 SITE HISTORY

The site was used as a landfill for at least the period of time beginning after World War II until 1955. (The date of initial landfilling activities at the site is unclear, but indications are that its use began after the war.) Following its closure in 1954, wastes generated at the naval complex were disposed of at Navy property, the McAllister Point Landfill. The site was transferred from the Navy to the State of Rhode Island in September 1983. Six months later the property was sold to its current owner, Melville Marine Industries. However, the Navy retained responsibility for environmental concerns from previous use of the site as a landfill.

The landfill reportedly received a variety of waste materials from World War II until 1955. These wastes included spent acids, various waste oils (diesel, fuel, lube), solvents, waste paints, and possibly polychlorinated biphenyls (PCBs). Some suspected and/or identified source areas at the site included two waste lagoons, approximately 60 feet long and 25 feet wide, in the central portion of the landfill; two small possible impoundment areas located in the southwest portion of the landfill; an oily waste pile located in the northern-central portion of the landfill (prior to a 1993 removal action); and several additional areas that were part of a 1995 removal action, including areas identified as “Area S” and “Area N”. (Information on removal actions is presented in Section 2, and areas of excavation are indicated on Figure 2-1).

Inspections of the site had revealed mounds of oil-soaked soil and other surface areas that were covered with oil and oil sludge. It was reported that the mounds of oily soil came from disposal of oil sludge material that was generated while cleaning fuel supply tanks at the nearby tank farms, or from cleanup operations of various oil spills. In addition, four drums containing petroleum product were found during the 1995 removal action excavation (Corah, 1995a). The total quantity of wastes disposed in the landfill is unknown.

The site was first studied in the early 1980s when the NETC Initial Assessment Study (IAS), completed in March 1983 by Envirodyne Engineers, Inc., of St. Louis, Missouri, identified Melville North Landfill as a site where suspected contamination may pose a threat to human health or the environment, and recommended further study (TRC, 1992). The NETC Confirmation Study (CS) Report was completed in May 1986 and included the collection and analysis of environmental samples; CS samples from the Melville North Landfill indicated that a more comprehensive investigation was necessary (Loureiro, 1986). The NETC was listed on the U.S. Environmental Protection Agency’s (EPA’s) National Priorities List (NPL) of abandoned or uncontrolled waste sites in November 1989.

A Phase I Remedial Investigation/Feasibility Study (RI/FS) Report on five sites at NETC, including the Melville North Landfill, was completed in January 1992 by TRC Environmental Corporation (TRC, 1992).

The Phase I RI concluded that further definition of site contamination was needed. In September 1992, TRC submitted a Draft Phase II RI/FS Work Plan for the Melville North Landfill Site to the Navy for review. Subsequent to submittal, the Navy made a policy decision to complete the environmental characterization work at the Melville North Landfill Site under the Navy CLEAN Program, Contract No. N62472-90-D-1298, and Halliburton NUS Corporation (HNUS) was directed to execute the Phase II RI/FS.

A removal action was conducted in 1993, removing oily soil piles from the northern end of the site. Approximately 800 cubic yards of soil and 100 cubic yards of railroad timbers were removed and sent to approved treatment and disposal facilities (B&R Environmental, 1997).

As part of an interim removal action in September and October 1995, an estimated 6,946 cubic yards of soil and debris were excavated from Area S, and 2,000 cubic yards were removed from Area N (Corah, 1995b). In September 1996, stockpiled materials were removed and shipped offsite for disposal (B&R Environmental, 1996). Additional information regarding removal actions is provided in Section 2.

In 1995, a Phase II RI/FS Work Plan, Revision 1.0, detailed additional RI activities necessary for site under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) regulatory framework (B&R Environmental, 1995). However, since ownership of the Melville North Landfill Site had been transferred to the state prior to NETC being placed on the NPL, it was agreed with the state that the Navy would not be required to follow the CERCLA process for this site; instead, environmental investigations at the site would be conducted according to the Rhode Island *Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases* (referred to as the "Remediation Regulations").

Therefore, in December 1996, B&R Environmental submitted the Final Amendment to the Phase II RI/FS Work Plan, Revision 1.0, on behalf of the Navy. This work plan addressed changes resulting from this change in the applicable regulations (state vs. federal), as well as changes resulting from the removal actions noted above. Under this work plan, the Navy conducted an SI in accordance with the Rhode Island Remediation Regulations.

The SI work was conducted between November 1996 and April 1997, and the SI Report was submitted in August 1997. The objectives of the SI were as follows (B&R Environmental, 1997): determine the nature and extent of contamination, including impacts to groundwater and potential impacts to the Narragansett Bay near-shore environment; conduct a human health risk assessment (HHRA); and develop and evaluate remedial alternatives for the site. The findings of the SI, including a summary of the risk assessment results, are presented in Section 1.3.

Based on the results of the SI, a removal action was conducted as a final remedy for the site from April 1999 to May 2000 (Tetra Tech, 2003). Additional information regarding this removal action is provided in Section 2.

Post-soil-removal groundwater monitoring efforts were conducted to evaluate groundwater quality at the site following the soil excavation/final remedy, based on a request from the Rhode Island Department of Environmental Management (RIDEM). The "Work Plan for Groundwater Monitoring" was submitted in May 2003 by Tetra Tech NUS, Inc. (Tetra Tech), and the groundwater monitoring effort included installing monitoring wells and collecting groundwater samples at the site. Three groundwater monitoring events were conducted in August 2003, April 2004, and August 2004. A summary of the post-soil-removal groundwater evaluation is provided in Section 3.

1.3 FINDINGS OF THE SITE INVESTIGATION (SI): 1996 - 1997

The information presented below is from the SI Report (B&R Environmental, 1997). The SI was conducted to determine the nature and extent of contamination at the former Melville North Landfill. The descriptions of the site geology and hydrogeology provided in this section are based on the 1996 – 1997 SI and do not reflect current conditions as of the date of this Closeout Report (excavation and backfilling was conducted in 1999 – 2000, as discussed in Section 2). An HHRA was also conducted as part of the SI, and remedial objectives were developed. Remedial alternatives were also developed and evaluated, and a preferred remedial alternative was presented.

The SI field activities were conducted primarily between October 1996 and May 1997, and included sediment sampling, a wetlands delineation survey and ecological assessment, a geophysical survey, passive soil gas sampling, soil borings and monitoring well installation, test pit excavations, surface and subsurface soil sampling, groundwater sampling, and a tidal study.

1.3.1 Site Geology and Hydrogeology

Site Soil Types

The natural soils at the site are primarily glacially-derived, as discussed further in the sections below. During the retreat of a glacier, meltwaters can form various outwash deposits such as stratified drift, including layers of sand, silt, and gravel, with occasional clay layers. During active ice movement, glacial tills are deposited that typically consist of a more dense mixture of gravel, silt, clay, and sand. Tidal marsh deposits consisting of fine sands, silts, and clay were deposited during tidal inundation and from surface water discharges from upland areas. Marsh soils can be divided into mucks, beaches, loams,

sands, and urban complexes. The mucks are found in the tidal flats and marshes as well as in inland depressions that hold surface water. Muck-type soils are associated with the wetland that borders the northern end of the landfill. The site also includes imported fill materials and other imported soils such as sand and gravel, termed “urban complexes,” believed to have been placed at the landfill as part of the landfill operations. Wood, metal, and other debris were found within the landfill (Envirodyne Engineers, 1983; B&R Environmental, 1997).

Site Geology

In general, the geologic materials beneath the site consist of three distinct unconsolidated units underlain by bedrock. The unconsolidated units consist of the following: fill (landfill cover material and fill/debris), stratified drift, and glacial till. The bedrock is a dark-colored, fine-grained metamorphic rock described as foliated graphitic rock, including slate, phyllite, and schist.

Fill: Generally described as sand and gravel (backfill and/or cover material), metal debris, ash and cinders, steel rope and netting, and construction debris (charred wood, lumber, glass, brick, asphalt, and concrete). The percentages of each material vary across the site. The average thickness of the fill is 4 feet with a maximum thickness measured at 8 feet.

Stratified Drift: Consists primarily of stratified sands containing variable amounts of silt and gravel. In general, the sand is comprised of fine to medium sand with some coarse sand observed locally. Peat was encountered in a few locations, generally limited to areas within the northern and central portions of the landfill. The stratified drift unit generally increases in thickness toward the bay, with a relatively uniform thickness along the bay.

Till: Consists of a dense, dark gray mixture of sand, silt, gravel, and clay. The depth to the top of the till unit varied from approximately 4 to 34 feet below ground surface (bgs), with the surface of the till sloping generally toward the west. The thickness of the till unit ranged from approximately 6 to 18 feet.

Bedrock: Generally consists of a dark-colored, foliated, metamorphosed, graphitic rock, including slate, phyllite, and schist. Depth to bedrock at the site ranges from approximately 20 to 50 feet bgs, with the bedrock surface sloping generally to the west. Compared to the relatively steep slope of the bedrock surface in the area underlying the railroad tracks to the east, the slope of the bedrock surface in the area underlying the site is more gradual. Bedrock cores observed from the site were generally broken near the top of the bedrock surface and exhibited low-angle fractures (typically less than or equal to 45 degrees) with depth. Quartz-filled veins and staining were common along fractures observed along bedding planes or foliation.

