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Remedial Investigation Report

Volume I - Technical Report

McAllister Point Landfill

Naval Education and Training Center Newport, Rhode Island



**Northern Division
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Contract Number N62472-90-D-1298
Contract Task Order 0218**

April 1997



REMEDIAL INVESTIGATION REPORT
Volume I - Technical Report
McAllister Point Landfill - NETC-Newport, Rhode Island

REMEDIAL INVESTIGATION REPORT

VOLUME I - TECHNICAL REPORT

MCALLISTER POINT LANDFILL

**NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND**

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ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT**

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LIST OF ACRONYMS

<u>ACRONYM</u>	<u>DESCRIPTION</u>
AVS	Acid Volatile Sulfides
AWQC	Ambient Water Quality Criteria
BOD	Biological Oxygen Demand
CaPAH	Carcinogenic Polynuclear Aromatic Hydrocarbon
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
COD	Chemical Oxygen Demand
CS	Confirmation Study
DERP	Defense Environmental Restoration Program
DFSP	Defense Fuel Supply Point
DNAPL	Dense Non-Aqueous Phase Liquid
ECD	Electron Capture Detector
EM	Electromagnetic
EPA	Environmental Protection Agency
ES	Executive Summary
FID	Flame Ionization Detector
FS	Feasibility Study
FUDS	Formerly Used Defense Site
GPM	Gallons Per Minute
GRM	Generalized Reciprocal Method
GSA	General Services Administration
HI	Hazard Index Ratio
IAS	Initial Assessment Study
IRP	Installation Restoration Program
LEL	Lower Explosive Limit
LNAPL	Light Non-Aqueous Phase Liquid
MCL	Maximum Contaminant Level
MW	Monitoring Well
NACIP	Naval Assessment and Control of Installation Pollutants

LIST OF ACRONYMS (continued)

<u>ACRONYM</u>	<u>DESCRIPTION</u>
NAPL	Non Aqueous Phase Liquid
NETC	Naval Education and Training Center
NOAA	National Oceanic and Atmospheric Administration
NORTHDIV	Northern Division
NPL	National Priorities List
NS	Near Shore
OS	Off Shore
OVA	Organic Vapor Analyzer
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenols
PID	Photo Ionization Detector
PPB	Parts Per Billion
PPM	Parts Per Million
RfD	Risk Reference Dose
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
ROD	Record of Decision
SARA	Superfund Amendment and Reauthorization Act
SASE	Study Area Screening Evaluations
SEM	Simultaneously Extracted Metals
SER	Shore Establishment Realignment Program
SMCL	Secondary Maximum Contaminant Levels
SS	Surface Soil
ST	Storm Sewer
SVOC	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TBT	Tributyltin
TCL	Target Compound List
TOC	Total Organic Carbon

LIST OF ACRONYMS (continued)

<u>ACRONYM</u>	<u>DESCRIPTION</u>
TP	Test Pit
TRC	Technical Review Committee - also TRC Environmental Corporation
TSS	Total Suspended Solids
VOC	Volatile Organic Compounds

E.0 EXECUTIVE SUMMARY

This report presents the results of a Phase II Remedial Investigation (RI) conducted by for the U.S. Department of the Navy, Northern Division at Site 01 -McAllister Point Landfill, located at the Naval Education and Training Center (NETC) in Newport, Rhode Island. The results of the Phase II RI at the McAllister Point Landfill are being presented herein as a separate report from the other Phase II RI site (Old Fire Fighting Training Area - Site 09) in order to fast-track the RI/FS process at the landfill.

Field investigations were performed for the United States Navy (Navy) by TRC Environmental Corporation (TRC) in 1993 and 1994, and the majority of the Phase II RI report presents information developed during those activities. A Record of Decision (ROD) was signed in September 1993 that selected a cap as the final remedy for the source control (landfill materials) operable unit. Cap construction activities at the McAllister Point Landfill were initiated in March 1995 and completed in October 1996. The ROD also specified additional studies to ascertain whether near-shore sediments had been affected by site-related contamination. Science Applications International Corporation (SAIC) and the University of Rhode Island (URI), under contract to Brown & Root Environmental (B&R Environmental, also known previously as Halliburton NUS Corporation), conducted marine sediments and biota sampling in 1995 to obtain data that assessed potential impacts; the results were presented in the Draft Final Marine Ecological Risk Assessment Report (SAIC/URI, June 1996). In the summer of 1996, it was noted that some sediments in the areas of interest appeared to have eroded as the result of storm events that occurred during the winter of 1995. An additional sediment sampling round was conducted in the fall of 1996 and the new data were subsequently integrated into the Final Marine Ecological Risk Assessment Report (SAIC/URI, March 1997) some information from the additional sediment sampling was used to assess potential human health risks for scenarios that were discussed with the United States Environmental Protection Agency (EPA) and the Rhode Island Department of Environmental Management (RIDEM) during a technical meeting held on March 5, 1997.

The Draft Final RI Report (June 1994) prepared by TRC was reviewed and commented on by EPA and RIDEM in late 1994. At that time it was determined that the Draft Final RI Report would not be revised until the Marine Ecological Risk Assessment was completed and the results would be integrated into the revised Draft Final RI Report. While TRC originated the Phase II Draft Final Report, B&R Environmental revised the document (by addressing EPA and RIDEM review comments) and incorporating the Marine Ecological Risk Assessment findings.

To complete the management of migration Feasibility Study (FS) Report originally drafted by TRC, it was necessary to assess the potential impact of capping the McAllister Point Landfill. A Leachate Generation, Fate and Transport and Ecological Assessment Report (TRC, September 1994) was prepared that used computer modeling to estimate the quantities of leachate that would be generated before and after the cap was placed. Since the cap was completed in October 1996, and the Navy has initiated its long-term ground water monitoring program, the actual current data would be used to assess ground water contaminant status and the effectiveness of the cap in reducing leachate generation, and assess the need for further remedial actions to address potential migration of ground water bearing chemicals into Narragansett Bay.

This RI report provides a summary of background information for NETC - Newport and the McAllister Point Landfill, describes the Phase II RI field investigation scope and methodology, includes a discussion and summary of the nature and extent of contamination at the site, and provides conclusions on "hot spots" or areas of potential concern at the site. A Human Health Risk Assessment conducted for the site is presented as Volume II of this report. An Ecological Risk Assessment completed for this site was previously submitted under separate cover. A Marine Ecological Risk Assessment (SAIC/URI, March 1997) was completed and submitted under separate cover. Summaries of both of these assessments are provided at the end of this executive summary.

E.1 PURPOSE

The general objectives of the RI site investigation are to determine the nature and extent of site contamination, sources of contamination, potential contaminant migration pathways, potential contaminant receptors, and associated exposure pathways. This information is necessary to determine whether, and to what extent, a threat to human health or the environment exists, and to provide the information required to develop and evaluate remedial action alternatives for the site, as necessary.

The objectives of the Remedial Investigation at McAllister Point Landfill are to:

- determine the site background soil and ground water quality;
- determine the nature and extent of site surface soil contamination;
- determine the extent of the fill material on the site;
- determine the nature of the fill material contamination;
- determine the nature and extent of ground water contamination;
- assess the potential source location of the ground water contamination; and

- determine the presence and nature of sediment and biota contamination in the adjacent bay.

The Phase II site investigation was conducted to address areas of concern discovered under the Phase I investigation and any site investigation data gaps. The Phase II investigation activities included geophysical and soil gas surveys, surface soil sampling, test pit sampling, soil boring sampling, monitoring well and piezometer installation, ground water sampling, surface water sampling, and leachate sampling. ~~The Marine Ecological Risk Assessment Investigation was conducted to assess potential impacts of chemicals associated with McAllister Point Landfill on marine sediments and biota.~~

E.2 NETC DESCRIPTION AND HISTORY

The NETC site is approximately 1,063 acres in size, with portions of the facility located in Newport, Middletown, and Portsmouth, Rhode Island. The site is approximately 60 miles southwest of Boston and 25 miles south of Providence. The facility layout is long and narrow, following the shoreline of Aquidneck Island for nearly 6 miles bordering Narragansett Bay. A site location map is provided on Figure ES-1.

The NETC facility area has been used by the US Navy since the era of the Civil War. Military activities at the base significantly increased during times of war. During World War I and II, servicemen were housed on the base. In subsequent peacetime years, on-site facilities were slowly disestablished, until the headquarters of the Commander Cruiser-Destroyer Force Atlantic was located there in 1962. In April 1973, the Shore Establishment Realignment Program (SER) reorganized Naval forces and resulted in the disestablishment of several on-site facilities and associated reductions in Navy personnel. Subsequent to this "downsizing", the Navy exceded a significant portion of its original acreage. Other portions of the facility are currently leased by the Navy to the State of Rhode Island and Economic Development Corporation. Some of these areas are subleased to private enterprises.

E.3 PREVIOUS ENVIRONMENTAL INVESTIGATIONS AT NETC

The Navy has conducted several environmental investigations at the NETC facility. The major environmental investigations have included:

- 1983 - An Initial Assessment Study (IAS)
- 1986 - A Confirmation Study (CS)

- 1992 - A Remedial Investigation (Phase I RI)
- 1993 - 1994 - A Remedial Investigation (Phase II RI)

The earliest of the environmental investigations conducted at NETC was initiated in 1982 and consisted of an Initial Assessment Study (IAS) conducted by Envirodyne Engineers, Inc. The IAS consisted of a background investigation and site visits to identified sites where contamination was suspected to exist and which may have posed a threat to human health or the environment. A total of eighteen potential sites were identified by the IAS.

Six of the sites identified during the IAS were judged to require further study and were investigated under a Confirmation Study (CS), conducted by Loureiro Engineering Associates, Avon, Connecticut. The CS included environmental sample collection and analysis and was completed in 1986.

The Phase I RI/FS investigation was conducted for five sites. Three of the NETC sites, McAllister Point Landfill, Melville North Landfill, and Tank Farm 4, were investigated in both the IAS and CS. Tank Farm 5 was studied in the IAS, and tank numbers 53 and 56 were extensively studied as part of a tank closure plan. The Old Fire Fighting Training Area had not been sampled or extensively studied prior to the Phase I RI. The numbers for the five RI/FS sites were assigned during the IAS and were retained during the Phase I RI/FS investigation for consistency and to avoid confusion. Results of the Phase I RI conducted at the McAllister Point Landfill are presented in this report along with the Phase II RI results.

E.4 NETC REGIONAL GEOLOGY, HYDROGEOLOGY, AND HYDROLOGY

The NETC site is located at the southeastern end of the Narragansett Basin. The rocks of the Narragansett Basin are non-marine sedimentary rocks of Pennsylvanian age. The bedrock at the NETC facility is almost entirely of the Rhode Island Formation. Within the Rhode Island Formation, there are a few areas of thick conglomerates. They consist of pebbles, cobbles, and boulders interbedded with sandstone and graywacke. Coasters Harbor Island is mostly covered with this conglomerate material. Overlying the Pennsylvanian rocks of the Narragansett Basin are surficial deposits of Pleistocene sediments. These unconsolidated, glacial sediments range in thickness from 1 to 150 feet and consist of till, sand, gravel and silt.

Many areas on Aquidneck Island, on which the NETC is located, obtain potable water supply from wells. Ground water is obtained from the unconsolidated glacial ~~of till and outwash~~ deposits and from the underlying Pennsylvanian bedrock. The average depth to ground water is 14 feet. In the NETC

area, glacial till deposits are typically less than 20 feet in thickness. Well yields in these materials range from 1 to 120 gallons per minute. Although till is considered an unconsolidated deposit, the upper limit of this well yield is likely from an outwash deposit that is well sorted and stratified. Till wells typically yield a few hundred gallons of water per day or less than 1 gallon per minute. Bedrock well yields range from less than 1 to as much as 55 gallons per minute and are highly dependent on the presence of joints and fractures. Most ground water is soft or moderately hard. In scattered locations, pumping has led to salt water intrusion.

The Rhode Island Department of Environmental Management (RIDEM) has classified ground water in Rhode Island to protect the quality of the state's ground water resources for use as drinking water and other beneficial uses, and to assure protection of the public health and welfare, and the environment. Ground water at the McAllister Point landfill has been classified as GA Non-attainment (GA-NA). Ground water classified GA is known or presumed to be suitable for drinking water without treatment. Non-attainment (NA) areas are those areas which are known or presumed to be out of compliance with the standards of the assigned classification. The goal for non-attainment areas is restoration to a quality consistent with the classification.

E.5 SITE 01 - McALLISTER POINT LANDFILL

The McAllister Point Landfill is located in the central portion of the Newport Naval Base (see Figure ES-1). The site is approximately 11.5 acres in size and is situated between Defense Highway and Narragansett Bay. Prior to completion of the CAP, the site was characterized by a mounded area in the central to north-central portion of the site and flat areas at the northern and southern ends. Ground elevations across the main portion of the site vary between approximately 15 and 35 feet above mean low water level (mlw). Along the western edge of the site, the grade dropped off quickly to the shoreline, in some areas by as much as 20 feet. The site was vegetated with grass, weeds, and some small trees. A small, lightly wooded area is present at the northern end of the mounded area. A more mature wooded area is present just off the northeastern edge of the site between the railroad tracks and Defense Highway. Several depressions were present in the central portion of the site where standing water collects during heavy precipitation events.

Available historic information indicates that McAllister Point Landfill was first used in 1955 following the closure of the landfill in Melville North, and continued to be used as a landfill until the mid-1970s. During the years that the site was operational, it received wastes from all of the operational areas (machine shops, ship repair, NUSC, etc.) Navy housing areas (domestic refuse), and from the 55 ships which were homeported at Newport. Materials reportedly disposed of at the landfill include spent

acids, paints, solvents, waste oils (diesel, lube and fuel), and PCB-contaminated transformer oil from at least two transformers. After 1955, an incinerator was built at the landfill, a 1958 aerial photograph indicated its presence. The incinerator operated until 1970 and was reportedly used to burn approximately 98% of the waste that was disposed of in the landfill. Following the landfill closure in the mid-1970s, a 3-foot-thick soil cap was reportedly placed over the site.

After completion of the Phase I RI, a Record of Decision was signed in September 1993, that selected a multi-media cap for the source (landfill) materials; the cap was completed in October 1996.

E.6 PREVIOUS INVESTIGATIONS

Previous investigations conducted at McAllister Point Landfill include its initial listing in the IAS, completion of the Confirmation Study, and completion of the Phase I and II RI. An off-shore study was also conducted by the Army Corps of Engineers in March of 1988. Results of these investigations were reported as follows:

Narragansett Bay Sediment and Mussel Sampling - Sediment sample results from the confirmation study indicated the presence of elevated levels of metals in sediment and mussel samples near the site. In addition, elevated concentrations of TPH and PCBs were reported in the sediment and mussel samples collected near the site. Concentrations in sediment samples collected adjacent to the landfill were generally at least one order of magnitude greater than concentrations in the control (background) sample.

Soils - A wide range of compounds including VOCs, SVOCs, pesticides, PCBs, and inorganics were detected in site soils. The most prevalent organic contaminants present in the soils include PAHs. Elevated concentrations of PAHs, including carcinogenic PAHs, were detected across the entire site, although the highest levels were detected in the southern portion of the site. VOCs were primarily detected in the subsurface soils in the central portion of the site and included both aromatic hydrocarbons, and chlorinated aliphatic hydrocarbons. PCBs were detected in almost 50% of the subsurface soil samples collected across the site at concentrations as high as 1.1 ppm; however, these concentrations do not exceed the RIDEM guidance standard of 10 ppm. Inorganic analytes detected in the site soils at elevated concentrations include antimony, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, lead, manganese, magnesium, nickel, silver, vanadium, and zinc.

Ground Water - Ground water sample results indicated the presence of low levels of VOC and SVOC contamination in samples collected from the central and southern portions of the site. Low concentrations (1 to 160 ppb) of VOCs were detected in five of the ten on-site wells. Benzene was detected in MW-3S at a concentration of 6 ppb, exceeding the federal MCLs and state guidance level of 5 ppb. SVOCs detected in the ground water consisted primarily of PAHs and phenols. The highest level of total PAHs were detected in MW-3S at a concentration of 407 ppb. PCBs were detected in only one monitoring well, MW-5S at a concentration of 0.73 ppb. Several inorganic analytes were present in the ground water at concentrations exceeding MCLs. These inorganics include antimony, arsenic, beryllium, cadmium, chromium, copper, mercury, lead, and nickel. The highest levels of inorganics were detected in the central portion of the site.

E.7 PHASE I HUMAN HEALTH RISK ASSESSMENT

In Phase I, a human health evaluation was conducted for the McAllister Point Landfill site on the basis of the Phase I RI findings. The exposure scenarios considered in the human health evaluation included both current use and potential future site use scenarios including trespassing (Scenario 1), recreational use (Scenario 2), on-site construction (Scenario 3), commercial/industrial use (Scenario 4), and residential use (Scenario 5). Both cancer risks and non-cancer risks were evaluated using available regulatory guidance. Total cancer risks were determined to exceed the acceptable risk range of 1×10^{-4} to 1×10^{-6} under both Scenarios 4 and 5. The maximum cancer risk for Scenario 2 also exceeded the acceptable risk range. Non-cancer Hazard Index Ratios (HI) were exceeded under Scenarios 3, 4, and 5.

The major contributing factor to the calculation of cancer risk for scenarios 1, 2, and 3 is ingestion of carcinogenic PAHs in soil. For Scenarios 4 and 5, the pathway of primary concern is ingestion of ground water containing inorganics (arsenic, beryllium) and carcinogenic PAHs. The primary contributor to the total HIs for scenarios 1, 2, and 3 is ingestion of inorganics in soils. Ingestion of inorganics in ground water drove the total HIs for Scenarios 4 and 5.

A Human Health Risk Assessment for the site was also conducted on the basis of the Phase I and Phase II RI findings and is presented as Volume II of this report. An Ecological Risk Assessment completed for this site was submitted under separate cover. Summaries of these risk assessments are incorporated into this executive summary.

E.8 PHASE II RI FIELD INVESTIGATION

The purpose of the Phase II RI was to further delineate the horizontal and vertical extent of contamination associated with the former disposal activities at the site. The field investigation activities conducted at the McAllister Point Landfill during the Phase II RI included:

- Completion of 1,985 linear feet of **seismic refraction survey lines**.
- Installation and collection of **53 soil gas points** at four different locations across the site. Soil gas measurements were typically conducted at two interval depths at each location.
- Completion of an **electromagnetic conductivity survey** on two 10-foot grid systems at the northern and southern ends of the site.
- Collection of **fourteen surface soil samples** with subsequent analysis for full TCL and TAL parameters and dioxin/furan analyses on four of the samples.
- Collection of **forty-three soil samples** from the fourteen soil borings and nine monitoring well borings with the subsequent analysis for full TCL/TAL parameters. Fourteen of the samples were collected from the 0-1' interval while the remaining twenty-nine were collected from just above the water table and/or the interval of greatest observed contamination.
- Excavation of **three test pits** in the southern portion of the site to characterize the material disposed of in this section of the site. Four test pit soil samples were collected and analyzed for the full TCL/TAL and total petroleum hydrocarbons (TPH).
- Installation of **four shallow monitoring wells** screened within the overburden material and **seven monitoring wells** screened within the weathered bedrock. Two shallow overburden and two bedrock monitoring wells were installed as monitoring well clusters.

- Installation of **two, three-well piezometer clusters** and **two, two-well piezometer clusters** within the central portion of the site. Two months of water levels measurements were collected from select piezometers and monitoring wells to assess potential tidal influences on the site.
- Collection and analysis of **ground water samples from the twenty-one site monitoring wells**. Ground water samples were field analyzed for the water quality parameters of pH, specific conductance, Eh, temperature, turbidity, dissolved oxygen, and salinity and submitted for laboratory analyses of the TCL/TAL parameters less pesticides/PCBs. Pesticide/PCB analyses were collected on four of the monitoring wells located in the southern portion of the site. In addition, five ground water samples were also analyzed for dissolved metals (filtered), BOD, COD, and TSS.
- Collection and analysis of **three leachate samples** and **one surface water sample**. The leachate and surface water samples were laboratory analyzed for the full TCL/TAL. In addition, the pH, specific conductance, and temperature of the leachate samples were measured in the field. The salinity of the surface water sample was also measured in the laboratory.
- Completion of **single well hydraulic conductivity tests** at twelve of the monitoring wells installed on or near the site.
- Collection of three rounds of **ground water elevation data** from all twenty-one site monitoring wells. Two rounds of elevation data were obtained from the site piezometers. In addition, two 1-month periods of continuous ground water elevation data was obtained from several of the wells and piezometers on the site.
- Collection of **seven near-shore sediment and bivalve samples** and **nine off-shore sediment and bivalve samples** from Narragansett Bay adjacent to McAllister Point Landfill. Sediment samples were analyzed for PAHs, PCBs, TAL metals, acid volatile sulfides (AVS) and simultaneously extracted metals (SEM), total organic carbon (TOC), and grain size. Bivalve (clams and mussels) samples were analyzed for PAHs, PCBs, and TAL metals. Mussel samples were also analyzed for butyltins.

E.9 MARINE ECOLOGICAL RISK ASSESSMENT FIELD INVESTIGATION

The objective of the Marine Ecological Risk Assessment (ERA) conducted by SAIC/URI, under contract to B&R Environmental, was to assess ecological risks to the environment offshore of McAllister Point Landfill in Narragansett Bay from chemicals associated with the McAllister Point Landfill. The field investigation activities performed under this Marine ERA included:

Phase I/II Sampling

- Collection of surface sediment and sediment core samples from 32 stations offshore and south of McAllister Point, and 3 reference stations from Cranston Cove off Conanicut Island in Narragansett Bay. The sediments samples were analyzed for grain size, total organic carbon (TOC), total and fecal coliforms, PAHs, pesticides, PCBs, metals, and butyltin compounds.
- The metal bioavailability and potential toxicity of surface sediment and subsurface intervals were measured through Acid Volatile Sulfides (AVS) and Simultaneously Extracted Metals (SEM) analyses.
- Collection of sediments from 32 stations for toxicity testing using 10-day amphipod tests and sea urchin larval toxicity tests.
- Collection of 47 tissue samples (including mussels, hard clams, cunner, and lobster) for analysis of organic constituents (polynuclear aromatic hydrocarbons, pesticides, and PCBs) and metals.
- Performance of side-scan and sub-bottom sonar and sediment core survey of subtidal habitats near shore.

Phase III Sampling

- Collection of sediment samples from 18 stations for analysis of PAHs, pesticides, PCBs, metals, grain size, and TOC.
- Collection of sediment samples from 18 stations for toxicity testing.

E.10 SITE GEOLOGY AND HYDROGEOLOGY

In general, the overburden material at the site consist of four distinct units. These units include: a silt, clay, and shale fragment layer, apparently used as a cover in the central portion of the site at the time of the landfill closure; a silt and sand layer, used as a cover across the southern portion of the site; domestic and construction debris (i.e., fill), and glacial till deposits. The silt, clay, and shale fragment "cover" layer ranges in thickness from 0 to 4 feet and was discontinuous in the central and north-central portion of the site. The silt and sand soil horizon was primarily observed in the southern portion of the site, however, this material was also discontinuous. The fill material observed across the site ranged from three feet to eight feet thick in the northern and eastern periphery of the site, to twenty-five feet and twenty-eight feet in the western portion of the site along Narragansett Bay. The fill material encountered at the site consisted of a wide variety of domestic and construction waste. Domestic waste was primarily observed in the central to north-central portion of the site and consisted of plastic, paper, cloth, and garbage. Fill encountered in the southern portion of the site primarily consisted of bricks, concrete, scrap metal, and wood. A thin layer of ash material was also observed in the north-central portion of the site and is believed to be the waste product of an on-site incinerator previously located in this portion of the site. The fill material across the majority of the site appears to have been deposited directly upon the bedrock surface.

Glacial till deposits were observed directly over the bedrock surface in the northern and southern portions of the site, at several locations within the central portion of the site, and at the off-site soil and monitoring well boring locations. The till material consists of fine to coarse sand and silt, with some horizons containing weathered shale fragments. The bedrock encountered across the site consists of a grey-brown to black, highly weathered to competent, carboniferous shale. The bedrock was encountered at depths ranging from three feet in the northern portions of the site to twenty-eight feet in the central portion of the site. The bedrock surface generally exhibits a uniform, westward slope across the site, towards Narragansett Bay.

Ground water elevation data indicates that shallow and deep ground water is flowing from east to west, towards the Narragansett Bay. The depth to ground water across the site ranged from 5.03 feet at off-site monitoring well MW-16R to 29.12 feet at monitoring well MW-8R as measured on December 29, 1993. Based on single well hydraulic conductivity tests performed on wells across the site, the hydraulic conductivities in the overburden fill material range from 15.03 ft/day to 59.58 ft/day, reflecting the heterogeneity of the fill material. Overburden transmissivity values ranged from 148.8 ft²/day to 784.7 ft²/day. Hydraulic conductivities observed in the on-site bedrock wells ranged from 0.40 ft/day to 6.40 ft/day. Transmissivity values for the on-site bedrock wells ranged from 8.76

ft²/day to 67.96 ft²/day. Average horizontal hydraulic gradients for shallow overburden ground water flow ranged from 0.009 ft/ft (northern inland) to 0.219 ft/ft (northern nearshore) from east to west. Average horizontal hydraulic gradients for the bedrock ground water ranged from 0.027 ft/ft (southern area) to 0.114 ft/ft (northern area). Gradients for both shallow and bedrock ground water were higher towards the western edge of the site, due to the significant topographic decrease towards Narragansett Bay. The average linear velocity of shallow ground water ranged from 2.25 ft/day (northern inland) to 54.72 ft/day (northern nearshore). Average linear velocities for the bedrock ground water ranged from 0.78 ft/day (southern area) to 3.36 ft/day (northern area).

E.11 NATURE AND EXTENT OF CONTAMINATION

E.11.1 Surface Soil

In general, the most significant contaminants in the site surface soils are PAHs. PAH compounds were detected in 85% of the surface soil samples collected at the site at concentrations ranging from 237 ppb to 878,810 ppb, while carcinogenic PAH concentrations ranged from non-detect to 157,800 ppb. PAH contamination was most prevalent in the southern portion of the site; however, extensive surface soil sampling was not conducted in the central mounded portion of the site. The highest concentrations of total PAHs and carcinogenic PAHs were detected in three samples (SS-6, SS-11, and B26-1) located in the southern portion of the site. Other SVOCs detected frequently in the site surface soils included dibenzofuran, carbazole, benzoic acid, 1,4-dichlorobenzene, and phthalate esters.

VOCs were present in site surface soils at low concentrations and included 1,1,1-trichloroethane, 4-methyl-2-pentanone, tetrachloroethene, xylene, acetone, and methylene chloride. The highest concentration of VOCs were detected at SS-25. Acetone and methylene chloride were detected at this location at concentrations of 1.9 ppm and 39 ppm, respectively. Upon becoming available, the VOC data for EPA's split soil sample from this location will also be assessed.

Pesticides were detected in each surface soil sample collected at the site during the Phase II RI. Elevated concentrations of pesticides including 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, heptachlor epoxide, and endrin ketone were detected in three surface soils located in the southern portion of the site. 4,4'-DDT was also detected at elevated concentrations at an additional eight surface soil samples in the southern portion of the site. PCBs were only detected in three of the surface soil samples collected during the Phase II RI at concentrations ranging from 34 ppb to 350 ppb. **These PCB concentrations fall well below the state's direct exposure criterion of 10 ppm (10,000 ppb).**

Numerous inorganic analytes were detected in the surface soil samples collected from the site. The inorganic analytes common to each of the surface soil samples collected at the site included chromium, copper, nickel, lead, vanadium, and zinc. In order to evaluate inorganic soil data, the inorganic analyte levels were compared with site-specific, off-site background surface soil sample results. Those surface soil samples whose analyte concentrations exceeded several (at least 4 analytes) of the background levels include surface soil samples SS-8, SS-9, SS-26, SS-27 and the surface soil samples from test borings B-23 and B-24 and well borings M-12 and M-13. Each of these samples were collected from the southern portion of the site.

It is important to note that while it appears that the greatest surface soil contamination at the site exists in the southern portion of the site, only a limited number of surface soil samples were collected from the central mounded portion of the site during both phases of the investigation.

E.11.2 Subsurface Soil

Consistent with the surface soil results, the most significant contamination present in the site subsurface soils are PAHs. PAHs were detected in 71% of the subsurface soil samples collected at the site at concentrations ranging from 47 ppb to 4,169,300 ppb. The highest concentrations of total PAHs were detected in subsurface soil samples collected from the central and north central portions of the site. The highest concentrations of total PAHs detected in the subsurface soils did not correspond with the locations of the highest surface soil PAH concentrations; however, a limited number of surface soil samples were collected from the central portion of the site. Other SVOCs detected in the subsurface soils include phthalate esters, phenols, dibenzofuran, carbazole, di- and trichlorobenzenes, and benzoic acid.

Volatile organic contamination was present across the entire site at low concentrations. The highest levels of VOC contamination were detected in samples collected from the fill material in the central portion of the site. The four samples which contain the highest concentrations (> 1 ppm) of total VOCs include B05-1 at 2.41 ppm, B05-3 at 21.59 ppm, B07-at 2.49 ppm and M09-2 at 1.13 ppm. Total VOC concentrations detected in the site subsurface soils consisted primarily of aromatic VOCs (benzene, toluene, ethylbenzene, chlorobenzene, and xylene). Low concentrations (< 400 ppb) of several chlorinated VOCs (TCE, PCE, 1,2-DCE) were also detected in a few of the subsurface soil samples.

Pesticides were widely detected in the subsurface soil samples collected across the site. Elevated concentrations of the pesticides heptachlor epoxide, dieldrin, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, endrin,

endosulfan, methoxychlor, endrin ketone, and alpha chlordane were detected in several of the subsurface soil samples collected from each portion of the site. PCBs were detected in twenty-seven of the subsurface soil samples at concentrations ranging from 17 ppb to 2,200 ppb. The highest concentrations of PCBs were detected in subsurface soil samples B12-2 at 1,100 ppb and M10-2 at 2,200 ppb, each located in the central portion of the site. ~~The concentrations of PCBs detected in the subsurface soils are all below the state's direct exposure criterion of 10 ppm for PCBs in soils.~~

Inorganic analytes were detected in each of the subsurface soil samples collected from across the site. Inorganics common to each of the subsurface soil samples include arsenic, chromium, cobalt, lead, nickel, and zinc. For comparison purposes, on-site subsurface soil inorganic results were compared with the background surface soil sample results. Comparison to the background surface soil sample results indicate that seventeen subsurface soil samples contained at least ten analytes which exceeded the background levels. Of these samples eleven were located in the central portion of the site, two were located in the north central portion of the site, and one was located in the southern portion of the site. Each of these samples were collected from sample intervals which were documented to contain fill and/or debris material. Subsurface soil samples which contained shale fragments typically had higher concentrations of several common elements including aluminum, cobalt, iron, magnesium, and nickel, indicating that these minerals may be common and naturally occurring in the native shale bedrock formation. Lead was detected in four subsurface soil samples at concentrations exceeding the state's direct exposure criterion of 500 ppm. Significantly elevated lead concentrations (> 1000 ppm) were detected in four subsurface soil samples collected from the central portion of the site and from one subsurface soil sample collected from the north central portion of the site. The two highest lead concentrations were detected in subsurface samples B19-2 and B05-2 at concentrations of 4,720 ppm and 3,610 ppm, respectively.

E.11.3 Ground Water

Phase II ground water sample results indicated the presence of VOCs, SVOCs, pesticides, PCBs, and inorganics in the shallow ground water monitoring wells, and VOCs, SVOCs and inorganics were detected in the deep (bedrock) monitoring wells sampled at the site.

In the shallow ground water monitoring wells, VOCs and SVOCs were detected in monitoring wells MW-3S, MW-4S, and MW-21S located in the central portion of the site, and in monitoring wells MW-12S and MW-13S located in the southern portion of the site. VOCs were also detected in MW-2S located in the north central portion of the site. VOCs detected in the site shallow ground water primarily consisted of petroleum-related VOCs (i.e, benzene, ethylbenzene, etc.) while SVOCs primarily

consisted of PAHs. However, none of the VOC or SVOC concentrations detected in the ground water samples exceeded either the federal or state ground water quality standards. The pesticide compound 4,4'-DDD was detected in only one shallow ground water monitoring well (MW-12S) at a concentration of 0.18 ppb. PCBs were detected in each of the shallow ground water samples collected (MW-5S, MW-12S, and MW-13S located in the southern portion of the site) at concentrations ranging from 0.76 ppb to 1.8 ppb. These concentrations exceed the federal MCL and state ground water quality standard of 0.5 ppb. Inorganics detected in the site shallow ground water exceeding federal MCLs and/or state ground water quality standards include antimony, arsenic, beryllium, cadmium, chromium, copper, mercury, lead, and nickel. The highest inorganic contamination in the site ground water was detected in monitoring well MW-3S.

In the deep ground water monitoring wells, only one sample contained detectable concentrations of VOCs. 1,2-Dichloroethene was detected in monitoring well MW-9R at a concentration of 1 ppb. SVOCs were detected in deep monitoring wells MW-3R, MW-9R, MW-10R, MW-11R, and MW-15R. The SVOC compounds primarily detected in the deep wells were phthalate esters at low concentrations (< 4 ppb) with the exception of MW-8R which had a concentration of bis(2-ethylhexyl)phthalate of 240 ppb, exceeding the federal MCL of 6 ppb. PAH compounds were also detected in monitoring wells MW-3R and MW-11R located in the central portion of the site. No pesticide or PCB compounds were detected in the one deep monitoring well (MW-5R) which was analyzed for these constituents. Inorganics detected in the deep ground water monitoring well samples at concentrations exceeding federal MCLs and/or state ground water quality standards include arsenic, beryllium, chromium, lead and nickel. Results of inorganic analysis on filtered ground water samples for both shallow and deep ground water indicate that the elevated inorganic concentrations detected across the site may be due to heavy siltation in the ground water samples.

A fate and transport assessment of the pesticides, PCB, and several metals detected in the ground water indicates there is a low potential for the transport of these contaminants via ground water to the adjacent bay.

E.11.4 Phase I RI Sediment and Bivalve Assessment

Results of the sediment and bivalve sampling conducted by Battelle Ocean Sciences indicate that PAHs, PCBs, and inorganics are present within both near-shore and off-shore sediments and bivalves. Sediment and bivalve samples were collected from thirty (30) intertidal and subtidal stations adjacent to the site. A total of seven near-shore intertidal composite samples (consisted of three aliquots each) and nine off-shore subtidal discrete samples. Blue mussels were present and collected over each of

the seven near-shore stations. Whereas, hard-shell clams or quahogs were collected from the seven off-shore locations and soft-shell were also present and collected at three of the near-shore stations. The near-shore composite sample station areas were each located over shoreline zones having similar physical characteristics (e.g., stone revetment area, exposed debris area, beach area).