Site Hydrogeology

Groundwater at the Melville North Landfill is relatively shallow. The water table occurs within the landfill materials across most of the site and depths to groundwater range from approximately 2 to 10 feet bgs.

State groundwater classifications at the site include *GB* (northern portion of the site) and *GA* (southern portion of the site), although the GA designation was believed to be in error, since groundwater beneath inactive landfills is classified as GB, according to Rhode Island *Groundwater Quality Regulations* (RIDEM, 1996) (B&R Environmental, 1997). In April 2010, RIDEM proposed amendments to the Groundwater Quality Regulations, which, among other things, governs the boundaries of the groundwater classifications in the state. This April 2010 proposed amendment included the modification of the GB area at the Melville Marina Development in Portsmouth Rhode Island. The modified GB area does not appear to have affected the Former Melville North Landfill area and its split between GA and GB classifications. The south portion of the site still lies within a GA designation. The Amendment was finalized in June 2010.

Groundwater at the site flows west toward Narragansett Bay. The geologic conditions identified during the SI and prior investigations indicate that groundwater present in the fill and natural overburden materials at the site and groundwater that occurs in the underlying fractured bedrock are separated by a glacial till unit of lower permeability; this unit forms a confining or semi-confining layer between the overburden and bedrock groundwater. The overburden consists of several sub-units, including fill/landfill materials and stratified drift.

Slug tests and/or constant discharge tests were performed to provide data for calculating hydraulic conductivities of the geologic materials adjacent to the monitoring well screens. These data were evaluated using analytical methods presented by Bouwer and Rice (1976) and Lambe and Whitman (1969). The hydraulic gradient estimated for the overburden ranges from 0.03 to 0.08, and the hydraulic gradient in bedrock is estimated at 0.04. The hydraulic conductivity of the shallow overburden materials (consisting of the landfill materials and other fill) ranges from 25.5 to 1,687 feet per day. The hydraulic conductivity of the intermediate overburden ranges from 8.6 to 18.1 feet per day. The bulk hydraulic conductivity of the bedrock aquifer ranges from 1.46 to 21.6 feet per day. Groundwater average velocity is estimated to be 253 feet per day, with a minimum average velocity calculated at 3.44 feet per day.

Cyclic changes in both the bedrock and overburden groundwater elevations correlate with observed changes in the bay, as measured during a tidal study performed to determine if tidal fluctuations have a significant impact on groundwater flow direction at the site. The observed changes in the bedrock groundwater elevations were greater than those observed in the overburden, indicating the bedrock is

under confined or semi-confined conditions. The tidal study also indicated an upward vertical gradient between the bedrock and overburden is almost always present. This also is an indication that the till layer is acting as an aquitard, impeding flow between the till/drift and the bedrock. Although the tidal influence of Narragansett Bay can be observed in monitoring wells at the site, the magnitude of the change is not expected to have a significant impact on the groundwater flow direction. As would be expected, groundwater elevations in both the overburden and bedrock are always above the surface water elevation of Narragansett Bay, indicating the ultimate discharge of groundwater into the bay.

1.3.2 Sampling and Analysis Results

Sampling and analytical results indicated that past site activities resulted in the release of both organic and inorganic contaminants detected in on-site soils and sediment. These contaminants were evaluated using RIDEM Industrial/Commercial Direct Exposure Criteria and RIDEM GB Leachability Criteria. The SI identified "hot spots" that appeared to be associated with historical activities at the landfill, such as the Former Oily Waste Pile, Suspected Waste Lagoons, and Possible Impoundment Area. An area of contaminated beach soils with an estimated volume of 850 cubic yards was also identified, resulting from contamination leaching from former "Area S" (some petroleum-contaminated soils had been removed from "Area "S" in 1995 [see Section 2]).

Contaminants exceeding RIDEM criteria included: benzo(a)pyrene; PCBs; arsenic; lead; and Total Petroleum Hydrocarbons (TPH). Some volatile organic compounds (VOCs) and pesticides were also detected in soil samples, but concentrations did not exceed applicable criteria. Evaluation of the groundwater chemical data indicated that groundwater at the site does not exceed the GB groundwater objectives. Upward vertical gradients observed within the overburden limit the downward migration of contaminants into the deep overburden and prevent migration into the bedrock aquifer. Evidence of free-phase petroleum product was observed in several soil samples gathered from test pits, however, no free product was detected in any of the monitoring wells during sampling.

The SI estimated the volume of contaminated surface and subsurface soil and landfill waste existing on site to be approximately 31,000 cubic yards, with an estimated 7,250 cubic yards below the water table.

1.3.3 Human Health Risk Assessment Summary

The HHRA evaluated the potential for adverse health effects resulting from exposure to the site based on the current use at the time (unused) and the future use as a marina. The site-specific (Remediation Regulations *Method 3*) HHRA used data collected during the SI in 1996 through 1997. Exposure pathways evaluated were exposures to surface and subsurface soil by construction workers, exposures to surface

soils by a typical site worker, and exposures to surface soils and beach soils by child and adult recreational users and adolescent trespassers. The risk assessment did not consider a residential scenario, because the site was not planned to be used for residential purposes. In addition, most of the groundwater under the site is classified as GB (not suitable as drinking water without treatment due to known or presumed degradation). Because site groundwater is neither used currently nor planned for use in the future as a potable water source, a drinking water exposure pathway was not applicable and not evaluated.

The risk assessment found that potential cancer risks for exposures to soils by all receptors were within or below the EPA's target risk of 10^{-4} to 10^{-6}. The risks associated with reasonable maximum exposure (RME) were all less than 10^{-5}; and the risks associated with central tendency exposure (CTE) were all less than 10^{-6}, except for exposure to the typical worker, which marginally exceeded 10^{-6}. Exposure input assumptions used to calculate RME risks were generally associated with "high-end exposure," while exposure input assumptions used to calculate CTE risks were associated with average exposures.

The risk assessment also found that the potential for experiencing noncarcinogenic effects as a result of exposure to noncarcinogens was likely for the construction worker, but was unlikely for all other receptors. With the exception of the construction worker, the hazard indices (HIs) for RME and CTE exposures for all receptors were less than the EPA benchmark of 1.0. Exposure to antimony in subsurface soils is the primary risk driver contributing to the exceedance of the HI benchmark for the construction worker.

RMEs and CTEs for the construction worker were calculated using appropriate default exposure input parameters. These default exposure input factors are generally associated with typical construction activities. However, since the subsurface soil at this site is in the saturated zone (the water table occurs primarily within the landfilled materials zone), exposure to subsurface soil constituents (i.e. below the water table) would not be typical. Therefore, a more site-specific exposure assessment was performed for the construction worker to account for more typical exposures to soils at this site, such as digging a trench or driving posts. The RME and CTE risks associated with this site-specific exposure for the construction worker were below the EPA risk ranges and benchmarks for carcinogenic and noncarcinogenic risk. Therefore, it was determined that it was realistically unlikely that a construction worker at this site would experience adverse health effects as a result of exposure to soils.

1.3.4 Remedial Objectives / Remedial Alternatives Summary

Although the Method 3 HHRA did not identify unacceptable risk from exposure to potential contaminants in soil and sediment, contaminants of concern (COCs) were identified based on a Remediation Regulations *Method 1* evaluation (B&R Environmental, 1997). That is, COCs were identified based on exceedances of RIDEM's industrial direct exposure criteria and GB groundwater criteria (groundwater

was included in the Method 1 evaluation). No COCs were identified for sediment or groundwater (no exceedances); however, COCs were identified for soils as summarized below:

- Surface Soil (0 to 2 feet bgs) – benzo(a)pyrene, total PCBs, TPH, arsenic, and lead. Non-aqueous phase liquid (NAPL; i.e., free-phase petroleum) was considered a substance of concern.

- Subsurface Soil (2 ft bgs to the water table) – benzo(a)pyrene, total PCBs, and TPH.

- Beach Soil (in the beach area / intertidal zone along the landfill's southwestern side) – TPH.

The volume of contaminated surface and subsurface soils, including landfill waste, was estimated at 31,000 cubic yards with 7,250 cubic yards below the water table. The volume of contaminated beach soil was estimated at 850 cubic yards.

The following remedial objectives were developed in the SI Report:

- Prevent unacceptable human exposure to contaminated landfill soils, sediments, and materials.

- Reduce migration of landfill contaminants to groundwater, the intertidal zone, and the adjacent wetlands (surface water and sediments).

Remedial alternatives were developed in the SI report by assembling combinations of technologies applicable to site conditions and media into an appropriate range of alternatives that address site contamination, risks, or threats. These alternatives do not apply to a residential use scenario. The following remedial alternatives were developed:

- Alternative 1: No Action

- Alternative 2: Low-Permeability Soil Cover, Beach Seep Excavation and Disposal, Administrative Controls, and Monitoring

- Alternative 3: Low-Permeability Soil Cover, Limited Landfill and Beach Seep Excavation and Disposal, Administrative Controls, and Monitoring

- Alternative 4: Low-Permeability Soil Cover, Limited Landfill and Beach Seep Excavation and Disposal, Groundwater Controls, Administrative Controls, and Monitoring

Each alternative was evaluated based on the following criteria:

- Overall protection of human health and the environment
- Compliance with overall remedial objectives
- Compliance with Section 8.0 of the RIDEM Remediation Regulations
- Compliance with regulatory requirements
- Implementability
- Cost

Based on a comparative analysis of the alternatives, the SI recommended Alternative 2 as the preferred alternative because it met the remedial objectives and could be implemented at a lower cost. However, based on additional discussions between RIDEM, the property owner, and the Navy, it was agreed that the actual final remedy would include the excavation and off-site disposal of contaminated soils and other landfill materials, rather than the construction of a landfill cover and continual monitoring (see Section 2).

2.0 SUMMARY OF REMEDIAL ACTIONS

Three separate remedial / removal actions involving excavation, removal, and off-site disposal of soils and other materials have been conducted at the former Melville North Landfill. This section presents a summary of the three remedial actions. Figure 2-1 indicates the approximate areal extent of excavated materials for each of these remedial actions.

1993: Oily soil piles were removed from the northern-central portion of the former Melville North Landfill. Approximately 800 cubic yards of soil and 100 cubic yards of railroad timbers were removed and shipped to approved treatment and disposal facilities (B&R Environmental, 1997).

September and October 1995: An interim removal action was conducted at two petroleum-impacted areas of the site, with a total of 8,496 cubic yards of material excavated from the two areas. The soil remediation goals for the removal action were as follows: 1,000 milligrams per kilogram (mg/kg) TPH; no physical evidence of petroleum-based contamination; and the toxicity characteristic leaching procedure (TCLP) regulatory limits (OHM, 1995). It is reported that 6,496 cubic yards were excavated from Area "S," located south of the access road, while approximately 2,000 cubic yards were excavated from Area "N," north of the access road, and reportedly in the location of a suspected lagoon (Corah, 1995d). The amount of visually-identified TPH-contaminated soil exceeded the projected excavation limits. Due to funding constraints, the removal action was terminated prior to removal of all visible TPH contamination.

Excavated material was stockpiled at the site and later disposed of by landfilling at NETC's McAllister Point Landfill and at another off-site permitted facility. Analytical data for excavated material from Areas "S" and "N" indicated that TPH was present at levels ranging from 1,000 mg/kg to 90,000 mg/kg in 50 samples. In ten composite samples, PCB levels were less than 10 mg/kg, with the exception of one sample that was reported at 20.6 mg/kg. No leachable concentrations of metals, VOCs, or semi-volatile organic compounds (SVOCs) were reported above the regulatory limits in (TCLP) testing of the samples (Corah, 1995d).

Ten samples were collected from the stockpiled soils by Foster Wheeler Environmental Corporation (FWENC) in May 1996. TCLP testing of the soils revealed that the lead level of 8.1 milligrams per liter (mg/L) in the extract from one stockpile sample exceeded the 5 mg/L regulatory limit. TCLP extract levels for all other metals, volatile organic compounds, semi-volatile organic compounds, and herbicides were below the regulatory limits. PCB levels ranged from nondetect to 1.9 mg/kg. Tetrachloroethene was reported at 11 mg/kg in one sample (Kopcow, 1996).

Lead-contaminated soils from one stockpile were stabilized using a combination of Portland cement, cement kiln dust, and hydrated lime, and were transported for disposal at the McAllister Point Landfill along with a portion of the other soil. Soils with a PCB level greater than 50 mg/kg were transported off site for disposal at a RCRA Subtitle C facility.

During the removal action excavation, OHM reported that four drums containing "product" were found. Drum contents were sampled and submitted for analysis in support of disposal characterization (Corah, 1995b).

April 15, 1999 to April 21, 2000: A third removal action was carried out as the final remedy for the site, as summarized in the *Closeout Report for Melville North Landfill at Naval Station Newport* prepared by FWENC (Final [Revision 1] dated August 25, 2000). The information below is from the report.

The soil excavation was conducted by FWENC in accordance with the Remedial Action Work Plan (FWENC, 1999). Initially, the estimated limits of the proposed excavation area were determined from previous sample locations with exceedances of the RIDEM Residential Direct Exposure Criteria (RDEC) and the RIDEM GB Leachability Criteria, as determined during the SI (B&R Environmental, 1997). During excavation activities, the actual vertical and horizontal limits of the excavation area were determined using soil sample field-screening results, laboratory confirmation results, visual inspection observations, and the presence of large quantities of debris. The actual volume of materials removed in all areas was significantly more than originally estimated.

A total of 73,001 cubic yards of soil and debris were removed by the beginning of 2000, with an additional 4,887 tons of material excavated from the southern part of the landfill (Area S) in April 2000. Following the completion of each removal action, the soils were replaced with clean fill to the approximate original grade. The ground surface was then raked and seeded (FWENC, 2000). The excavation limits are shown on Figure 2-1.

The following soil remediation goals were used as the basis for the soil excavation activities:

- Arsenic – 11.8 mg/kg throughout the vadose zone (95 percent Upper Threshold Limit [UTL] based on background concentrations reported in the *Background Soil Investigation, Melville North Landfill, Portsmouth, Rhode Island* [TtNUS, 1998]).

- Lead – 150 mg/kg throughout the vadose zone (RIDEM RDEC).

- TPH – 1,000 mg/kg throughout the vadose zone and 2,500 mg/kg throughout the saturated zone (RIDEM RDEC). The residential TPH standard requires site compliance with RIDEM RDECs for all other substances for the classification.

- Benzo(a)pyrene – 0.4 mg/kg throughout the vadose zone (RIDEM RDEC).

- Non-aqueous phase liquids (NAPLs) – None in any environmental medium in the vadose or saturated zones, a condition considered as exceeding the RIDEM Upper Concentration Limits (UCLs) in soil and groundwater (see RIDEM Remediation Regulations Section 8.07).

- RIDEM GB Leachability Criteria - Not to be exceeded throughout the vadose or saturated zones.

These remedial goals (primarily RIDEM criteria for residential use areas - RDECs) were used as a conservative approach and it was recognized by the Navy that this approach is not consistent with the future land use (commercial marina) in the vicinity of the impacted area.

Additional soil remediation goals were applied to areas containing elevated concentrations of PCBs and/or asbestos. In addition to the soil remediation goals listed above, the following soil remediation goals applied to these areas:

- PCBs – 10 mg/kg throughout the vadose zone (RIDEM RDEC).

- Asbestos – 1 percent throughout the vadose zone (National Emissions Standard for Asbestos).

The excavation activities were initially conducted within three planned soil excavation areas, Areas 1 through 3. A fourth excavation area, “Area S”, was required due to additional contaminated soils encountered during excavation at Area 3. The estimated and actual volumes of soils/materials removed from these areas are listed below:

Area 1 (including PCB Hotspot Removal Area):	Estimated Volume -	14,500 cubic yards
	Actual Volume -	24,600 cubic yards
Area 2:	Estimated Volume -	25,000 cubic yards
	Actual Volume -	45,210 cubic yards
Area 3:	Estimated Volume -	500 cubic yards
	Actual Volume -	2,736 cubic yards
Area S:	Estimated Weight -	4,000 tons
	Actual Weight-	4,887 tons

The Area 1 excavation was conducted from June 20 through September 1, 1999, and backfilling was completed on October 14, 1999. In addition to soil and solid waste, metal debris was also encountered and removed.

The Area 2 excavation was conducted from August 13 through December 17, 1999, and backfilling was completed on December 22, 1999. Oil was observed on the groundwater in one test pit. Based on previous information obtained during the SI and analytical results of soil and groundwater samples, FWENC concluded that the soil excavation activity in this area caused a small amount of normally immobile oil from within the pore spaces of the aquifer to be released into the open excavation, causing the oil droplets to form on the surface of the water accumulated in the test pit. Neither NAPL nor contamination above the groundwater criteria were detected in any well. The analytical results confirmed that the cleanup objectives were met.