Elevated PAHs were detected in the near-shore sediments at the two southern-most stations (NS-16/17/18 and NS-19/20/21) along the sites beach area shoreline. The highest total PAH concentrations were detected at an off-shore station (OS-28) located off the south central portion of the site. Elevated petrogenic PAH concentrations (primarily combustion and/or creosote/coal tar originating PAH) were detected in the sediment samples from stations NS-13/14/15, NS-16/17/18, and NS-19/20/21. The individual PAH data for sample NS-13/14/15, which was collected from the steel debris area, suggests a partial contribution of petroleum product to the PAH contamination at this location. The mussel and clam PAH data indicates fairly consistent PAH levels along the site. Slightly elevated PAH levels were detected in two clam samples collected off the southern area of the site. The PAH class distribution for the mussel and clams was nearly evenly distributed between petrogenic and pyrogenic PAHs. The PAH sediment and bivalve data for the site generally indicates comparable PAH levels to published PAH sediment and bivalve data for Narragansett Bay. However, as presented above, elevated PAH levels were detected in several of the near-shore sediment samples.

Elevated PCB levels were detected sediments collected from the three near-shore adjacent station NS-13/14/15, NS-16/17/18, and NS-19/20/21. The PCB congener data for sample NS-13/14/15 indicates that there appears to be a different or additional source of PCB contamination at this location as compared to the PCBs detected in other site sediment samples and reference stations. The mussel PCB data varied along the site, with the highest total PCB mussel concentrations being detected at the southern-most stations NS-13/14/15, NS-16/17/18, and NS-19/20/21. The clam PCB data was fairly consistent along the site and did not indicate any obvious locations of PCB contamination. The PCB sediment and mussel data along the "Point" of the site was elevated in comparison to published PCB sediment and mussel levels in Narragansett Bay.

Butyltins were analyzed for in all of the site mussel samples. The butyltins, tributyltin (TBT) was detected at a very low concentration (2.05 ppb) in the near-shore mussel sample NS-10/11/12. Non-detected concentrations were reported for butyltins in all other site and reference mussel samples.

Elevated metals concentrations were detected in the sediment samples from the three near-shore stations NS-10/11/12, NS-13/14/15, and NS-16/17/18. These sample locations are located along the site shoreline area where there is a large amount of scattered steel debris and/or in areas of exposed

shoreline fill materials. Lead and mercury showed some of the most significantly elevated metals sediment concentrations over the other sample locations. Other metals detected at elevated levels in the sediment include antimony, copper, zinc, silver, and nickel. The metals concentrations in the mussels and clams varied less dramatically than in the sediments. In the mussel samples, the highest levels of several metals were detected in mussel sample NS-13/14/15 collected from along the central portion of the site. In the clam samples, the highest metals levels were generally detected in samples NS-19/20/21 and OS-22, located at opposite ends of the site. The metals sediment and bivalve concentrations along the "Point" of the site were elevated in comparison to published metals levels for Narragansett Bay.

E.11.5 SAIC/URI SEDIMENT AND BIOTA ASSESSMENT

Sediment and biota sampling were conducted in 1994 and 1995 to support the Marine Ecological Risk Assessment. Additional sediment sampling was conducted in 1996 to assess the impact of observed erosion in the intertidal zone.

Sediments

Analytical results from 1994 and 1995 investigations indicated that surface sediment samples collected at five of seven nearshore (NSB) stations contained total PCBs concentrations that exceeded NOAA's upper adverse effects benchmark value (Effect Range-Median or ER-M), while total PCBs concentrations in samples from most of the offshore stations only exceeded NOAA's lower benchmark value (Effects Range-Low or ER-L). For total PAHs, four of the nearshore stations exceeded the corresponding ER-L value; similarly, only a few offshore stations exceeded the total PAHs ER-L value. The pesticide p,p'-DDE ER-L value was exceeded only by four nearshore stations. The proposed EPA screening value for tributyltin in marine sediments was not exceeded by any of the nearshore or offshore stations.

Analytical results from 1994 and 1995 also indicated that the highest metal concentrations in surface sediments were generally found at the nearshore stations, where copper, lead, mercury, nickel and zinc exceeded ER-M values, while cadmium and chromium only exceeded ER-L values. The spatial pattern of metal distribution and concentrations in the surface sediments was generally similar to those determined in previous investigations, and strongly indicate, the McAllister Point Landfill as a dominant source of metals into the marine environment.

Additional sediment samples (surface and core) were collected in 1996 to assess changes in contaminant exposure conditions due to sediment erosion in the nearshore area caused by the construction of the landfill revetment. Total PCBs concentrations increased and values above the ER-M benchmark were associated with nearshore stations NSB-4, NSB-5, NSB-7, and offshore station MCL-12. Increased concentrations to levels above the ER-L were observed for PCBs at nearshore stations NSB-1 and NSB-2, and for PAHs at nearshore station NSB-6 and offshore station MCL-12.

Metal concentrations measured in sediments during 1996 were generally higher than those measured previously within the study area. The concentrations of copper, lead, and zinc exhibited the greatest degree of change.

The 1996 data indicated that nearshore stations NSB-2 through NSB-4 had higher concentrations of PCBs and PAHs in the core samples (0-18 cm) relative to the surface sediments (0-2 cm). Concentrations of metals in the nearshore sediment core samples were generally comparable to surface sediment concentrations.

Biota Sampling

During 1995 studies, 38 biota tissue samples [blue mussels (*Mytilus edulis*); hard clams (*Mercenaria mercenaria*); cunner (*Tautogolabrus adspersus*); and lobster (*Homarus americanus*)] were analyzed for contaminant concentrations.

Blue mussels represented bivalve exposure to contaminants in the nearshore (intertidal) area. Total PCBs concentrations in mussels were highest at station NSB-3; p,p'-DDE residues were highest at stations NSB-6 and NSB-7; tributyltin was highest at stations NSB-1 and NSB-3; and total PAHs were highest at station NSB-1. For total PCBs, p,p'-DDE, and total PAHs, sediment in the mussel gut contributed about 10 to 30 percent of the total chemical load of the animal.

Hard clams represented infaunal conditions in the offshore (subtidal) environment. When compared to the mussel results, hard clam tissue concentrations of PCBs, PAHs, and p,p'-DDE were approximately five times lower and also were more spatially uniform among stations. Sediments in the gut of hard clams contributed 5 to 10 percent of the PCBs, PAHs and p,p'-DDE contained in the animal.

Cunner tissue analytical results were available only for nearshore stations NSB-1, NSB-3, NSB-4, and NSB-6. In general, all the samples had measurable concentrations of the contaminants, but no one

station had elevated values for all the contaminants. Total PCBs and p,p'-DDE concentrations in fish tissue were many times higher than in bivalves, reflecting possible food web biomagnification of these lipophilic contaminants.

Lobsters were used to represent subtidal epibenthic invertebrates. Concentrations of organic contaminants in lobster tissues were, in general, two times higher at offshore stations MCL-13 and MCL-14 as compared to other offshore stations.

Tissue samples of blue mussels, hard clams, and lobster muscle and hepatopancreas were also analyzed for trace metals. The distributions of arsenic, iron, chromium, zinc, manganese, and nickel did not appear to exhibit either spatial- or species-dependent patterns.

The 1995 bivalve tissue residue results were compared to the samples collected by TRC in 1993. In general, a good agreement in concentrations and spatial distribution existed for PCBs and tributyltin in mussels and clams between the two data sets. However, PAHs concentrations in mussels reported by TRC were at the low end of the range of concentrations from the 1995 studies, and PAHs concentrations in clams reported by TRC were two to four times higher than those detected in 1995. Metal tissue concentrations in mussels were, in general, similar between the TRC data and the 1995 studies, except for chromium and nickel, which were approximately five times higher in the TRC data. A similar pattern was identified for hard clam data; TRC results for chromium and nickel were approximately 50 and 10 times higher, respectively, than those from the 1995 investigation.

A more comprehensive presentation and discussion of investigation results can be found in the Marine Ecological Risk Assessment Report (SAIC/URI, 1997).

E.11.6 Extent of Landfill Materials

In April 1996, when cap construction resumed after the winter hiatus, B&R Environmental noted that the shoreline had changed seaward of the new stone revetment near stations NSB-2, NSB-3, and NSB-4. In November 1995, a small beach, consisting of sand and gravel, had been present in the intertidal zone. In April 1996, sand was absent from this area, and landfill debris, consisting of wire, metal, concrete, asphalt, glass, and other material were visible at low tide. Further inspections indicated erosion had probably occurred over the winter thereby uncovering landfill materials that had previously been covered.

From August through October 1996, a new baseline topographic survey was performed for the area seaward of the new stone revetment using sonar and standard survey methods. The results were compared to the baseline topographic survey performed by TRC in 1994. The results confirmed that up to 1.72 vertical feet of surficial material had eroded from the intertidal zone of the landfill between 1994 and 1996.

Borings advanced seaward of the new stone revetment identified landfill materials up to 9 feet thick immediately seaward of the bottom of the stone revetment at the central portions of the landfill. Fill was not found seaward of the revetment at the southern and northern limits of the stone revetment. Fill near NSB-4 was found as far as 50 to 80 feet from the toe of the stone revetment.

E.12 SITE CONTAMINATION ASSESSMENT SUMMARY

Elevated levels of organic and inorganic contamination are present in the soil and fill at the site. Overall, the greatest amount of soil and fill contamination is present in the fill in the central portion or main landfill area of the site. Significantly elevated concentrations of SVOCs (namely PAHs) and metals were detected in subsurface soil/fill samples from the central portion. Significant metals contamination was also detected in the ground water in this area. Large amounts of trash and debris were observed in the central site area. Under the off-shore investigation, significantly elevated metals and PCB levels were detected in the sediments and mussel samples collected near this central portion of the site. However, only low level PCB contamination was detected in the soil/fill in the central portion of the site.

An area of trash/debris fill having significantly elevated levels of SVOCs (namely PAHs) and metals in the soil/fill is also present in the north central site area. This is the area of the site where an incinerator reportedly once operated. Fill/ash samples from this area were shown to have low levels of dioxins and furans. The ground water in this area also has elevated levels of metals and phthalate contamination. A slightly elevated level of PAHs were detected in the mussels collected near this portion of the site.

Elevated SVOCs and metals levels were detected in the fill in the southern portion of the site. The fill in this area consisted primarily of construction/demolition-like debris materials. Petroleum-related contamination was observed in the subsurface soils in the southern portion of the site. A floating oil layer was also once observed in a well in this area of the site in Phase I. VOC and PCB contamination was also detected in the ground water in this area. Low level PCB contamination was detected in the soil in the southern area of the site. Elevated PCB levels were detected in the sediments and mussels

collected along the southern portion of the site. Although PCBs were detected in the ground water, PCBs have a strong affinity for organic materials in soils and low water solubility which tends to reduce their mobility in soil and ground water.

Although elevated levels of several other metals (aluminum, iron, lead, manganese, and nickel) were detected in the site soil and ground water samples, these common elements were also detected in off-site background soil and off-site upgradient ground water, indicating that these are naturally-occurring minerals in the area soils and ground water. Other site ground water data, including salinity and total chloride measurements, also indicates the occurrence of some degree of salt water intrusion on the site. Furthermore, a fate and transport assessment of several metals detected in the ground water indicates there is a low potential for the transport of these contaminants via ground water to the adjacent bay.

Because only a few organics and a few metals were detected in the bedrock ground water at concentrations that exceed either the federal MCLs or the state's ground water quality criteria, and the detected chemical concentrations in the bedrock are lower than in the overburden, the bedrock aquifer does not appear to be a major contaminant transport pathway. Review of the hydrogeologic data indicates that both overburden and bedrock ground water discharge to the bay. Given the low observed levels of bedrock contaminants and documented ground water flow characteristics (to the bay), further assessment of contaminant transport in the bedrock will not be conducted.

Long-term monitoring of ground water underlying the McAllister Point Landfill will be conducted as part of the long-term operations and maintenance of the cap. Monitoring will provide analytical data and hydraulic head measurements to assess the overburden and bedrock ground water contamination status and potential migration. The additional data will provide more information to assess whether contaminant transport in the bedrock aquifer is of concern and whether additional actions are needed to assess impacts.

E.13 CONCLUSIONS

In assessing the presence or absence of any specific "hot spot" contamination or areas of concern at the site, two areas may be considered of potential concern. These areas include ground water at the southern end of the site and the near-shore sediments along the central and southern portions of the site. The findings of the site RI indicate that the ground water at the southern end of the site has evidence of petroleum-related contamination with VOCs, SVOCs, PCB, and metals. In addition, in 1990, a light non-aqueous phase liquid (LNAPL) or oil product was observed in one ground water

monitoring well located in this area during one of the seven sampling/measurement events. However, recent monitoring and sampling indicates that now the LNAPL is not present. The findings of the RI also indicate that the soil near the depth of the ground water table in this area indicates the presence of petroleum-related contamination. However, no specific source for the petroleum-related contamination has been discovered on the site. Continued monitoring of the site ground water is included under the source control action (capping) long-term monitoring for the site.

The other area of potential concern may be the near-shore sediments along the central and southern portions of the site. The findings of the off-shore investigation indicate that elevated levels of PAHs, PCBs, and several metals are present in the sediments along this portion of the site. Bivalve data for this area also indicated some elevated levels of contaminants. The findings of the site human health risk assessment indicated potential increased human health risks related to the contaminated sediments and bivalves. The site ecological risk assessment indicates a general, but low potential for risk to marine organisms. The area along the shoreline with the greatest levels of contaminants was the central area which was scattered with assorted debris (e.g., metal, concrete, asphalt) and the connecting wide, beach-like depositional area along the southern portion of the site. In addition, the face of the landfill was exposed along the central portion of the site, likely allowing for an increased erosion of the site soils and fill material. The results of the leachate generation study indicate that any ground water contaminant inputs into the bay will be substantially reduced with the capping of the site. As part of the cap installation, the shoreline debris was cleaned up, the exposed shoreline was cut back and capped, and stone revetment was placed along the entire shoreline of the site, thereby eliminating any potential erosion of landfill materials into the bay. The cap was completed in October 1996. Furthermore, additional monitoring is planned in Narragansett Bay along the NETC which will aid in assessing this condition.

Thus, based upon these findings and implemented remedial measures for the source control operable unit, it appears that the remaining primary pathway of contaminant exposure and migration at the site is related to the near-shore sediments and any fill/debris material that remain outside the limits of the cap. The degree of this near-shore sediment impact was addressed under the Marine Ecological Risk Assessment Study (March 1997) SAIC/URI. Long-term groundwater monitoring is ongoing; the results will be evaluated to assess whether groundwater with chemical levels exceeding applicable criteria is discharging to Narragansett Bay. Therefore, the need for any further actions will be evaluated after completing the review of the marine ecological risk assessment data and long-term results conducted for the site.

E.14 PHASE II HUMAN HEALTH RISK ASSESSMENT SUMMARY

A Human Health Risk Assessment (HHRA) was conducted for the McAllister Point Landfill based upon the Phase I and Phase II RI sampling data and is included as Volume II of this report. Using these data, constituents of potential concern (COCs) were selected for the media of interest (i.e., surface soil, subsurface soil, shoreline/near-shore sediment, and shellfish from Narragansett Bay). For each of the COCs, EPA toxicity values including cancer slope factors and non-cancer reference doses (RfDs) were identified. The exposure scenarios evaluated in the HHRA included both current land uses as well as potential future site uses including current trespassing (Scenario 1), future construction (Scenario 2), and future shellfishing (Scenario 3). Recreational, commercial/industrial, and residential exposure scenarios were excluded from the Phase II HHRA since the site remediation plans include coverage with a landfill cap and these future land uses are not anticipated for the site. In addition, ground water was excluded as a potential exposure medium at the site since ground water at the site is brackish, a strong gradient of ground water flow towards the Narragansett Bay exists, and dermal exposures are unlikely given that the average depth to ground water across the site is below 10 feet.

Estimates of human health risks which reflect the toxicity and exposure assessment components of the HHRA were presented with regard to potential effects from the identified COCs. These potential effects include an increased risk of cancer and the occurrence of non-cancer (e.g., systemic) effects. The estimated total pathway cancer risks were compared to the acceptable lifetime cancer risk range for evaluating the need for remediation of 1E-04 to 1E-06, as stated in 40 CFR Part 300, while the estimated cancer risks for individual COCs were compared to the 1E-06 point of departure for determining risk-based remediation goals. For evaluating the estimated total pathway non-cancer hazard indices (HIs), a target HI of unity (1E+00) was used. Hazard quotients (HQs) for individual COCs were also compared to a target of 1E+00. For assessing potential exposures to lead in soil and sediment, EPA's Integrated Uptake/Biokinetic (IU/BK) model was used and the resulting estimates of blood lead concentrations compared to a criterion level of 10 micrograms lead per deciliter of blood ($\mu\text{g}/\text{dL}$).

The estimated total pathway cancer risks exceeded the acceptable lifetime cancer risk range of 1E-04 to 1E-06 only for Scenario 3 (future shellfishing). Total pathway cancer risks within the target range were estimated for incidental ingestion of soil under Scenario 1 (current trespassing) and Scenario 2 (future construction), and for incidental ingestion of shoreline/near-shore sediment under Scenario 1 (current trespassing). The total pathway cancer risks for incidental ingestion of shoreline/near-shore sediment only exceeded 1E-06 under the reasonable maximum exposure (RME) (i.e., maximum

concentration-based) case. With regard to the non-cancer assessment, incidental ingestion of soil (RME only) under Scenario 2 was the only pathway associated with a total pathway HI above 1E+00.

The COCs associated with cancer risks above 1E-06 included arsenic in shoreline/near-shore sediment, subsurface soil and shellfish (i.e., clams and mussels), beryllium in clams, carcinogenic PAHs in surface soil, subsurface soil, and shellfish, and polychlorinated biphenyls (PCBs) in shellfish. No individual COCs were associated with HQs above 1E+00. However, blood lead concentrations above 10 $\mu\text{g}/\text{dL}$ were estimated for lead in shoreline/near-shore sediment under Scenario 1 (current trespassing).

The key uncertainties associated with the risk estimates for these COCs include the following:

- Presence of arsenic, lead, carcinogenic PAHs, and PCBs in sediment and/or shellfish may be attributable to background, site-related or other source contributions to Narragansett Bay.
- Presence of carcinogenic PAHs in mussels and arsenic, beryllium, carcinogenic PAHs, and PCBs in clams at concentrations similar to those reported for reference locations in Narragansett Bay.
- Use of the benzo(a)pyrene slope factor for the other carcinogenic PAHs likely overstates the potential risks.
- Use of shellfish ingestion rates provided by RIDEM which are 3- to 4-fold larger than those available in EPA's Exposure Factors Handbook.
- Cancer risks for arsenic in subsurface soil, beryllium in clams, and carcinogenic PAHs in surface soil, subsurface soil and shellfish exceeded 1E-06 only under the RME (maximum concentration-based) case.

E.15 HUMAN HEALTH RISK ASSESSMENT FOR ADDITIONAL SCENARIOS SUMMARY

The Phase II HHRA was amended based on additional exposure scenarios that were identified to be of importance based on EPA and RIDEM comments to the Draft Final HHRA Report (TRC, 1994) and results of discussions with the Navy. The exposure scenarios developed for evaluation included: future shellfishing by subsistent fishermen (Scenario 4), future shellfish ingestion by children (Scenario 5), adult recreational visitors (Scenario 6), and the child recreational visitors (Scenario 7). Sediment

sampling results from 1996 were used to evaluate the recreational exposure scenarios, while shellfish tissue concentrations estimated using ERA biological-sediment accumulation factors were used to assess shellfish ingestion scenarios.

The risk assessment methodology used followed the procedures presented in Section E.14 of this report. Detailed discussion of the exposure scenarios, risk estimates, uncertainty analysis, and conclusions are presented in Revision 1 of the Draft Final Human Health Risk Assessment Report (B&RE, April 1997).

A summary of the risk assessment results for the four additional exposure scenarios are presented below. The sediment sampling locations were divided into zones. Following the delineation used in the marine ecological risk assessment (Figure 4-13 of RI) data from zones 1, 2, 3, and 3A were evaluated because the highest contaminant levels were identified in these areas or were closest to the landfill.

Scenario 4 (Future Shellfishing by Subsistent Fishermen)

The cancer risks for Scenario 4 ranged from $3E-03$ (Central Tendency (CT) and RME for mussels in Zone 1, and CT for mussels in Zone 3) to $2E-02$ (CT and RME for clams in Zone 3A). Ingestion of mussels and clams was associated with cancer risks greater than the $1E-04$ to $1E-06$ range under the CT and RME cases.

Arsenic and PCBs were the primary contributors to cancer risk due to ingestion of mussels in Zones 1, 2, 3 and ingestion of clams in Zone 3A. Several carcinogenic PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b) and (k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene) were also, associated with individual cancer risks above $1E-06$. Due to the contributions of arsenic and PCBs, the mean and RME cancer risks for ingestion of mussels and clams remained unchanged when based on the TEFs for carcinogenic PAHs.

The non-cancer HIs for Scenario 4 ranged from $1E+01$ (CT and RME for mussels in Zones 1 and CT for mussels in Zone 3) to $1E+02$ (RME for clams in Zone 3A). These non-cancer HIs exceed $1E+00$. Arsenic is the primary contributor to this adverse health hazard index in Zones 1, 2, 3, and 3A. In Zone 2, cadmium and copper also have HIs greater than $1E+00$ under both CT and RME cases; mercury and zinc have HIs greater than $1E+00$ under the RME case.

There is currently a ban on shellfishing in this portion of Narragansett Bay as the result of unacceptable bacterial levels.

Scenario 5 (Future Shellfish Ingestion by Children)

The cancer risks for Scenario 5 ranged from $2E-05$ (CT and RME for mussels in Zone 1) to $2E-04$ (RME for clams in Zone 3A). Ingestion of clams was associated with cancer risks greater than the $1E-04$ to $1E-06$ range under the RME case.

Arsenic and PCBs were associated with individual cancer risks above $1E-06$ in Zones 1, 2, and 3 from ingestion of mussels. Arsenic was associated with individual cancer risks above $1E-06$ from ingestion of clams in Zone 3A.

Several carcinogenic PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b) and benzo(k) fluoranthene, and chrysene) were also associated with individual cancer risks above $1E-06$ under the RME case for Zones 3 and 3A. Due to the contributions of arsenic and PCBs, the CT and RME cancer risks for ingestion of mussels and clams remained unchanged when based on the TEFs for carcinogenic PAHs. The non-cancer HIs for Scenario 5 ranged from $5E-01$ (CT and RME for mussels in Zones 1) to $5E+00$ (RME for clams in Zone 3A). The non-cancer HIs for Zones 2 and 3A exceed $1E+00$. Arsenic is the primary contributor to this adverse health hazard index in both of these zones. In Zone 2, cadmium and copper also contribute to the HI under both CT and RME cases.

There is currently a ban on shellfishing in this portion of Narragansett Bay as the result of unacceptable bacterial levels.

Scenario 6 (Adult Recreational Visitors)

The estimated cancer risks for Scenario 6 ranged from $8E-09$ (CT and RME for dermal contact with sediment in Zone 1 and CT for dermal contact with sediment in Zone 3A) to $7E-07$ (RME for ingestion of sediment in Zone 3). Pathway cancer risks do not exceed the $1E-04$ to $1E-06$ range for either the CT or RME case in Zones 1, 2, 3, and 3A. The CT and RME cancer risks for ingestion of and dermal contact were essentially unchanged when based on the TEFs for carcinogenic PAHs. Using the TEFs to determine cancer risks, the estimated cancer risks for Scenario 6 (adult recreational visitors) ranged from $8E-09$ (CT and RME for dermal contact with sediment in Zone 1 and CT for dermal contact with sediment in Zone 3A) to $4E-07$ (RME for ingestion of sediment in Zones 2 and 3).

The non-cancer HIs for Scenario 6 ranged from $1E-05$ (CT and RME for dermal contact with sediments in Zone 1) to $1E-02$ (RME for ingestion of sediments in Zone 2). The non-cancer HIs for Scenario 6 do not exceed $1E+00$.

Scenario 7 (Child Recreational Visitors)

The estimated cancer risks for Scenario 7 ranged from $7E-09$ (CT and RME for dermal contact with sediment in Zone 1 and CT for dermal contact with sediment in Zone 3A) to $1E-06$ (RME for ingestion of sediment in Zone 3 and 3A). Pathway cancer risks do not exceed the $1E-04$ to $1E-06$ range for either the CT or RME case in Zones 1, 2, 3, and 3A. Pathway cancer risks fall within the $1E-04$ to $1E-06$ range for the RME cases in Zones 3 and 3A for ingestion of sediment. Due to the contribution of arsenic, the CT and RME cancer risks for ingestion and dermal contact of sediments were changed only slightly when based on the TEFs for carcinogenic PAHs. Using the TEFs to determine cancer risks, the estimated cancer risks for Scenario 7 ranged from $7E-09$ (CT and RME for dermal contact with sediment in Zone 1 and CT for dermal contact with sediment in Zone 3A) to $8E-07$ (RME for ingestion of sediment in Zone 2). Pathway cancer risks fall below the $1E-04$ to $1E-06$ range for either the CT or RME case in Zones 1, 2, 3, and 3A.

The non-cancer HIs for Scenario 7 (child recreational visitors) ranged from $5E-05$ (CT and RME for dermal contact with sediments in Zone 1) to $1E-01$ (RME for ingestion of sediments in Zone 2). The non-cancer HIs for Scenario 7 do not exceed $1E+00$.

E.16 PHASE II ECOLOGICAL RISK ASSESSMENT SUMMARY

The Phase II Re ecological risk assessment (ERA) performed for the McAllister Point Landfill, was prepared as part of another ERA performed for Site 09, the Old Fire Fighting Training Area site. The ERA incorporated field investigations and modeling approaches to develop a weight of evidence assessment of potential risks to a variety of indicator species. Site reconnaissance activities included terrestrial and shoreline habitat surveys, and benthic infaunal and epifaunal surveys in both nearshore and offshore habitats of the portion of Narragansett Bay adjacent to the landfill. Additionally, studies describing benthic communities within Narragansett Bay were reviewed to provide background information for this assessment.

Terrestrial, avian, and aquatic exposure pathways were assessed by modeling several plausible and representative scenarios: herring gull feeding upon intertidal shellfish (clams and mussels); raccoons feeding upon intertidal shellfish; bottom-dwelling finfish (winter flounder) consumption of benthic

invertebrates; marine invertebrate viability as assessed by sediment criteria; toxicity to benthic and pelagic species from ground water to Bay transport of contaminants. The McAllister Point Landfill Phase II ERA did not address terrestrial or freshwater wetland risks because a capping plan for the landfill has already been agreed upon.

Overall the assessment demonstrates a generalized, but low potential for risk to marine and terrestrial organisms due to exposure to metals and PCBs. Metals detected in nearshore, intertidal, and offshore sediments at the site may pose only a slight potential risk since the metals do not appear to be bioavailable in areas where their concentrations are highest. In addition, field observations indicate that the infaunal and epifaunal communities do not appear to differ when comparing benthos adjacent to the site to reference locations. PCBs detected in nearshore sediments at the site may pose a potential risk to benthic invertebrates and fish as indicated by concentrations in excess of the PCB sediment criterion. Further, modeled flounder concentrations were within the range where PCB-induced reproductive effects in flounder are possible. Herring gull consumption of intertidal and nearshore clams and mussels was not associated with elevated risk estimates for PAHs or PCBs. However, elevated risks were found for exposure to chromium and lead. These risk predictions are conservative because the model assumes that the gull's feeding range is solely restricted to the nearshore areas the site. Risk estimates for raccoons feeding upon clams and mussels were generally low. While ground water discharge to the Bay was associated with elevated risk estimates for benthic receptors, these risks are likely to be lower since the landfill was capped in 1996.

This pattern of results suggests a generally low level of risk, with no single receptor or medium predicted to be associated with risks warranting a high level of concern. Since concentrations of contaminants attenuated with distance from shore, the zone of potential concern is mainly in the nearshore.

E.17 MARINE ECOLOGICAL RISK ASSESSMENT SUMMARY

The Marine ERA conducted by SAIC and URI incorporated the assessment of several exposure and effects endpoints within a weight-of-evidence framework. There were five weights of evidence in the exposure assessment, which included:

- 1) comparison of sediment contaminant concentrations to NOAA's ER-L and ER-M benchmark values
- 2) comparison of porewater concentrations to EPA's Ambient Water Quality Criteria

- 3) assessment of bioavailability of divalent metals in sediments
- 4) measurement of fecal pollution indicator concentrations in sediments
- 5) evaluation of contaminant concentrations in aquatic biota tissues relative to the reference location

Correspondingly, there were three weights of evidence in the effects assessment, which included:

- 1) evaluation of sediment toxicity and comparison of these results to contaminant concentrations in sediments and porewater.
- 2) evaluation of field effects indicators (bivalve condition index, benthic community structure, and fecal pollution indicators in tissue) and analysis of these results against contaminant concentration measurements.
- 3) analysis of contaminant accumulation in aquatic biota tissues in relation to potential impacts on avian predators.

To facilitate the integration of the results from the numerous weights of evidence, the study area was divided into eight ecological exposure zones based on similar characteristics, contaminant distribution, effects, and proximity of sampling stations. The ecological exposure zones, which are presented in Figure 4-13. Based on the integration of results from the numerous exposure and effects weights of evidence for the stations within each of the ecological exposure zones, the overall risk probabilities in the study area were ranked as follows:

Zone 2 was identified as a *high* risk probability zone in the study area. Zones 1, 3, 3A, 4 and 6 were identified as *intermediate* risk probability zones. Zone 5 and Zone 7 (Reference) were identified as *low* risk probability zones. Detailed information on the methodology, results and conclusions are presented in the Marine Ecological Risk Assessment Report (SAIC/URI, 1997).

1.0 INTRODUCTION

This Remedial Investigation (RI) report is submitted in partial fulfillment of completing a Remedial Investigation and Feasibility Study (RI/FS) for the McAllister Point Landfill (Site 01), located at the Naval Education and Training Center (NETC) in Newport, Rhode Island. The findings of the Phase II RI for the McAllister Point Landfill are presented here in a report separate from the other NETC Phase II RI site (Old Fire Fighting Training Area - Site 09). The completion of the RI/FS is being conducted under Contract Number N62472-90-D-1298 for the Northern Division Naval Facilities Engineering Command. Northern Division (NORTHDIV) is headquartered in Lester, Pennsylvania.

Field investigations were performed for the United States Navy (Navy) by TRC Environmental Corporation (TRC) in 1993 and 1994, and the majority of the Phase II RI report presents information developed during those activities. A Record of Decision (ROD) was signed in September 1993 that selected a cap as the final remedy for the source control (landfill materials) operable unit. Cap construction activities at the McAllister Point Landfill were initiated in March 1995 and completed in October 1996. The ROD also specified additional studies to ascertain whether near-shore sediments had been affected by site-related contamination. Brown & Root Environmental (B&R Environmental) conducted marine sediments and biota sampling in 1995 to obtain data that assessed potential impacts; the results were presented in the Draft Final Marine Ecological Risk Assessment Report (B&RE, June 1996). In the summer of 1996, it was noted that some sediments in the areas of interest appeared to have eroded as the result of storm events that occurred during the winter of 1995. An additional sediment sampling round was conducted in the fall of 1996 and the new data were subsequently integrated into the Final Marine Ecological Risk Assessment Report (B&RE, March 1997). Some information from additional sediment sampling was used to assess potential human health risks for scenarios that were discussed with the United States Environmental Protection Agency (EPA) and the Rhode Island Department of Environmental Management (RIDEM) during a technical meeting held on March 5, 1997.

The Draft Final RI Report (June 1994) prepared by TRC was reviewed and commented on by EPA and RIDEM in late 1994. At that time it was determined that the Draft Final RI Report would not be revised until the Marine Ecological Risk Assessment was completed and the results would be integrated into the revised Draft Final RI Report. While TRC originated the Phase II Draft Final Report, B&R Environmental revised the document (by addressing EPA and RIDEM review comments) and incorporating the Marine Ecological Risk Assessment findings.

To complete the management of migration Feasibility Study (FS) Report originally drafted by TRC, it was necessary to assess the potential impact of capping the McAllister Point Landfill. A Leachate Generation, Fate and Transport and Ecological Assessment Report (TRC, September 1994) was prepared that used computer modeling to estimate the quantities of leachate that would be generated before and after the cap was placed. Since the cap was completed in October 1996, and the Navy has initiated its long-term ground water monitoring program, the actual current data would be used to assess ground water contaminant status and the effectiveness of the cap in reducing leachate generation, and the need for further remedial actions to address potential migration of ground water-borne chemicals into Narragansett Bay.

This document provides a summary of background information for NETC and the McAllister Point Landfill, details of the Phase II RI field investigation scope and methodology, and a discussion of the nature and extent of contamination at the landfill. For completeness, the Phase I RI results, as appropriate, have also been included in the discussions of the nature and extent of the site contamination in order to provide a comprehensive site contamination assessment in this report. The complete Phase I RI scope along with the findings of the Phase I site investigations were presented in the Phase I Remedial Investigation Report completed by TRC in January, 1992 (TRC, 1992). The Human Health Risk Assessment portion of this RI is being submitted as Volume II of this document. A Draft Final Ecological Risk Assessment Report for this site was submitted as Volume III of this document (TRC, 1994). These risk assessments include an evaluation of both the Phase I and Phase II RI data. The Marine Ecological Risk Assessment (SAIC/URI, March 1997) assessed risks to biota in the portion of Narragansett Bay adjacent to Site 01.

This RI report (Volume I) has been divided into six sections and includes a series of tables, figures, and appendices. This section of the report, Section 1.0, provides a summary of the NETC background, including the base description, history, and history of environmental regulatory response actions. Section 1.0 also provides a discussion of the McAllister Point Landfill, including the site location and description, site history, and previous investigations conducted at the landfill. Section 2.0 of the report provides an overview of the Phase II investigation which includes a description of the scope and methodologies employed for each of the Phase II RI field investigation activities, including sample types, numbers, location, and field observations and measurements. Section 3.0 provides a description of the site physical characteristics, including regional physiography, regional and site-specific geology, and regional and site-specific hydrology and hydrogeology. Section 4.0 includes a discussion of the nature and extent of contamination at the site. A presentation of the results of the Phase I and Phase II sampling activities, including data summary tables, data/standard comparison tables, and

contaminant concentration maps, is also included in Section 4.0. A summary of the site contamination assessment and RI conclusions are presented in Section 5.0.

1.1 OBJECTIVES AND SCOPE OF THE INVESTIGATION

The general objectives of the RI site investigation are to determine the nature and extent of site contamination, sources of contamination, potential contaminant migration pathways, potential contaminant receptors, and associated exposure pathways. This information is necessary to determine whether, and to what extent, a threat to human health or the environment exists, and to provide the information required to develop and evaluate remedial action alternatives for the site, as necessary.

The scope of the Phase I and Phase II sampling efforts for this site were developed to meet site-specific RI/FS objectives. The site-specific objectives were refined based upon the findings of the Phase I RI. Below is a list of the RI objectives for the McAllister Point Landfill investigation:

- determine the site background soil and ground water quality;
- determine the nature and extent of site surface soil contamination;
- determine the extent of the fill material on the site;
- determine the nature of the fill material contamination;
- determine the nature and extent of ground water contamination;
- determine any source location(s) of the ground water contamination; and
- determine the presence and nature of sediment and biota contamination in the adjacent bay.

The Phase II site investigation was conducted to address areas of concern discovered under the Phase I investigation and any site investigation data gaps. The Phase II investigation activities included geophysical and soil gas surveys, surface soil sampling, test pit sampling, soil boring sampling, monitoring well installation and ground water sampling, surface water sampling, and leachate spring sampling.

1.2 NETC BACKGROUND INFORMATION

1.2.1 NETC Description

The NETC is located in Newport, Rhode Island, on the west shore of Aquidneck Island, facing the east passage of Narragansett Bay. A general location map of the NETC is provided as Figure 1-1. The

NETC is approximately 60 miles southwest of Boston and 25 miles south of Providence. Rhode Island Sound and the Atlantic Ocean are approximately 6 miles south of the Naval complex.

NETC presently encompasses approximately 1,374 acres of active land, which is significantly below the 2,805 acres held prior to the 1973 Shore Establishment Realignment Program (SER) (Navy, 1986). Impacts of the SER are described in more detail in Section 1.2.2. The NETC is spread out along nearly 6 miles of shoreline of Aquidneck Island and borders Narragansett Bay. Portions of the NETC lie within the boundaries of the towns of Newport, Middletown, and Portsmouth.

1.2.2 NETC History

Extensive information in these areas has already been gathered in the Initial Assessment Study (IAS) (Envirodyne Engineers, 1983), Confirmation Study (CS) (Loureiro Engineering Associates, 1985), and Phase I RI/FS (TRC, 1992). Therefore, blocks of text will be incorporated from these reports and referenced with an "IAS" or "CS" and the appropriate reference page numbers.

The NETC is located north of Newport, Rhode Island, (Figure 1-1) on the west shore of Aquidneck Island facing the east passage of Narragansett Bay. The history of the base is as follows:

The Newport area was first used by the Navy during the Civil War when the Naval Academy was moved from Annapolis, Maryland to Newport in order to protect it from Confederate troops. The Naval Academy operated at Newport for about four years before returning to Annapolis.

In 1869, the experimental Torpedo Station at Goat Island was established. This was the Navy's first permanent activity at Newport. The station was responsible for developing torpedoes and conducting experimental work on other forms of naval ordinance.

In 1881, Coasters Harbor Island was acquired by the Navy from the City of Newport and used for training purposes. In 1884, the Naval War College was established on the island. A causeway and bridge linking the island to the mainland was constructed in 1892. In 1884, the USS Constellation was permanently anchored as a training ship for the Naval War College.

The Melville area was established as a coaling station for the steam-powered ships in 1900. The Navy purchased 160 acres of land and constructed the Narragansett Bay Coal Depot. With the advent of ships burning liquid fuel, it became necessary to add oil tanks.

Consequently, in 1910, four fuel oil tanks were added in the Melville area. These tanks are still used today.

In 1913, the Navy established the Naval Hospital on the mainland of Aquidneck Island, directly adjacent to Coasters Harbor Island. At this time, the main hospital building was constructed.

The outbreak of World War I caused a significant increase in military activity at Newport. Some 1,700 men were sent to Newport and housed in tents on Coddington Point and Coasters Harbor Island. A bridge was built at this time connecting Coddington Point with Coasters Harbor Island. In 1918, Coddington Point was purchased by the Navy. Much of the base organization was then transferred to Coddington Point. During the war, numerous destroyers and cruisers were fueled by the Melville coal depot and fuel tanks. By this time, a pipeline had been extended to the north fueling pier and two additional oil tanks constructed.

Following World War I, fuel oil gradually replaced the use of coal by the Navy fleet. In 1921, the Coal Depot was changed to the Navy Fuel Depot. In 1931, the coal barges and coaling equipment were sold to the highest bidder.

In 1923, some two hundred buildings, which were part of the emergency war camps established on Coddington Point, were stripped and sold for scrap. The station was put on caretaker status in 1933. The base remained relatively inactive until the onset of World War II.

Reactivation of the base occurred in the late 1930s as a result of military build-up in Europe. Just prior to the reactivation, a 1938 hurricane and tidal wave had destroyed or severely damaged over 100 buildings and much of the sea walls. In 1940, Coddington Cove was acquired for use as a supply station, and hundreds of Quonset huts were constructed throughout the base. Additional barracks were constructed on Coasters Harbor Island, increasing the base housing capacity to over 3,500 men. Power plant facilities were also constructed at this time. Coddington Point was reactivated to house thousands of recruits. The Anchorage housing complex in the Coddington Cove area was constructed in 1942. In the Melville area, additional fuel facilities were constructed along with a Motor Torpedo Squadron Boat Training Center and nets for harbor defense were constructed. Tank Farms 1 through 5 were constructed during this time period. The Fire Fighting School, Fire Control Training Building, and the Steam Engineering Building were constructed in 1944.

The Torpedo Station at Goat Island was very active during World War II and had expanded its operation to Gould Island. The Torpedo Station employed more than 13,000 people and manufactured 80 percent of all torpedoes used by our country during the war. The station was the largest single industry ever operated in Rhode Island.

Following World War II, naval activities at Newport converted to a peace time status. This resulted in a reduction of naval activity. Some 300 Quonset huts and buildings were removed, and the entire naval complex was consolidated into a single naval command designated the U.S. Naval Base in 1946.

The Naval Base adjusted to its peace time status by increasing its activities in the fields of research and development, specialized training, and preparedness for modern warfare. There was a brief period during the Korean War when some 25,000 sailors trained at Newport.

In 1951, the Torpedo Station was permanently disestablished after 83 years of service. Future manufacture of torpedoes was to be awarded to private industry. In place of the Torpedo Station, a new research and development facility, the Naval Underwater Ordnance Station, was established and given the responsibility of overseeing the private contractors. The Officer Candidate School was also established in 1951.

In 1952, the Training Station and other naval schools were disestablished, and the U.S. Naval Station and the U.S. Naval Schools Command were established.

In 1955, Pier 1 was constructed, with Pier 2 being added in 1957. Newport became the headquarters of the Commander Cruiser-Destroyer Force Atlantic in 1962. Some 55 naval warships and auxiliary craft were homeported at Newport. New housing and bachelor quarters were added in the late 50's and early 60's.

Major expansion of the Naval War College occurred during the late 50's and early 70's, transforming the college into a major university. In July of 1971, the Naval Schools Command was restructured and named the Naval Officer Training Center (NOTC).

In April of 1973, the Shore Establishment Realignment Program (SER) was announced and resulted in the largest reorganization of Naval forces in the Newport area. The fleet stationed in Newport was relocated to other naval stations on the east coast. SER resulted in the disestablishment of the Naval Communication Station and the Fleet Training Center and related

activities. The Public Works Center, Naval Supply Center, Naval Station and Naval Base were absorbed by NOTC. In April of 1974, NOTC was changed to the Naval Education and Training Center (NETC).

The drastic changes which resulted from SER caused a reduction of Navy personnel, both military and civilian, in excess of 14,000. Coupled with the reductions at the Naval Construction Battalion Center at Davisville, and the closure of the Naval Air Station at Quonset Point, SER had severe economic impacts in the Narragansett Bay area.

The reorganization brought about by SER resulted in the Navy excessing some 1,629 acres of its 2,420 acres. Some of the land has been leased to the State of Rhode Island pending final sale of the land by the General Services Administration. Table 1 [outdated and in IAS] shows an area by area breakdown on land holdings prior to SER and following.

The Navy also leases 44 acres of land in Coddington Cove to the State of Rhode Island and Economic Development Corporation. The state has subleased this property to a private enterprise engaging in shipbuilding and repair. Available information indicates that the Navy intends to reclaim 41 acres of this property prior to mid-1994. Also, a fish food processing operation utilizes the cold storage warehouse in Building 42 near Pier 1.

The above information on the history of the installation was obtained from the most recent Master Plan (NORTHDIV, 1980), the 1981 Annual Report of the Navy in the Rhode Island Area (NETC Public Affairs Office, 1981), and the Command Histories at the Naval History Office in Washington, DC.

(IAS, pp. 5-6 to 5-14)

1.2.3 History of Response Actions

This section presents a brief chronology of the interaction between the Rhode Island Department of Environmental Management (RIDEM), other regulators, and NETC Newport concerning environmental issues at the Naval base.

Chronology of Regulatory and Navy Actions

The following chronology pertinent to NETC Newport site investigations was obtained from environmental reports prepared for the Navy and a review of information in RIDEM files:

Mid-1960s - burning of oil tank bottom sludges generated from NETC Newport Tank Farms was discontinued due to air pollution regulations.

Unknown Date - the NETC Newport shoreline is closed to shellfishing due to concerns about bioaccumulation of contaminants in Narragansett Bay from sites at the facility.

Post 1971 - the required scrubbers were installed on the Navy's classified document incinerator.

April 1973 - the Shore Establishment Realignment (SER) Program resulted in drastic reductions in Navy personnel at NETC Newport and initiated the process of excessing (selling) large portions of the base's real estate.

September 11, 1980 - the Navy Assessment and Control of Installation Pollutants (NACIP) program was initiated. The purpose of this program is to systematically identify, assess, and control environmental contamination from past use and disposal of hazardous substances at Navy and Marine Corps installations.

1982 - RIDEM adopted hazardous waste regulations which classified waste oil as a hazardous waste.

March 1983 - the IAS of NETC Newport was completed. Eighteen potentially contaminated sites were identified under the IAS. (Table 1-1)

1984 - The Navy ceased using Tanks 53 and 56 at Tank Farm Five for waste oil storage.

1984 - The Defense Environmental Restoration Program (DERP) was established to promote and coordinate efforts for the evaluation and cleanup of contamination at DOD installations. A major element of the program was the establishment of the IRP. The IRP involves the investigation and cleanup of contaminated sites in compliance with the

procedural and substantive requirements of CERCLA, as amended by SARA, as well as regulations promulgated under these acts or by applicable State law.

1986 - RIDEM implemented new regulations for the operation and closure of underground storage tanks used to hold oils and hazardous materials.

May 1986 - the CS for NETC Newport was completed at the following six sites:

- Site 01 - McAllister Point Landfill,
- Site 02 - Melville North Landfill,
- Site 07 - Tank Farm One,
- Site 12 - Tank Farm Four,
- Site 14 - Gould Island Disposal Area, and
- Site 17 - the Gould Island Electroplating Shop.

1987 - A Tank Closure Plan for Tanks 53 and 56 located at Tank Farm Five was completed (Environmental Resource Associates).

1988 - A Technical Review Committee (TRC) was convened to facilitate communication of information with regard to actions to be undertaken at NETC Newport. TRC members include representatives from the U.S. Navy, EPA - Region I, RIDEM, the City of Newport, the Towns of Portsmouth and Middletown, and local citizens groups.

November 21, 1989 - NETC Newport was listed on the NPL.

1989 - A Phase I RI/FS Work Plan for four NETC Newport sites was prepared. These sites included:

- McAllister Point Landfill (Site 01),
- Old Fire Fighting Training Area (Site 09),
- Tank Farm Four (Site 12), and
- Tank Farm Five (Site 13).

1989 - The Phase I RI/FS Work Plan was also developed for Site 02 - Melville North Landfill. This Work Plan was undertaken pursuant to the Navy's authority under

CERCLA, Executive Order 12580, and the DERP. The Melville North Landfill was excessed (or sold) by the Navy prior to being listed on the NPL and is being addressed by the Navy as a Formerly-Used Defense Site (FUDS).

The Navy has undertaken and plans to continue to undertake IRP activities for the Melville North Landfill pursuant to the Navy's authority under CERCLA, Executive Order 12580, and the DERP.

1990 - A Community Relations Plan was issued for NETC Newport by the Navy. Public Information Repositories were also established to allow public access to NETC Newport documents.

June 1991 - A ground water investigation was conducted under the tank closure investigation of Tanks 53 and 56 at Tank Farm Five.

November 1991 - The draft Phase I RI and Risk Assessment Report on the four NETC Newport sites and Melville North Landfill was completed.

July 1992 - A draft Study Area Screening Evaluation (SASE) Work Plan for investigation of six suspected sites at NETC Newport was completed. The sites include:

- Coddington Cove Rubble Fill Area (Site 04),
- Tank Farm One (Site 07),
- NUSC Disposal Area (Site 08),
- Tank Farm Two (Site 10),
- Tank Farm Three (Site 11), and
- the Gould Island Electroplating Shop (Site 17).

Summer 1992 - The contents of Tanks 53 and 56 at Tank Farm Five were removed and the tank interiors cleaned.

August 1992 - The Defense Fuel Supply Point (DFSP) initiates investigations of Tank Farm One, Tank Farm Two, and Tank Farm Three.

September 1992 - The draft Phase II RI/FS Work Plan for the four NETC Newport and Melville North Landfill sites was completed.

September 29, 1992 - A Record of Decision (ROD) was signed by the U.S. Navy, RIDEM, and EPA for the implementation of an interim ground water pump and treat remedy at Tank Farm Five.

October 1992 - A soils investigation was conducted under the tank closure investigation of Tanks 53 and 56 at Tank Farm Five.

December 1992 - The Final Study Area Screening Evaluation (SASE) Work Plan for investigation of three suspected sites at NETC Newport was completed. The three sites include:

- Coddington Cove Rubble Fill Area (Site 04),
- NUSC Disposal Area (Site 08), and
- the Gould Island Electroplating Shop (Site 17).

SASE investigations of Tank Farm One (SA-07), Tank Farm Two (SA-10), and Tank Farm Three (SA-11) are being reevaluated pending a review of the findings of on-going DFSP (Defense Fuel Supply Point) contracted investigation activities of these areas.

January 1993 - A Draft Soil Investigation Work Plan for near Tanks 53 and 56 was submitted to the Navy, the EPA, and RIDEM for review and comments.

March 1993 - The Final Phase II RI/FS Work Plan for the four RI/FS sites was completed.

August 1993 - Remedial Design Work Plan completed for the McAllister Point Landfill Cap. 35% design development for the McAllister Point Landfill cap submitted in **December 1993**.

September 27, 1993 - Record of Decision (ROD) signed for the Source Control Action, a Subtitle C landfill cap, for the McAllister Point Landfill.

January 1994 - Phase II RI field work completed at McAllister Point Landfill and Old Fire Fighting Training Area.

January 1994 - 90% final submission for the Design Analysis for the Soil Remediation at Tank 53 at Tank Farm Five.

January 1994 - 90% final submission for the Design Analysis for soil removal actions at the Melville North Landfill.

March 1994 - Bidding Document submission (100%) for the Soil Remediation at Tank 53 at Tank Farm Five.

March 1994 - Bidding Document submission (100%) for the Soil Removal Action at the Melville North Landfill

March 1994 - 90% final submission for the Tank Contents Removal at Tank Farm Five.

May 1994 - Bidding Document submission (100%) for the McAllister Point Landfill Cap Design.

May 1994 - Bidding Document submission (100%) for the Tank Contents Removal at Tank Farm Five.

Previous investigations at NETC Newport included: an Initial Assessment Study (IAS) in 1983; a Confirmation Study (CS) in 1986; a Closure Plan for Tanks 53 and 56 at Tank Farm Five in 1988; and a Phase I RI/FS investigation completed in 1991. The Initial Assessment Study (IAS), conducted by Envirodyne Engineers, Inc., St. Louis, Missouri, for the Navy in 1983, identified sites where contamination was suspected to exist and which may have posed a threat to human health or the environment. Eighteen potential sites were identified by the IAS and are provided in Tables 1-1 and 1-2. Six of these sites were judged to require further study and were investigated under a Confirmation Study (CS), conducted by Loureiro Engineering Associates, Avon, Connecticut, which was completed in 1986. The Phase I RI/FS investigation was conducted on five sites: Site 01 - McAllister Point Landfill; Site 02 - Melville North Landfill; Site 09 - Old Fire Fighting Training Area; Site 12 - Tank Farm Four; and Site 13 - Tank Farm Five. Three of the NETC sites, McAllister Point Landfill, Melville North Landfill, and Tank Farm 4, were investigated in both the IAS and CS. Tank Farm 5 was studied in the IAS, and tank numbers 53 and 56 were extensively studied as part of a tank closure

plan. The Old Fire Fighting Training Area had not been sampled or extensively studied prior to the Phase I RI. The numbers for the five RI/FS sites were assigned during the IAS and were retained during the Phase I RI/FS investigation for consistency and to avoid confusion.

In April 1973, the Shore Establishment Realignment Program (SER) resulted in drastic reductions in Navy personnel at the Newport base and initiated the process of excessing (selling) large portions of the base's real estate. Disposition of each of the five RI/FS areas by the General Services Administration (GSA) is pending the results of the IR Program. The status of the eighteen potentially contaminated sites is presented in Table 1-3.

The entire NETC was listed on the U.S. Environmental Protection Agency (EPA) National Priorities List (NPL) of abandoned or uncontrolled hazardous waste sites in November 1989. The NPL identifies those sites which pose a significant threat to the public health and environment. Four RI/FS sites at NETC (McAllister Point Landfill, Old Fire Fighting Training Area, Tank Farm Four, and Tank Farm Five) are currently being studied (Phase I was completed in 1991) by the Navy under the Department of Defense Installation Restoration (IR) Program. This program is similar to the U.S. EPA's Superfund Program authorized under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

A Federal Facilities Interagency Agreement (FFA) was signed by the Navy, the State of Rhode Island, and the EPA on March 23, 1992. The FFA outlines response action requirements under the Department of Defense IR Program at the NETC. The FFA was developed, in part, to ensure that environmental impacts associated with past and present activities at NETC are thoroughly investigated and remediated, as necessary. The four RI/FS sites and the additional six study areas were listed in the FFA and are shown on Figure 1-2.

The fifth Phase I RI/FS site not listed in the FFA is Site 02, the Melville North Landfill. The non-NPL status of this site and its resulting exclusion from the FFA, is due to the site not being owned by the Navy at the time of the NPL listing of the NETC. However, the Melville North Landfill site will be addressed under a separate Phase II RI/FS. Six additional sites (Tank Farm One, Tank Farm Two, Tank Farm Three, Coddington Cove Rubble Fill Area, NUSC Disposal Area, and the Gould Island Electroplating Shop) or study areas (as referred to in the FFA) are also currently planned for initial investigations under Study Area Screening Evaluations (SASEs).

1.3 MCALLISTER POINT LANDFILL SITE BACKGROUND

1.3.1 Site Location and Description

The McAllister Point Landfill is located in the central portion of the Newport Naval Base (see Figure 1-2). The site is approximately 11.5 acres in size and is situated between Defense Highway and Narragansett Bay. A set of Penn Central Railroad tracks run in a north-south direction along the eastern side of the site. Access to the site is off of Defense Highway, across the railroad tracks, through a gate in the south-central portion of the site. A map of the site is presented as Figure 1-3 with site topography shown on Figure 1-4.

The following text describes Site 01 prior to the cap completion in October 1996:

A short section of chain-link fence bordered the eastern edge of the site at the site entrance and transects the south central portion of the site. An opening in the portion of the fence which transects the site allowed travel between the central and southern portions of the site. Overhead power lines run along the eastern edge of the site.

The site was characterized by a mounded area in the central to north-central portion of the site and flat areas at the northern and southern ends. Ground elevations across the main portion of the site varied between approximately 15 and 35 feet above mean low water level (mlw). Along the western edge of the site, the grade dropped off quickly to the shoreline, in some areas by as much as 20 feet.

The site was vegetated with grass, weeds, and some small trees. A small, lightly wooded area was present at the northern end of the mounded area. A more mature wooded area is present just off the northeastern edge of the site between the railroad tracks and Defense Highway. Several depressions were present in the central portion of the site where standing water collects during heavy precipitation events. The Navy routinely cleared vegetation along overhead power lines which run between the edge of the site and the railroad tracks.

Currently the McAllister Point Landfill is covered by a multi-media capping system that prevents direct exposure to landfill materials and prevents further erosion of those materials. The surface is vegetated and graded to promote surface runoff of precipitation thus minimizing potential infiltration that could cause further leaching of landfill contaminants. The cap area is fenced; however, access to the shoreline adjacent to the capped area is not entirely restricted. A passive gas vent system was installed during the cap system construction to dissipate potential offgas buildup that could disturb the capping

materials. A network of monitoring wells remains on site that would be used as part of the long-term monitoring program.

1.3.2 Site History

The McAllister Point Landfill was investigated in both the Initial Assessment Study (IAS) and Confirmation Study (CS). The following site history information was obtained from the IAS report (Envirodyne, 1983):

This is the site of a sanitary landfill which was operational over a 20-year period. The site was first used in 1955 following the closure of the landfill in Melville North. The site continued to be used as a landfill until the mid-1970s and encompasses approximately 6 acres. The site is located on land which is being excessed by the Navy.

During the years that the site was operational, it received all the wastes which were generated at the naval complex. This included wastes from all the operational areas (machine shops, ship repair, NUSC, etc.), Navy housing areas (domestic refuse), and from the 55 ships which were homeported at Newport prior to the 1973 SER action. Generally, 25 to 30 of these ships were in port at any one time. Each day, fourteen 40-cubic yard containers were emptied from the pier areas and disposed of in the landfill. The materials disposed of at this site included spent acids, paints, solvents, waste oils (diesel, lube and fuel), and PCB-contaminated transformer oil.

The operators of the landfill indicated that it was common practice for barrels filled with liquids to be brought to the landfill. These barrels contained paints, oils and other unidentifiable liquids. The barrels were crushed by the bulldozer operator before being covered. It was also discovered through interviews with base personnel that at least two transformers, each of which contained approximately 100 gallons of PCB-contaminated oil, and at least 4 or 5 capacitors were disposed of in the landfill. The Superfund notification for McAllister Point indicated that PCBs were disposed of at the site.

For the period 1955 through 1964, wastes were simply trucked to the site, spread out with a bulldozer, and then covered over. In 1965, an incinerator was built at the landfill. From 1965 through 1970-71, some 98 percent of all the wastes were burned before being disposed of in the landfill. [Note: An incinerator was also identified on the site in an RI review of a 1958 historical aerial photograph. The IAS may not have examined aerial photographs prior

to 1965. Discussion with a former operator indicated that only one incinerator was ever present (Parente, 1997)]. The incinerator was closed about 1970 as a result of the air pollution it was causing. During the remaining years that the site was operational, all wastes were again disposed of directly into the landfill.

The site is located along the shoreline of Narragansett Bay as shown in Figure 1-2. Throughout the time period that the site was operational, the landfill was extended out into the bay using the wastes as fill material. The site used to be subject to periodic flooding until the elevation of the site was increased through additional filling. . . .

Operations at the site were discontinued in the mid-1970s. Following this, all wastes generated at NETC were disposed of at the City of Newport's transfer station. A final covering of soil three feet thick was placed over the NETC landfill following its closure. (IAS, pp. 6-25, 6-31)

Discussion with a former operator of the landfill indicated that the northern portion of Site 01 was used to store nets, anchors, buoys, etc. from the World War II era (Parente, 1997).

1.3.2.1 Aerial Photography

Historic site maps and plans for the NETC facility as well as historic aerial photos and photo prints were reviewed to identify the locations and extent of historic site activities and previous site structures and their uses. A detailed list of the photos and maps reviewed and associated descriptions is presented in Appendix B of the Phase I RI report (TRC, 1992). Copies of all available aerial photographs of the site have been provided to the EPA Region I and RIDEM by the Navy. Summaries of the information obtained from the site map and aerial photo reviews for the site are presented below. It is important to note that the small and varying scale of the available historic aerial photographs of the site may not have resulted in a completely accurate interpretation of the site features on the photographs. In addition, the lack of a consistent set of identifiable aerial benchmarks on each photograph does not allow for an direct one-to-one comparison of the photos. In addition, the unknown tidal conditions (low versus high tide) in each photo makes it impossible to accurately interpret the actual shoreline conditions in each photo or any temporal changes in the site shoreline conditions.

Aerial photos and facility maps were reviewed covering the years from 1938 to 1988. Activity on the site dates back to 1938, with some evidence of stressed vegetation at the southern end of the site

and a grassy open area on the remaining portion of the site. In a 1942 photo, a railroad spur is visible entering the site near the current site entrance, and running north into the center of the site along with evidence of disturbed soils across the site. Throughout the 1940s and 1950s, large open depressions are visible on the site (at southern end and along western edge of the central portion of the site), along with material storage areas and what appeared to be above-ground tanks (unconfirmed). From 1958 through 1972, what appears to be a cone-shaped incinerator is visible in the north-central portion of the site. From 1965 through 1975, the shoreline of the central to south central portion of the site appeared to change shape, indicating increased landfilling activities along the shoreline edge of the site. In addition, during this time period the site appeared to be nearly completely devegetated. In the 1981 and 1988 aerial photos, the site appeared to be generally inactive with dirt roads along the eastern edge and down the middle of the central portion and southern portions of the site, respectively. In 1981 and 1988, the site appeared to be vegetated with grass, with areas of what appears to be denser or thicker vegetation or brush along the sites' shoreline in 1988. In addition, the two small intermittent standing water areas (recently surveyed as potential inland wetland areas) currently present in the north central portion of the site are visible on the 1988 photo as relatively darker areas.

1.3.3 Previous Site Investigations

Initial Assessment Study (IAS)

An IAS (Envirodyne Engineers, 1983) conducted on this site in 1983 identified areas on NETC where potential contamination from past waste disposal or handling practices may pose human health or environmental risks. The McAllister Point Landfill site was reviewed under the IAS. Based upon the reported historic use of the site as a landfill for hazardous wastes (e.g. oils, solvents, paints) and the potential contaminant migration pathways at the site, the site was recommended for a Confirmation Study (CS).

Confirmation Study (CS)

A CS (Loureiro Engineering Assoc., 1986) was conducted at this site from 1984 to 1985. The CS involved the collection and analysis of sediment, mussel, landfill leachate, surface soil, and ground water samples at or near the site. The surface soil samples indicated that low levels of contamination may be associated with the landfill cap material. Leachate spring samples from the western edge of the landfill exhibited levels of metals, cyanide, phenol, and some other organic constituents. The sediment and mussel samples indicated the presence of inorganic contaminants in samples collected adjacent to the site, especially near the southern end of the landfill, with levels decreasing with

distance from the site. The polychlorinated biphenyls (PCB) levels detected in mussels samples appeared to be attributable to bay-wide contamination, on the basis of similar levels also detected in background mussel samples. Site ground water samples exhibited elevated levels of metals.

Phase I Remedial Investigation (RI)

The Phase I Remedial Investigation (RI), which was conducted from 1989 to 1990, included site geophysical surveys, surface soil sampling, soil boring sampling, leachate sampling, and ground water sampling. Figure 1-5 and Plate A-1 in Appendix A show the Phase I sampling locations. The findings and results of the Phase I RI for the McAllister Point Landfill are summarized below:

Soil Assessment - Volatile organic compounds (VOCs), base neutral/acid extractable organic compounds (BNAs) (including polynuclear aromatic hydrocarbons (PAHs)), pesticides, PCBs, and inorganics were all detected in on-site soils. The major areas of the site where contaminants were detected in the soil at elevated levels include the following:

- Northern area - carcinogenic PAHs;
- North-central area - BNAs, carcinogenic PAHs, and inorganics;
- Central landfill area - VOCs, BNAs, PCBs, and inorganics;
- South of access road - BNAs, carcinogenic PAHs, and inorganics; and
- Shoreline - BNAs, carcinogenic PAHs, and inorganics.

Significant VOC contamination (i.e., greater than 1 ppm total VOCs) was detected in subsurface soils and fill in the central portion of the landfill area, but VOC levels were not consistently high throughout the depth of the soil horizons sampled.

BNAs were detected at elevated levels (i.e., greater than 10 ppm total BNAs) throughout the site, with the highest levels (i.e., greater than 100 ppm total BNAs) detected at spot locations in the central and southern portions of the site. Elevated levels of total carcinogenic PAHs (i.e., greater than 1 ppm) were also detected at locations where total BNA concentrations were less than 10 ppm. These locations were generally in the northern portion of the site, with smaller areas identified in the southern portion of the site and along the shoreline.

Pesticides were detected at low levels (i.e., 10s of ppb) in surface soil samples across the site, while PCBs were detected in surface and subsurface soils. PCBs were detected in soils along the shoreline

and in subsurface soils in the north-central and southern portions of the site. None of the sites' soil boring samples analyzed for PCBs exceeded the 1 ppm RIDEM PCB soil action level.

Inorganics levels detected in the soils and fill were compared to off-site background surface soil levels. Inorganics were detected in soil and fill samples collected from across the site at levels exceeding background levels. The highest inorganic levels were detected in soils from the central and south-central portions of the landfill, in the northern portion of the site (ash area), in the southern portion of the site, and along the shoreline.

Ground Water Assessment - VOCs, BNAs, PCBs, and inorganics were all detected in site ground water samples. The major areas of the site where contaminants were detected at levels exceeding action levels include the following:

- Northern area - inorganics;
- North-central area - inorganics;
- Central landfill area - VOCs, and inorganics; and
- South of access road - VOCs, PCBs, and inorganics.

VOC detections, consisting mostly of petroleum-related VOCs (e.g., xylene, benzene), were limited to wells located in the central and southern portions of the site. VOCs were also detected in soil boring samples collected at the depth of the water table from the north-central to southern portions of the site, indicating the potential for ground water contamination throughout this area. Oil was observed in one well (MW-5S) in the southern portion of the site five months after it was sampled. No BNAs were detected above ground water action levels and no pesticides were detected in the ground water samples. A PCB concentration of 150 ppb was detected in the well in the southern portion of the site (MW-5S) in which oil was subsequently observed. The highest levels of inorganic analytes were detected in wells from the north-central to southern portions of the site.

Sediment/Mussel Assessment - In early March 1988, the Water Quality Laboratory Engineering Division of the U.S. Army Corps of Engineers (ACOE) collected a series of six (6) sediment and mussel samples (MP#1 through MP#6) in Narragansett Bay near McAllister Point Landfill. In addition, one set of control samples (MP#7) were collected near the site. This sampling was performed along with similar sampling near Gould Island and in Allen Harbor at the request of the Navy.

The sampling was performed in the intertidal zone. All samples were taken as close to the waters edge as possible during the low tide period. As a result of the presence of large stones, boulders, and debris

in the sediments, a steel shovel and crow bar were used in collecting the sediment samples. The sediment samples were collected from a depth of four to eight inches using a stainless steel spoon. Mussel samples were collected using unspecified methods.

The sediment samples were analyzed for total petroleum hydrocarbons (TPH), PCBs, and six metals (cadmium, chromium, copper, nickel, lead, and zinc). The tissue samples were also analyzed for the same six metals. The analyses were performed using unspecified analytical techniques by the Hubbardton, Massachusetts ACOE Water Quality Laboratory. The sediment sample results indicate the presence of TPH at concentrations from 30 ppm (MP#7) to 1,100 ppm (MP#6), PCBs from 0.01 ppm (MP#7) to 2.03 ppm (MP#3) and the presence of elevated levels of metals. Levels of copper and zinc above the control sample levels were detected in the mussel tissue samples. The sample analytical results and sample locations are provided in the ACOE sampling report in Appendix B.

1.3.4 Phase I Human Health Assessment

A human health evaluation was conducted for the McAllister Point Landfill site on the basis of the Phase I RI. The exposure scenarios considered in the human health evaluation of the site included both current use and potential future site use scenarios, as listed:

- **Trespassing Scenario (Scenario 1)** - Exposure of trespassing children from 9 to 18 years of age to site surface soils through dermal contact and incidental ingestion.
- **Recreational Use Scenario (Scenario 2)** - Exposure of children from 6 to 18 years of age (due to development of the site as a ballfield) to site surface soils through dermal contact and incidental ingestion.
- **Construction Scenario (Scenario 3)** - Exposure of adult construction workers for a period of one year to subsurface soils through inhalation, dermal contact and incidental ingestion.
- **Commercial/Industrial Use Scenario (Scenario 4)** - Exposure of adult employees through commercial/industrial use of the site to surface soils through incidental ingestion and dermal contact and to ground water through ingestion.

- **Residential Use Scenario (Scenario 5)** - Exposure of children from 0 to 6 years of age and adults (30-year period) to surface soil through dermal contact and incidental ingestion of soil/house dust and inhalation of particulates, and to ground water through dermal contact, ingestion and inhalation of volatiles.

Human health risks potentially associated with the site, which may include risks of cancer or non-cancerous (systemic) effects, were evaluated. Both average-case (based on the geometric mean of the on-site data) and maximum (based on the highest detected on-site concentration) risks were calculated. Cancer risk levels, the lifetime incremental probabilities of excess cancer due to exposure to the site contaminants, were estimated, taking into account exposure concentrations and the carcinogenic potencies of the chemicals. The cancer risk estimates are presented in scientific notation, where a lifetime risk of 1E-04 represents a lifetime risk of one in ten thousand.

Health effects associated with exposures to non-carcinogenic chemicals were evaluated using U.S. EPA Risk Reference Doses (RfDs). The associated chemical-specific risk was quantitated by the Hazard Index Ratio (HI), which is the ratio of the exposure dose to the RfD.

The calculated cancer risks and non-cancer HIs were evaluated using available regulatory guidance. The calculated risk is compared to the acceptable lifetime cancer risk range (1E-04 to 1E-06) for evaluating the need for remediation, as stated in 40 CFR Part 300 (EPA, 1990b). EPA (1990b) considers a cancer risk of 1E-06 as the point of departure for determining risk-based remediation goals. For non-carcinogenic risks, a target HI of unity is used (i.e., $HI = 1$). When the total HI for an exposed individual or group of individuals exceeds unity, there may be concern for potential non-cancer health effects. Thus, the cancer risk and HI ratios that constitute a potential concern are those which are greater than 1E-04 and unity (1), respectively. Cancer risks which fall within the range of 1E-04 to 1E-06 (referred to as within the acceptable risk range) require further evaluation. The potential risks posed by the site in association with each scenario were evaluated, and the exposure pathway(s) driving the calculated risks are summarized below:

- **Trespassing Scenario (Scenario 1)** - Total cancer risks fall within the acceptable range; total HIs are acceptable (less than unity).
- **Recreational Use Scenario (Scenario 2)** - The maximum cancer risk value (1.3 E-04), slightly exceeds the acceptable risk range. The mean risk value and total HIs are within acceptable values.

- **Construction Scenario (Scenario 3)** - The total cancer risk range and the mean HI are within acceptable values. The maximum HI (2.5) exceeded the acceptable value.
- **Commercial/Industrial Use Scenario (Scenario 4)** - The total cancer risks (1.8 E-03 and 3.9 E-03) and the HIs (1.8 and 13) exceed acceptable values.
- **Residential Use Scenario (Scenario 5)** - The total cancer risks (ranging from 2.3 E-03 to 1.3 E-02) and the HIs (ranging from 5 to 65) exceed acceptable values for both children and adult receptors.