The Area 3 excavation was conducted from September 28 through December 10, 1999. Prior to excavation activities in Area 3, a silt curtain was installed in Narragansett Bay around the perimeter of Area 3, and was keyed into the beach. During the planned excavation at Area 3, a product sheen was observed and FWENC noted that two geologic units on the eastern edge of Area 3 were contributing to the sheen. These were described as a dense, fine-grained sand and a weathered, coarse-grained unit. The units appeared to extend toward the east, beyond the planned Area 3 excavation, toward the area south of excavation Area 2. On October 6, 1999, three test pits were excavated on the eastern side of Area 3 to attempt to delineate the extent of oil contamination to the east. Observations during these test pitting activities included the locations of various stratigraphic units with and without oil, and various areas with free product. The complete limits of oil-impacted soil were not finalized at this time. The Area 3 excavation limits as originally planned were now approaching Area 2 and the previous location of Area S from the 1995 removal action (OHM had excavated contaminated soils from the vicinity - Area S - in this southern portion of the landfill in 1995.) Therefore, a temporary erosion-control barrier was placed over the oil-impacted units to minimize tidal washing of the soils, and FWENC was contracted by the Navy to conduct additional borings and soil sampling to further delineate this oil contamination, and to characterize soils for offsite disposal, prior to continuing excavation in this area. Based on the results of the additional soil borings and soil sampling and analysis in the area, it was estimated that approximately 4,000 tons of contaminated materials would require excavation from this former Area S (continuing from the Area 3 excavation). An additional estimated 6,000 tons of overlying clean materials were planned for removal and temporary stockpiling.

The additional excavation of contaminated soils at Area S was initiated on April 3, 2000. Excavation continued until confirmation sample results met the cleanup levels. The excavation removed contaminated soils to below the water table. An oil boom and oil wipes were utilized to remove floating

product encountered. Approximately 4,887 tons of materials excavated from Area S were shipped for offsite disposal in April 2000. A total of 5,241 tons of material were imported to restore the Area S portion of the site, which was then hydro-seeded.

Confirmation soil sampling was performed throughout the excavation activities to demonstrate that the remedial objectives for the site had been achieved in accordance with the RIDEM Remediation Regulations. Confirmation samples were analyzed using field test methods and fixed laboratory analyses. Complete confirmation sampling results and additional details of the remedial action activities are presented in the *Final Closeout Report for Melville North Landfill at Naval Station Newport, Newport, Rhode Island* prepared by FWENC (FWENC, 2001).

The total cost of the remedial actions was approximately $9 million (FWENC, 2001).

3.0 POST-SOIL-REMOVAL GROUNDWATER MONITORING

The information presented in this section is from the *Post-Soil Removal Groundwater Evaluation for Former Melville North Landfill, Naval Station Newport, Newport, Rhode Island* (Tetra Tech, 2004). At RIDEM's request, efforts were conducted to evaluate groundwater quality at the site after soil had been addressed through a series of removal actions (described in Section 3).

The *Work Plan for Groundwater Monitoring, Former Melville North Landfill, Naval Station Newport, Newport, Rhode Island* (Work Plan) was prepared by Tetra Tech in 2003. Three new monitoring wells were installed in August 2003 (see Table 3-1). Headspace screening results and the field geologist's observations were recorded on boring logs and are summarized in Table 3-2. A summary of well construction details and water levels measured during each sampling round is presented in Table 3-3.

The initial round of groundwater sampling was conducted in August 2003. Additional groundwater sampling rounds were conducted in April 2004 (Round 2) and on August 2004 (Round 3). Sampling during the months of August and April provided groundwater data during seasonal low and seasonal high water table conditions at the site.

A summary of Rounds 1 and 2 were presented in Tetra Tech (2004). The report included the rationale for placement of the monitoring wells, a description of well installation efforts, data acquisition procedures and analysis, the findings of the investigation, and conclusions and recommendations. Groundwater quality is classified GA at the southern portion of the site and GB at the northern portion of the site. Groundwater results were compared to RIDEM's more conservative GA groundwater criteria.

Following the Round 3 groundwater sampling event, results of all three rounds were presented in the Post-Soil-Removal Groundwater Evaluation (Tetra Tech, 2004b).

Two methods of groundwater sample collection were employed, as described in the Work Plan. Low flow (low stress) sample collection was conducted in order to acquire samples in accordance with EPA and Navy policy for collection of groundwater samples. In addition, samples were also collected using bailers, in accordance with a request from RIDEM.

During Round 1, groundwater samples were collected from each well using both low flow purge sampling (EPA Standard Operating Procedure [SOP] No. GW 001) and using standard bailing techniques (at the request of RIDEM). Only low flow purging sampling was conducted during Round 2. This approach was deemed adequate for the second round, as compliance with RIDEM's request for use of bailers was met

TABLE 3-1
MONITORING WELL LOCATION RATIONALE, POST-SOIL-REMOVAL GROUNDWATER EVALUATION
FORMER MELVILLE NORTH LANDFILL
PORTSMOUTH, RHODE ISLAND

MONITORING WELL No.	LOCATION/DEPTH RATIONALE
MW-PC01	Located on the north side of the former Melville North Landfill between former monitoring wells MW-12S, MW-11S and MW-1. This monitoring well was placed at the former location of high concentrations of total petroleum hydrocarbons (TPH) in soil, VOCs in soil gas, and sheens in water found at former test pit TP12 during the SI, prior to removal actions completed in 2000. Boring installed to a depth of 13.5 feet, fill was present to 8 feet, underlain by natural soils.
MW-PC02	Located in the central area of the former Melville North Landfill near former monitoring wells MW-3S and MW-3R. This monitoring well was placed at the location of high concentrations of TPH in soil and VOCs and SVOCs in soil gas found during the SI, prior to removal actions completed in 2000. Boring installed to a depth of 16 feet, fill was present to a depth of 8 feet, underlain by natural soils.
MW-PC03	Located on the south side of the former Melville North Landfill near the former MW-7 monitoring well cluster. This monitoring well was placed at the location of high concentrations of TPH in soils and where sheens were evident in well purge water during the SI, prior to removal actions completed in 2000. Boring installed to a depth of 16 feet, fill was present to a depth of 12 feet, underlain by natural soils.

TABLE 3-2
DRILLING AND SAMPLING OBSERVATIONS, POST-SOIL-REMOVAL GROUNDWATER EVALUATION
FORMER MELVILLE NORTH LANDFILL
PORTSMOUTH, RHODE ISLAND

BORING ID/ LOCATION	SAMPLE DEPTH (FEET BGS)	VISUAL/OLFACTORY	HEADSPACE RESULTS BY FID (ppm)	SELECTED FOR LAB ANALYSIS?
MW-PC01	0-2	None/H_2S	3	
	2-4	H_2S, light petroleum odor	120	Yes
	4-6	None/ H_2S	170*	
	6-8	None/ H_2S	560*	
	8-10	None/ H_2S	1980*	
	10-12	None/ H_2S	410*	
MW-PC02	0-2	None/None	0	
	2-4	None/None	0	
	4-6	None/None	0	
	6-8	None/None	55	Yes
	8-10	None/None	0	
	10-12	None/None	0	
	12-14	None/None	0	
	14-16	None/None	0	
MW-PC03	0-2	None/None	0	
	2-4	None/None	0	
	4-6	None/None	380	Yes
	6-8	No Recovery	NA	
	8-10	No Recovery	NA	
	10-12	Staining/Petroleum odor	400	Yes
	12-14	None/None	2	
	14-16	None/None	1	

* - Presence of H_2S odors indicates that FID was likely reading methane.
bgs - feet below ground surface
ppm - parts per million by volume

TABLE 3-3

WELL CONSTRUCTION SUMMARY AND DEPTH TO GROUNDWATER
POST-SOIL-REMOVAL GROUNDWATER EVALUATION
FORMER MELVILLE NORTH LANDFILL
PORTSMOUTH, RHODE ISLAND

Well No.	Type of Protective Casing	Protective Casing Dia. (inches)	Protective Casing Stick-Up (inches)	Well Diameter (inches)	Well Screen Length (feet)	Well Screen Interval (ft bgs)	PVC Stick-Up (ft)	Water Depth (ft bpvc) 8/18/03	Water Depth (ft bgs) 8/18/03	Water Depth (ft bpvc) 4/20/04	Water Depth (ft bgs) 4/20/04	Water Depth (ft bpvc) 8/25/04	Water Depth (ft bgs) 8/25/04
MW-PC01	Steel	6.0	2.0	2	10.0	3.5/13.5	1.44	6.05	4.61	6.70	5.26	6.55	5.11
MW-PC02	Steel	6.0	4.0	2	10.0	5.6/15.6	3.37	6.32	2.95	3.66	0.29	6.90	3.53
MW-PC03	Steel	6.0	1.47	2	8.0	4.1/12.1	1.30	9.00	7.70	6.91	5.61	9.15	7.85

Notes:
ft bgs feet below ground surface
ft bpvc feet below PVC riser
MP measuring point (top of PVC riser)
Dia. diameter

* PVC stick-up in feet above ground surface

during Round 1. During Round 3, low flow purge sampling was used to collect the metals samples and a bailer was used to collect the samples for the other analyses in accordance with a RIDEM request.

Groundwater samples from all three rounds were analyzed for VOCs (EPA Method 8260B), gasoline range organics (GRO) and diesel range organics (DRO) (Method 8015B, modified for C-9 through C-36 hydrocarbons by gas chromatograph [GC]), SVOCs (Method 8270), pesticides and PCBs (Method 8080), and total Target Analyte List (TAL) metals (Method 6010).

All wells were checked with an oil-water interface probe for the presence of LNAPL and/or dense non-aqueous phase liquid (DNAPL) prior to sampling. There was no measurable NAPL during either of the three rounds; however, a petroleum odor was noted at well MW-PC03 during Rounds 1 and 3.

During Round 1, the intake for the pump during low flow sampling was set at the mid-point of the well screen in both MW-PC01 and MW-PC02, 3 to 6 feet below the water table. However, it was recognized that during the drilling of well MW-PC03, there was evidence of residual petroleum at 10 to 12 feet bgs. Therefore, the pump intake was set at 11.5 feet bgs while sampling MW-PC03this well. Bailer samples were not specific to any portion of the water column.

During Round 2, the pump intake was set as close to the water table as possible for MW-PC01 and MW-PC02, while the intake was set at 10.5 feet bgs for MW-PC03, again to maximize withdrawing groundwater from the interval with suspected contamination.

For Round 3, RIDEM requested that low flow pump intakes be placed at the zones with the highest PID reading from purge water. There were no PID responses, so the pump was set at the mid-point of the saturated screen length. Bailer samples were not specific to any portion of the water column.

Soil Analytical Results

As part of the post-soil removal groundwater monitoring activities, soil samples were collected and analyzed at the request of RIDEM during the advancement of soil borings for the new monitoring wells. TPH was not detected or was detected at concentrations below 200 mg/kg in all soil samples. The highest concentration of TPH (190 mg/kg) was detected at 10 to 12 feet bgs in the soil boring sample collected at MW-PC03. All TPH results were below the RDEC of 500 mg/kgand the TPH GA Leachability Criterion of 500 mg/kg.

VOCs were not detected in soil samples, with the exception of acetone and methylene chloride, which were also found in the laboratory blank samples. Acetone and methylene chloride are both common laboratory contaminants and in this case are not indicative of site contamination.

Groundwater Analytical Results

Chemicals and analytes detected in groundwater samples from Rounds 1 through 3 are shown on Figure 3-1. No site contaminants were detected above criteria.

GRO was not detected in any of the groundwater samples. DRO was detected at 0.54 mg/L in MW-PC03 during Round 1 (in the bailed sample), but was not detected during Round 2. During Round 3, DRO was detected in wells MW-PC01 (0.39 mg/L), MW-PC02 (0.06 mg/L), and MW-PC03 (0.14 mg/L) (in the bailed samples).

Metals analysis indicated the presence of naturally occuring metals in groundwater collected from all wells. Higher concentrations of metals were found in the bailed samples, likely due to the uncontrolled turbidity of the samples. In particular, in Round 1, lead was detected at 10.1 µg/L, 29.1 µg/L, and 24.2 µg/L at wells MW-PC01, -PC02, and -PC03, respectively, in bailer samples only. Corresponding, reproducible low flow samples in all rounds showed no lead detected at any location.

As demonstrated during the SI, the post-soil-removal groundwater evaluations confirm that groundwater at the site is tidally influenced (B&R Environmental, 1997). The groundwater levels observed at each of the monitoring wells during well development and sampling responded to tidal fluctuations. Although all groundwater samples were not collected during the same tidal stage, samples from all three sampling events are considered representative of the groundwater conditions at the site (Rounds 1 and 3 collected in summer – low water table period; Round 2 collected in spring – high water table period).

Conclusions and Recommendations of the Post-Soil-Removal Groundwater Monitoring

The groundwater evaluation was conducted to determine if any residual contamination was present at the former Melville North Landfill following contaminated soil removal actions conducted between 1993 and 2000. Per RIDEM's request, soils also were evaluated and sampled for residual contaminants. Soils collected from the 10- to 12-foot interval during installation of monitoring well MW-PC03 showed oil staining. Laboratory analysis of these soils showed a concentration of 190 mg/kg of TPH in soil by gas chromatograph/flame ionization detector (GC/FID). Although evidence of petroleum was noted in this sample, the sample is below the water table and samples taken above and below this interval do not exhibit the presence of oil. The physical location indicates that this is an isolated remnant of the fill, in

place well below the water table. The analytical result is below the RDEC (500 mg/kg) and GA Leachability Criterion (500 mg/kg). Observations and analysis of soil samples from other borings do not indicate the presence of oil or oil-impacted soil.

Petroleum constituents were not detected in any groundwater sample collected using the low flow procedure, and only trace levels of petroleum (specifically, DRO, a fraction of TPH) were detected in bailed groundwater samples from Round 1 (0.54 mg/L at MW-PC03) and Round 3 (maximum of 0.39 mg/L at MW-PC01).

Metals (most of which are naturally-occurring in groundwater) were detected in groundwater samples collected using both the low flow procedure and the bailer. The only analyte to exceed either a GA or GB groundwater criterion was the metal, lead, in bailed samples from MW-PC02 and MW-PC03 during Round 1 only. However, the corresponding samples collected from these wells using the low flow technique (RIDEM-approved for metals samples) had no detections of lead, indicating that the lead reported in the bailed samples likely is associated with uncontrolled turbidity present in the sample due to the bailing procedure.

Groundwater quality underlying the Site is classified GA at the southern portion of the Site and GB at the northern portion of the Site. The groundwater data were compared to the more conservative RIDEM GA groundwater criteria. GA groundwater criteria were not exceeded for any analytes detected in groundwater, with one exception: the RIDEM GA groundwater objective for lead (0.015 mg/L) was exceeded in groundwater samples collected with bailers at MW-PC02 and MW-PC03 during Round 1. However, corresponding samples collected using RIDEM-approved low flow techniques for metals at these wells during all three rounds showed no lead detections. None of the results exceeded the RIDEM GB criteria.

Based on the “low flow” groundwater sampling and analysis data collected during the three post-soil-removal sampling events, no compounds detected in groundwater samples exceeded the regulatory comparison criteria.

Considering the removal actions and the subsequent monitoring data results, “no further action” is recommended at the Melville North Landfill.

4.0 CONCLUSIONS AND RECOMMENDATIONS

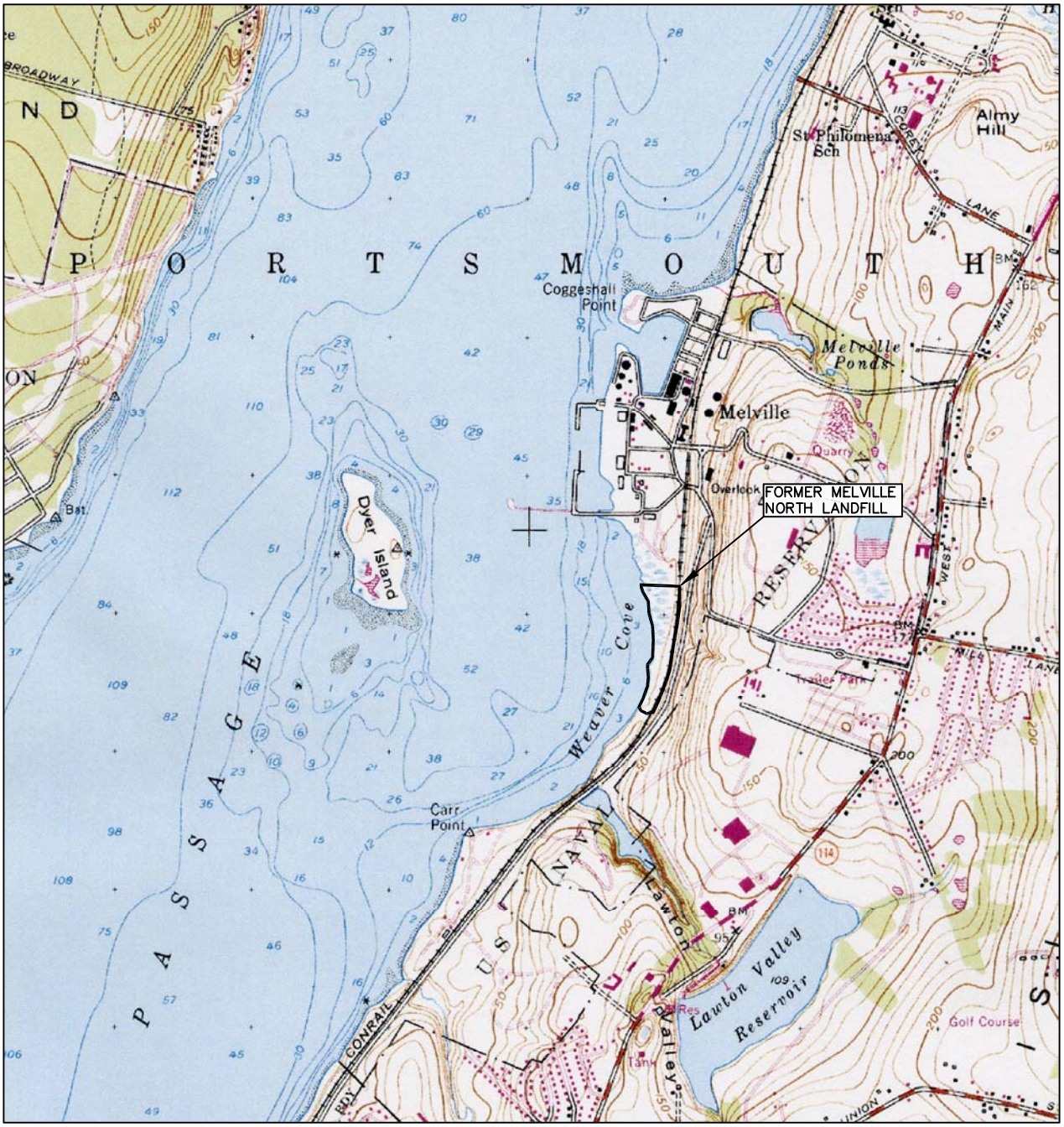
This report has been prepared to support closeout of the former Melville North Landfill in Portsmouth, Rhode Island, formerly owned by Navy. The site is recommended for close-out because, as summarized in previous sections, the soil excavation activities have been completed in accordance with the soil remediation cleanup goals, and three rounds of post-soil-removal "low flow" groundwater sampling have resulted in no elevated detections of any site-related contaminants (and no exceedances of Rhode Island criteria).