For Scenarios 1, 2, and 3, the major contributing factor to the calculation of cancer risk is ingestion of carcinogenic PAHs in soil. The pathway of primary concern associated with Scenarios 4 and 5 with respect to cancer risk is ingestion of ground water containing inorganics (arsenic, beryllium) and carcinogenic PAHs. The primary contributor to the total HIs for Scenarios 1, 2, and 3 is ingestion of inorganics in soil. Ingestion of inorganics (antimony, arsenic, cadmium, chromium, copper, manganese, mercury and zinc) in ground water drives the total HIs for Scenarios 4 and 5.

While current risks posed by site surface soils to potential trespassers fall within the acceptable risk range of 1E-04 to 1E-06, they exceed the point of departure risk level of 1E-06. Conditions at the site prior to capping may have posed a potential risk to the environment as well, due to the potential for contaminant migration via erosion, the continued generation of leachate as a result of the infiltration of precipitation, and ground water flow towards the bay. Additional assessment of site-related human health and environmental risks are conducted as part of the Phase II RI and are presented in separate volumes of this report. Volume II of the Site 01 RI report presents the risk assessment for the Phase II RI findings. These risk assessments include an evaluation of both the Phase I and Phase II RI data.

The completion of the cap for McAllister Point Landfill in October 1996 addressed most of the potential exposure scenarios evaluated under the Phase I and the Phase II risk assessments. During 1996, additional analytical data were acquired for newly exposed marine sediments that indicated higher contaminant concentrations (for some stations). As a result, it was determined by EPA and RIDEM that an evaluation was needed of potential health risks associated with a future recreational exposure scenario and ingestion of shellfish by subsistent individuals. The Revised Draft Final Human Health Risk Assessment Report (B&RE, April 1997), submitted separately as Volume II of the Site 01 RI Report, presents the results of the risk assessment for these additional exposure scenarios.

2.0 PHASE II RI SITE INVESTIGATION

This section of the report provides information on the Phase II RI field investigation activities conducted at Site 01 - McAllister Point Landfill.

2.1 PURPOSE AND APPROACH

The purpose of the Phase II Remedial Investigation conducted at this site was to further delineate the nature and horizontal and vertical extent of any contamination associated with the landfill. The scope of the Phase II field investigations were based upon the final Phase II RI Work Plan (TRC, 1993) which was submitted in final form to the Navy in March of 1993. The Phase II RI field investigation activities were conducted between October 1993 and January 1994. The field investigation activities conducted during the Phase II RI included geophysical and soil gas surveys, surface soil sampling, test pit sampling, soil boring sampling, and ground water sampling. In addition, off-shore sampling was conducted in August 1993 to assess the quality of the sediment and biota adjacent to the site in Narragansett Bay. A survey map showing the Phase II sampling locations is provided as Figure 2-1. Plate A-1 in Appendix A provides a summary of all the Phase I and II sampling locations.

Following this section of the report, a separate discussion is provided for each of the field investigation activities listed above. An overview of the investigation activities for each media is presented, including an identification of sample numbers, locations, analyses, and sample rationale. Also provided in each section is a discussion of any field observations and measurements. Samples were collected and analyzed according to the quality assurance/quality control criteria defined in the Quality Assurance Project Management Plan prepared as part of the Phase II RI Work Plan (TRC, 1993).

The Phase I RI samples were analyzed by Weston Analytics in Lionville, Pennsylvania. The Phase II RI soil samples were analyzed by Enseco, Inc. in Somerset, New Jersey, while the ground water and test pit samples were analyzed by Weston Analytics. Both Phase I and Phase II samples were analyzed for compounds included under the U.S. EPA Contract Laboratory Programs target compound list/target analyte list (TCL/TAL). Non-CLP analyses were performed according to established, current EPA protocols. Appendix M contains the sample indices for the Phase I and Phase II RI samples collected at the site. A list of the TCL and TAL compounds/analytes is provided in Tables 2-1 and 2-2, respectively. All of the sample analytical results are discussed in Section 4.0 of this report and presented in data summary tables in Appendix O.

2.2 GEOPHYSICAL INVESTIGATION

A geophysical investigation consisting of a seismic refraction survey and an electromagnetic conductivity survey was conducted at Site 01. The seismic refraction survey was conducted by Hager-Richter Geoscience, Inc. The electromagnetic conductivity survey was conducted by TRC. Appendix C provides the results of the Hager-Richter seismic survey as well as the results of the Phase I RI electromagnetic (EM) and magnetometer surveys of the site.

2.2.1 Seismic Refraction Survey

The seismic refraction survey was primarily used at this site to profile the bedrock surface below the site and to ascertain additional information on the depth of fill at the site. The seismic refraction survey is a means of accessing the depths to refracting horizons and the thickness of overlying subsurface or geologic units. Seismic refraction data interpretations are based on the travel-time curves which measure the time required for a compressional seismic wave to travel from the source point to each vibration sensitive device (geophone).

Seismic Refraction Methodology

The following presents the scope and findings of the seismic survey as summarized from the Hager-Richter report provided in Appendix C. Seismic refraction data was recorded into a 48-channel Bison Model 9024 Digital Instantaneous Floating Point Stacking Seismograph. This seismograph is a microprocessor controlled instrument that records digital data and displays onto paper output. The seismograph was coupled to two 24-element seismic spread cables for a total of 48 geophones. The geophones measure only the vertical component, and their resonant frequency was 14 Hz.

Seismic energy was provided by an accelerated weight drop (Bison EWG), which drops a steel base plate at an accelerated speed onto the ground creating seismic energy. The number of stacks per shot point was variable, and the quality of the stacked seismic signal for each shot point was verified in the field with the paper record. Five shot points were used per geophone spread. Shot points were located at the first, middle, and last geophones. Symmetrical offsets of up to 100 feet were also made from the ends of each spread to obtain bedrock arrivals from all geophones. Figure 2-2 shows the locations of the seismic refraction survey lines.

The seismic refraction survey at this site consisted of 6 spreads totaling 1,985 feet. Seismic lines 1A, 1B, and 1C were orientated in a north-south direction along the length of the landfill, and each

consisted of a 48-channel geophone spread, with geophones spaced at 10 feet apart. Seismic line 2 was orientated in a east-west direction across the southern end of the site, while seismic lines 3 and 4, also orientated in a east-west direction, were located across the central portion of the landfill. Seismic lines 2, 3, and 4, each consisted of a 24-channel geophone spread, with geophones spaced 5 feet apart for line 2, and 10 feet apart for lines 3 and 4. Due to the location of lines 3 and 4 directly on the landfill materials and due to the high attenuating properties of the fill, refracted signals could not be detected on these lines. Thus, the data for seismic lines 3 and 4 could not be interpreted.

The seismic data were analyzed using a Generalized Reciprocal Method (GRM) of seismic refraction interpretation. GRM allows for some variation in the surface topography as well as lateral variations in the seismic velocity of the upper layers. The seismic refraction results are used to construct an interpreted velocity profile of the subsurface layers for each seismic line. The velocities of seismic waves are functions of the types of geologic material through which they pass. One can thus infer the general subsurface stratigraphy from the velocities determined.

Seismic Refraction Results

The seismic refraction survey at the McAllister Point Landfill site resulted in the identification of two distinct velocity ranges. The upper material, which had a velocity range of 1,100 -2,100 feet per second (fps), was interpreted to consist of unsaturated overburden (fill and/or sediments). The second range was material with a velocity range of 9,500 - 13,100 fps, which was interpreted to consist of relatively competent bedrock. The saturated zone under the seismic lines occurred either within the bedrock or within a few feet of the top of bedrock. Appendix C contains all of the seismic refraction results, as included with the Hager-Richter report.

Based on the seismic refraction results, the depth to bedrock beneath the landfill varies between approximately 8 and 23 feet below ground surface. The seismic results also indicate that the bedrock surface slopes gently to the southeast in those portions of the site where the seismic survey was conducted, the eastern edge and southern end of the site. This finding is consistent with the findings of the boring investigations conducted in these portions of the site; however, as is discussed in Section 3.2.2 of this report, the bedrock surface topography generally exhibits a westward slope over a majority of the site.

The quality of the seismic refraction results were evaluated by comparing bedrock depths determined seismically with depths to bedrock determined in several nearby borings. In general, the depth to bedrock determined seismically falls between the depth of weathered shale bedrock and more

competent bedrock as noted in the boring logs. The fact that the depth of bedrock determined seismically is generally shallower than the depth of the less weathered bedrock determined in borings would indicate that the transition from weathered to competent bedrock is gradual.

2.2.2 Electromagnetic Conductivity Survey

An electromagnetic conductivity survey was conducted at the McAllister Point Landfill by TRC on November 1, 1993. The survey was conducted using a Geonics EM-31 electromagnetic terrain conductivity meter. The EM-31 has a fixed intercoil spacing of 12 feet and allows for an approximate exploration depth of approximately 20 feet. EM-31 surveys are used to aid in determining the location and/or extent of buried electrically conductive objects (e.g., drums, tanks, structures), or potential contaminant plumes. These features are recognized by large meter fluctuations which occur within a short distance, with the buried conductor showing up as a negative peak between two positive peaks.

Although one of the objectives of the EM survey which is discussed in the Phase II RI/FS Work Plan was to aid in assessing the extent of salt water intrusion on the site, it was realized that the EM method would be unable to penetrate the extensive fill on the site (up to 27 feet thick) and would therefore be useless in completing this task. Furthermore, the large EM readings caused by the fill material (as documented in Phase I) would very likely mask or interfere with an EM distinction of any salt water intrusion. Thus, the EM survey completed in Phase II was not used to investigate salt water intrusion on the site.

EM-31 Survey Overview

The EM-31 survey was conducted along a 10-foot grid spacing which was oriented in a east-west direction across the southern portion of the site. The survey began approximately 30 feet south of boring B-10, and continued to approximately 50 feet north of monitoring well MW-5. Each survey line began on the eastern edge of the site, under the power lines, and was completed west to the edge of the bank overlooking Narragansett Bay. The purpose of this survey was to aid in locating any buried source(s) of the petroleum contamination found in well MW-5S during the Phase I RI. Potential sources of the contamination could include buried tanks or drums, or petroleum contaminated soil, all of which could be detected by the EM-31. Figure 2-3 shows the area over which the survey was conducted.

Another EM-31 survey was conducted in the northern portion of the site, from boring B-1 north past monitoring well MW-1. The purpose of this survey was to determine the northern extent of the fill at

the site. The survey lines were oriented in a east-west direction, and set on a 10-foot grid spacing. Each survey line began on the eastern edge of the site, under the power lines, and was completed west to the edge of the bank overlooking Narragansett Bay. Fill materials are generally more conductive than native soils, and also generate more heterogeneous readings than native soils.

EM-31 readings were recorded at every 10-foot station on the traverses. In addition, EM readings were continuously observed between each of the stations, and any reading which significantly deviated (e.g., negative values) was also recorded. Site features, including overhead wires and surficial metal debris, which cause interference with the EM-31 were also noted.

EM-31 Survey Results

EM-31 readings consisted of elevated values and negative values detected across the southern portion of the site. Elevated values were detected along the eastern edge of the survey grid, and were believed to be attributable to interference caused by the overhead power lines. In addition, several areas of elevated values followed by negative values were detected, and were attributed to surficial metal debris in those areas.

EM-31 readings varied between negative values and small positive values (< 5 mmhos/m), from boring B-1 north to well MW-1. North of MW-1, the readings became consistently positive at approximately 5 mmhos/m. Based upon these values, fill material does not appear to extend north beyond well MW-1.

2.3 SOIL GAS INVESTIGATION

The objective of the soil gas survey was to identify the presence of volatile organic compounds (VOCs) in subsurface soil vapors and, thereby, to aid in defining the presence, nature, and extent of any subsurface volatile organic contamination. Increased concentrations of gaseous VOCs are commonly present within pore spaces of VOC contaminated unsaturated soils, above contaminated buried wastes, and above contaminated plumes of ground water.

The soil gas survey was performed by Target Environmental Services, Inc. (Target) of Columbia, Maryland. The soil gas survey at this site was performed from October 12 to October 21, 1993. Soil gas sampling was conducted at four separate areas of the landfill. Soil gas points were installed in concentric grid patterns around monitoring wells MW-3S/3R and MW-5S/5R, and around soil borings B-3 and B-7, which were completed during the Phase I RI. Twelve to fifteen soil gas points were

sampled at each of the four areas. Two soil gas samples were collected from each soil gas point, one from the interval just above the ground water table and one at the mid-point in the vadose soil column. The locations of the soil gas points are provided in Figure 2-4.

The scope of the Phase II RI soil gas survey as defined in the Phase II RI/FS Work Plan was modified just prior to the sampling in concurrence with both the EPA and RIDEM. This modification included expanding the survey from 24 points to 55 points to address two other subsurface areas which were of concern to the RIDEM based on the detection of VOCs at these locations in Phase I. These areas included points around the locations of Phase I RI test borings B-3 and B-7. As with the planned points, two soil gas samples were also collected from each of these additional points for analysis.

2.3.1 Soil Gas Methodology

The soil gas samples were collected using a truck-mounted hydraulic sampling probe (e.g., Geoprobe) which advanced connected 3-foot sections of 1-3/8" OD diameter, threaded steel casing to the sampling depth. Once at depth, the casing was hydraulically raised several inches in order to release a disposable drive point and open the bottom of the casing. A teflon line with a perforated hollow stainless steel probe end was then inserted into the casing to the bottom of the hole, and the bottom-hole line perforations were isolated from the up-hole annulus by an inflatable packer. Following isolation of the sampling zone, a sample of in-situ soil gas was then withdrawn through the probe and used to purge atmospheric air from the sampling system. A second sample of soil gas was then withdrawn through the probe and encapsulated in a pre-evacuated glass vial at two atmospheres of pressure (15 psig). The self sealing vial was detached from the sampling system, packaged, labeled, and stored for laboratory analysis.

Prior to the day's field activities the sampling equipment was decontaminated by washing with soapy water and rinsed thoroughly. Internal surfaces were flushed dry using pre-purified nitrogen or filtered ambient air, and external surfaces were wiped clean using clean paper towels.

All of the soil gas samples collected during the survey were shipped by overnight service to the in-house Target Environmental laboratory for analysis. The samples were analyzed by two methods. One analysis was conducted according to EPA Method 601 (modified) on a gas chromatograph equipped with an electron capture detector (ECD), using a direct injection technique. Specific analytes standardized for this analysis were:

- 1,1-dichloroethene (11DCE)
- methylene chloride (CH₂Cl₂)
- trans-1,2-dichloroethene (t12DCE)
- 1,1-dichloroethane (11DCA)
- cis-1,2-dichloroethene (c12DEC)
- chloroform (CHCl₃)
- 1,1,1-trichloroethane (111TCA)
- carbon tetrachloride (CCl₄)
- trichloroethene (TCE)
- 1,1,2-trichloroethane (112TCA)
- tetrachloroethene (PCE)
- 1,1,2,2-tetrachloroethane (TECA)

The chlorinated hydrocarbons were chosen because of their common usage in industrial solvents, and/or their degradational relationship to commonly used industrial solvents.

The second soil gas analysis was conducted according to EPA Method 602 (modified) on a gas chromatograph equipped with a flame ionization detector (FID), using a direct injection technique. The analytes selected for the standardization in this analysis were:

- benzene
- toluene
- ethylbenzene
- meta- and para- xylene
- ortho- xylene

These compounds were chosen to evaluate the presence of fuel products, or petroleum-based solvents.

The analytical equipment was calibrated using a 3-point instrument-response curve and injection of known concentrations of the target analytes. Retention times of the standards were used to identify the peaks in the chromatograms of the soil gas samples, and their response factors were used to calculate the analyte concentrations.

Total FID Volatile values were generated by summing the areas of all integrated chromatogram peaks and calculated using the instrument response factor for toluene. Injection peaks, which also contain the light hydrocarbon methane, were excluded to avoid the skewing of Total FID Volatile values due

to injection disturbances and biogenic methane. For samples with low hydrocarbon concentrations, the calculated Total FID Volatiles concentration is occasionally lower than the sum of the individual analytes. This is because the response factor used for the Total FID Volatiles calculation is a constant, whereas the individual analyte response factors are compound specific. It is important to understand that the Total FID Volatiles levels reported are relative, not absolute values.

Field control samples were collected at the beginning and end of each day's field activities, after every twentieth soil gas sample and prior to sampling at a new site. These quality assurance/quality control (QA/QC) samples were obtained by inserting the probe tip into a tube flushed by a 20 psi flow of pre-purified nitrogen. Concentrations of all analytes were below the reporting limit in all field control samples, indicating that the QA/QC measures employed in the field were sufficient to prevent cross-contamination of the samples during collection.

A duplicate analyses was performed on every tenth field sample. Laboratory blanks of nitrogen gas were also analyzed after every tenth field sample. Concentrations of all analytes were below the reporting limit in all laboratory blanks and all duplicate analyses were within acceptable limits.

2.3.2 Soil Gas Results

The soil gas survey results were reported as total FID volatiles, as well as separate breakdowns for the individual compounds. The soil gas survey results are presented in Appendix D, as part of the report from Target Environmental. Note that the soil gas sample designations presented in the appendix (for example, MPSG1-4) indicate both the site name (MP = McAllister Point), the soil gas point number (SG1 = soil gas point number 1), and the sample depth (4 = four feet below grade). Total VOC concentrations ranged from not-detected to greater than 1,020 ppb. Individual elevated VOC levels ranged from not-detected to greater than 266 ppb. VOC levels for chlorinated compounds were lower than those for the petroleum compounds, and ranged from not-detected to 3.6 ppb.

Soil gas survey results indicated the presence of volatile organics compounds around well MW-5S/5R, in the southern portion of the site. Total FID volatiles ranged from not-detected to greater than 850 ppb in this area. Individual VOC levels ranged from not-detected to 880 ppb xylene in SG1-8. Xylene was detected in at least one sample from each soil gas location. Benzene and toluene were detected in one sample, SG10-8, at levels of 1.5 and 14 ppb, respectively. Ethylbenzene was present in several of the soil gas samples, with the highest reading detected in SG10-8, at 46 ppb. However, no chlorinated VOC compounds were detected within this soil gas survey area.

Volatile organic compounds were also detected around B-7, on the south-central portion of the landfill. Total FID volatiles ranged from not-detected to greater than 1,020 ppb in SG26-15. The highest readings of petroleum compounds were detected in SG32-6, with levels of toluene, ethyl benzene, and xylene detected at 19, 67, and 117 ppb, respectively. SG-32, along with several other soil gas points with elevated readings, are located downgradient of B-7. Trans-1,2-dichloroethene was the only chlorinated volatile organic compound detected in two of the soil gas points, SG29-6 and SG30-6, at 3.1 and 3.6 ppb, respectively, in this soil gas survey area.

The soil gas survey results from the area around MW-3S/3R, on the central portion of the landfill, also indicated the presence of volatile organic compounds. Total FID volatiles for this area ranged from not-detected to 356 ppb. SG15-6 exhibited the highest detected levels of benzene and ethylbenzene, at 6.7 and 38 ppb, respectively. The highest level of toluene was detected in SG23-15 at 51 ppb, while SG13-6 had the highest level of xylene at 225 ppb. Three chlorinated compounds were present in SG50-6: 1,1-dichloroethane, trichloroethene, and tetrachloroethene, at levels of 2.4, 1.5, and 3.2 ppb, respectively. Methylene Chloride was found in two samples, SG21-6 and SG23-15, at levels of 1.8 and 1.6 ppb, respectively.

Volatile organic compounds were detected at low levels around B-3, on the north-central portion of the landfill. Total FID volatiles ranged from not-detected to 766 ppb in this portion of the site. SG46-16 exhibited the highest levels of benzene at 4.2 ppb. The highest level of toluene was detected in SG54-6, at 83 ppb. SG41-6 exhibited the highest values of ethylbenzene and xylenes, at 30 and 58 ppb, respectively. Cis-1,2-dichloroethene was detected in one soil gas sample, SG37-6, at 1.1 ppb, and tetrachloroethene was detected in SG48-6, at 1.2 ppb, within this soil gas survey area.

Based on the soil gas survey results, some of the Phase II planned well and boring locations were slightly adjusted to further investigate areas of detected subsurface VOC soil gas levels. These modifications were made in agreement with the Navy, EPA, and RIDEM, after reviewing the soil gas results. At the southern end of the site, the locations for wells MW-12 and MW-13 were adjusted slightly to coincide with areas of elevated soil gas VOCs. At the south-central portion of the site, B-22 was adjusted slightly to coincide with an area of elevated soil gas VOCs, and MW-10 was moved to be just downgradient of the area of elevated soil gas VOCs detected around boring B-7. At the central portion of the site, B-20 was adjusted slightly to coincide with another area of elevated soil gas VOCs.

2.4 SURFACE SOIL INVESTIGATION

Surface soil sampling was conducted under the Phase II field investigation to further evaluate the presence, nature, and extent of surface soil contamination detected during Phase I RI explorations at the landfill. During the Phase I RI, a total of seventeen surface soil samples (SS-1 to SS-17) were collected across the site. Surface soil samples SS-1 through SS-11 were collected within the main portion of the landfill, surface soil samples SS-12 through SS-15 were collected along the Narragansett Bay shoreline, and surface soil samples SS-16 and SS-17 were collected as background samples to the east of Defense Highway. Figure 2-5 shows the locations of the Phase I surface soil samples.

The scope of the Phase II RI surface soil sampling as defined in the Phase II RI/FS Work Plan was modified just prior to the sampling in concurrence with both the EPA and RIDEM. This modification included the elimination of many of the surface soil samples from the central and shoreline portions of the site. In light of the planned capping of the site and the fact that these areas were known to have fill, it was agreed that these samples would not be collected. In addition, this sampling did not seem appropriate in that the findings of the Phase I RI showed what appeared to be cover (or non-fill or waste) material over a majority of the central site area. The surface soil sampling was instead focused on assessing the surface soil quality at the southern and northern ends of the site to aid in determining the extent of any surface soil contamination, as well as the off-site background surface soil conditions. Surface soil samples which were planned for characterizing visible surface ash material were also retained in the north central portion of the site. These surface soil samples were also used for assessing the presence of any dioxins/furans in the ash material.

2.4.1 Overview of Investigation

During the Phase II investigation, fourteen (14) surface soil samples (SS-18 through SS-27 and SS-29 through SS-32) were collected and analyzed for the full Target Compound List (TCL) and the Target Analyte List (TAL) parameters. Surface soil samples SS-22 to SS-25 were also submitted for dioxin/furan analyses. Of the fourteen surface soil samples collected, six were collected from within the boundaries of the landfill (SS-21 to SS-26), five were collected along the shoreline of Narragansett Bay (SS-27, SS-29 to SS-32), and three were collected as background samples (SS-18 to SS-20). The surface soil samples were collected to further characterize surface soil quality across the site, to investigate shoreline soil contamination detected during the Phase I RI, and assess the background soil quality near the site. The locations of the Phase I and Phase II surface soil samples are shown as Figure 2-5. No surface soil samples were collected from the central portion of the landfill, as this area will be covered by the planned landfill cap.

All surface soil samples were collected with a dedicated, decontaminated, stainless-steel spoon. Surface soil samples were collected from within the 0 to 1 foot horizon to be consistent with EPA risk assessment protocol for characterizing "surface soil". Soil samples collected for VOC analysis were collected from 6 to 12 inches below ground surface and were transferred directly to the sample container, in order to minimize loss of VOCs from the sample. Soils for the remaining analyses were collected from 0 to 6 inches below ground surface, homogenized in a stainless-steel bowl, and placed into the appropriate sample containers.

In addition to the fourteen surface soil samples mentioned above, fourteen (14) test boring/monitoring well boring surface soil samples (0-1' sample interval) were also collected and analyzed for full TCL/TAL parameters. These samples were collected from nine soil borings (B-14 to B-16, B-18, and B-23 to B-27) and five monitoring well borings (MW-9 and MW-12 to MW-16). The locations of these soil borings and monitoring wells are provided in Figures 2-7 and 2-8, respectively.

2.4.2 Field Measurements and Observations

A description of each of the Phase II surface soil samples and first interval test boring/monitoring well boring samples was recorded in a field notebook. Soil descriptions from the surface soil sample logs are presented in Table 2-3.

The McAllister Point Landfill surface soils primarily consisted of a brown fine to medium sand and silt with varying amounts of gravel and organics. However, in the north-central portion of the landfill, the surface soils consisted of grey fine sand, silt, and ash. These soils were noted in surface soil samples SS-23, SS-24, and SS-25, and in test boring B-16, during the Phase II investigation, and also in B-1 and B-2, completed during the Phase I investigation. At surface soil samples SS-31 and SS-32 collected along the shoreline, the soil material sampled consisted of weathered shale fragments. No odors were noted in any of the surface soil samples collected at the site. Debris-type material (i.e., glass, metal, asphalt, etc.) was noted in surface soil sample SS-27 and in the surface soil samples from test borings B-15, B-23, and B-25.

2.5 SUBSURFACE SOIL INVESTIGATION

2.5.1 Test Pit Investigation

Test pit investigations and sampling were conducted in the southern portion of the landfill. Test pit investigations were not proposed in the Phase II RI Work Plan; however, these excavations were

conducted to aid in characterizing the subsurface materials in the southern portion of the site. This additional information was considered critical in evaluating capping options for this portion of the site.

2.5.1.1 Overview of Investigation

A total of three test pits were excavated in the southern portion of the landfill. Test pits were excavated to the depth of the ground water table (approx. 8 to 9 feet below grade) using a backhoe. The soils and fill material encountered in the test pits as well as the size of the test pit and depth to ground water were recorded in a field notebook. The test pits/trenches were approximately 4 feet wide and ranged from 18 to 23 feet long. Test pit logs are presented in Table 2-4. At the completion of test pit excavations, the excavated material was left on the surface at the direction of RIDEM. The material was covered using polyethylene sheeting and the open test pit was fenced off using snow fence. The locations of the three test pits are provided in Figure 2-6.

At least one soil sample was collected from each of the test pit excavations' soil piles in order to characterize the excavated material. Composite samples were collected from each of the soil piles using a dedicated, decontaminated stainless-steel spoon and bowl. An additional soil sample was collected from test pit TP-3 from the last backhoe bucket excavated due to the noted presence of a slight petroleum-like odor in this soil. Each soil sample was analyzed for the full list of TCL/TAL parameters and total petroleum hydrocarbons (TPH) (at the request of the RIDEM). The soil sample aliquot for VOC and TPH analysis was not composited, but rather collected as a discrete sample throughout the pile to minimize the loss of any volatile compounds.

2.5.1.2 Field Measurements and Observations

All of the field measurements and observations were recorded in a field notebook during the test pit investigation activities. Recorded field measurements included OVA instrument readings. Observations which were recorded included geological soil descriptions and visual observations (e.g., debris, waste, discolored soils). All of the test pit measurements and observations are presented as test pit logs located in Table 2-4.

The fill material encountered in the three test pits primarily consisted of construction/demolition debris, including scrap metal, wood, and brick fragments. This debris material was intermixed with soil in each of the test pits at depths ranging from 3 to 7.5 feet below grade. Small amounts of newspaper and plastic were also encountered in test pit TP-3.

The material encountered in test pit TP-1 consisted of 2 feet of soil cover, a 1-foot layer of sand and brick fragments and a 4.5-foot interval of sand, gravel, scrap metal and wood debris which was located just above the ground water table, encountered at 7.5 feet below grade. Soil and debris removed from test pit TP-1 had a slight garbage odor and OVA readings taken from the soil pile ranged from 10 to 85 ppm. A slight sheen was also observed on the surface of the ground water in the test pit excavation.

The subsurface conditions at test pit TP-2 consisted of 3 feet of soil cover, 2.5 feet of sand, gravel, brick, scrap metal, and wood debris, and 3 feet of native soil material which consisted of a light brown till. A petroleum odor was noted in the soils removed at the 3- to 5.5- foot interval and black oil globules were noted in the soil in the bottom 3 feet of native material. The ground water table was encountered at 8.5 feet below grade and what appeared to be small oil globules were observed in the ground water in the excavation. OVA readings taken of the excavated material ranged from 10 to 500 ppm. The highest OVA reading was measured in the soils and debris removed from the 3- to 5.5-foot interval.

Test pit TP-3 consisted of 4 feet of soil cover, a 1-foot layer of wood, plastic, newspaper, metal, and sand, and 3 feet of native till material at the bottom of the pit. No odors were detected in the soils/fill material removed from the test pit, except for the last backhoe bucket which had a slight petroleum-like odor. Excavation at TP-3 was discontinued after the odor was encountered. The ground water at TP-3 was also encountered at this depth which was approximately 8 feet below grade.

2.5.2 Soil Boring Investigation

A subsurface soil investigation was conducted at the McAllister Point Landfill by drilling and sampling soil borings to characterize the soil quality, to determine the extent of fill across the site, and to define the geological conditions at the site. This section of the report includes an overview of the test boring investigations and a summary of the field measurements and observations made during the drilling activities.

Previous subsurface soil investigation activities conducted at the site included the installation of two on-site monitoring wells (MW-21 and MW-22) and one off-site monitoring well (MW-23) during the Confirmation Study and the drilling of thirteen soil borings (B-1 to B-13) and seven monitoring well borings (MW-1 to MW-7) during the Phase I RI. Figures 2-7 and 2-8 show the locations of the Phase I soil borings and well borings, respectively.

2.5.2.1 Overview of Investigation

A total of fourteen (14) test borings (B-14 to B-27) were drilled and sampled across the site to characterize the nature and extent of the fill material. In addition, soil samples were collected from six (6) on-site monitoring well borings (MW-8 to MW-13) and three (3) off-site monitoring well borings (MW-14 to MW-16).

Based on the findings of the soil gas investigation and in concurrence with the EPA and RIDEM, test borings B-20 and B-22 were relocated to the locations of soil gas points SG-50 and SG-34, respectively. Monitoring wells MW-10, MW-12 and MW-13 were also relocated to soil gas points SG-32, SG-10 and SG-6, respectively. The Phase II RI test borings and monitoring well borings locations are shown on Figures 2-7 and 2-8, respectively.

In Phase II, continuous split-spoon soil sampling was conducted at each of the test borings and monitoring well borings until the weathered bedrock was encountered. Bedrock was present at depths ranging from three to twenty-eight feet below grade. Hollow-stem augering was typically continued through the weathered bedrock at the test boring locations to a maximum depth of 20 feet below the weathered bedrock surface or until competent bedrock was encountered. In the case of test boring B-24, augering was continued to a depth of 49 feet below the weathered bedrock surface without encountering highly competent bedrock. The monitoring well borings for each well installed in the bedrock were completed to a depth necessary for the installation of a bedrock well. A 5-foot Nx core was also collected of the bedrock during the drilling of the boring for well MW-8R. The highly weathered nature of the shale bedrock at the site did not allow for the collection of competent bedrock cores at other locations.

The physical characteristics of each soil sample were geologically logged and described in a field notebook according to the Burmeister soil classification system. In addition, general observations such as staining, odors, and fill material were also recorded in a field notebook. Each split-spoon sample was also screened for the presence of volatile organic compounds using an Organic Vapor Analyzer (OVA/FID) and/or an HNu (PID).

A total of one to three soil samples were collected for full TCL/TAL analyses from each of the fourteen test borings and nine monitoring well borings completed during the Phase II RI. Soil samples were generally collected from the 0-2' interval (0-1' portion for analyses) and from the last sample interval of the observed fill or the interval just above the ground water table, whichever was encountered first. A third sample was also collected at those locations at which potential contamination (e.g., oil, stains,

odors) were observed. However, the selection of which split-spoon samples were to be submitted for analyses was also constrained by the amount of sample material recovered by each split spoon.

At the three off-site monitoring well locations, only the surface interval (0- to 1-foot) samples was collected for analyses for use as a background surface soil sample. A total of twenty-five (25) subsurface soil samples were collected for full TCL/TAL analyses, one (1) soil sample was collected for full TCL analyses, and three (3) soil samples were collected for TCL VOCs. Partial analyses were conducted at these four locations due to the recovery of insufficient sample volume in the split-spoon for any other analysis. In addition to the above sample analyses, one subsurface soil sample which was collected from boring B-17 and appeared to contain ash was also submitted for dioxins/furans analyses.

In addition to the samples collected for the above-listed chemical analysis, five subsurface soil samples were also collected from beneath the ground water table at five well locations (i.e., in the saturated zone and within the screened well interval) and analyzed for total organic carbon (TOC), cation exchange capacity, and grain size analysis to aid in evaluating the well construction and contaminant transport issues at the site. Such samples could not be collected from the other Phase II RI well locations because all of the other wells are screened within the bedrock from which split-spoon samples could not be physically collected for these tests.

2.5.2.2 Field Measurements and Observations

During the Phase II soil boring drilling and sampling investigation activities, all of the field measurements and observations were recorded in a field notebook. Recorded field measurements included organic vapor measurements made with an OVA and/or HNu and combustible gas (or LEL) readings. Observations that were recorded in the field included geologic soil descriptions and visual signs of potential contamination (i.e., discolored soils, waste products, odors, etc.). All of the Phase II soil boring drilling measurements and observations are presented in the soil boring logs and well boring logs in Appendices F and G, respectively. The Confirmation Study and Phase I RI soil boring and well boring logs are presented in Appendix E.

Three different categories of fill material were encountered across the site during the Phase II investigation. In the central, mounded portion of the landfill, the fill material consisted of domestic-type refuse (i.e., plastic bags, rags, newspapers, etc.). Samples collected from this portion of the landfill typically exhibited strong garbage odors, which typically resulted in high OVA readings (at times > 1,000 ppm). However, lower volatile organic gas readings were typically measured with the HNu,

indicating the likely presence of methane gas in this portion of the landfill. The depth of the fill material ranged from 10 feet deep at monitoring well boring MW-9R to 28 feet deep at monitoring well boring MW-11S/R. Boring observations appear to indicate that the fill material was generally placed directly on top of the bedrock in this portion of the site. Monitoring well boring MW-9R and piezometer borings PZ-1, PZ-2 and PZ-4 were the only borings which contained a natural overburden material (till) between the domestic debris and the weathered bedrock.

In the southern portion of the site, the fill consisted of materials typical of building/construction debris (wood, metal, brick, concrete, etc.). The fill material ranged in thickness from 5 to 13 feet, was typically overlain with a 0.5 to 4 foot soil cover, and was placed on top of a sand/silt/gravel till layer. Volatile organic vapor readings were typically lower in this portion of the site than in the central portion of the site; however, petroleum odors were noted in soils collected just above the ground water table from test borings B-24 and B-25 and from monitoring well borings MW-12S and MW-13S. The test pit investigation findings described in Section 2.5.1 also showed construction/demolition debris fill in this area and signs of petroleum-related contamination near the depth of the ground water table.