There have been no exceedances of RIDEM groundwater criteria and no detections of measurable petroleum free-product during the post-soil removal sampling activities. The oil/water interface probe used to gauge site wells can detect free-phase product (LNAPL or DNAPL) as thin as 0.005 foot (1 millimeter).

RIDEM regulations state that "Non-Aqueous Phase Liquid (NAPL) shall mean an organic compound present at a concentration such that it exists as a **separate** [emphasis added] phase in equilibrium with water" (RIDEM's Remediation Regulations, DEM-DSR-01-93; Section 8.07, part A, and Section 3.43; as amended August 1996, February 2004). Concentrations of dissolved-phase petroleum constituents would be higher in the water samples at the site if free product were present and in equilibrium with the groundwater, but TPH-DRO concentrations at the site were all less than 0.5 mg/L, and TPH-GRO was not detected at all.

While the Navy recognizes that minor amounts of remnant constituents of petroleum remain in some areas of the site, the levels present in soil or groundwater do not require any further action. Following the removal actions and associated monitoring, there are no exceedances of RIDEM soil or groundwater criteria, and there is no measurable petroleum free-product. Therefore, no further action is needed at this site. The former Melville North Landfill is recommended for close-out under the RIDEM Remediation Regulations.

FIGURES



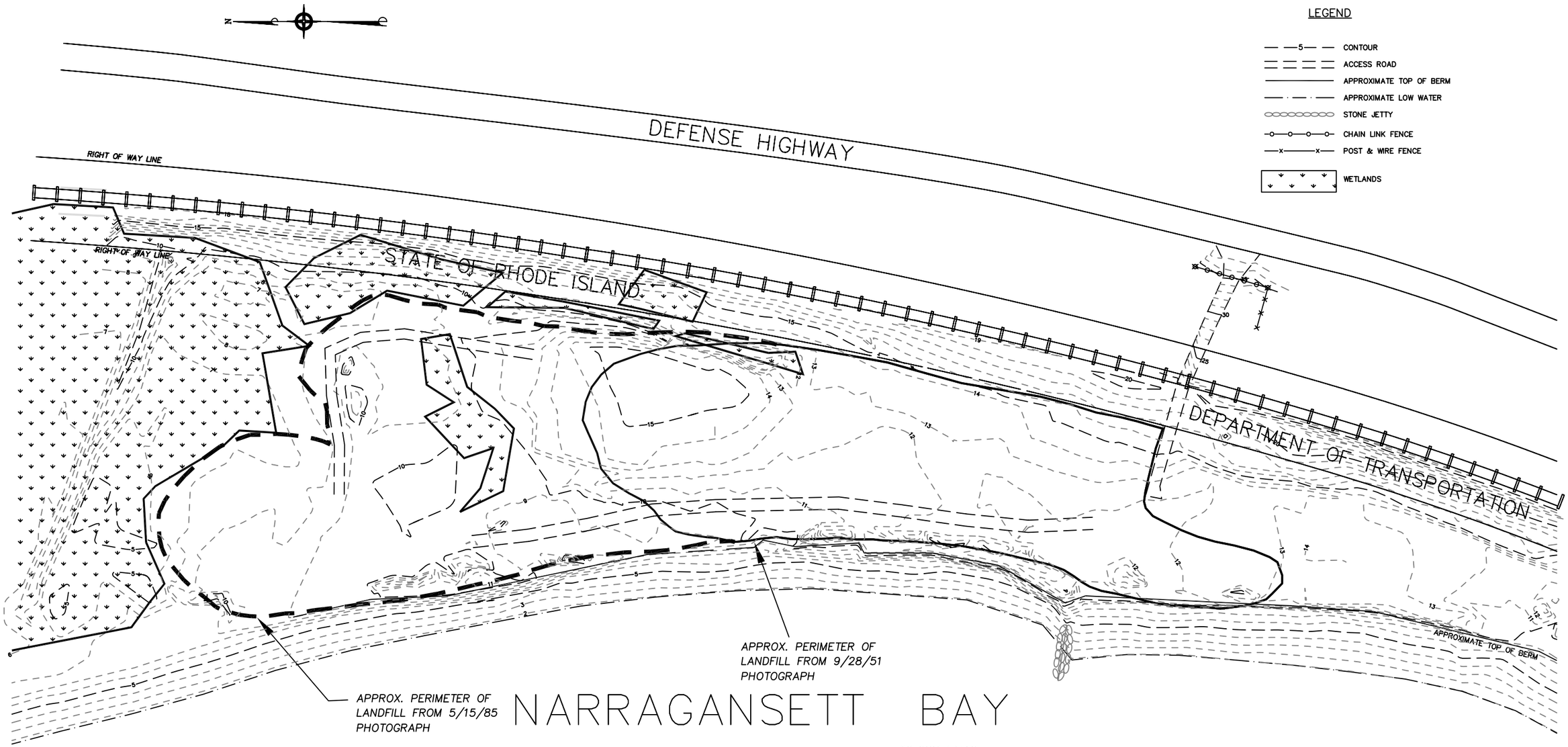
BASE MAP IS A PORTION OF THE FOLLOWING 7.5 X 15 MINUTE U.S.G.S. QUADRANGLE:
PRUDENCE ISLAND, RHODE ISLAND, 1955, PHOTOREVISED 1970 AND 1975

GRAPHIC SCALE
0 — 0.5 MILE — 1 MILE

QUADRANGLE LOCATION

SITE LOCUS	FIGURE 1–1
FORMER MELVILLE NORTH LANDFILL	TETRA TECH NUS, INC.
PORTSMOUTH, RHODE ISLAND	
DRAWN BY: D.W. MACDOUGALL — REV.: 0	
CHECKED BY: R. O'NEILL — DATE: AUGUST 24, 2010	
SCALE: AS NOTED — ACAD NAME: \02865\MS.DC\MEL_LOCUS.DWG	

55 Jonspin Road Wilmington, MA 01887
(978)474–8400



NOTES:

1. ALL COORDINATES SHOWN HEREON ARE RHODE ISLAND GRID COORDINATES, NORTH AMERICAN DATUM OF 1927, PER REFERENCE PLAN.
2. ELEVATION DATUM: MEAN LOW WATER, U.S. NAVY.
3. THE CONTOUR INTERVAL IS ONE (1) FEET.
4. CONTROL POINTS 1 & 2 ARE LOCATED ALONG RAILROAD BASELINE, EACH FOUND APPROXIMATELY 1 FOOT BELOW SURFACE.