In the northern site area, a suspected incinerator ash area was further investigated in Phase II. Surface soil samples SS-22, SS-23, SS-24, and SS-25 were collected from suspected ash locations in this area. Soil borings B-16 and B-17 were also completed in areas of what appeared to be ash. The thickness of the ash observed at the surface of these two borings was 0.5 feet and 2 feet, respectively. The Phase I RI also identified ash material in test borings B-1, B-2, and B-4, and monitoring well boring MW-2S, each completed in the northern portion of the site. A mixture of domestic-type debris and demolition-type debris was also encountered in the test borings and monitoring well borings completed in the northern portion of the site. The thickness of the fill material in this portion of the site ranged from 8.5 feet to 17 feet in test borings B-15 through B-18 and monitoring well boring MW-8S/R. The fill material observed in this portion of the site also appears to have been placed directly on top of the bedrock. A core of the bedrock in this area (at well MW-8R) confirmed the presence of a highly weathered and fractured shale.

The extent of the fill (i.e., debris) at the northern-most end of the site does not appear to go much beyond monitoring well MW-1R. Test borings B-14 and B-27 completed 130 feet and 60 feet, respectively, to the north of MW-1R did not contain any domestic or demolition-type debris. Weathered bedrock was encountered at 3 feet below grade at both of these locations. The thickness of the surface fill/debris encountered at monitoring well MW-1R in Phase I was recorded to be 6 inches.

2.6 GROUND WATER INVESTIGATION

A ground water investigation was conducted at the McAllister Point Landfill site to further investigate the nature and extent of ground water contamination, as well as to provide information on the hydrogeology at the site. The following sections provide an overview of the ground water investigation, a summary of the monitoring well installation methods and well construction details, a summary of the ground water sampling methodology used during Phase II sampling, and a summary of the field measurements and observations associated with the ground water investigation conducted at the site. A description of the site hydrogeology based on the data collected during the Phase II investigation is provided in Section 3.3.6.

Previous ground water investigations conducted at the site included the installation of two on-site monitoring wells (MW-21S and MW-22S) and one off-site monitoring well (MW-23R) during the Confirmation Study, and the installation of nine monitoring wells (MW-1R, MW-2S, MW-3S, MW-3R, MW-4S, MW-5S, MW-5R, MW-6S, and MW-7S) during the Phase I RI. Figure 2-8 provides the locations of the previously installed ground water monitoring wells.

2.6.1 Overview of Investigation

The Phase II RI ground water investigation included the installation of four shallow monitoring wells (MW-8S, MW-11S, MW-12S, and MW-13S) screened in the unconsolidated materials above the bedrock surface, and seven bedrock wells (MW-8R, MW-9R, MW-10R, MW-11R, MW-14R, MW-15R, and MW-16R) screened entirely within the bedrock material. While the Phase II RI Work Plan proposed the installation of upgradient shallow and bedrock well clusters at the locations of MW-14, MW-15, and MW-16, the ground water table at these three locations was encountered within the bedrock, therefore, shallow overburden wells were not installed. Thus, given the absence of any ground water within the very thin unconsolidated zone at these locations, overburden wells would not be effective in intercepting any ground water.

Each of the Phase II monitoring wells was installed using standard 4-¼" I.D. hollow-stem auger drilling techniques. The presence of weathered bedrock material at this site also allowed for the use of hollow-stem augering for the installation of the bedrock wells. As previously mentioned in Section 2.5.2.1, continuous split spoon sampling was conducted in all of the well borings to the depth of the weathered bedrock or beyond any observed fill material. Soil samples submitted for laboratory analyses were transferred from the split spoon directly into the appropriate sample containers with a dedicated stainless steel spoon. Each split spoon was monitored using and OVA and/or HNu and all

field observations and measurements were recorded in a field notebook. Well boring drill cuttings were contained in labelled, DOT-approved 55-gallon drums at each well location.

Monitoring wells were constructed in accordance with the approved Phase II Field Sampling Plan (TRC, 1993). Each well was constructed of 2-inch inside-diameter (I.D.), flush-threaded, Schedule 40 PVC riser and 10-slot (0.010 inch) PVC screen. All of the monitoring wells were constructed using ten (10) feet of screen, with the exception of monitoring wells MW-9R and MW-14R, which were constructed using fifteen (15) feet of screen due to the uncertain depth to ground water during the well installation. A silica (quartz) sand was backfilled to at least 1 foot above the top of the well screen and a 1- to 2-foot thick bentonite seal was placed above the sand pack. Although the Phase II RI/FS Work Plan specified a 2-foot sand layer above the screen and an overlying 2-foot minimum bentonite seal, this was not feasible at all well locations. A 1.5-foot sand layer was installed at the two bedrock wells MW-15R and MW-16R to ensure that the overlying bentonite seal would be within or intercept the bedrock zone. Whereas, only a 1-foot bentonite seal was installed at wells MW-12S and MW-13S to allow adequate room for the placement of a surface cement seal. At all well locations, a portland cement/bentonite slurry grout was placed in the well annulus from the top of the bentonite seal to the ground surface. A steel casing with a locking cap was securely set in cement over the well casing stick up and below the ground surface at all wells.

As is specified in the approved Phase II RI/FS Work Plan, the specifications for the monitoring well screen slot size and sand pack was that "the well screen slot size shall retain at least 90% of the grain size of the filter pack". This requirement is consistent with the State of Rhode Island Groundwater Quality Regulations. The screen slot size used for all of the wells installed at the site is a No. 10 (0.01 inch). The sand pack used in these wells is a uniform No. 1 sand which has an effective grain size ($D_{10} = 10\%$ passing or 90% retained) of approximately 0.035 inches. Therefore, according to RIDEM regulations, the screen size was sized such that it would retain at least 90% of the grain size of the filter pack.

It is important to note that much of the commonly used sand pack sizing criteria has primarily been developed for water supply wells or wells which are to be installed in uniform water-bearing geologic materials that are considered to be aquifers (i.e., water bearing units that yield significant quantities of water to wells). It is apparent that the fill materials and shallow bedrock zone in which the wells are installed on the site should not be considered aquifers. In addition, the results of grain size analysis of site formation samples (see Appendix H) indicate that the formation materials are not very uniform (uniformity coefficients range from 36 to 114) and include a significant percentage of fines. Thus, although an attempt was made to install wells from which representative, sediment-free ground water

samples could be collected, there is not a defined well design criteria which would have assured truly sediment-free or low turbidity ground water in the wells at this site.

One common filter pack sizing criteria for artificially packed wells (i.e., the wells at this site), is that along with the screen retaining 90% of the filter pack, the size of the sand pack material should be from 3 to 5 times greater than the 50 percent retained size of the formation (D50). The grain size analysis of several site formation samples indicates that the D50 of the formation material ranges from approximately 0.01 to 0.12 inches. Thus, if the suggested 3 to 5 factors are conservatively applied to the smallest D50 (0.01 inches) to reduce the percentage of fines in the ground water samples, a sand pack grain size of between 0.03 and 0.05 inches is obtained, which is consistent with the No. 1 sand pack used at the site. Although an even more conservative, finer sand pack grain size could have been used in the wells, it is felt that the No. 1 sand pack not only helps to retain the finer fractions of the formation material, but also allows for the free entry of water into the well by creating a zone of higher permeability around the wells screen. In addition, given that the site formation material has an average percentage of silts and clays (grain size less than No. 200 sieve or 0.0029 inches) of approximately 20%, a finer sand pack would most likely not have even retained these fines. Furthermore, the sand pack and screen slot size used also allowed for an effective determination of the surrounding aquifer properties using single well slug tests.

Each of the monitoring wells installed during the Phase II RI was developed using either the surge-block technique with a Waterra pump assembly, a centrifugal pump, or a bailer. Bailers were used at those locations with a low groundwater recovery rate (i.e., low well yield). During the development of each well, water quality parameters including pH, conductivity, temperature, and turbidity were monitored. Table 2-5 provides all of the Phase II well development data for the site. The goals of the well development program were to remove fine-grained sediments from the vicinity of the well screen until the water attained visual clarity and/or until the water quality parameters equilibrated. Due to the fine-grained materials around many of the monitoring well screens, visual clarity was not attainable at each location. Thus, according the Phase II RI/FS Work Plan, given that the turbidity criteria of 10 NTUs was not achievable, a $\pm 10\%$ change in turbidity on successive well volumes criteria was used in an attempt to attain the greatest clarity possible from the wells. The monitoring wells were pumped for a minimum of at least 1 hour to verify that lower turbidity values were not achievable. In all cases, the $\pm 10\%$ turbidity criteria was met within the 1 hour minimum development time. Continuous pumping was not attainable at many of the monitoring wells due to poor well yield. All water produced during well development activities was contained in 55-gallon drums and appropriately labelled. Consistent with the approved work plan, final disposition of this water is pending the evaluation of the site ground water sampling results.

Ground water samples were collected from twenty-one of the monitoring wells installed during the Confirmation Study, Phase I RI, and Phase II RI. Ground water samples could not be obtained from monitoring wells MW-8S and MW-11S in Phase II due to a lack of water in the wells. These two wells were installed at the top of the bedrock surface and at the time of sampling, there was no ground water in the overburden material at those locations. The monitoring wells were sampled on December 20, 21, and 22, 1993, approximately two weeks following well development.

Prior to the initiation of sampling activities and immediately upon opening each well cover, a headspace reading was measured from the casing of each well with a PID and FID. These readings are discussed in Section 2.6.2. The ground water level of each monitoring well was then measured to the nearest 0.01 foot using an electric water sensing device. These water levels are presented and discussed in Section 3.3.6. The water level indicator and probe was decontaminated before each use with a tap-water/non-phosphate detergent wash and a distilled/deionized water rinse. Additionally, an oil/water interface probe was used at several of the wells (MW-3S, MW-3R, MW-5S, MW-5R, MW-12S, and MW-13S) where the presence of volatile organics or a non-aqueous phase liquid (NAPL) was suspected due to previous site information. The entire water column in the tested wells was monitored for the presence of both light non-aqueous phase liquids (LNAPLs) or "floaters" and dense non-aqueous phase liquids (DNAPLs) or "sinkers" with an oil/water interface probe. No NAPLs were encountered in any of the wells during the Phase II RI.

Prior to ground water sampling, a minimum of three well volumes was purged from each well using a dedicated/decontaminated Teflon bailer. A Teflon leader-line approximately 3-feet in length was attached to the end of the bailer and a polyethylene coated nylon rope was attached to the Teflon line and used to lower and raise the bailer in the monitoring well. The ground water extracted from the well was continually monitored for pH, temperature, specific conductance, and turbidity. Purging of the ground water was continued until the pH, temperature, specific conductance and turbidity stabilized to $\pm 10\%$ on successive well volumes.

Ground water samples were collected using the same bailer used to purge the well. The ground water sample was collected by slowly lowering the bailer into the well until the bailer was filled with water. Once filled, the bailer was raised to the surface where the ground water was transferred into the appropriate sample container. In general, the monitoring wells were sampled for full TCL/TAL less pesticides/PCB analyses, and total chloride. However, the monitoring wells in the southern portion of the landfill (MW-5S, MW-5R, MW-12S, and MW-13S) were also analyzed for pesticides/PCBs. Monitoring well MW-2S could only be sampled for TCL VOCs due to the low volume of water in the well. In addition to the above analyses, monitoring wells MW-3S, MW-3R, MW-8R, MW-13S, and

MW-15R were also analyzed for biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), and dissolved metals (filtered) for ground water treatability information. Ground water samples which were to be analyzed for dissolved metals were filtered through a Ready-Flow™ high capacity 0.45 μm in-line disposable filter immediately following collection. Each sample was labeled according to the procedures described in the Phase II RI Work Plan and placed into an iced cooler prior to shipment to Weston Analytical Laboratories.

In addition to the monitoring well ground water sampling, three leachate spring samples were collected from along the shoreline at the toe of the landfill. The three leachate samples were collected near low tide from three separate, nearby springs on November 4, 1993 and submitted for full TCL/TAL analyses and total chloride. Only these three leachate springs were observed during the Phase II field activities. Field measurements including pH, specific conductivity, and temperature were conducted on each of the samples at the time of collection. Other field tests originally planned for the leachate samples (dissolved oxygen and redox potential) were not completed because the leachate springs were present and sampled at a time when not all of the field instrumentation was present at the site. However, given the typical absence of the leachate springs, it was still believed necessary to collect the samples at this opportunity. The locations from which the three leachate samples were collected are shown on Figure 2-9.

A surface water sample from Narragansett Bay was also collected at the southern end of the site during the Phase II Investigation, and analyzed for the full TCL/TAL analyses, total chloride, hardness, and salinity. The location from which the surface water sample was collected is shown on Figure 2-9. Although the collection of this sample was not in the Phase II RI/FS Work Plan, it was decided during the Phase II field investigation that the sample would be collected to provide a representative sample of the water quality of Narragansett Bay to aid in assessing the ground water data for the site. In addition, the chemical data for this sample was compared to the leachate sample results to aid in assessing if the leachate springs were actually sea water returning during low tide from bank storage or ground water leachate seepage from the site.

In addition to monitoring well installation and sampling, four piezometric well clusters (PZ-1A and -1B; PZ-2A, -2B, and -2C; PZ-3A and -B; and PZ-4A, -B, and -C) were installed within the central portion of the landfill to investigate the tidal influence of Narragansett Bay on the site ground water. The piezometers were constructed in accordance with the approved Phase II Field Sampling Plan (TRC, 1993). Each piezometer was constructed of 1-inch inside-diameter (I.D.), flush-threaded, Schedule 40 PVC riser and 10-slot (0.010 inch) PVC screen. A 2.5 foot section of screen was used at each location. The screen placements for the four piezometer well clusters are as follows:

- Piezometer locations PZ-1 and PZ-3: A - screen intersects the ground water table within the bedrock; and B - screen placed approximately 10 feet below ground water table piezometer.
- Piezometer locations PZ-2 and PZ-4: A - screen intersects the ground water table within the overburden material; B - screen placed 10 feet below ground water table piezometer into bedrock; and C - screen placed 20 feet below ground water table piezometer into bedrock.

The piezometer construction logs are presented along with the site monitoring well construction logs in Appendix G. The locations of the four piezometer clusters are shown on Figure 2-10.

As is presented above, two piezometers were installed at locations PZ-1 and PZ-3 and three piezometers were installed at locations PZ-2 and PZ-4. Given the presence of the ground water table in the overburden at locations 2 and 4, three piezometers could be installed at these locations as specified in the Phase II RI/FS Work Plan; one which intercepts the ground water table in the overburden, one just within the bedrock zone, and the other approximately 10 feet deeper. Whereas, given the occurrence of the ground water table in the bedrock at locations 1 and 3, only two piezometers could effectively be installed; one which intercepts the water table in the bedrock and the other screened approximately 10 feet deeper in the bedrock. Thus, the relationship between the depth of the ground water table and the overburden and bedrock zones did not always allow for the piezometer configuration specified in the work plan. Instead, the most appropriate number of piezometers which could be installed at each location was determined in the field based on the actual site conditions.

2.6.2 Field Measurements and Observations

Several field measurements were collected as part of the site ground water investigation. These measurements included headspace readings of the wells just after opening, periodic and continuous water level measurements of site wells and the pH, specific conductance, Eh, temperature, turbidity, dissolve oxygen, and salinity of each ground water sample. All field measurements and notable observations made during ground water sampling were recorded in the field notebook and are discussed below.

Headspace readings were measured at each of the monitoring wells using an OVA (FID) and an HNu (PID). OVA readings ranged from non-detect to greater than 1,000 ppm. The highest OVA readings

were detected in the shallow ground water monitoring wells located in the main portion of the landfill. OVA readings from the deep monitoring wells ranged from non-detect to 700 ppm at monitoring well MW-11R. HNu readings ranged from non-detect to 2 ppm at monitoring wells MW-4S and MW-12S. No HNu reading was detected at MW-11R. The large difference in volatile organic headspace readings obtained between the OVA and HNu likely indicates the presence of methane gas in the monitoring wells within the landfill since the HNu does not detect methane, unlike the OVA (without a charcoal filter). Headspace levels detected in each of the monitoring wells are provided in Table 2-6.

The ground water levels were measured in each of the monitoring wells on December 20, 1993 and in each of the monitoring wells and piezometers on December 29, 1993 and April 29, 1994 with an electric water sensing device. In addition to periodic ground water level measurements, continuous ground water level measurements were recorded in four of the piezometers and in two of the monitoring wells over two 1-month periods, January 1994 and May/June 1994, to investigate tidal effects on the site ground water. A complete discussion of the periodic and continuous ground water level measurement results is presented in Section 3.3.6.

The ground water field parameters pH, specific conductance, Eh, temperature, turbidity, dissolved oxygen, and salinity were measured prior to ground water sample collection at each well and are provided in Table 2-7. Field measurements of the three leachate spring samples are provided in Table 2-8. The pH of the ground water samples were very similar and ranged from 5.21 to 6.84. The temperature values ranged from 9.1 to 16.3 °C, with most of the ground water temperatures around 12 to 13 °C. The lowest or coldest temperature of 9.1 °C was recorded in well MW-14R which is one of the deeper wells and is screened the deepest into the bedrock of any of the site wells. The highest or warmest temperature of 16.3 °C was measured in bedrock well MW-11R which has been shown have the greatest tidal influence all monitoring wells on the site. The specific conductance of the ground water samples ranged from 0.163 to 5.717 mmhos/cm, with the larger conductivity values typically found in the central and shoreline portions of the site. Dissolved oxygen readings measured during ground water sampling varied across the site from 2.34 to 8.00 mg/l, with no trends evident in the measured values. Ground water salinity values ranged from 0 to 0.17%, with the greatest values measured in the shoreline wells. Recorded oxidation/reduction potential (Eh) values ranged from -58 to 131 mV, with the lowest Eh values or more reducing conditions typically located in the central portion of the site and along the site shoreline. The clarity of the ground water samples collected from the site varied greatly.

Observations made during the ground water sampling event included any unusual appearances or odor of the ground water. These observations were recorded in the field notebook. A garbage-like odor

was noted from the ground water collected from monitoring wells MW-2S, MW-3S, MW-4S, and MW-21S, all located in the central portion of the landfill and screened within the fill material. A petroleum-like odor was noted in monitoring wells MW-5S and MW-12S located in the southern end of the landfill. The ground water from these two wells were also noted as having a slight sheen on the water surface; however, no measurable layer of oil was detected in these wells with an oil/water interface probe.

Each of the ground water monitoring wells and piezometers was also surveyed for location in reference to the Rhode Island Grid System and for elevation by a licensed State of Rhode Island surveyor. The elevations of the top of the PVC inner well casing and the ground adjacent to the well/piezometer were surveyed to the nearest one hundredth of a foot (0.01 feet). All of the well and piezometer coordinates and elevations are provided in Table 2-9.

2.6.3 Hydraulic Testing

After the completion of the ground water sampling at the landfill, single well hydraulic conductivity tests (slug tests) were performed at all of the nine monitoring wells installed during the Phase II RI. In addition, slug tests were performed at three (3) of the monitoring wells installed during the Phase I RI. The hydraulic conductivity estimates obtained from the slug test analysis were used along with site hydraulic gradients and estimated site porosity values to calculate horizontal ground water flow velocities. Hydraulic gradients, site porosities, and horizontal velocities are discussed in Section 3.3.6.

A slug test estimates the hydraulic conductivity and transmissivity of an aquifer from the rate of rise of the water level in a well after a certain volume or "slug" is suddenly removed from the well. Tests which measure the rate of rise of water within the well are known as rising head slug tests. Falling head slug tests estimate the same parameters, however, the test instead measures the rate at which the water level falls in the well following the injection of a slug into the well.

At each well, a pressure transducer connected to an In-Situ, Inc., Hermit 2000 electronic data logger was lowered several feet into the water and secured to the top of the well. For the rising head tests, one or two closed, five-foot, sand-filled PVC cylinders were submerged in the well to displace a portion of the water column. After the water level had returned to the original level, the cylinder(s) were rapidly pulled out to produce an instantaneous drop in hydraulic head. Falling head tests were conducted in a similar manner, with the test beginning with the placement of the cylinder(s) into the well. The piezometric response of the water level was recorded at the data logger according to a preprogrammed logarithmic schedule until the water level had re-equilibrated, or up to a total elapsed

time of one hour, whichever came first. The logarithmic schedule results in one reading every 0.5 seconds for the first 20 seconds, one reading per second for the next 40 seconds, one reading every 12 seconds for 1 to 10 minutes, and one reading every 2 minutes for 10 to 100 minutes of test time.

Rising head tests were conducted on each of the wells selected for hydraulic testing during the Phase II RI and in most cases, two rising head tests were conducted on each well. In addition, falling head tests were conducted on those wells where the water table was above the top of the well screen. Falling head tests are not applicable to wells where the well screen intercepts the water table.

The slug test data was analyzed using SLUGIX™ (Interpex Limited, 1988), an interactive computer slug test analysis program, using the option for the Bouwer and Rice (1976) method for completely or partially penetrating wells in unconfined aquifers. Using this method, the hydraulic conductivity and transmissivity of the aquifer near each well were calculated. The results of the slug tests are discussed in Section 3.3.6.

2.7 PHASE II SEDIMENT AND BIVALVE INVESTIGATION

Off-shore investigation activities including sediment and bivalve sampling were conducted between Phase I and Phase II to determine if any contamination had migrated from the landfill into the adjacent Narragansett Bay. The bivalve sampling included the collection of both mussel and clam samples. The detailed scope of the off-shore investigation activities are presented in an Off-shore Investigation Work Plan prepared by Battelle Ocean Sciences of Duxbury, Massachusetts (Battelle, 1993) and the **Final** Report for the Off-shore Investigation (Battelle, **July** 1994) provided as Appendix R of this report.

2.7.1 Overview of Investigation

The off-shore investigation activities were conducted by Battelle Ocean Sciences (Battelle) under direction of TRC in August 1993. Sediment and bivalve samples were collected from thirty (30) stations adjacent to the McAllister Point Landfill. Samples were collected from both the near-shore intertidal zone and the off-shore subtidal zone. A total of seven near shore composite samples and nine off-shore discrete samples were collected at the site. The nearshore sediment samples were collected as a composite of three nearby stations. The bivalve compositing was conducted by collecting bivalves for one sample over the entire area which represented the station composite. The sediment and bivalve station locations are shown on Figure 2-11. The near shore stations were numbered as NS-1 through NS-21; with stations NS-1 through NS-3 making up the first composite

sample area and so on up to seven composite samples. The off-shore samples were collected from nine discrete station locations numbered OS-22 through OS-30.

The target bivalve species during the sampling were blue mussels (*Mytilus edulis*) and hard-shell clams (*Mercenaria mercenaria*) or quahogs. Blue mussels were collected over each of the seven station areas. If hardshell clams were not present in sufficient numbers, attempts were made to collect the softshell clam (*Mya arenaria*). The clam species population varied with location and sediment characteristics (e.g., energy of environment, water depth, and sediment composition), and was therefore location-specific. Soft shell clams were collected over three near shore stations areas (NS-1/2/3, NS-4/5/6, and NS-19/20/21). Hard shell clams or quahogs were collected at seven of the off-shore stations. Clams were not collected from the last two off-shore stations, OS-29 and OS-30, because only sediment sampling was planned at these locations to assess the sediment depositional conditions in this area.

The sediment samples were analyzed for PAHs, PCBs, TAL metals, acid volatile sulfides (AVS) and simultaneously extracted metals (SEM), total organic carbon (TOC), and grain size. The bivalve samples were analyzed for PAHs, PCBs, and TAL metals. In addition, the mussel samples were analyzed for butyltins. The PAHs included the sixteen priority pollutant PAHs, a series of alkylated PAHs, and additionally environmentally relevant parent PAHs. The PCB analysis was for the determination of twenty individual PCB congener analytes. The NOAA National Status and Trends Mussel Watch Project analytical methods were used for this study (NOAA, 1992). These methods have been developed specifically for the analysis of trace contaminants in marine tissue and sediment. The PAH, PCB, TAL metal, butyltin, AVS and SEM analyses were performed by Battelle. The TOC and grain size analyses were performed by Battelle's subcontractors Global Geochemistry and Geo/Plan Associates, respectively.

The following is a summary of the field sampling techniques for the sediment and bivalve samples. A detailed discussion of the sampling methods is presented in the Off-shore Investigation Report in Appendix R. The sediment samples were collected in 3-inch diameter, 16-inch long clear polybutyrate cores. Attempts were made to drive the core into the sediment at least 15 cm, and ideally to 25 cm. At two of the off-shore locations, a 2-foot sediment core was also collected for archiving and potential future analysis. The actual depth of each core was documented. The water in the cores was siphoned off and the cores were placed upright on dry ice and frozen at the site for transport to the laboratory. The bivalve samples were collected by hand from each sample station. The near-shore bivalve samples were collected approximately evenly distributed between the three station markers that indicated the boundaries of the station composite area. The off-shore discrete samples were collected within

approximately 25 feet of the sediment core sample location at each station. After the bivalve samples were collected they were separated from one another (if necessary) and washed with site seawater to remove any mud and debris. The bivalve samples were double wrapped with aluminum foil, labelled, placed in a sealing plastic bag, and stored on dry ice until transport to the laboratory. Field duplicate samples were also collected of the sediment and bivalve samples.

2.7.2 Field Measurements and Observations

Sample collection forms were completed by Battelle for each station as it was being sampled. The information on these forms included the sample identification code, site and station identification number, latitude and longitude, description of the station locations relative to shoreline stakes and landmarks, sampling date and time, sampling personnel, water depth at time of collection, type of samples collected, and any significant observations. A summary of this information is presented in the report in Appendix R.

The target size range for the mussels was 5 to 8 cm; whereas, the size range for the clams varied significantly depending upon the species and age of the local population. Information on the bivalve number and size (length, weights) is presented in the Appendix R report.

The location of each sample station was determined at the time of sampling with a hand-held global positioning system (GPS) and recorded on the sample collection forms. All sample locations were also professionally surveyed by a licensed State of Rhode Island land surveyor at the completion of the sampling.

2.8 MARINE ECOLOGICAL RISK ASSESSMENT INVESTIGATION

Following the completion of the Phase II RI sediment and bivalve sampling, and completion of the draft final Ecological Risk Assessment Report by TRC in October 1994, EPA and RIDEM indicated that the composite sediment sampling methodology employed by TRC and Battelle Ocean Sciences did not fully characterize the nature and extent of contamination. A sediment and biota sampling program was initiated by SAIC and URI, under contract to B&R Environmental in 1995 that employed grab sampling to better characterize contaminant presence and distribution for discrete near-shore and off-shore stations adjacent to the McAllister Point Landfill. The detailed discussions of the objectives, sampling methodology, results, presentation and interpretations are presented in the Final Marine Ecological Risk Assessment Report (SAIC/URI, March 1997).

3.0 PHYSICAL CHARACTERISTICS

This section of the report presents information on the regional physiography, regional and site-specific geology, regional and site-specific hydrology, and regional and site-specific hydrogeology.

3.1 REGIONAL PHYSIOGRAPHY

This section is divided into three subsections: climate, terrestrial features, and marine features. Regional geology and hydrology will be addressed in separate sections following this discussion.

3.1.1 Climate

The climate at NETC Newport is presented below. Much of the climatological information was obtained from the IAS report, and is referenced as such with page numbers which follow excerpts:

The climate at NETC is greatly influenced by its proximity to Narragansett Bay and Atlantic Ocean, which tend to modify the area's temperatures. Winter temperatures are somewhat higher and summer temperatures lower than more inland areas. Winters are moderately cold in the area, and summers are generally mild with many summer days cooled by sea breezes.

...

The average annual precipitation for the area is 42.75 inches, but this has varied from as little as 25.44 inches to as much as 65.06 inches. Measurable precipitation (.01 inch or greater) occurs on about one day out of every three and is evenly distributed throughout the year. Thunderstorms are responsible for much of the rainfall from May through August. These thunderstorms often produce heavy amounts of rainfall, but their duration is relatively short. Summer thunderstorms are frequently accompanied by high winds which may result in property damage, especially to small boats. The average snowfall during winter is close to 40 inches, ranging from a low of 11.3 inches to a high of 75.6 inches. February is usually the month of greatest snowfall, but January and March are close seconds. It is unusual for the ground to remain snow covered for any long period of time. . . .

Severe weather from tropical cyclones (winds 39 to 73 miles per hour) and hurricanes (winds greater than 73 miles per hour) is a serious threat in the area of NETC. The probability that a tropical cyclone will invade the area is one in five in any year, while the probability of

hurricane force winds invading the area is less than one in fifteen in any year (Outleasing EIS, 1977). The most damage from these severe storms results when they strike at high tide.

(IAS, pp. 5-14 to 5-15)

3.1.2 Terrestrial Features

The topography of the NETC area was shaped by the bedrock geology, glaciation, and recent erosion. The bedrock geology controlled the locations of the ancient river valleys which glaciers subsequently gouged out of the bedrock. The hills are the result of bedrock highs. A mantle of till, on average 20 feet thick, was spread over the bedrock during the Wisconsin glaciation. As the glaciers melted, ocean levels rose and flooded the river valleys forming the passages of Narragansett Bay.

Elevations at NETC range from near mean sea level to 175 feet in the Melville North area. Many areas of NETC have low elevations which are susceptible to flooding during hurricane storm surges. The 100 and 500 year tidal flood elevations for the NETC area are 12.6 feet and 15.6 feet above mean low water, respectively. Areas below these elevations are subject to flooding.

Ninety percent of the land within the boundaries of NETC has slopes of from 0 to 9 percent (Master Plan, 1980). The remaining land has slopes in the categories of 10 to 25 percent and greater than 25 percent. Maps showing slopes on all NETC areas are included in the most recent Master Plan for NETC.

(IAS, pg. 5-15)

The soils in the area of NETC formed in glacial deposits of till and outwash. . . . There are also a few areas with tidal marsh soils along the shores of Narragansett Bay. These tidal marsh areas receive deposits of silt and clay during tidal inundation and from upland areas. These sediments are deposited along with the plant remains of the salt tolerant plants growing in the marshes.

(IAS, pg. 5-21)

There are five basic types of soils at the NETC: mucks, beaches, loams, sands, and urban complexes. The mucks are found in tidal flats and inland depressions which hold ponded water. Loams (mixture

of sand, silt, clay, and organic matter) and sands are found in upland areas on-site and generally drain rapidly. Urban complexes are mixtures of natural soils, imported soils, and urban materials.

¶The flora and fauna of the NETC is strongly influenced by human activity.

The southern portion of the base is heavily industrial with machine shops and other support facility operations. The north portion of the base is divided in land usage between residential, vacant (held for expansion), tank farms, and storage-fueling facilities (industrial). There are no land areas on NETC which have not been disturbed at some time during base operations. . . .

Southern Rhode Island has relatively few forests of mature climax successional stage. Fires, logging, and the agricultural conversion of forest land prior to the Civil War have greatly reduced the extent of climax forest acreage. The predominant forest vegetation in southern Rhode Island is that of abandoned fields in early successional stages, and forests of immature hardwoods. Pure stands of mature softwoods are the least abundant. . . .

The upland vegetation within the NETC is restricted primarily to perennial weeds and grasses. The majority of trees is located near residences, drainageways and around the tank farms. The upland vegetation of NETC reflects complete management (mowing) or recent disturbance of the area.

The habitats available for lowland vegetation on the NETC are located on the waterfront along Narragansett Bay and surrounding the small impoundments and their drainage further inland. Those areas located on the waterfront are comprised of borrow pits along the railroad tracks and abandoned disposal areas where excavation has created depressions.

The largest of these depressions is the Melville North landfill. This area was excavated during landfill operations and depressions were created. These depressions support a limited diversity of wetland flora including reeds and various shrub and grass species. Borrow pits can be found along the railroad tracks which parallel the shoreline extending from McAllister Point northward to the Melville North landfill. These are individually less than one acre in size and contain similar wetland species with a lack of diversity.

All lowlands on NETC have been artificially created and are in a disturbed condition. The potential for maintaining diversified floral species within the lowlands of NETC is poor. This area did not previously contain these habitats, and sills and drainage are not conducive to their successional development.

The fauna of the region have been affected by similar disturbances (clearing, excavation, construction) which led to the impoverishment of the flora. Field studies have indicated impoverished fauna, particularly of reptile and mammal types. Widespread habitat destruction over a period of several hundred years has caused emigration or elimination of many species. As a result, the present regional fauna consist primarily of species of wide distribution and ecological tolerances, high adaptability, and nonrestrictive habitat requirements.

No large animals such as deer, turkey, or cougar are known within the boundaries of NETC. However, red fox, raccoon, rabbit, and gray squirrel are present in the woodlands.

Mammalian forms expected to be found on base include: the Eastern chipmunk, New England cottontail rabbit, white-footed mouse, short tailed shrew, gray squirrel, and red squirrel. Several of these species inhabit the few remaining wooded areas on base slated to be excised.

Various herptiles occupy NETC habitats. Common ones include the red backed salamander, American toad, wood frog, eastern gartersnake, northern black racer and the wood turtle.

Common herptiles of the wet areas include the American toad, spring peeper, bullfrog and northern watersnake (Natrix sipedon), along with the snapping turtle.

Avian species which may be found within the NETC upland habitats include the bobolink, meadowlark, chimney swift, kingbird, eastern phoebe (Sayorius phoebe), barn shallow, red-tailed hawk and kestrel.

In addition, game birds, such as the ring-necked pheasant, bobwhite quail and the mourning dove, are highly dependent on the plant communities on the base.

(IAS, pp. 5-37 to 5-39)

3.1.3 Marine Features

The Narragansett Bay marine features are presented below. Much of the marine features information was obtained from the IAS report, and is referenced as such with page numbers which follow excerpts.

Narragansett Bay occupies three former river valleys which have been drowned by the advance of the Atlantic Ocean. Narragansett Bay is 20 miles long and 11 miles wide. The bay has a surface area of 102 square miles. The shape of the former river valleys has changed little since the last glaciation. The bay is divided into an eastern and western passage by Conanicut Island. The average depth of the bay is 30 feet. In the western passage, the average depth is 25 feet, while in the eastern passage, the average depth is 50 feet. The eastern passage, which NETC fronts, allows deep water access up to the south end of Prudence Island. Channel depth exceeds 80 feet in the eastern passage from Gould Island seaward, and depths in excess of 150 feet occur near the mouth of the bay.

Freshwater flows into the bay at an average rate of 1,239 cubic feet per second from a drainage area of 1,850 square miles. This accounts for 90 percent of the annual flow of fresh water into the bay. The other 10 percent is provided by direct rainfall into the bay and sewage effluent. An average of some 43 inches per year of precipitation falls directly into the bay. The freshwater input into the bay is small compared to the large volume of saline water in the bay. The relatively small freshwater input into the bay results in the bay water being well mixed with only small salinity gradients through the bay. Salinity ranged from about 22 parts per thousand (ppt) in the Providence River to 32 ppt at the mouth of the bay.

Tides are semi-diurnal in Narragansett Bay with a mean range of 3.6 feet at the mouth of the bay and 4.6 feet at the head. About 13 percent of the volume of water in the bay is exchanged each tidal cycle (Oviatt and Nixion, 1973). This is over 250 times the mean tidal river flow into the bay during a tidal cycle. The tidal movement is the single most important factor in water circulation in the bay. Tidal currents range in velocity from 0.07 to 2.3 feet per second (Atlantic Scientific, 1982). The faster velocities occur in the east and west passages near the mouth of the bay, while slower velocities occur in the upper bay.

Non-tidal current in the bay moves slowly at an average of 0.34 feet per second (Olsen, 1980). Although the non-tidal currents are slow, they are important in the exchange of water out of the bay and into Rhode Island Sound. The amount of time needed to transport a particle of water from Providence to the mouth of the bay is some 45 to 50 days (Olsen, 1980). However, this time can vary depending on the winds. Research seems to indicate that southeast winds blowing up the bay may prevent surface waters from flowing down the bay (Olsen, 1980).

The sediments in the bay are contaminated with heavy metals, hydrocarbons, and sewage sludge (Master Plan, 1980). A survey conducted by EPA (EPA, 1975) has shown the presence of heavy metal concentrations in the sediments in interstitial waters north of the Naval Complex. The values found were 7,048 mg/l manganese, 2,351 mg/l zinc, 559 mg/l iron, 55 mg/l lead, 46 mg/l nickel, 44 mg/l copper, and less than 1 mg/l cadmium. These contaminants are the result of industrial and municipal discharges into the bay.

The water quality for Narragansett Bay as determined by the State of Rhode Island is shown in Figure 5.3-8 (Figure 3-1). Most of the bay is Class SA, which means it suitable for direct shellfish harvesting, bathing and other water contact sports. Areas classified as SB are suitable for shellfish harvesting after depuration and for bathing and other recreational activities. Areas classified as SC are suitable for fish, shellfish, and wildlife habitat areas, but the shellfish cannot be harvested. The entire shoreline of NETC is closed to shellfishing. ❏

(IAS, pg 5-28, 5-31)

❏ The marine ecosystem of Narragansett Bay forms the shoreline of the base for approximately 9 miles. The bay is of great economic and aesthetic importance of the entire southern portion of Rhode Island. It is an estuary and the fishery resources of the bay are extremely important. The annual value of the combined commercial and sport fishing is estimated at several million dollars.

In Narragansett Bay, the phytoplankton are by far the most important primary producers, synthesizing organic matter from carbon dioxide and inorganic nutrients with sunlight as the energy source. In shallower, less turbid estuaries, seaweeds and sea grasses may assume this role. . . .

The phytoplankton and zooplankton are rich and varied in Narragansett Bay. The species composition is relatively uniform from station to station indicating a good movement of the water mass within the bay. The estimated productivity figure of 84 grams of carbon per square meter per year is also indicative of good environmental conditions. . . .

Most species of finfish move in and out of Narragansett Bay following well established seasonal patterns. These migratory movements, although different for each species, provide for distinct summer and winter populations of finfish. The migrations are related primarily to

temperature, and the major shifts between winter and summer populations take place when the water temperature is about 10°C (50°F).

Narragansett Bay is visited each year by a great many species of fish because it lies along the boundary between southern and northern populations. Thus, herring from Georges Bank may visit the bay at the end of their southward midwinter migrations, and species such as scup and occasional exotic tropical strays brought up by the Gulf Stream make their appearance during the summer. In all, over 100 species may appear in any given year, about half of which are occasional visitors.

In various studies during the 1970's a total of 99 species of fish have been taken from Narragansett Bay (Oviatt and Nixon, 1973; Jeffries and Johnsons, 1974; Camp, Dresser and McKee, 1978; Department of the Navy, 1978). Ten species accounted for 91 percent of the fish catch with the winter flounder, the sand dab, scup and butterfish the most commonly occurring fish taken. These four species are also of commercial importance. . . .

A year-long, bay-wide survey (excluding Mount Hope Bay and the Sakonnet River) of bottom fish made in 1972 yielded an annual minimum estimate of 117 individuals, or 28.5 pounds per acre. This translates into a standing crop of 1.9 million pounds of bottom fish. (The margin of error gives a range of 0.8 to 2.9 million pounds.) This is comparable to other estimates made using similar sampling techniques in New England estuaries and offshore fishing grounds. This bay-wide survey showed that despite the constant movement of species in and out of the bay, the total biomass of bottom fish is remarkably steady.

There are fewer species of pelagic fish than of bottom fish in the bay.... All the pelagic species are highly seasonal, with anchovies and sea herring appearing in the winter, and menhaden, bluefish, and striped bass in the summer. When schools of menhaden are present, their biomass may be far greater than that of the bottom fish. Population estimates for the bay are for as much as 16 million pounds of menhaden and 2 million pounds of bluefish and stripers. . . .

The benthic community in Narragansett Bay plays a critical role in the functioning of the ecosystem. Benthic filter feeders consume significant amounts of phytoplankton, and the bay's high primary productivity may be attributable in good part to the recycling activity of the benthos. . . .

The shellfish of Narragansett Bay include both bivalve molluscs (clams, oysters, scallops) and decapod crustaceans (crabs, shrimp, lobster). Lobster are caught both within and outside of Narragansett Bay. Lobsters are trapped in much of Narragansett Bay including the Coddington Cove area. Some lobster traps are located a short distance from Pier 2.

Bivalves harvested in the region of Narragansett Bay include the northern quahog (known as the bay quahog in Rhode Island), soft shell clam, and Atlantic bay scallop.

The quahog is the most valuable shellfish resource within the bay system. The number of people harvesting this organism for individual or commercial use is increasing. Shellfishing areas open to the public do not include the NETC shoreline.

Quahogs are the most abundant benthic animal of their size in Narragansett Bay (URI, 1980, Bulletin #40). In recent years, the total Rhode Island harvest ranged from 5 million pounds of meats in 1955 to 2 million pounds in 1978, the great majority of which are taken from the bay. . . .

Water pollution continues to take a heavy toll in the reduced numbers of quahogs available for harvesting. The primary criterion used in closing areas to shellfishing is the abundance of fecal coliforms in the water; these are an indicator of sewage and the pathogenic bacteria and viruses it may contain. A shellfish depuration plant is capable of killing harmful microorganisms that might be found within the shellfish, but has not been built in the bay area. Unfortunately, pathogenic microorganisms are only one aspect of the pollution in the upper bay. There are signs that Providence River quahogs are not healthy and may be dying off at least in some areas. Several researchers are concerned that they may be accumulating significant levels of petroleum or heavy metals, which are not removed by the usual depuration methods.

Aquaculture within the bay includes the eastern oyster and the blue mussel. Two species of clams are harvested offshore and landed at bay fishing ports. They are the Atlantic surf clam and the ocean quahog. Most of the northern areas of the bay are closed permanently or opened on a conditional basis. Most of the lower bay localities are opened. The shellfish area just south of the Newport Naval Facility is permanently closed because of municipal sewage discharge.

A small commercial fishery for squid occurs in the bay. A large squid trap is presently located in Coddington Cove (RIDEM, 1982) Sportsmen harvest squid with rod and reel throughout the spring and early summer months in the lower bay.

The blue crab and the rock crab are taken throughout the bay by recreational fishermen. Both of these species inhabit the shallow bays, sounds, and pools during the warm months and migrate to deeper water in the fall. The commercial fishing for blue crabs ended in 1938 with a severe population decline. The reason for the decline is not understood, but pollution from heavy metals and chlorinated hydrocarbons may have played an important role. At present, the population of blue crabs is increasing. The commercial use for rock crabs will be expanded with the development of new techniques for extracting the crab meat from the shells.

(IAS, pp. 5-40 to 5-47)

3.2 GEOLOGY

3.2.1 Regional Geology

The regional geology for NETC Newport is presented below. Much of the regional information was obtained from the IAS report, and is referenced as such with page numbers which follow the excerpts.

NETC is located at the southeastern end of the Narragansett Basin. This basin is a complex synclinal mass of Pennsylvanian aged sedimentary rocks and is the most prominent geologic feature in eastern Rhode Island and adjacent Massachusetts. Narragansett Basin is an ancient north to south trending structural basin originating near Hanover, Massachusetts. The basin has a length of approximately 55 miles and varies from 15 to 25 miles wide. The western margin of the basin is in the western portion of Providence, Rhode Island, and the eastern margin runs through Fall River, Massachusetts. Exposures of older rocks on Conanicut Island and in the vicinity of Newport suggest that the southern extent of the basin is near the mouth of Narragansett Bay.

The rocks of the Narragansett Basin are non-marine sedimentary rocks of Pennsylvanian age. The rocks are chiefly conglomerates, sandstones, shales, and anthracite. Total thickness of the strata in the Narragansett Basin has been estimated at 12,000 feet. Both vertical and lateral irregularities in the lithologic character of the rock are present within the basin. Many folds and some faults occur throughout the basin, but the character and amount of the folding

and faulting are not clearly known. The sedimentary rocks of the basin are believed to have been deposited in a lowland area which was surrounded by an upland area of considerable relief. The presence of coal beds within the basin also indicates that there were fairly extensive swampy areas. Figure 5.3-2 (Figure 3-2) shows a general geologic map of Rhode Island.

The bedrock of the Narragansett Basin has been divided into the following five units: the Rhode Island Formation, Dighton Conglomerate, Wansulta Formation, Pondville Conglomerate, and Felsite at Diamond Hill. AT NETC and most of the surrounding area, the bedrock is entirely of the Rhode Island Formation, and thus, only this unit will be examined in detail. Figure 5.3-3 [in IAS] represents a detailed look at the geology at NETC and the surrounding areas.

The Rhode Island Formation is the most extensive and thickest of the Pennsylvania formations in Rhode Island. The vast majority of the Narragansett Basin is underlain by this formation. Included within the Rhode Island Formation are fine to coarse conglomerate, sandstone, lithic graywacke, graywacke, arkose, shale and a small amount of meta-anthracite and anthracite. Most of the rock is gray, dark gray, and greenish, but the shale and anthracite are often black. Crossbedding and irregular, discontinuous bedding is characteristic of the formation. Rocks of the Rhode Island Formation, which are in the northern portions of the basin, are strong and indurated but are not metamorphosed. However, those rocks in the southern portion of the basin, such as the NETC, are metamorphosed, and these rocks contain quartz-mica schist, feldspathic quartzite, garnet-staurolite schist, and some quartz-mica-sillimanite schist. The beds of meta-anthracite and anthracite are mostly thin, but many areas within basin have been mined. Vein quartz, fibrous quartz, and pyrite are commonly associated with these coal layers, and the ash content is high.

Within the Rhode Island Formation, there are a few areas of thick conglomerates. These conglomerate layers are gray to greenish in color and are mostly very coarse. These conglomerates consist of pebbles, cobbles, and boulders (up to several feet long), interbedded with sandstone and graywacke. The stones are predominantly quartzite and have been elongated as a result of tectonic forces in the southern portion of the basin. These thick conglomerate layers are more resistant to erosion than are the surrounding rocks and thus, are topographically higher. Coasters Harbor Island is mostly covered with this conglomerate material.

Throughout the Narragansett Basin, the Pennsylvanian rocks are underlain by pre-Pennsylvanian igneous and metamorphic rocks such as Bulgarmarch granite, Metacom granite gneiss, porphyritic granite and slate and quartzite. For the most part, these basement rocks are deeply buried beneath the Pennsylvanian rocks. However, these older rocks occur north of NETC in the Bristol area and south of NETC in the Fort Adams and Newport Neck areas and on the southern tip of Conanicut Island. Rose Island and Goat Island also have older metamorphic rocks of slate and quartzite.

Overlying the Pennsylvanian rocks of the Narragansett Basin are surficial deposits of Pleistocene sediments. These Pleistocene sediments owe their origin to the Wisconsin glaciation which covered the area with ice several thousand feet thick. As the glaciers receded some 10,000 to 12,000 years ago, they deposited unconsolidated glacial materials of variable thicknesses throughout the Narragansett Basin area. The unconsolidated glacial material ranges from 1 to 150 feet thick, being thicker in the valleys and thinner in the uplands. The glacial material consists of till, sand, gravel, and silt. These glacial deposits were derived from shale, sandstone, conglomerate, and in a few places, coal.

The glacial materials serve as the parent materials for the soils in the area. Areas where sand and gravel were deposited serve as important regional mineral sources. . . .

(IAS, pp. 5-18, 5-21)

Much of the geologic information contained in this section was obtained from Geological Survey Bulletin 1295 (Quinn, 1971). . . .

(IAS, pg. 5-21)

According to the "Bedrock Geologic Map of Rhode Island," bedding features in the bedrock at McAllister Point strike north and dip approximately 35 degrees east. The foliation strikes north and dips approximately 50 degrees east. Although highly fractured, essentially open zones have been noted in the sedimentary bedrock at the northern end of the Narragansett basin. No such faults are documented to exist in the central Aquidneck Island area.

Several soil borings were completed into bedrock as part of a Remedial Investigation conducted at four RI/FS sites within the NETC (TRC, 1991). Generally, the bedrock consisted of a grey-green to black, highly weathered to competent, carboniferous shale. Rock cores indicated a high degree of fracturing

with quartz and iron oxide deposits present along the fracture planes. Depth to bedrock varied amongst boring locations from approximately one to 33 feet below ground surface at the four RI/FS sites.

Glacial till deposits were encountered at several locations overlying the bedrock at NETC during the RI investigations. The till material was characterized as containing fine to coarse sand with varying amounts of silt, with some horizons containing weathered shale fragments. A single Shelby Tube sample of the till indicated a triaxial permeability of 2.7×10^{-7} cm/sec (7.7×10^{-4} feet/day). Natural deposits of sand and silt and organic muck were also encountered.

3.2.2 Site Geology

The soil boring activities performed at the McAllister Point Landfill site under the Phase I and Phase II RI, as well as under previous subsurface investigations, provided information on the site geology. Previous subsurface investigation activities included the drilling and sampling of three soil borings completed for the installation of three (3) monitoring wells. Subsurface investigation activities conducted during the Phase I RI included the drilling and sampling of thirteen (13) test borings and seven (7) well borings. Subsurface investigation activities conducted during the Phase II RI included the drilling and sampling of fourteen (14) soil borings, nine (9) well borings, and ten (10) piezometers. The locations of the Phase I and Phase II RI borings, wells and piezometers, as well as the three previous site investigation wells, are shown on Plate A-1 in Appendix A. Using the information from these logs, five geologic cross sections were developed for site. The locations of the five geologic cross sections are shown on Figure 3-3. The five geologic cross sections are presented as Figures 3-4 through 3-8.

The overburden soils on this site consists of soil, fill, and glacial till deposits. All of the test borings except for borings B-14 and B-27, located at the northern end of the site, and boring B-13, completed upgradient and off-site to the east, encountered fill material consisting of household-type and/or construction-type debris. In addition, all of the monitoring wells installed at the site also encountered fill material, with the exception of the four off-site, upgradient wells, MW-14, MW-15, MW-16, and MW-23.

The thickness of the fill material ranged from 3 feet (MW-1) and 8 feet (MW-4) at the northern and eastern periphery of the site, to 25 feet (MW-8) and 27 feet (MW-11) in the western portion of the landfill along Narragansett Bay. The boring for well MW-21, previously installed at the western edge of the central portion of the landfill, reportedly encountered 38 feet of fill material; however, the

installation of piezometers (PZ-2 nest) approximately 30 feet north of MW-21 found fill only extended to 23 feet below ground surface. The fill material encountered at the site consisted of a wide variety of municipal and industrial wastes (e.g., plastic, wood, paper, cloth, garbage, construction debris). In several of the borings and wells completed in the north-central portion of the site (B-1, B-2, B-4, B-16, B-17, B-18, and MW-2) a thin layer of ash material was noted and is believed to be the waste product of an on-site incinerator which operated in that area of the site. The fill material across a majority of the site appears to have been deposited directly upon the bedrock surface.

Overlying the fill material, at several locations across the landfill, is a layer of silt, clay, and shale fragments ranging in thickness from 0 to 4 feet. This layer is presumably the cover material or "cap" which was reportedly placed on-site when the landfill was closed in 1973. This material is discontinuous across the site, and was found primarily in the central and north-central portion of the landfill. A soil horizon consisting of fine sand, silt, and shale fragments was also encountered overlying the fill material in several soil and well borings, completed at the southern end of the landfill; however, this material was not continuous across the southern end of the site. A thin horizon of fine sand and silt was also noted in boring B-1, which was completed in the northern portion of the landfill. In general, the material found at the southern and northern ends of the landfill did not appear to be the same "cap" material encountered in the central landfill area.

Glacial till deposits were observed directly overlying the bedrock up to ground surface in the borings at the northern periphery of the site (B-14 and B-27), and in the upgradient, off-site borings and wells (B-13, MW-14, MW-15, MW-16). Till deposits were observed beneath the fill and overlying the bedrock in the several of the borings and wells completed at the northern and southern ends of the site (B-8, B-10, B-23, B-25, B-26, MW-1, MW-5, MW-12, MW-13). Till was also encountered in boring B-4 and piezometers PZ-1 and PZ-2, which were completed in the central portion of the site. The till encountered consisted primarily of fine to coarse sand and silt, with some horizons containing weathered shale fragments. The till varied in thickness from 3.0 feet (B-14, B-27, MW-14) to 14 feet (PZ-1).

During the Phase I RI, one undisturbed Shelby tube soil sample was collected from the till encountered at the southern end of the site (MW-5). The Shelby tube was collected from 14 to 15.5 feet below grade. The undisturbed soil sample was tested by Empire Soils Investigations, Inc. for triaxial permeability, particle size, and Atterberg limits. The till sample was determined to have a permeability of 2.69×10^{-7} cm/sec (7.626×10^{-4} ft/day). Grain size analysis indicated the till sample consisted of 23.5% gravel, 44.6% sand, 13.4% silt, and 18.5% clay. According to its Atterberg limits, the soil sample was classified as "non-plastic", which is typical of till.

The bedrock encountered at the McAllister Point Landfill site consists of a grey-brown to black, highly weathered to competent, fissile carboniferous shale. Cores of the shale exhibited a high degree of fracturing with quartz and iron-oxide deposits common along some of the fractures. Other fractures were filled in with silt and clay or calcite. All but four of the soil borings were completed to the depth of the bedrock surface in Phase I. All of the Phase II soil and well borings were completed to a minimum depth of the bedrock surface. The depth to bedrock at the site varies from 3 feet below ground surface (B-14 and B-27) to 28 feet below ground surface (MW-11). In the three upgradient, off-site wells, the depth to bedrock ranges from 3 to 8 feet below ground surface. A bedrock contour map of the site is provided as Figure 3-9. The thickness of the weathered bedrock zone, as determined by auger refusal, ranges from 1 foot (B-18) to over 49 feet (B-24). The bedrock surface generally exhibits a uniform, westward slope across the site, towards Narragansett Bay. Although findings indicate the presence of fractures or joints in the surface of the shale bedrock, site-related bedrock ground water contamination was found to be "low". Bedrock beneath the site may not likely be a primary pathway for ground water contamination based on the current site data. Ongoing long-term ground water monitoring would be conducted by the Navy to assess whether contaminant migration is occurring and whether downgradient environmental media may be affected.

3.3 HYDROLOGY AND HYDROGEOLOGY

3.3.1 Regional Surface Water Hydrology

The regional surface water hydrology for NETC Newport is presented below. Much of the regional information was obtained from the IAS report, and is referenced as such with page numbers which follow the excerpts:

NETC is located within the Narragansett Bay Drainage Basin. This drainage basin covers an area of 1,850 square miles, 1,030 square miles of which are in Massachusetts and 820 square miles of which are in Rhode Island. All surface water drainage from the basin is into Narragansett Bay. Three major rivers, the Taunton, Blackstone, and Pawtucket, as well as the Providence River and a number of smaller rivers and streams, drain into Narragansett Bay. Discharge from Narragansett Bay is into the Atlantic Ocean between Point Judith and Sakonnet Point in Rhode Island.

Throughout NETC, the surface drainage is westward toward Narragansett Bay with the exception of one area in Tank Farm #2 which drains eastward into Melville Reservoir. Surface drainage at NETC is provided by the Melville Ponds, Normans Brook, Lawton Brook and

Reservoir, Gomes Brook, a stream and pond in the northeastern portion of NUSC, and a stream discharging into Coasters Harbor. The surface drainage for NETC is shown in Figure 5.3-6 [IN IAS]. All these streams discharge into Narragansett Bay. . . .

The Melville Ponds have been disposed of by GSA and are now part of the Melville Public Fishing Area.

While these streams and ponds receive drainage from many of the areas within NETC, a substantial portion of the NETC area drains directly into Narragansett Bay or infiltrates into the soil before reaching a stream or body of water. Direct runoff into Narragansett Bay would especially occur following thunderstorms. . . .

(IAS, pp. 5-26, 5-28)

The potential for pollutant migration by surface drainage at NETC is greatly increased by its proximity to Narragansett Bay. Many of the waste disposal areas, such as the McAllister Point landfill, Melville North disposal site and Gould Island disposal site, are located right along the shoreline of Narragansett Bay. Surface drainage from these areas is directly into the bay. The NETC area is frequently subjected to thunderstorms during which intense periods of rainfall are common. Surface drainage into the bay would be greatest following these thunderstorms.

Pollutants from these portions of NETC drain into the Melville Ponds, Normans Brook, Lawton, Brook, Gomes Brook, and the NUSC stream and would also migrate off-site. All of the streams discharge directly into Narragansett Bay.

(IAS, pg. 5-34)

3.3.2 Regional Surface Water Classifications

The surface water quality classifications for Narragansett Bay, as determined by RIDEM, are shown on Figure 3-1. Most of the Narragansett Bay is classified as Class SA, which means it is suitable for bathing and contact recreation, shellfish harvesting for direct human consumption, and fish and wildlife habitat.

Areas classified as Class SB are suitable for public drinking water after depuration, agricultural uses, bathing, other primary contact recreational activities, and fish and wildlife habitat. Areas classified as

Class SC are suitable for boating, other secondary contact recreational activities, fish and wildlife habitat, industrial cooling, and good aesthetic value.

Two freshwater streams located on NETC property have been classified as Class B surface waters. Class B surface waters are suitable for public water supply with appropriate treatment, agricultural uses, bathing, other primary contact recreational activities, and fish and wildlife habitat. A description of water quality classifications for Narragansett Bay in the NETC area, as obtained directly from the State surface water quality regulations (RIDEM, Division of Water Resources, Section 6 - Water Quality Standards, Appendix A, Narragansett Bay Drainage Basin) is provided in Table 3-1.

3.3.3 Site Surface Water Hydrology

There are no surface water bodies present on the McAllister Point Landfill site. The general site topography slopes in an east to west direction. Surface water on the site (precipitation or runoff from surrounding higher elevations) either evaporates, infiltrates into the site soils, or flows overland to surrounding lower elevation areas or the adjacent Narragansett Bay. During periods of heavy rainfall, ponded water forms in a several small depressions located in the north-central and central portions of the site and in a larger depression in the south-central portion of the site. The western edge of the entire site, which borders Narragansett Bay, is at an elevation ranging from approximately 15 feet higher in the southern portion of the site to approximately 30 feet higher in the northern portion of the site than the beach shoreline along the bay. It is likely that surface water runoff from the site is limited by the general presence of low-lying areas on the site landward from the bank. The presence of these areas and the surrounding site topography results in the accumulation of ponding of overland flow in these areas inland from the landfill periphery. At low tide, water or springs have been observed discharging from the bottom of the landfill bank along the western edge of the site, into the bay.

3.3.4 Regional Ground Water Hydrogeology

The regional ground water hydrology for NETC Newport is presented below. Much of the regional information was obtained from the IAS report, and is referenced as such with page numbers which follow the excerpts:

Many areas on Aquidneck Island, on which NETC is located, obtain their water supply from wells. Areas relying on ground water are mostly north of the Middletown area, but there are wells throughout the entire island. Most ground water is used for domestic needs, although some is used by small industries and businesses.

Ground water on Aquidneck Island is obtained from the unconsolidated glacial deposits of till and outwash and from the underlying Pennsylvanian bedrock. Throughout the area, depth to ground water ranges from less than one foot to about 30 feet, depending upon the topographic location, time of year, and character of subsurface deposits. The average depth to the ground water is around 14 feet on Aquidneck Island and moves from areas of high elevations to Narragansett Bay or the Sakonnet River.

Seasonal water level fluctuations are common in the area. These fluctuations range from less than 5 feet to as much as 20 feet on the hills. In the valleys and lowland areas, the fluctuations are generally less than 5 feet. 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 autumn and following winter thaws.

The unconsolidated glacial deposits range in thickness from less than one foot near the rock exposures to about 50 feet throughout Aquidneck Island. Most of the glacial deposits are till, but isolated outwash areas occur. In the NETC area, the glacial deposits are till with a thickness of less than 20 feet. Wells completed in the till are usually dug and range in depth from less than 10 feet to as much as 75 feet. The average depth for these wells is about 20 feet. These dug wells are usually 2 to 3 feet in diameter and are usually dug down to the top of the bedrock.

The yield of till wells varies considerably depending upon the type and thickness of the water-bearing deposits penetrated. Yields range from less than one to as much as 120 gallons per minute. Under normal weather conditions, till wells yield a few hundred gallons of water per day and are adequate for domestic supplies. The large diameter of dug wells also provides substantial water storage area between periods of use. Each foot of water in a 3-foot diameter well represents storage of 53 gallons. However, these wells are subject to going dry during seasonal or unusual droughts.

Bedrock wells in the area range from 14 to 1,300 feet in depth. The average depth for these bedrock wells is 135 feet. Yields from bedrock wells range from less than one to as much as 55 gallons per minute. Most wells yield less than 10 gallons per minute. The yields vary considerably in the bedrock over short distances because the joints and fractures which transmit water to the wells occur intermittently. Joints and fractures are most numerous and widest near the top of the bedrock and become fewer and narrower with depth. Bedrock wells

seldom go dry, but yields can be extremely low if not enough fractures and joints occur in the area of the well.

The chemical characteristics of the ground water are similar throughout the area, and the water is generally satisfactory for most ordinary uses. Most ground water in the area is soft or only moderately hard, with ground water from till generally containing less mineral matter and being softer than ground water from bedrock. Areas where the ground water has high iron content are scattered throughout the area, being most numerous around Newport and Middletown and the northern part of Portsmouth. Wells which have a high iron content usually penetrate only rocks of Pennsylvanian age.

In scattered locations near the shoreline, over-pumping has led to salt water intrusion in some wells. Bedrock wells are not as easily contaminated with salt water as are till wells, but the chance of contamination increases as the depth of the well below sea level increases.

No wells were identified within the boundaries of NETC other than on Gould Island, although there are numerous wells in close proximity. These wells are upgradient of NETC. . . .

The 1 to 120 gallons per minute well yield range for till wells appears to be more appropriate for wells completed in "unconsolidated deposits", which include stratified sand and gravel interbedded with clay and silt.

Although till may be considered an unconsolidated deposit, the upper limits of the referenced well yield range are more likely appropriate for outwash, which is fairly well sorted and stratified. Based on a review of the ground water map of the Prudence Island and Newport Quadrangles (USGS, 1964), the referenced high yield well (120 gpm) is a shallow public supply well on Prudence Island approximately 5.5 miles north of the site.

(IAS, pp. 5-31 to 5-34)

The ground water at NETC is very shallow, being less than 10 feet below the surface in most areas. This shallow depth makes ground water contamination at NETC very possible. Those pollutants which do find their way into the ground water would migrate to the west and discharge into Narragansett Bay. NETC extends along the western shoreline of Aquidneck Island, and the ground water only has to migrate a short distance before discharging into Narragansett Bay.

The soils occurring at NETC have permeabilities which are moderate to moderately rapid, and they do not restrict the vertical movement of water. The glacial till, from which these soils were derived, is generally less permeable than the overlying soils but does not represent a barrier to the vertical migration of water. Therefore, it is possible that any contaminant transported in this water could contaminate the ground water. There are also isolated areas where the bedrock occurs at the surface. Contamination is possible in these areas through the cracks and fissures which commonly occur in the bedrock.

(IAS, pg. 5-34)

The well yields for those bedrock wells closest to the site range from 3 to 7 gpm. The closest of these wells is approximately 0.4 miles southeast of the southern end of the site.

Information obtained from the Phase I Remedial Investigations indicated that, in general, ground water on NETC flows from east to west towards Narragansett Bay. Depth to ground water ranged from approximately four to 28 feet below ground surface at the four RI/FS sites. Slug tests conducted on monitoring wells at these sites indicated that the hydraulic conductivity of the till unit encountered above the bedrock ranged from 0.22 to 0.44 feet per day and the upper bedrock hydraulic conductivity ranged from 0.029 to 0.21 feet per day. The RI report noted that bedrock test data produced hydraulic conductivities higher than those normally attributed to shale (3.28×10^{-4} to 3.28×10^{-8} feet per day (Driscoll, 1987).

3.3.5 Ground Water Classifications

The Rhode Island Department of Environmental Management (RIDEM) has classified ground water in Rhode Island to protect and restore the quality of the state's ground water resources for use as drinking water and other beneficial uses, and to assure protection of the public health and welfare, and the environment. The ground water under the four RI/FS sites has been classified as follows:

<u>RI/FS Sites</u>	<u>RIDEM Ground Water Classification</u>
Site 01 - McAllister Point Landfill	Class GA-NA
Site 09 - Old Fire Fighting Training Area	Class GB
Site 12 - Tank Farm Four	Class GA-NA
Site 13 - Tank Farm Five	Class GA-NA

Ground water classified GAA includes those ground water resources which the Director (RIDEM) has designated to be suitable for public drinking water without treatment and which are located in one of the three following areas:

1. Ground water reservoirs and portions of their recharge areas as delineated by RIDEM;
2. A 2,000 foot radius circle around each community water system well or within the delineation of a wellhead protection area to each well delineated by RIDEM;
3. Ground water dependant areas, such as Block Island, that are physically isolated from reasonable alternative water supplies and where the existing ground water supply warrants the highest level of protection.

Ground water classified GA is known or presumed to be suitable for drinking water without treatment. Ground water classified GB may not be suitable for drinking water without treatment due to known or presumed degradation. GB classified ground water is primarily located at highly urbanized areas or is located in the vicinity of disposal sites for solid waste, hazardous waste or sewerage sludge. Areas which are unclassified are presumed by RIDEM to be Class GA ground water.

Non-attainment (NA) areas are those areas which are known or presumed to be out of compliance with the standards of the assigned classification. The goal for non-attainment areas is restoration to a quality consistent with the classification.

The RIDEM Ground Water Quality Regulations were codified into Rhode Island law in May 1992 (Regulation DEM-GW-01-92, May 1992) and amended in July 1993. Figure 3-10 indicates the relative location of the four RI/FS sites and RIDEM ground water classes.

3.3.6 Site Ground Water Hydrogeology

Ground water levels were measured in the twenty monitoring wells installed during the Phase I and Phase II RI, as well as the three wells installed during the Confirmation Study, on December 20 and 29, 1993, and April 29, 1994. Ground water levels were concurrently measured in the site piezometers on December 29, 1993 and April 29, 1994. A summary of all of the ground water

elevation data for the site is presented in Table 3-2. Representative shallow and bedrock ground water contour maps for the site are presented as Figures 3-11 and 3-12 for December 29, 1993. Ground water contour maps for all other Phase I and Phase II elevation measurements are provided in Appendix I.

As with the Phase I data, the ground water contour maps indicate that the site ground water is flowing from east to west, towards the Narragansett Bay. The Phase II ground water contour maps also provide further definition of the site ground water flow characteristics as a result of the additional water level measurements from the monitoring wells and piezometers installed in Phase II. Based upon the ground water elevation data obtained for the site, the highest observed ground water elevations occurred in April for both Phase I and Phase II. The lowest observed water level elevations were measured during Phase I in September, 1990.

The depth to ground water across the site varies significantly and is generally a function of the changing site topography and the proximity to Narragansett Bay. At the southern end of the site, the depth to ground water varies from approximately seven feet below grade during the wetter, spring-time months, to approximately nine to ten feet below grade during the fall and winter months. Although winter months are not characteristically "drier", there is less infiltration of precipitation during this time of the year as a result of the below freezing temperatures and frozen ground. The southern portion of the site is also topographically lower than the central and northern portions of the site, thereby resulting in relatively smaller physical depths to the ground water.

The depth to ground water measured in wells located in the central portion of the site was also observed to vary seasonally similar in nature to that in the southern portion of the site. The depth to ground water in the central portion ranges from approximately 14 feet (MW-10R) to approximately 28 feet (MW-11R) below grade. Wells located along the western edge of the site (MW-11 and MW-8) generally have the greatest depth to water, while those located further inland have a lesser depth to water (MW-10R and MW-3). As shown on the geologic cross sections of the site, the ground elevation and amount of fill are also generally the greatest along the sites' shoreline.

The wells located in the northern portion of the site show similar trends to the other site wells. The depth to water increases with proximity to the bay. Seasonal effects are also apparent in this area, in that the highest ground water elevations recorded in April. The wells along the western edge of the site (MW-1, MW-8, and MW-11) generally show the least effects of seasonal changes in ground water elevation, while those wells located further inland show the greatest seasonal fluctuations. However,

as would be expected and is discussed later in this section, greater tidal influences were observed in the shoreline ground water.

Single well hydraulic conductivity tests (slug tests) were performed in all nine of the monitoring wells installed at the site during the Phase II RI. In addition, slug tests were also performed during the Phase II RI on three wells which were installed during the Phase I RI (MW-3S, MW-3R, and MW-6S) to provide additional information on the site hydrogeology. Four of the tested wells (MW-3S, MW-6S, MW-12S and MW-13S) are screened in the overburden fill materials, while the other tested wells are screened within the weathered bedrock at the site. A summary of the Phase II slug test results is presented in Table 3-3. The Phase I and Phase II RI slug test data and results are provided in Appendix J. For the purpose of simplifying the slug test calculations, the initial depth to water as shown on the slug test data tables was set at an arbitrary value of 20 feet below the top of the well casing.

Rising head slug tests were conducted on the selected overburden wells at the site. The three wells located at the southern end of the site (MW-6S, MW-12S, and MW-13S) are all partially screened in the construction-debris fill material and the underlying fine sand and silt. The hydraulic conductivities for these three overburden wells as calculated during the Phase II RI ranged from 15.03 ft/day (MW-12S) to 59.58 ft/day (MW-6S), reflecting the heterogeneity of the fill material. Transmissivity values at the wells ranged from 148.8 ft²/day (MW-12S) to 784.7 ft²/day (MW-6S). The remaining overburden well (MW-3S), which is located in the central portion of the landfill, is entirely screened within municipal waste-like fill materials. Hydraulic conductivities calculated for this well ranged from 24.96 to 30.46 ft/day and transmissivity values ranged from 116.0 to 141.6 ft²/day.