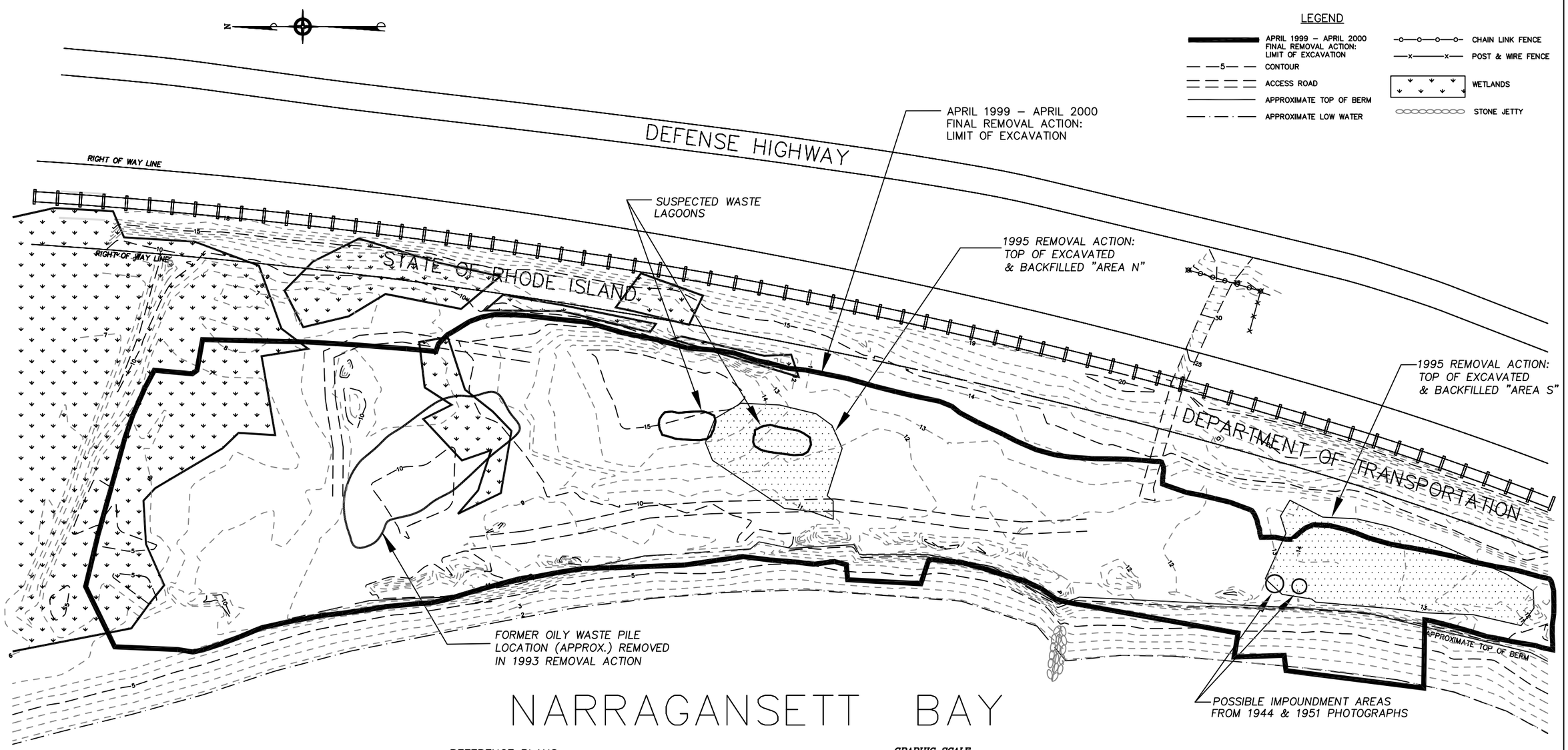
REFERENCE PLANS:

1. NAVAL COMPLEX, NEWPORT, R.I., MELVILLE (NORTH), EXISTING CONDITIONS MAP, BY NAVAL FACILITIES ENGINEERING COMMAND, DWG. NO. 994, 207.
2. PLAT SHOWING LAND IN CITY OF NEWPORT & TOWNS OF MIDDLETOWN & PORTSMOUTH, ACQUIRED FOR RAILROAD PURPOSES ON BEHALF OF THE STATE OF RHODE ISLAND & PROVIDENCE PLANTATIONS, BY THE DIRECTOR OF TRANSPORTATION, RAILROAD PLAT NO. 1.
3. BASE PLAN ENTITLED "SITE 02, MELVILLE NORTH LANDFILL, SITE MAP" PREPARED FOR NAVAL EDUCATION TRAINING CENTER, NEWPORT, RHODE ISLAND, SCALE: 1"=60', DWG.NO. 2, PROJ.NO. 6760-N81, DATED: 5/29/91, PREPARED BY: SAI SURVEYING, CO.

GRAPHIC SCALE

0' 100' 200'

SITE MAP			FIGURE 1-2
FORMER MELVILLE NORTH LANDFILL			TETRA TECH NUS, INC.
PORTSMOUTH, RHODE ISLAND			55 Jonspin Road Wilmington, MA 01887 (978)474-8400
DRAWN BY: D.W. MACDOUGALL	REV.: 0		
CHECKED BY: R. O'NEILL	DATE: OCTOBER 08, 2010		
SCALE: AS NOTED	FILE NO.: \02865\MS.DC\MEL_FORM_SITE_MAP.DWG		



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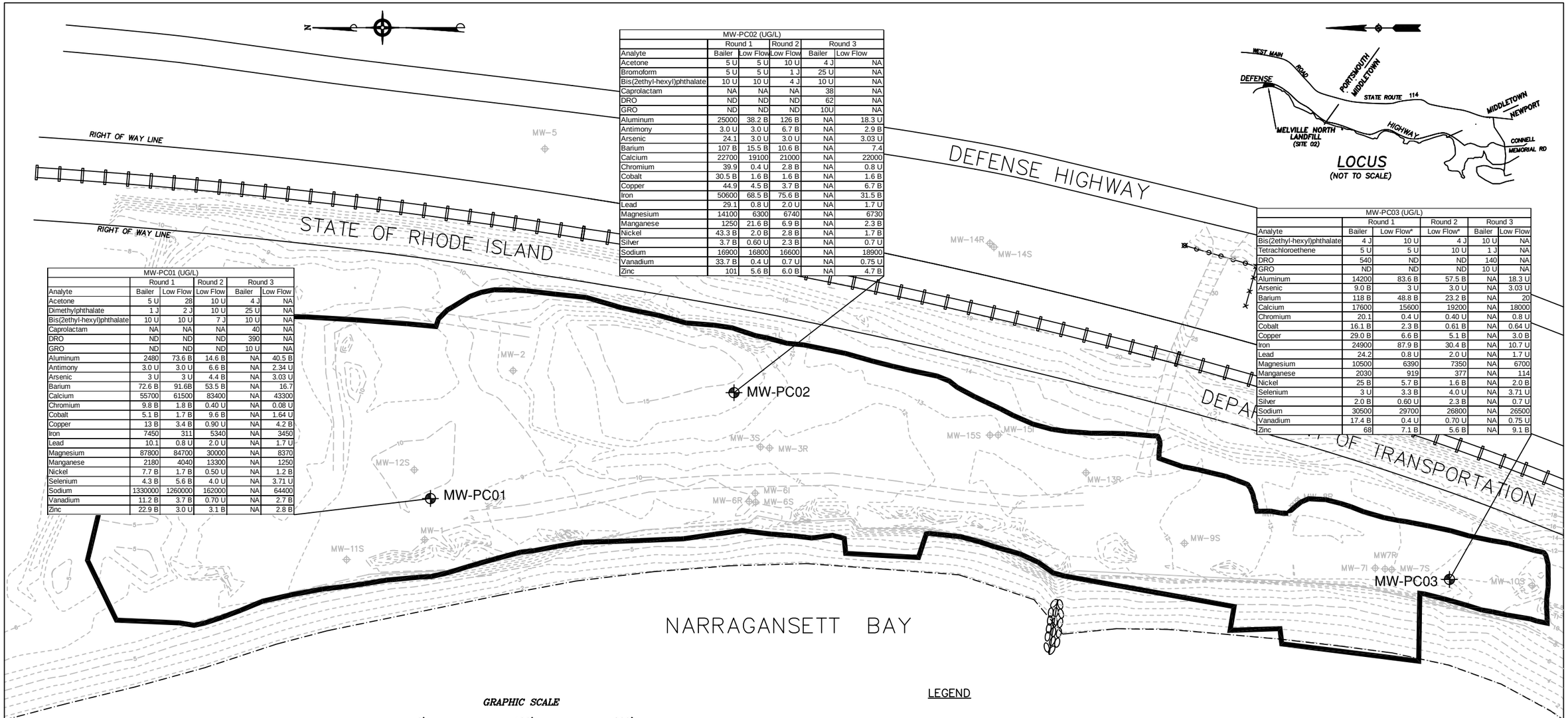
1. NAVAL COMPLEX, NEWPORT, R.I., MELVILLE (NORTH), EXISTING CONDITIONS MAP, BY NAVAL FACILITIES ENGINEERING COMMAND, DWG. NO. 994, 207.
2. PLAT SHOWING LAND IN CITY OF NEWPORT & TOWNS OF MIDDLETOWN & PORTSMOUTH, ACQUIRED FOR RAILROAD PURPOSES ON BEHALF OF THE STATE OF RHODE ISLAND & PROVIDENCE PLANTATIONS, BY THE DIRECTOR OF TRANSPORTATION, RAILROAD PLAT NO. 1.
3. BASE PLAN ENTITLED "SITE 02, MELVILLE NORTH LANDFILL, SITE MAP" PREPARED FOR NAVAL EDUCATION TRAINING CENTER, NEWPORT, RHODE ISLAND, SCALE: 1"=60', DWG.NO. 2, PROJ.NO. 6760–N81, DATED: 5/29/91, PREPARED BY: SAI SURVEYING, CO.