Rising head tests were conducted on all the Phase II RI bedrock wells. Falling head tests were also conducted on four of the bedrock wells for slug test data comparison purposes. Table 3-3 provides a summary of the slug test results for the bedrock wells for both the rising and falling head tests. Bedrock hydraulic conductivities determined from the Phase I slug tests ranged from 0.07 ft/day (MW-7S and MW-3R) to 0.20 ft/day (MW-5R). Slug tests conducted on bedrock wells during Phase II resulted in hydraulic conductivities that ranged from 0.094 ft/day (MW-14R) to 68.66 ft/day (MW-16R). The bedrock hydraulic conductivity values determined at off-site upgradient wells MW-14R and MW-16R are significantly lower and higher, respectively, than the values determined at the other site bedrock wells. Excluding these two wells and the other off-site bedrock well (MW-15R), the hydraulic conductivities at the site in Phase II ranged from 0.40 ft/day (MW-3R) to 6.40 ft/day (MW-9R).

The extreme variations in bedrock hydraulic conductivities may be explained by the presence or absence of fractures in the bedrock, as well as the extent of bedrock weathering at a particular well

location. The bedrock hydraulic conductivity values determined for this site are higher than values normally attributed to shale (3.28×10^{-4} to 3.28×10^{-9} ft/day) (Driscoll, 1987) and again probably reflect the highly weathered and fractured nature of the upper portion of the bedrock at the site. Bedrock transmissivity values at the site ranged from 2.56 ft²/day (MW-14R) to 1,169 ft²/day (MW-16R). Once again excluding these off-site wells and off-site well MW-15R, the on-site bedrock transmissivity values ranged from 8.76 ft²/day (MW-3R) to 67.96 ft²/day (MW-9R). As shown in Table 3-3, very similar slug test results were obtained for both the duplicate rising head tests and the falling head tests which were conducted on four of the bedrock wells.

In order to compare the Phase I slug test results with those from Phase II, a slug test was again conducted on well MW-3R in Phase II. As shown by the slug test results in Appendix J, the results of the Phase II slug test indicated a bedrock hydraulic conductivity value which was more than twice of that determined at the well in Phase I. The likely explanation for this difference is the use of a more precise ground water elevation data logger during the Phase II slug tests. The data logger used in Phase II enabled the collection of ground water elevation data at a greater frequency (every 0.5 seconds versus every 9 seconds), thus providing much more ground water elevation data (especially the very important "early" data). This allowed for a more accurate determination of the hydraulic conductivity of the surrounding formation from the well response curve. Although the Phase I slug test results are presented in Appendix J, the calculated hydraulic conductivities very likely underestimate the true conductivity of the material surrounding the wells. Therefore, the subsequent calculations concerning ground water velocities and gradients will only use the Phase II RI slug test results.

Vertical Hydraulic Gradients

Vertical hydraulic gradients were determined across the site based upon the Phase I and Phase II RI ground water elevation measurements obtained at the two on-site wells nests, MW-3S/R and MW-5S/R, and at the four piezometer well clusters installed during the Phase II RI. A summary of those ground water elevation measurements are presented in Table 3-2. Vertical hydraulic gradients are commonly used to evaluate the potential for contaminant migration in aquifers. A positive hydraulic gradient indicates an upward flow, whereas, a negative gradient indicates a downward flow. ~~If a hydraulic connection between the overburden and the bedrock aquifers is established.~~ An upward flow could tend to retard downward contaminant transport, and a downward flow could tend to enhance downward contaminant migration. Table 3-4 provides a summary of the vertical hydraulic gradients calculated for both the Phase I and Phase II ground water elevation measurements. Included in Appendix J is an explanation of the method used to calculate the vertical hydraulic gradients.

The ground water elevations measured at the nested wells and piezometers indicate that the vertical hydraulic gradients at the site vary both spatially (by location) and temporally (with time). Both positive and negative vertical gradients were observed in the ground water. Consistently negative or downward gradients were observed for the southern portion of the site at well MW-5. The measured vertical gradients varied little between the water level measurements at this location, ranging from -0.181 ft/ft to -0.231 ft/ft. Well nest MW-5 includes wells screened in the overburden fill material and shallow underlying bedrock. Table 3-2 presents data that show consistently higher ground water elevations in the MW-5S overburden well than in the deeper MW-5D bedrock well for Phase I and Phase II observations, thus indicating an overall negative vertical hydraulic gradient under different seasonal conditions. Tidal effects observed in the MW-5 nested wells during Phase I are graphically depicted in Appendix L-6 to this RI. The plot indicates only minor variations of the water level in the overburden well, MW-5S, over the 3-day continuous observation period. The bedrock well, MW-5, had an approximate 2-foot decrease in hydraulic head for each tide cycle; the net vertical gradient between the overburden and the underlying bedrock is still negative (downward). Although the tide and season (precipitation recharge) noticeably affected the ground water elevations at this location, the observed effects were not great enough to change the vertical gradient from negative to positive.

The vertical gradient observed in the ground water in the central portion of the site varied between the wells and piezometers. At well nest MW-3, which includes a well screened in the overburden fill material and another screened in the shallow bedrock, a negative or downward gradient was observed on all of the ground water elevation measurement dates except April 29, 1994. On this date, a positive vertical gradient (0.051 ft/ft) was observed at the well MW-3 location. The ground water elevation measurements on this date were taken at high tide and the diurnal cycle of the tide was also at a spring high. Another change in the vertical gradient from negative to positive was observed at this well during the 1-month continuous water level monitoring conducted in January 1994 (see Figure 3-13). During much of this month, a slight positive gradient was measured between the overburden and bedrock ground water at this location. Based on the January data, this change appeared to be a result of the spring tide effects (e.g., new moon and full moon) on the site ground water. This is evident by the gradient changes occurring near the times of the new and full moons and approximately 2 week apart, the time cycle from a new moon to full moon. It appears that during this time, the water elevations between the overburden and bedrock were very similar (less than 1 foot), thus leading to a change in the gradient as a result of the spring tide. However, this gradient change did not occur during the May 1994 measurement event, where there was a greater difference (several feet) in the two water elevations.

At piezometer location PZ-3, where one piezometer is screened just within the bedrock and the other is screened 10 feet deeper in the bedrock, a negative or downward gradient was consistently observed during both the single measurement events and the two 1-month continuous measurement periods. Although some tidal effects were evident in the deeper piezometer water elevations during the continuous monitoring, the affects were minimal and did not change the vertical flow gradients observed within the shallow bedrock at this location. The largest negative vertical gradient observed in this area of the site, -0.042 ft/ft, was between the two bedrock piezometers at this location on the December 29th measurement date.

At piezometer location PZ-1, where one piezometer is screened just within the bedrock and the other is screened 15 feet deeper in the bedrock, a very slight positive or upward gradient was observed during the two measurement events. The vertical gradients measured at this location ranged from 0.004 ft/ft to 0.019 ft/ft on the two measurement dates. Thus, on these two dates, an upward vertical gradient was measured in the bedrock ground water at this location. The reason why a positive vertical bedrock gradient was observed at PZ-1, while a negative gradient was observed at the similar bedrock piezometer nest PZ-3, may be due to the greater proximity of PZ-1 to the bay. Thus, the tidal affects observed in the bedrock at PZ-3 may have had a greater positive affect on the bedrock piezometric water elevations at PZ-1.

At piezometer location PZ-2, where one piezometer is screened in the overburden fill material (PZ-2A), another is screened just within the underlying bedrock (PZ-2B), and a third is screened 10 feet deeper in the bedrock (PZ-2C), both positive and negative vertical gradients were observed. A negative vertical gradient was consistently observed on the two measurement dates between the overburden (PZ-2A) and the shallow bedrock (PZ-2B). However, both positive and negative gradients were observed between the other two piezometers at this location. Although, the gradients measured at these other two piezometers were consistently positive or negative on each measurement event. The reason for the observed variations in the vertical gradients between the two measurement events is likely related to the different seasonal (precipitation recharge) and tidal conditions on each date. The tidal effects on the gradients at this location are evident from the 1-month of continuous water level data shown on Figures 3-13 and 3-14 for two of the piezometers at this location. Both of these figures both show the presence of significant tidal effects in the piezometric conditions in the bedrock at this location. However, a more frequent switching of the gradient from positive to negative occurs during the January period when smaller ground water elevation differences were observed between the two piezometers. Thus, indicating the likely influence of seasonal effects (precipitation recharge) on the measured ground water elevations and resulting gradients.

At piezometer location PZ-4, where one piezometer is screened in the overburden fill material (PZ-4A), another is screened just within the underlying bedrock (PZ-4B), and a third is screened 10 feet deeper in the bedrock (PZ-4C), both positive and negative vertical gradients were observed. Once again, as with similarly constructed PZ-2, both variable positive and negative vertical gradients were observed at PZ-4. However, for the same measurement dates, the gradients differed from positive to negative between the two piezometer nests. The largest positive vertical gradient observed in this area of the site, 0.076 ft/ft, was between the two bedrock piezometers at this location on the April 29th measurement date.

Overall, the specific reasons for the variability in the vertical gradients observed both during and between the water elevation measurement events are unknown. This variability is likely the result of many factors, including differences in aquifer heterogeneity (hydraulic conductivity, bedrock quality), tidal effects, and seasonal precipitation recharge effects. Further discussions on the tidal affects on the site ground water are provided later in this section.

Horizontal Hydraulic Gradients

Horizontal hydraulic gradients were also determined for the ground water across the site based on the more extensive Phase II RI ground water elevation data. Horizontal gradients are used, along with the aquifer hydraulic conductivity and effective porosity, in determining horizontal ground water flow velocities, and hence the rate at which an aquifer may transport contaminant solutes. Horizontal gradients were calculated for the shallow overburden ground water flow, as well as the bedrock ground water flow across the site. The horizontal gradient represents the change in head, measured in feet, per horizontal foot of travel through the flow medium. Horizontal gradients were calculated using the ground water contour maps generated for the site. Figures 3-11 and 3-12 in this report, as well as Figures 4 through 7 in Appendix I, show the ground water contour maps and the areas for which horizontal hydraulic gradients were calculated. Table 3-5 provides a summary of the calculated average horizontal hydraulic gradients across the site. Included in Appendix J is an explanation of the method used to calculate average horizontal gradients.

Average horizontal hydraulic gradients measured for the shallow overburden ground water flow ranged from 0.009 ft/ft (northern inland) to 0.219 ft/ft (northern nearshore) from east to west. Average horizontal hydraulic gradients for the bedrock ground water ranged from 0.027 ft/ft (southern area by MW-13) to 0.114 ft/ft (northern area). Gradients for both overburden and bedrock ground water were higher towards the western edge of the site, where there is a significant topographic decrease towards Narragansett Bay.

Average Linear Velocities

The calculated average horizontal hydraulic gradients, along with hydraulic conductivity and effective porosity values, were used to calculate average linear ground water velocity values at the site. Table 3-5 provides a summary of the calculated average linear velocities. Included in Appendix J is a summary of the method used to calculate average linear velocities.

For the purposes of calculating average horizontal hydraulic gradients, a value of hydraulic conductivity which was considered representative of each unit was chosen for the calculations. For the shallow, overburden materials, the hydraulic conductivity value used in the calculations was 37.48 ft/day, which represents an average of the seven hydraulic conductivity measurements shown in Table 3-3. This average is believed to be representative of ground water flow through the overburden materials. For the underlying bedrock, an average hydraulic conductivity value was also used for the velocity calculations. However, the hydraulic conductivity values determined at MW-14R and MW-16R were not used in calculating the average due to their significant deviation from other measured values and the fact that these two wells are located off of the site. In addition, the hydraulic conductivity determined for well MW-15R was also not used because it too is an off-site well. The remaining values shown in Table 3-3 were averaged to obtain a mean value of 3.42 ft/day for the bedrock wells, which was used to calculate the average linear velocities for the shallow bedrock unit.

Calculated average linear velocities for the shallow ground water ranged from 2.25 ft/day (northern inland) to 54.72 ft/day (northern nearshore). Average linear velocities for the bedrock ground water ranged from 3.91 ft/day (northern area) to 0.91 ft/day (southern area). It is important to note that the calculated average linear velocity values are likely lower than the "true microscopic velocities" because water particles must travel along irregular paths that are longer than the linearized paths represented by the calculated average linear velocities (Freeze and Cherry, 1979). As with the horizontal gradients, average linear velocities increase with proximity to the western edge of the site along Narragansett Bay, as the ground water drops to the level of the bay.

Saturated Fill Evaluation

To assess the extent and quantity of saturated fill present at the McAllister Point Landfill, a comparison was made between the elevation of the base of the artificial fill material and the observed high and mean ground water elevations. The observed differences between the ground water elevations and base of fill across the site represents the volume of saturated fill material. To conduct this assessment, figures which show the topography of the base of the fill and the topography of the water table were

developed from existing subsurface and water level elevation data. These figures are provided with supporting information in Appendix K. Development of the base of fill and ground water contour figures are described below.

The topography of the base (bottom) of the fill was contoured from depth to fill and bedrock information provided from site boring and monitoring well logs. The site bedrock topography is contoured on Figure A in Appendix K. Results of the base of fill contour assessment are shown on Figure B in Appendix K. As indicated, in most cases the topography of the base of the fill closely parallels the topography of site bedrock. This implies that over most of the site, landfill material was deposited directly on top of bedrock. Exceptions are present in the southern end of the site where fill appears to have been placed over natural till deposits, in the central portion of the site near the bedrock topographic high, and along the eastern edge of the site adjacent to the RIDOT right-of-way. As indicated by the geologic cross-sections the amount of saturated fill is variable over the site. In the northern portion of the site, the saturated fill generally varies between approximately two and four feet in thickness. Although, little to no saturated fill is present near the bedrock topographic high between wells MW-9 and MW-2 and at a second bedrock high near MW-9. On the southern end of the site, the saturated fill appears to be thickest (nearly 10 feet at station 18 + 00, see Figure B) between wells MW-6 and MW-12. The base of fill topographic contour map provided in Appendix K is supported by the geologic cross sections presented as Figures 3-4 through 3-8.

Following development of the base of fill contour map, two separate ground water contour plans were developed from elevation data collected during the April 29, 1994 measurement event and from a calculated mean water level elevation. The ground water contour plans were developed from elevation data from the following series of ten monitoring wells which represent the shallow unconfined ground water table at the site: MW-1R, MW-2S, MW-3S, MW-4S, MW-5S, MW-6S, MW-8S, MW-11S, MW-12S, and MW-13S. The April 29th ground water contour plan is provided as Figure C in Appendix K and the mean (average) ground water elevation contour plan is provided as Figure D in Appendix K. The April 29, 1994 ground water elevation event was selected from available elevation data to represent the "high water" elevation at the site. The mean water level elevation data was calculated from existing water elevation data as presented in Table 3-2. As is evident from the relatively few ground water elevation data sets (three events) obtained for all of the site monitoring wells, the average ground water elevation is in most cases skewed or biased by the April 29th Spring "high" ground water elevation data and may represent a higher average than would be calculated using data from throughout the year. This hypothesis is generally supported by regional precipitation data for the Newport, Rhode Island area (see Appendix K) which indicates that, on a yearly basis, precipitation (and presumably ground water elevation) tends to be greatest in late summer (August), early winter

(November, December), and spring (March, April). However, increased evapotranspiration during periods of high temperature typically results in reduced groundwater levels in the late summer period. In addition, at the time of two December 1993 ground water elevation measurement events, 6.72 inches of precipitation fell, an amount significantly higher than the approximately 3.7 inches per month annual average for this area.

Available water level data information from USGS observation well POW551 in Portsmouth, Rhode Island, supports the nature of seasonal water level fluctuations. POW551 is screened in till and is 51.9 feet deep. From 1994 to 1996, data indicate that water levels ranged from approximately 25 to 50 feet below land surface during portions of each year. In 1994, water levels were higher from February to May (winter and spring) and lower from June to November (summer and fall). The highest and lowest water levels in 1994 were in March (27.71 ft bls) and November (49.90 ft bls), respectively. Similarly, water levels in 1995 and 1996 were higher during winter months and lower during the late summer and fall seasons (USGS, 1997).

Following development of the base of fill and ground water elevation contour plans, a fill analysis was conducted using a modular DCA computer software package. This software package was used in conjunction with an AutoCAD[®] drafting package to obtain saturated fill volumes. These fill volumes collectively represent the amount or volume of saturated fill on-site under the conditions stated. To develop this estimate, a series of 13 section stations (7+00 to 19+00) were established at the site on 100-foot centers. These stations were the same stations used to design the Subtitle C cap at the site. At each station the area between the base of fill elevation and the ground water elevation were computed and the volume of fill calculated using the average end-area method as illustrated below.

$$V = (A_1 + A_2/2)(L)/27$$

Where: V = Volume in cubic yards (CY)

A₁ = area of saturated fill on Section 1 (ft²)

A₂ = area of saturated fill on Section 2 (ft²)

L = Distance between Sections (ft)

27 = conversion factor from ft³ to CY

The total estimated volume of saturated fill was then calculated by summing the volume of saturated fill for each section. Results of this analysis are presented in Appendix K for each ground water contour plan and indicate estimated volumes of 28,785 cubic yards and 42,785 cubic yards of

saturated fill are present under mean and the April 29, 1994 spring "high" ground water conditions, respectively.

Tidal Influence

Continuous ground water level measurements were recorded in six of the monitoring wells and piezometers, as part of the Phase II site RI, (MW-3S, MW-3R, PZ-2A, PZ-2C, PZ-3A, and PZ-3B) for two 1-month periods, January 5 to January 31, 1994 and May 10 to June 11, 1994. Ground water levels were recorded every 30 minutes during the study periods. Ground water elevation plots generated for both of these events are presented as Figures 3-13 and 3-14. The data for these plots is provided in Appendix L.

Tidal influences were observed in each of the monitoring wells and piezometers. The ground water at well nest MW-3S/3R exhibited negligible tidal influences and showed only slight fluctuations over a seven-hour period; however, a lag time was noted between actual high/low tides and the recorded extremes at this well. Lag times are common in wells which are influenced by tides and located at some distance from the actual shoreline. Piezometers PZ-3A and PZ-3B both exhibited a stronger tidal influence than MW-3S/R, as would be expected by their closer proximity to the bay. PZ-3B (deeper bedrock) consistently had a lower elevation than PZ-3A (shallow bedrock). The ground water at both piezometers also showed little to no lag time between actual high and low tides. Piezometers PZ-2A and PZ-2C both showed the greatest fluctuations in response to tidal changes. Both piezometers are located within 50 feet of the bank overlooking Narragansett Bay, on the western edge of the site. PZ-2C recorded water level fluctuations of over 2.6 feet within a single tidal cycle. Depending on the tidal cycle, the water elevation in PZ-2C (bedrock) fluctuated above and below the water elevation in PZ-2A (shallow). At high tides, the water elevation in PZ-2C ranged from 0.5 feet below to up to 1.3 feet above the elevation in PZ-2A at extreme high tides. At low tides, the elevation in PZ-2C was at least 0.9 foot below the elevation of water in PZ-2A.

In general, the tidal effects on the wells and piezometers appear to primarily be a function of proximity to Narragansett Bay and whether the screened interval intercepts the bedrock. Wells and piezometers which are closer to the bay and have screens intercepting the bedrock tend to be more susceptible to tidal effects.

The tidal effects monitoring data were also utilized for the purpose of providing estimates of net shallow and deep ground water flow directions and gradients. Use of single-time water level observations cannot be used to accurately determine flow direction and gradient in tidally fluctuating

aquifers since these measurements delineate hydraulic head at only one point in time during a tidal cycle, not the net or mean effect of tidally induced water level changes. Therefore, a more rigorous approach was used in order to characterize flow transport in the tidally influenced shallow and deep ground water at the site using geostatistical filtering of the tidal effects monitoring data to determine mean shallow and deep ground water flow directions.

Although longer term cycles affect ground water levels in tidally influenced aquifers, including solar annual and semiannual cycles, resulting primarily from climatic factors, and lunar monthly and semimonthly components, the most influential and persistent cycles are shorter term daily and semidaily tidal fluctuations. Because tidal fluctuations results predominantly from the gravitational interaction between the moon and earth (i.e., the magnitude of lunar tidal fluctuations is over twice the magnitude of solar tidal fluctuations), there is one first-order tidal cycle and two second-order tidal cycles that occur during the 24 hours and 50 minutes that comprise a "lunar" day, which are termed diurnal and semidiurnal tidal cycles, respectively. Each diurnal tidal cycle is comprised of two semidiurnal tidal cycles, each with a period of 12 hours and 25 minutes (half a "lunar" day). In contrast, the lower amplitude tides associated with the sun occur once every 24 hours, the period of a "solar" day. Because shorter period tidal cycles are generated by comparatively short wavelength and large amplitude pressure waves in the surface water body, the corresponding ground water level changes resulting from diurnal and semidiurnal tides are greater than those resulting from longer period tidal cycles. The principal exception to this relationship occurs during new or full moon when the earth, moon and sun are aligned; during this time, maximal tidal ranges called spring tides occur (Marquis and Smith, 1994).

For the January and May/June 1994 tidal monitoring events, mean ground water elevations were determined for each of the six monitoring points using a 71-hour filtering method described by Serfes (1991). Additional information on this filtering method (paper by Serfes - 1991) is provided in Appendix L.

Using the 71-hour filtering method for both the January and May monitoring events, a mean ground water elevation was calculated for each well/piezometer using a filtering method to remove daily and semidaily lunar and solar harmonics from 71 consecutive hourly ground water level observations. The 71-hour filtering method consists of calculating a set of moving averages using a filtering interval of 24 consecutive hourly ground water level measurements. Multiple sequences of moving averages were calculated to achieve a single mean elevation for the median time of 72 hours (hour 36) as follows:

Let the consecutive hourly ground water level observations be $h(1), h(2), h(3), \dots, h(71)$:
the first sequence of means (X_i) is

$$X_i = \frac{\sum_{k=0}^{23} h_{i+k}}{24}$$

where $i = 1, 2, 3, \dots, 48$;

the second sequence of means (Y_j) is

$$Y_j = \frac{\sum_{i=0}^{23} X_{i+j}}{24}$$

where $j = 1, 2, 3, \dots, 25$;

and the mean elevation (M) at hour 36 is

$$M = \frac{\sum_{j=1}^{25} Y_j}{25}$$

It should be noted that the filtering method described above does not filter the longer period frequencies associated with the semilunar monthly tidal (spring tide) component. The lack of filtering of this component can lead to an inaccurate determination of ground water flow in unconfined aquifers with gentle gradients using the 71-hour filtering method if ground water level measurements are obtained during the spring tide (Marquis and Smith, 1994). Given that both the January and May/June monitoring events resulted in the production of nearly one month of data each, the following rationale was used to select a representative 72-hour period for calculation of the mean elevations. Plots depicting the two months of measured ground water elevation are provided as Figures 3-13 and 3-14 and in Appendix L.

- Monthly new and full moon periods were identified for each of the monitoring periods and are identified on the ground water data plots provided in Appendix L.
- A zone of two days was established on either side of the new and full moon zones to eliminate potential long-term semilunar fluctuations.

- Based on a visual inspection of the ground water elevation data plots, a three-day period (72 hours) which appeared to exhibit the highest overall ground water elevation was selected from the remaining tidal data. This zone corresponded to January 15 to 17 and May 17 to 20, 1994. Each of these zones are identified on the figures provided in Appendix L.

Appendix L presents the hourly tidal effects water level elevation data and the calculations of the mean ground water level elevations at each of the monitored stations. The calculated mean shallow and deep ground water elevations are summarized below.

<u>Location</u>	<u>Mean Elevation January 13 to 15, 1994</u>	<u>Mean Elevation May 17 to 20, 1994</u>
MW-3S	11.95	14.25
MW-3R	12.17	11.70
PZ-3A	8.41	8.59
PZ-3B	8.03	8.14
PZ-2A	3.53	3.71
PZ-2C	3.56	3.34

As indicated by a review of the above data, the mean vertical gradients at the site indicate both upward and downward flow between the overburden materials and the bedrock at the site. However, since these data were developed in such a fashion as to filter out both daily and monthly tidal variability, the changes in vertical gradient at each location are likely representative of temporal recharge conditions (precipitation) during the selected 72-hour averaging period. In addition, as indicated by the figures provided in Appendix L, it is apparent that observable tidal influence is present at piezometer cluster PZ-2A/2C, only slight sinusoidal fluctuations are visible at PZ-3B, and no significant tidal influence is evident at PZ-3A and the MW-3S/3R monitoring well cluster. Based on this observation, the estimated tidal influence at the site near the locations of the piezometer/monitoring well clusters appears to extend approximately 200 feet, or less, inland.

Based on the Phase I RI 3-day continuous ground water elevation data also provided in Appendix L, there does not appear to be as significant of a tidal influence in the southern portion of the site. As shown on the ground water elevation plot for this period, there was very little affect observed in the shallow overburden well at MW-5. In fact, the recorded ground water elevation values for well MW-5S show changes of only 0.04 feet in the observed elevations from low to high tide. This well is located approximately 80 feet inland from Narragansett Bay. Thus, based on this information, there appears

to be very little tidal influence in the overburden materials in the southern portion of the site. This may be a result of the different overburden fill and geologic characteristics in this area of the site as compared to the central portion. Although, similar hydraulic conductivities were observed for the shallow overburden wells located in the central and southern portions of the site.

3.3.7 Area Water Use

Public water in the City of Newport and Town of Middletown is supplied and managed by the Newport Water Department. The Town of Portsmouth purchases water from the Newport Water Department but operates its own distribution system. Approximately two thirds of Portsmouth is serviced by public water with the remaining one third supplied water from private water wells. While no specific records exist as to private well use in the information reviewed, in general, the majority of private wells are reportedly located on the eastern portion of Aquidneck Island, primarily in Middletown (Personal Communication, Town of Portsmouth, 1992) (Quinlan, 1997).

The Newport Water Department receives its water supply from a series of seven surface water reservoirs located on Aquidneck Island and two surface water reservoirs (Tiverton and Fall River) on the mainland. The seven surface water reservoirs on Aquidneck Island are:

1. Lawton Valley Reservoir,
2. St. Marys Pond,
3. Sisson Pond,
4. Easton North Pond,
5. Easton South Pond,
6. Paradise or Nelsons Pond, and
7. Gardners Pond.

Each of these reservoirs is supplied water via rainfall and runoff and is not augmented by ground water supply wells. The Newport Water Department stated that the safe yield of the reservoir system is approximately 11 to 13 million gallons per day (MGD). Water use in 1991 was 7.07 MGD, and adequate capacity reportedly exists for projected water usage on Aquidneck Island for the next ten to twenty years, or more (Personal Communication, Newport Water Department, 1992). Figure 3-10 indicates the location of surface water reservoirs (Lawton Valley, Sisson Pond, St. Marys Pond, and the Easton North Pond) in the vicinity of the Newport Naval Base. The McAllister Point Landfill directly abuts Narragansett Bay at an elevation of approximately 30 to 40 feet above mean low water (mlw).

and the locations of the water supply reservoirs are at inland elevations greater than 40 ft mlw. The McAllister Point Landfill does not lie within the watershed of any of the area water supply reservoirs.

The Prudence Island Utilities Company supplies ground water to approximately 800 people on Prudence Island, Portsmouth, located east and off-shore of the Melville area.

The locations of known public ground water supply wells and surface water reservoirs within the NETC Newport vicinity are shown on Figure 3-10. The locations of ground water supply wells were obtained from the February, 1992 RIDEM Ground Water Section Facilities Inventory map for the Prudence Island quadrangle (USGS). The map shows the locations of known public ground water supply wells, in addition to known or suspected sources of ground water contamination. RIDEM Ground Water Section personnel indicated that the location of the supply wells within the Prudence Island Quadrangle had been field verified by RIDEM personnel.

Figures 3-15 and 3-16 show the locations of known private bedrock wells, as well as known community and non-community wells. The location, depth, and yield of private bedrock wells in the area of the Newport Naval Base are shown on Figure 3-15. The closest of these bedrock wells is approximately 0.4 miles southeast of the southern end of the site (USGS, 1984). The IAS report indicated that bedrock wells in the area range from approximately 14 to 1,300 feet deep. Well yields from 55 gallons per minute (GPM) to less than 1 GPM are reported in the IAS report.

Private wells are reported to withdraw water from till, bedrock, and stratified-drift aquifers. Of these aquifers, bedrock is considered the most reliable source of ground water, and well yields are commonly sufficient for domestic supplies (Johnston, U.S.G.S., undated).

Figures 3-16 shows the location of community and non-community wells and wellhead protection areas in the area of the Newport Naval Base. The locations of these wells were obtained from a RIDEM water supply well overlap map of the Prudence Island quadrangle, dated 1993.

A limited search of potential users of groundwater in the immediate vicinity of the McAllister Point Landfill was conducted by B&R Environmental. Personal communication with the Superintendent of the Wanumetonomy Golf Course and Country Club, situated directly upgradient of the McAllister Point Landfill, reveals there are no active water supply wells on the property. The golf course property has always been privately owned and operated (Jalkut, 1997b).

Based on a review of a water main distribution map for Middletown, Rhode Island, the western half of the town is primarily served by a public water supply system. Residents on the east side of town are more dependent on private water supplies for domestic and/or small business needs (Newport Water Works, 1990). The residential population on the east side of the town is much less dense than the western half of Middletown (Town of Middletown, 1995).

Through personal communication with the Newport Water Department, several residential lots along portions of Browns Lane, Oliphant Lane, and Jepson Lane (on the west side of Middletown) were identified as not being connected to a public water main pipeline. The homes on these lots likely rely on private water supply sources for potable water needs (Jaikut, 1997a). In relation to McAllister Point Landfill, the nearest private well location may be on Browns Lane, approximately 0.5 to 1.0 miles east and upgradient of the site. Private well locations on Oliphant and Jepson Lanes are 1.0 to 2.0 miles east of the landfill (Town of Middletown, 1996). Characteristics of these wells have not been determined.

4.0 NATURE AND EXTENT OF CONTAMINATION

This section of the report presents the sample results for the sampling activities described throughout Section 2.0, with emphasis on the Phase II sample results. The Phase I results are included during the general evaluation of the site regarding the overall nature and extent of contamination, where appropriate. For a detailed discussion of the Phase I results, see Section 4.0 of the Phase I Remedial Investigation (RI) report (TRC, 1992). Summary tables of the Phase I sample data are presented in Appendix N.

The discussion on the nature and extent of contamination is presented in separate sections for the soil (surface soil and subsurface soil), ground water, sediment and biota. Each section provides a summary of each investigation activity and is followed by a separate discussion for each of the following chemical compound classes: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/PCBs, inorganic analytes, and dioxin/furans (where applicable). A summary of the samples collected at the McAllister Point Landfill site during the Phase II RI is provided in Table 4-1 and the locations of the Phase II site investigation activities are shown on Figure 2-1.

The Phases I and II sediment and biota investigation used composite sampling to provide data that was assessed and used to plan and implement a subsequent investigation, the Marine Ecological Risk Assessment. A detailed discussion of the nature and extent of contaminated sediments and affected biota investigated under the subsequent ecological investigation is presented in the Final Marine Ecological Risk Assessment Report (SAIC/URI, March 1997). This section includes a summary of this report.

The chemical class discussions contain summaries of analytical results along with comparisons of detected contaminant levels to action levels, guidelines and/or standards. Ground water contaminant levels were compared to federal maximum contaminant levels (MCLs) established under the Safe Drinking Water Act, and to the Rhode Island DEM Rules and Regulations for Ground Water Quality. In addition, off-site upgradient background levels are provided for comparison.

In the case of surface and subsurface soils, there are state direct exposure criteria for PCBs (10 ppm) and for lead (500 ppm). In order to evaluate the remaining analytical soil data and identify areas of concern at the site, contaminant-comparison levels were established for the totals of the volatile and semivolatile organic compounds. As is discussed in Section 4.1, these levels do not reflect the risks posed by the individual compounds within the chemical class. Rather, they were used as general

indicators of the degree of soil contamination, and as a means of identifying general locations where potential "hot spots" may exist. The site soil sample results were also compared to the site-specific background soil samples results, especially in the evaluation of the inorganic analytes data.

All samples were analyzed according to U.S. EPA Contract Laboratory Program (CLP) protocols. Summary tables of the Phase II sample data are presented in Appendix O. All of the sample data were also validated according to established US EPA Region I data validation guidelines for quality assurance data validation. Where applicable, the impact of data validation activities on the analytical results is discussed. For example, where data validation has resulted in the qualification of analytical results for common laboratory contaminants as undetected ("U" qualifier) due to blank contamination, these analytical results are generally eliminated from further consideration in the contaminant assessments.

4.1 SOIL ASSESSMENT

Soil samples were collected during the Phase I and Phase II site investigation during the surface soil sampling, test pit, and drilling activities. The Phase II surface soil sample, test pit, test boring, and monitoring well locations were established based on the findings of the Phase I investigation and, in some instances, were relocated based on the Phase II soil gas investigation. The locations of the Phase I and Phase II RI soil sample locations are provided on Plate A-1 located in Appendix A.

A total of fifty-seven (57) soil samples were collected during the Phase II site investigation. Twenty-eight (28) surface soil samples, twenty-nine (29) subsurface soil boring samples, and six (6) duplicates were collected at the site. Samples collected from the 0- to 2-foot interval (0- to 1-foot for analyses) of test borings and monitoring well borings were also included as surface soil samples and will be discussed within the surface soil sample results discussions. A summary of the analyses conducted on the soil samples is provided in Table 4-1. Summaries of the surface soil, subsurface soil, and test pit soil sample results are provided as detection summary or "hits" tables in Tables 4-2, 4-3, and 4-4 respectively.

In addition to the surface and subsurface soil samples collected from the site, soil samples were collected in Phase I from the shoreline of the site. These samples were collected from the surface of the beach area which runs from the south central portion of the site to beyond the southern end of the site. These soil samples characteristically consisted of medium to coarse sand mixed with stones and cobbles. These samples are being evaluated separately from the other soil samples for two reasons: these samples were not collected from soil or fill areas similar to those found on the raised portion of

the site or landfill, and these samples were collected from areas which are believed to be influenced by Narragansett Bay waters.

The test pit samples were collected from soils removed from test pits excavated at the southern end of the site. The test pits were completed at the very end of the Phase II investigation to provide additional information on the characteristics of the fill at the southern end of the site. Under direction from the RIDEM, soil samples were collected from the stockpiled soil from each test pit. These samples were collected to determine if the stockpiled soil could be backfilled. The analytical results of the test pit samples are discussed in this section of the report.

Presented in this section of the report is a discussion on the nature and extent of the soil contamination at the McAllister Point Landfill site. The discussion proceeds from surface soils to subsurface soils to shoreline soils and is presented in the order of the following chemical compound classes: VOCs, SVOCs, pesticides/PCBs, inorganics, and dioxin/furans. The contaminant discussion for each section presents general observations regarding soil contamination along with comparisons to applicable soil guidance or action levels and to background concentrations established at the site. Soil action levels established by the RIDEM for lead and PCBs were also evaluated in this comparison.