GRAPHIC SCALE

0' 100' 200'

REMOVAL AREAS			FIGURE 2–1
FORMER MELVILLE NORTH LANDFILL			TETRA TECH NUS, INC.
PORTSMOUTH, RHODE ISLAND			55 Jonspin Road Wilmington, MA 01887 (978)474–8400
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	R. O'NEILL	DATE:	OCTOBER 08, 2010
SCALE:	AS NOTED	FILE NO.:	\02865\MS.DC\MEL_REM_AREAS.DWG



MW-PC02 (UG/L)					
	Round 1		Round 2	Round 3	
Analyte	Bailer	Low Flow	Low Flow	Bailer	Low Flow
Acetone	5 U	5 U	10 U	4 J	NA
Bromoform	5 U	5 U	1 J	25 U	NA
Bis(2ethyl-hexyl)phthalate	10 U	10 U	4 J	10 U	NA
Caprolactam	NA	NA	NA	38	NA
DRO	ND	ND	ND	62	NA
GRO	ND	ND	ND	10U	NA
Aluminum	25000	38.2 B	126 B	NA	18.3 U
Antimony	3.0 U	3.0 U	6.7 B	NA	2.9 B
Arsenic	24.1	3.0 U	3.0 U	NA	3.03 U
Barium	107 B	15.5 B	10.6 B	NA	7.4
Calcium	22700	19100	21000	NA	22000
Chromium	39.9	0.4 U	2.8 B	NA	0.8 U
Cobalt	30.5 B	1.6 B	1.6 B	NA	1.6 B
Copper	44.9	4.5 B	3.7 B	NA	6.7 B
Iron	50600	68.5 B	75.6 B	NA	31.5 B
Lead	29.1	0.8 U	2.0 U	NA	1.7 U
Magnesium	14100	6300	6740	NA	6730
Manganese	1250	21.6 B	6.9 B	NA	2.3 B
Nickel	43.3 B	2.0 B	2.8 B	NA	1.7 B
Silver	3.7 B	0.60 U	2.3 B	NA	0.7 U
Sodium	16900	16800	16600	NA	18900
Vanadium	33.7 B	0.4 U	0.7 U	NA	0.75 U
Zinc	101	5.6 B	6.0 B	NA	4.7 B

MW-PC01 (UG/L)					
	Round 1		Round 2	Round 3	
Analyte	Bailer	Low Flow	Low Flow	Bailer	Low Flow
Acetone	5 U	28	10 U	4 J	NA
Dimethylphthalate	1 J	2 J	10 U	25 U	NA
Bis(2ethyl-hexyl)phthalate	10 U	10 U	7 J	10 U	NA
Caprolactam	NA	NA	NA	40	NA
DRO	ND	ND	ND	390	NA
GRO	ND	ND	ND	10 U	NA
Aluminum	2480	73.6 B	14.6 B	NA	40.5 B
Antimony	3.0 U	3.0 U	6.6 B	NA	2.34 U
Arsenic	3 U	3 U	4.4 B	NA	3.03 U
Barium	72.6 B	91.6B	53.5 B	NA	16.7
Calcium	55700	61500	83400	NA	43300
Chromium	9.8 B	1.8 B	0.40 U	NA	0.08 U
Cobalt	5.1 B	1.7 B	9.6 B	NA	1.64 U
Copper	13 B	3.4 B	0.90 U	NA	4.2 B
Iron	7450	311	5340	NA	3450
Lead	10.1	0.8 U	2.0 U	NA	1.7 U
Magnesium	87800	84700	30000	NA	8370
Manganese	2180	4040	13300	NA	1250
Nickel	7.7 B	1.7 B	0.50 U	NA	1.2 B
Selenium	4.3 B	5.6 B	4.0 U	NA	3.71 U
Sodium	1330000	1260000	162000	NA	64400
Vanadium	11.2 B	3.7 B	0.70 U	NA	2.7 B
Zinc	22.9 B	3.0 U	3.1 B	NA	2.8 B

MW-PC03 (UG/L)					
	Round 1		Round 2	Round 3	
Analyte	Bailer	Low Flow*	Low Flow*	Bailer	Low Flow
Bis(2ethyl-hexyl)phthalate	4 J	10 U	4 J	10 U	NA
Tetrachloroethene	5 U	5 U	10 U	1 J	NA
DRO	540	ND	ND	140	NA
GRO	ND	ND	ND	10 U	NA
Aluminum	14200	83.6 B	57.5 B	NA	18.3 U
Arsenic	9.0 B	3 U	3.0 U	NA	3.03 U
Barium	118 B	48.8 B	23.2 B	NA	20
Calcium	17600	15600	19200	NA	18000
Chromium	20.1	0.4 U	0.40 U	NA	0.8 U
Cobalt	16.1 B	2.3 B	0.61 B	NA	0.64 U
Copper	29.0 B	6.6 B	5.1 B	NA	3.0 B
Iron	24900	87.9 B	30.4 B	NA	10.7 U
Lead	24.2	0.8 U	2.0 U	NA	1.7 U
Magnesium	10500	6390	7350	NA	6700
Manganese	2030	919	377	NA	114
Nickel	25 B	5.7 B	1.6 B	NA	2.0 B
Selenium	3 U	3.3 B	4.0 U	NA	3.71 U
Silver	2.0 B	0.60 U	2.3 B	NA	0.7 U
Sodium	30500	29700	26800	NA	26500
Vanadium	17.4 B	0.4 U	0.70 U	NA	0.75 U
Zinc	68	7.1 B	5.6 B	NA	9.1 B

GRAPHIC SCALE

0' 100' 200'

LEGEND

- APRIL 1999 – APRIL 2000 FINAL REMOVAL ACTION: LIMIT OF EXCAVATION
- APPROXIMATE LOW WATER
- STONE JETTY
- CHAIN LINK FENCE
- POST & WIRE FENCE
- PRE-CONSTRUCTION CONTOUR
- PRE-CONSTRUCTION ACCESS ROAD
- PRE-CONSTRUCTION APPROXIMATE TOP OF BERM
- MW-3R FORMER MONITORING WELL (PRE-REMOVAL ACTION)
- EXISTING MONITORING WELL (POST-REMOVAL ACTION)

U – NOT DETECTED, WITH ASSOCIATED DETECTION LIMIT
J – ESTIMATED VALUE
B – BELOW PRACTICAL QUANTITATION LIMIT BUT ABOVE INSTRUMENT DETECTION LIMIT (VALUE SHOULD BE CONSIDERED APPROXIMATE)
NA – NOT ANALYZED
ND – NOT DETECTED

REFERENCE PLANS:

1. NAVAL COMPLEX, NEWPORT, R.I., MELVILLE (NORTH), EXISTING CONDITIONS MAP, BY NAVAL FACILITIES ENGINEERING COMMAND, DWG. NO. 994, 207.
2. PLAT SHOWING LAND IN CITY OF NEWPORT & TOWNS OF MIDDLETOWN & PORTSMOUTH, ACQUIRED FOR RAILROAD PURPOSES ON BEHALF OF THE STATE OF RHODE ISLAND & PROVIDENCE PLANTATIONS, BY THE DIRECTOR OF TRANSPORTATION, RAILROAD PLAT NO. 1.
3. BASE PLAN ENTITLED "SITE 02, MELVILLE NORTH LANDFILL, SITE MAP" PREPARED FOR NAVAL EDUCATION TRAINING CENTER, NEWPORT, RHODE ISLAND, SCALE: 1"=60', DWG.NO. 2, PROJ.NO. 6760–N81, DATED: 5/29/91, PREPARED BY: SAI SURVEYING, CO.

NOTES:

1. ALL COORDINATES SHOWN HEREON ARE RHODE ISLAND GRID COORDINATES, NORTH AMERICAN DATUM OF 1927, PER REFERENCE PLAN.
2. ELEVATION DATUM: MEAN LOW WATER, U.S. NAVY.
3. THE CONTOUR INTERVAL IS ONE (1) FEET.
4. CONTROL POINTS 1 & 2 ARE LOCATED ALONG RAILROAD BASELINE, EACH FOUND APPROXIMATELY 1 FOOT BELOW SURFACE.
5. ALL GROUNDWATER RESULTS ARE REPORTED IN µg/L.
6. GROUNDWATER SAMPLING ROUND 1 CONDUCTED IN AUGUST 2003. GROUNDWATER SAMPLING ROUND 2 CONDUCTED IN APRIL 2004. GROUNDWATER SAMPLING ROUND 3 CONDUCTED IN AUGUST 2004.

DETECTED GROUNDWATER ANALYTES – ROUNDS 1 – 3 (2003 – 2004)

FIGURE 3–1

FORMER MELVILLE NORTH LANDFILL

PORTSMOUTH, RHODE ISLAND

DRAWN BY:	D.W. MACDOUGALL	REV.:	2
CHECKED BY:	R. O'NEILL	DATE:	OCTOBER 10, 2010
SCALE:	AS NOTED	FILE NO.:	\02865\MS.DC\MELVILLE_DET_GW_CONST.DWG

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)474–8400

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Corah Jr., N. L. (OHM Corporation), 1995c. Letter to Dave Dorocz (U. S. Navy, NETC) Re: Melville North Landfill Area N TCLP Data. October 3.

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