Site-specific background surface soil concentrations were established on the basis of the soil quality determined for off-site surface soil samples SS-16, SS-17, SS-18, SS-19, and SS-20, off-site monitoring well boring surface soil samples M14-1, M15-1, and M16-1, and off-site test boring surface soil sample B13-1. All of these samples were collected from nearby locations which are believed to be unaffected by the operation of the McAllister Point Landfill. An attempt was made to collect all of the background samples as close to the site as possible as well as being located away from any potential man-made sources of potential contamination (roadway runoff, automobile exhaust, railroad tracks, dumping). Samples SS-16, SS-17, SS-18, SS-19, M14-1, M15-1, M16-1, and B13-1 were all collected from the area east of the site across Defense Highway. Five of these eight samples were collected from the area between the highway and the fence which runs along the highway. The other three samples, SS-18, SS-19, and B13-1 were collected from the small wooded area just on the other side of the fence east of the highway. The other background sample, SS-20, was collected from the off-site wooded area just east of the site between the railroad tracks and highway.

Contaminant-comparison levels have also been developed for volatile organic (VOCs) and semivolatile organic compounds (SVOCs) as a means of evaluating the relative contamination of soil samples with respect to the associated group of chemical compounds. The comparison levels developed do not reflect the risks posed by the individual compounds within the chemical class. Rather, they have been

used as general indicators of the degree of soil contamination, and as a means of identifying general locations where potential contaminant "hot spots" may exist. Contaminant-comparison levels have been set at 1 ppm for total volatile organics and 10 ppm for total SVOCs. For SVOCs, contaminant-comparison levels have also been set for polynuclear aromatic hydrocarbons (PAHs) and carcinogenic PAHs, as a means of further evaluating the relative contamination of the soil samples with respect to the more toxic BNA components. Contaminant-comparison levels have been set at 10 ppm for total PAHs and 1 ppm for total carcinogenic PAHs.

4.1.1 Volatile Organic Compounds (VOCs)

Surface Soils

During the RI, eleven (11) surface soil samples were collected in Phase I and fourteen (14) surface soil samples were collected in Phase II and analyzed for TCL volatile organic compounds (VOCs). In addition, fourteen (14) surface soil samples were also collected in Phase II for VOC analysis from the first sampling interval of many of the borings completed at the site. These boring samples are also included in this evaluation of the surface soil sample data. Figure 4-1 is provided to show those surface and subsurface soil sample locations where total VOCs were greater than 100 ppb and 1,000 ppb (1 ppm).

In Phase I, only three VOCs (1,1,1-trichloroethane, tetrachloroethene, and toluene) were detected in the surface soil samples. These VOCs were detected in a set of four samples which were recollected after the laboratory missed the re-analysis holding times for the original samples. It is the Navy's opinion that the real presence of the detected VOCs in these samples is suspect in that these same VOCs were also unexpectedly detected in other samples collected from another site that were in that same laboratory batch. In addition, these VOCs were not detected in the initial analysis of these samples or in any of the other Phase I surface soil samples.

Twenty-eight (28) surface soil samples were collected during the Phase II RI and analyzed for VOCs. This included six (6) off-site background samples. The VOC analysis of the surface soil samples indicates the presence of very low levels (low ppb) of several VOCs known to be common laboratory solvents, including methylene chloride, acetone, 2-butanone, and toluene. The detected concentrations for several of these VOCs were qualified as undetected in the data validation and are not reported in the data tables. Much of this qualification of the VOC data was based upon the documented presence of these VOCs in laboratory, field, and trip blanks associated with the samples. Based on these

findings, many of the remaining unqualified low concentrations (less than 10 ppb) for these VOCs will not be discussed.

Another VOC which was detected in laboratory and field blanks associated with the surface soil samples is carbon disulfide. This chemical is also used as a solvent and its presence in these blanks indicates that it is likely a laboratory or sample container contaminant. However, its detection in the blanks did not result in any qualification of the surface soil sample data since it was not detected in any of these samples.

The VOCs that were detected in the surface soil samples at elevated concentrations include methylene chloride and acetone. The highest concentrations of both of these compounds were detected in surface sample SS-25 collected from the north central portion of the site. The total VOC concentration of this sample and the location from which it was collected is shown on Figure 4-1. As shown on this figure, SS-25 is the only surface soil sample which had a total VOC concentration greater than 1 ppm, the total VOC contaminant comparison level. In fact, sample SS-25 was also the only surface soil sample to have a total VOC concentration which exceeded 100 ppb. Methylene chloride and acetone were detected in this sample at concentrations of 1.9 ppm and 39 ppm, respectively. Acetone was also detected in the duplicate of this sample (SS-40) at a similar concentration of 33 ppm; however, no methylene chloride was detected. The description log of this sample does not indicate any signs of potential VOC contamination (no odors, no petroleum staining). In fact, this sample was actually collected to investigate a grey ash-like material observed at the surface in this area. Thus, it is the Navy's opinion that the high VOC levels detected in this sample are suspect; however, the duplicate sample from this area supports the finding of a high acetone concentration in this sample. A circumstance that may prove useful in confirming or denying the presence of VOCs at this location is the collection of a split sample at this location by the EPA. Therefore, when available, the VOC data for EPA's split soil sample from this location will also be assessed and compared to these results.

Other VOCs detected in the surface soil samples at low concentrations include 1,1,1-trichloroethane (1,1,1-TCA), 4-methyl-2-pentanone, tetrachloroethene (PCE), and xylene. The compounds 1,1,1-TCA and PCE were both detected at low concentrations (5 ppb and 2 ppb, respectively) in the off-site background sample SS-18. This sample had no signs of potential VOC contamination (odors, stains); in the Navy's opinion, the VOC concentrations detected in this sample are suspect. The compound 2-methyl-2-pentanone was detected in two samples (SS-40 and M12-1) at very low concentrations (3 ppb and 2 ppb, respectively). Neither of these two surface samples exhibited any signs of potential VOC contamination. In addition, this compound was not detected in sample SS-25, the duplicate sample of SS-40. Xylene was detected in two of the off-site background surface soil samples (M15-1

and M16-1) at very low concentrations (3 ppb and 2 ppb). ~~In the Navy's opinion~~, the presence of xylene in these samples is very suspect in that they did not exhibit any signs of potential VOC contamination. In addition, these two samples were analyzed after and in the same batch (laboratory batch number 31597) as two subsurface soil samples which appeared to have real xylene contamination (samples M11-1 and M11-2). Thus, it is possible that the low xylene levels detected in the two background surface soil samples is a result of instrument carry over from the prior analysis.

Overall, the surface soil VOC data does not appear to indicate the real presence of any VOC contamination in the site surface soils. The low levels of VOCs detected in several of the samples is likely due to typical laboratory contamination of the samples. However, the VOC results for sample SS-25 will be reassessed after reviewing the data for EPA's split soil sample for this location.

Subsurface Soils

During the RI, forty-eight (48) subsurface soil samples were collected in Phase I and twenty-nine (29) were collected in Phase II from the site and analyzed for TCL VOCs. Low levels of VOCs were detected in many of the subsurface soil samples. The following is a discussion of the VOCs detected in the subsurface soils. The results of both the Phase I RI and the Phase II RI subsurface soil sample analysis are presented together with the following discussion. Figure 4-1 is provided to show those surface and subsurface soil sample locations where total VOCs were greater than 100 ppb and 1,000 ppb (1 ppm).

As with other site samples, the VOC analysis of the subsurface soil samples indicated the presence of very low levels (low ppb) of several VOCs known to be common laboratory solvents. This includes the VOCs methylene chloride, acetone, 2-butanone, and toluene. The detected concentrations for several of these VOCs were qualified as undetected in the data validation and are not reported in the data tables. Much of this qualification of the VOC data was based upon the documented presence of these VOCs in laboratory, field, and trip blanks associated with the samples. Based on these findings, many of the remaining unqualified low concentrations (less than 10 ppb) for these VOCs will not be discussed.

Another VOC which was detected in laboratory and field blanks associated with the subsurface soil samples is carbon disulfide. This chemical is also used as a solvent and its presence in these blanks indicates that it is likely a laboratory or sample container contaminant. The detection of carbon disulfide in several blanks resulted in the qualification of the results for this compound as undetected for several subsurface soil samples.

Other VOCs detected in the subsurface soil samples include 1,2-dichloroethene (1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA), trichloroethene (TCE), benzene, 4-methyl-2-pentanone, 2-hexanone, 1,1,2,2-tetrachloroethane, tetrachloroethene, chlorobenzene, ethylbenzene, and xylene. In addition, elevated concentrations were detected for 2-butanone and toluene in several of the samples indicating that there also appears to be some real concentrations of these VOCs in the subsurface soil samples.

As discussed previously, in order to conduct an overall evaluation of the VOC soil sample data, a contaminant comparison value of 1 ppm was used for the total VOCs concentration. The total VOCs concentration for four of the subsurface soil samples exceeded the 1 ppm total VOC comparison level. These four samples and the associated total VOC concentrations are: B05-1 at 2.41 ppm, B05-3 at 21.59 ppm, B07-2 at 2.49 ppm, and M09-2 at 1.13 ppm. All four of these samples were collected from fill materials encountered in three borings completed in the central portion of the site. The locations of these borings are shown on Figure 4-1. The two samples collected from boring B-5 (B05-1 and B05-3) both contained elevated levels (high ppb to low ppm) of the aromatic VOCs toluene, ethylbenzene and xylene. Sample B05-1 also contained lower levels of TCE and PCE. Although carbon disulfide was also detected in sample B05-3, this compound was also detected in one of the field blanks at a similar concentration and is a common laboratory contaminant.

Other subsurface soil /fill samples in which elevated levels of total VOCs (> 100 ppb) were detected include: B03-2 at 537 ppb, B07-1 at 154 ppb, B09-2 at 340 ppb, B16-2 at 405 ppb, B19-2 at 138 ppb, B20-1 at 108 ppb, B21-2 at 177 ppb, B24-2 at 389 ppb, M10-1 at 423 ppb, M10-2 at 182 ppb, M11-1 at 116 ppb, M11-2 at 357 ppb, and TP2-1 at 112 ppb. As is evident from Figure 4-1, these samples were collected from borings located across the site. However, six of these nine locations are in the central portion of the site. The majority of the total VOC concentration detected in these samples consisted primarily of petroleum-related aromatic VOCs, including benzene, toluene, ethylbenzene, chlorobenzene, xylene. Only one of these samples, TP2-1, was observed to have any petroleum-like odors or staining. Elevated levels of several other VOCs were detected in the subsurface soil samples. This includes the following: B05-1 with TCE at 240 ppb and PCE at 380 ppb, B09-2 with 1,2,-DCE at 340 ppb, and M09-2 with 2-butanone at 660 ppb.

In general, the subsurface soil VOC data indicates the presence of low level VOC contamination in the fill across the site. In addition, although elevated VOC levels were detected in several soil samples, other soil samples from these same borings showed much lower VOC levels. Thus, although the subsurface soil VOC sample results do not indicate any specific VOC "hot spot" contamination areas, there were signs of significant petroleum-related contamination (e.g., staining, odors) observed in the

subsurface soils around the depth of the ground water table at a location in the southern portion of the site.

Shoreline Soils

The four soil samples collected from along the shoreline of the site in Phase I were also analyzed for VOCs. Although, low levels of methylene chloride and acetone were initially reported in each of these samples, validation of the data qualified these compounds as undetected ("U" qualifier) based upon their presence in associated laboratory blanks. Toluene was also reported in one of these samples at a low concentration which was later qualified as undetected under data validation. Thus, no real levels of VOCs were detected in these four samples. In addition, no signs of potential VOC contamination was observed in these samples.

4.1.2 Semivolatile Organic Compounds (SVOCs)

Surface Soils

Eleven (11) surface soil samples collected during the Phase I RI and fourteen (14) surface soil samples collected during the Phase II RI were submitted for TCL SVOC analysis. An additional fourteen (14) surface soil samples collected from the first interval of many of the test borings and monitoring well borings completed during the Phase II RI were also submitted for SVOC analysis. The results of both the Phase I RI and Phase II RI surface soil sample analysis are presented together within this surface soil SVOC contamination assessment. A map showing the SVOC surface soil sample results is presented as Figure 4-2.

The results of the SVOC surface soil analysis indicate that SVOCs are present across the entire site as well as in off-site soils. Of the thirty-nine surface soil samples collected during the two phases of the RI, only seven contained no SVOCs. Two of these samples (B13-1 and M15-1) were collected off-site, east of Defense Highway, three were collected from the site (B18-1, B14-1, and M12-1), and two (SS-31 and SS-32) were collected from along the western bank of the site along Narragansett Bay. Of the SVOCs detected in the site surface soil samples, polynuclear aromatic hydrocarbons (PAHs), a subset of SVOCs, were the most prevalent. PAH compounds were present in 85% of the surface soil samples collected at concentrations ranging from 63 ppb to 356,240 ppb. Carcinogenic PAH (CaPAH) concentrations at these locations ranged from non-detect (ND) to 157,800 ppb.

As discussed previously, contaminant-comparison levels have been developed for SVOCs as a means of evaluating the relative contamination of the soil samples. The comparison levels used do not necessarily reflect the risks posed by the individual compounds within the chemical classes. Rather, they have been used as a general indicator of the degree of soil contamination, and as a means of identifying locations or areas where contaminant "hot spots" may exist. Contaminant-comparison levels have been set at 10 ppm for total SVOCs, 10 ppm for total PAHs, and 1 ppm for total carcinogenic PAHs. Figure 4-2 shows the SVOC, PAH, and carcinogenic PAH levels detected in the surface soil samples collected from across the site.

A comparison of the site soil data to the established SVOC contaminant-comparison levels indicate that ten of the surface soil samples exceed the 10 ppm total SVOC level. At each of these locations, the 10 ppm total PAHs and 1 ppm total carcinogenic PAHs comparison levels have also been exceeded. These ten surface soil samples include SS-2, located in the northern portion of the site, SS-24 and B16-1, located in the north-central portion of the site, and SS-6, SS-7, SS-8, SS-9, SS-11, B24-1, and B26-1, located in the southern portion of the site. It is important to note that only one surface soil sample (B18-1) was collected from the central portion of the site. The highest concentrations (> 100 ppm) of total SVOCs were detected in surface soil samples SS-6 (201 ppm), SS-11 (194 ppm), and sample B26-1 (360 ppm). These three locations also contained the highest total PAH and total CaPAH concentrations of the site surface soil samples. Samples SS-11 and B26-1 are located at the very southern tip of the landfill, while sample SS-6 is located just to the north of the entrance to the site. It should be noted that asphalt pieces were observed and logged in surface soil sample SS-11 and large pieces of asphalt were observed on the surface in the location of test boring B-26. Asphalt is known to contain high concentrations of PAHs.

Other SVOCs detected in the McAllister Point surface soils include dibenzofuran, carbazole, benzoic acid, 1,4-dichlorobenzene, 3,3'-dichlorobenzidine, n-nitrosodiphenylamine, and phthalate esters. Dibenzofuran was detected in eight surface soil samples collected from across the site at concentrations ranging from 51 ppb to a maximum of 2,800 ppb in sample SS-6. Carbazole was detected in nine of the surface soil samples collected from across the site at concentrations ranging from 43 ppb to a maximum of 1,200 ppb in sample B24-1. Benzoic acid, 1,4-dichlorobenzene, 3,3'-dichlorobenzidine, and n-nitrosodiphenylamine were detected in only one surface soil sample. Benzoic acid was detected in surface soil sample SS-1 at a concentration of 380 ppb, 1,4-dichlorobenzene was detected in sample SS-25 at 79 ppb, and 3,3'-dichlorobenzidine and n-nitrosodiphenylamine were detected in sample B26-1 at concentrations of 360 ppb and 1,500 ppb, respectively.

Phthalate esters detected in the McAllister Point Landfill surface soils include bis(2-ethylhexyl)phthalate, di-n-butylphthalate, and diethylphthalate. Generally, phthalate esters were detected infrequently in the site surface soils at low concentrations. Bis(2-ethylhexyl)phthalate was detected in six surface soil samples at concentrations ranging from 38 ppb to 970 ppb. Di-n-butylphthalate was detected in three surface soil samples at concentrations ranging from 47 to a maximum of 6,700 ppb at soil boring B-2. Diethylphthalate was only detected in sample B27-1 at a concentration of 55 ppb.

As is evident from the above information, SVOC contamination is present in the surface soils across McAllister Point Landfill. The highest levels of SVOC contamination were detected in surface soils in the southern portion of the site; however, extensive surface soil sampling was not conducted in the central mounded portion of the site.

Subsurface Soils

Forty-eight (48) subsurface soil samples were collected during the Phase I RI and an additional thirty-one (31) subsurface soil samples were collected during the Phase II RI for TCL SVOC analysis. The results of both the Phase I RI and Phase II RI subsurface soil sample analysis are presented together within this subsurface soil SVOC contamination assessment. A map showing the elevated subsurface soil SVOC results is presented as Figure 4-3.

Results of the subsurface soil SVOC analysis indicated that SVOCs are present throughout the site subsurface soils. Of the seventy-nine (79) subsurface soil samples analyzed, only seven did not contain detectable concentrations of SVOCs. Total SVOC concentrations of the remaining samples ranged from 70 ppb to 4,328,410 ppb (4,328 ppm). The SVOCs detected in the site subsurface soils consisted primarily of PAHs and phthalate esters. PAHs were detected in just over 70% of the subsurface soil samples collected at the site at concentrations ranging from 47 to 4,169,300 ppb. Other SVOCs detected in the site subsurface soils include phenols, dibenzofuran, carbazole, di- and trichlorobenzenes, and benzoic acid.

As discussed previously, contaminant-comparison levels of 10 ppm for total SVOCs, 10 ppm for total PAHs, and 1 ppm for total carcinogenic PAHs have been developed as a means of identifying locations where potential contaminant "hot spots" may exist. These levels do not necessarily reflect the risks posed by the individual compounds within the chemical classes. A comparison of the site soil data to the established SVOC contaminant-comparison levels indicate that twenty-five of the subsurface soil samples exceed the 10 ppm total SVOC level. A majority of these samples (20) were collected from

the central to north-central portion of the landfill. The remaining five samples were collected from the southern portion of the site. The highest concentrations (> 100 ppm) of total SVOCs were detected in samples B21-2 (17-19' interval at 4,328 ppm), M3-2 (18-20' interval at 1,943 ppm), M3-3 (22-24' interval at 506 ppm), M11-1 (8-10' interval at 432 ppm), B05-2 (14-16' interval at 117 ppm), M8-2 (16-18' interval at 106 ppm), and B09-1 (4-6' interval at 101 ppm). A map showing these sample locations and total SVOC concentrations is provided as Figure 4-3. With the exception of subsurface soil samples M8-2 and B09-1, all of the above samples were collected from the central portion of the site. As previously mentioned, PAHs make up the majority of the SVOCs detected in the site subsurface soils. A total of twenty of the twenty-five subsurface soil samples which exceeded the total SVOC level of 10 ppm also exceed the total PAH concentration of 10 ppm.

A total of thirty-five subsurface soil samples exceeded the total carcinogenic PAH (CaPAHs) concentration of 1 ppm. Sample B21-2, which contained the highest concentrations of total SVOCs (4,328 ppm), total PAHs (4,169 ppm), and total CaPAHs (1,769 ppm), was collected from fill material which consisted of glass, brick, metal, and fine gravel and contained a "strong charcoal odor". The highest levels of total PAHs detected in the subsurface soils did not correspond with the locations of the highest surface soil PAH concentrations; however, a limited number of surface soil samples were collected on the mounded portion of the landfill area in the center of the site. Table 4-5 provides a list of the subsurface soil samples which exceed the established total SVOC, PAH, and/or CaPAH contaminant-comparison concentrations. The depth and location from which each sample was collected is also provided in the table.

Phthalate esters detected in the site subsurface soils include bis(2-ethylhexyl)phthalate, di-n-butylphthalate, butylbenzyl phthalate, diethylphthalate, and di-n-octyl phthalate. At least one of these phthalate esters were detected in just over 50% of the subsurface soil samples collected across the site. The most prevalent phthalate ester detected was bis(2-ethylhexyl)phthalate, which was detected in forty subsurface soil samples at concentrations ranging from 56 to 210,000 ppb. The highest concentrations of bis(2-ethylhexyl)phthalate were detected in samples M11-1 (210,000 ppb), B09-1 (93,000 ppb), and M10-1 (41,000 ppb). Samples M11-1 and M10-1 were each collected from fill material in the central portion of the landfill. Sample B09-1 was collected from the southern portion of the site and contained a black ash and an unknown pink fibrous material. Di-n-butylphthalate and butylbenzylphthalate were detected in thirteen subsurface soil samples at concentrations ranging from 40 to 13,000 ppb and 48 to 23,000 ppb, respectively. Diethylphthalate was detected in seven subsurface soil samples at concentrations ranging from 45 to 380 ppb, and di-n-octyl phthalate was detected in one subsurface soil sample at a concentration of 700 ppb.

Phenolic compounds detected in the site subsurface soils include 4-methylphenol, phenol, 2,4-dimethylphenol, 2,4-dichlorophenol, 2,4,5-trichlorophenol, and 4-chloro-3-methylphenol. 4-Methylphenol was detected in 23 of the subsurface soil samples at concentrations ranging from 61 to 5,800 ppb. The highest concentrations of 4-methylphenol were detected in samples B09-2 (5,800 ppb), B07-2 (2,900 ppb) and B05-2 (2,100 ppb). Samples B09-2 and B05-2 each contained an unknown white pasty substance. Generally, the remaining phenolic compounds were detected infrequently (in 6 or less samples) and at low concentrations (54 to 430 ppb). One sample (M11-1) contained 2,4-dimethylphenol at a concentration of 1,400 ppb.

Dibenzofuran was detected in twenty-five of the subsurface soil samples at concentrations ranging from 41 to 58,000 ppb. Carbazole was detected in ten subsurface soil samples at concentrations ranging from 45 to 100,000 ppb. The highest concentrations of these two compounds were detected in subsurface soil samples B21-2 and M11-2. Carbazole was not included in the SVOC target compound list during the Phase I RI.

Other SVOCs detected in the subsurface soil samples include several chlorinated benzene compounds. The compound 1,4-dichlorobenzene was detected in fifteen of the subsurface soils at concentrations ranging from 43 to 1,500 ppb. The highest concentration of 1,4-dichlorobenzene was detected at sample M4-1. As will be discussed in the ground water summary, 1,4-dichlorobenzene was also detected in the ground water at this location. The compounds 1,2,4-trichlorobenzene and 1,2-dichlorobenzene were each detected in only one subsurface soil sample and at low concentrations. The compound 1,2,4-trichlorobenzene was detected in sample M4-1 at a concentration of 850 ppb, while 1,2-dichlorobenzene was detected in sample M12-2 at a concentration of 210 ppb.

Several other SVOCs were detected in the subsurface soil samples. The compounds n-nitrosodiphenylamine and benzoic acid were detected infrequently across the site. N-nitrosodiphenylamine was detected in four subsurface soil samples at concentrations ranging from 97 to 1,600 ppb, while benzoic acid was detected in two samples at concentrations of 640 ppb and 3,800 ppb.

Shoreline Soils

Four shoreline soil samples were collected in Phase I and analyzed for the TCL SVOCs. The results of these analysis indicate the presence of SVOCs in each of the samples. Total SVOC concentrations detected in the samples ranged from 2,743 ppb to 13,164 ppb (13.16 ppm). The total SVOCs concentrations for each of these soil samples are shown next to each of the respective sample

locations on Figure 4-2. The SVOCs detected in the shoreline soils consisted primarily of PAHs. Other SVOCs detected in the shoreline soil samples included dibenzofuran and butylbenzylphthalate.

In order to evaluate this data, contaminant comparison values of 10 ppm for total SVOCs, 10 ppm for total PAHs, and 1 ppm for total carcinogenic PAHs have been developed. A comparison of the shoreline soil data to these levels indicate that two of the soil samples (SS-13 and SS-15) exceed the 10 ppm comparison level set for total SVOCs and total PAHs. The highest total SVOC, PAHs, and carcinogenic PAHs concentrations were detected in sample SS-15.

Dibenzofuran was detected in two of the samples at concentrations of 120 ppb (SS-13) and 77 ppb (SS-15). Butylbenzylphthalate was detected in the sample SS-15 at a concentration of 200 ppb.

Based upon these findings, sample SS-15 appeared to have the overall highest levels of SVOC contamination of the shoreline soil samples. The physical characteristics of this soil sample differed from the other three in that it was logged as darker brown in color and organic rich. The shoreline area from which this sample was collected is covered with metal debris and concrete rubble. However, no obvious signs of potential contamination (e.g., odors, staining) were evident in this or any of the shoreline samples.

4.1.3 Pesticides/PCBs

Surface Soils

During the RI, eleven (11) surface soil samples were collected in Phase I and fourteen (14) surface soil samples were collected in Phase II and analyzed for the TCL pesticides/PCBs. In addition, under the Phase II RI, fourteen (14) surface soil samples were also collected for pesticides/PCBs analysis from the first sampling interval of many of the borings completed at the site. These boring surface samples are included in this evaluation of the surface soil sample data. The results of both the Phase I RI and Phase II RI pesticides/PCBs surface soil sample analysis are presented together within this contamination assessment. A map showing the PCB concentrations detected in the soil samples collected from the site is provided as Figure 4-4.

Pesticides were detected in every one of the surface soil samples collected at the site. In Phase I, only the pesticides 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT were reported in all of the surface soil samples. However, with the much lower Phase II analytical detection limits for pesticides in soil (revised lower CLP method detection limits), many more pesticides were reported in the Phase II samples. In fact,

all but one (toxaphene) of the twenty one TCL pesticides were detected in at least one of the Phase II surface soil samples. In many instances, however, the detected concentrations were very low (ppt to ppb) estimated concentrations ("J" qualifier) at levels lower than the actual analytical reporting limits.

To aid in evaluating the pesticides data, the pesticides detected in the on-site samples were compared with those detected in the off-site background surface soil samples (SS-18, SS-19, SS-20, M14-1, M15-1, M16-1, and B13-1). The background data indicates the presence of low levels of all but seven of the twenty one TCL pesticides in the nearby off-site soils. The only pesticides not detected in the background surface soil samples are delta-BHC, heptachlor, aldrin, endosulfan, dieldrin, endrin-ketone, and toxaphene (also not detected on-site).

Given the widespread presence of pesticides in the on-site and background surface soil samples, it was decided that an overall relative evaluation of the pesticide data would be performed to locate samples having some of the highest individual pesticide concentrations. This review identified elevated concentrations of several pesticides (heptachlor epoxide, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, and endrin ketone) in the three surface soil samples B24-1, B25-1, and B26-1 collected from the southern portion of the site. In addition, elevated concentrations of 4,4'-DDT (28 ppb to 1,800 ppb) were also detected in surface soil samples SS-08, SS-09, SS-10, SS-11, SS-26, SS-27, SS-29, and SS-30 collected from the southern site area.

Under the Phase I RI, no PCBs were detected in the site surface soil samples. However, in Phase II very low levels (ppb) of PCB Aroclors were reported in three surface soil samples, SS-25, B15-1, and B23-1/B23-3 (duplicates). The PCB concentrations detected in the surface soil samples are summarized in Table 4-6 and compared to the state's direct exposure criterion of 10 ppm PCBs. These locations are also shown on Figure 4-4 which summarizes all of the PCB concentrations detected in the surface and subsurface soil samples. The detected surface soil sample PCB concentrations ranged from 34 ppb to 350 ppb. Thus, all of the detected PCB surface soil sample concentrations are far below the state's direct exposure criterion of 10 ppm PCBs.

Subsurface Soils

During the RI, forty-eight (48) subsurface soil samples were collected in Phase I and thirty (30) subsurface soil samples were collected in Phase II and analyzed for the TCL pesticides/PCBs. The results of both the Phase I RI and Phase II RI pesticides/PCBs subsurface soil sample analysis are presented together within this contamination assessment.

As with the surface soil samples, pesticides were widely detected in the subsurface soil samples. An overall relative evaluation of the pesticide data indicates that elevated pesticide levels were detected in several of the subsurface samples. Elevated concentrations of the pesticides heptachlor epoxide, dieldrin, 4,4'-DDE, endrin, endosulfan, 4,4'-DDD, 4,4'-DDT, methoxychlor, endrin ketone, and alpha chlordane were detected in several of the subsurface samples. One or a few of these pesticides were detected at higher concentrations than those detected in other site samples and the background surface soil samples. Those samples having the elevated individual pesticide concentrations are the following: B17-2, B18-2, B19-2, B21-2, B22-1, B25-2, M08-2, M10-1, M10-2, M11-1, M11-2, M12-2, TP2-1, and TP2-2. These samples were collected from locations across the site; four in the southern area, five in the central area, and two in the north central area. Several of the Phase I subsurface soil samples (B04-2, B05-2, B10-2, and M03-3) also had elevated levels of 4,4'-DDD. The greatest number of elevated pesticides were detected in samples B19-2, M08-2, M11-1, and TP2-1. Each one of these samples contained a large amount of trash or debris material.

The highest detected subsurface soil concentrations of several of the other elevated pesticide concentrations are as follows: endrin at 21 ppb and methoxychlor at 110 ppb in B19-2; methoxychlor at 110 ppb in B17-2; 4,4'-DDD at 2,300 ppb in B05-2; and 4,4'-DDE at 150 ppb, 4,4'-DDT at 480 ppb, and dieldrin at 35 ppb in M08-2. As with the surface soil samples, the compound 4,4'-DDT and its breakdown products 4,4'-DDE and 4,4'-DDD were most common pesticides detected at elevated concentrations in the subsurface samples.

PCBs were detected in thirty two (32) of the subsurface soil samples collected from the site. A summary of the PCB concentrations detected in the subsurface soil samples along with a comparison to the federal PCB action level of 10 ppm and state's direct exposure criterion of 10 ppm is presented in Table 4-7 and on Figure 4-4. PCBs were detected in subsurface soil/fill samples from ten of the test boring locations, six of the monitoring well boring locations, and three of the test pit locations. The detected PCB concentrations were relatively low ranging from 17 ppb to 2,200 ppb (2.2 ppm), all less than the referenced soil PCB action levels. It is likely that with the new, lower analytical PCB detection limits, much lower PCB levels were reported in Phase II. The detected PCB levels are all below the state's direct exposure criterion of 10 ppm for PCBs in soils. In fact, only two of the detected PCB concentrations (B12-2 at 1.1 ppm and M10-2 at 2.2 ppm) exceed 1 ppm. Both of these samples were collected from borings completed in the central portion of the site. The sample from boring B-12 was collected from the bottom of the fill material and noted to contain a black ash. Whereas, the sample from well boring M-10 was collected from the grey weathered shale encountered at the bottom of the boring beneath the fill. Neither sample was observed to have any signs of potential petroleum-related contamination (e.g., petroleum odors, oily, sheen).

PCB concentrations were detected in subsurface samples collected from across the entire site. As shown on Figure 4-4, PCBs were detected in the subsurface across the site as follows: 11 samples at 8 locations in the southern area, 10 samples at 6 locations in the central area, and 8 samples at 5 locations in the northern area. Based upon the Phase I and Phase II data, there do not appear to be any obvious trends or "hot spots" of PCB soil/fill contamination at this site. The low PCB levels detected appear to be fairly evenly distributed in the soil and fill across the site. In addition, although visibly petroleum-contaminated soils were encountered in the subsurface at the southern end of the site, the PCB levels detected in this material were similar to those detected in fill across the site.

Shoreline Soils

No pesticides were detected in the four shoreline soil samples. The PCB Aroclor-1254 was detected in all four of the shoreline soil samples at concentrations ranging from 130 ppb to 610 ppb. These soil samples were all collected from the sites shoreline along Narragansett Bay. The levels detected in the shoreline soil samples fall far below the RIDEM action level of 10 ppm for PCBs in soils. The highest PCB concentration of 610 ppb was detected in soil sample SS-15 which was observed to be a more organic-rich, finer-grade sand.

4.1.4 Inorganic Compounds

Surface Soils

During the RI, thirteen (13) surface soil samples were collected in Phase I and fourteen (14) surface soil samples were collected in Phase II and analyzed for the TAL metals and cyanide. In addition, under the Phase II RI, fourteen (14) surface soil samples were also collected for metals and cyanide analysis from the first sampling interval of many of the borings completed at the site. These boring surface samples are included in this evaluation of the surface soil sample data. As discussed previously, several soil samples were also collected from along the shoreline of the site in Phase I; however, these soil samples are discussed separately at the end of this section.

Numerous metals were detected in the soil samples collected from this site. The inorganic analytes common to each of the surface soil samples collected on the site included chromium (5.2 to 65 ppm), copper (7.1 to 293 ppm), nickel (3.4 to 49.1 ppm), lead (6.3 to 362 ppm), vanadium (8.4 to 119 ppm), and zinc (25.5 to 622 ppm). Other metals detected in all but a few of the surface soil samples included arsenic (1.9 - 24.1 ppm), barium (3.1 - 53.6 ppm), beryllium (0.21 - 1.0 ppm), and cobalt (3.6 - 24.9 ppm). Other inorganics common to each of the surface soil samples included aluminum,

calcium, iron, magnesium, and manganese. Cyanide and thallium were not detected in any of the surface soil samples (excluding the shoreline soil samples) collected from the site. A summary of the maximum detected inorganic compound concentrations is provided in Table 4-8.

To evaluate the inorganic analyte soil data, the inorganic analyte levels detected in the surface soil samples were compared with site-specific, off-site background surface soil sample results. A summary of the site-specific background surface soil sample inorganic compound results is provided in Table 4-9. In addition, published ranges of background elements in soils in the eastern United States were reviewed. An overall comparison of the inorganic analyte concentration ranges detected in surface soil samples from the McAllister Point Landfill to the site-specific background surface soil sample inorganics results are presented in Table 4-10.

To aid in evaluating the surface soil inorganics data, a map of the metals concentrations of select metals above the mean site-specific background values was developed. This map is presented as Figure 4-5. Given the large number of metals detected in the site soils, a reduced list of metals was selected to make the map more legible and useful. Thus, the metals shown on this map are arsenic, beryllium chromium, copper, lead, mercury, and nickel. These metals were considered to be the key metals of concern based upon other RI media results and the findings of the human health and ecological risk assessments conducted for the site.

A comparison of the site soil data to the site-specific background soil data indicates that elevated analyte levels were detected in several of the surface soil samples collected from the site. Those surface soil samples whose analyte concentrations exceeded several (at least 4 analytes) of the background levels include surface soil samples SS-8, SS-9, SS-26, SS-27 and the surface soil samples from test borings B-23 and B-24 and well borings M-12 and M-13. The greatest number of background analyte concentrations were exceeded in samples SS-8 (15 analytes) and boring sample B23-1 (10 analytes). All of these samples were collected from the southern end of the site; however, it is important to note that only one surface soil sample (B18-1) was collected from the central portion of the site, five samples (SS-23, SS-24, SS-25, B15-1, B16-1) were collected from the north-central area, and three samples (SS-21, B14-1, and B27-1) from the northern end.

As indicated in Table 4-8, many of the highest analyte concentrations which exceeded the background levels were detected in surface samples SS-8 (9 analytes) and B23-1/B23-3 (duplicates; 4 analytes) collected near each other from the southern portion of the site. Between these two samples (one is a duplicate sample), the highest concentrations for aluminum, antimony, barium, beryllium, chromium, copper, iron, lead, mercury, nickel, silver, vanadium, and zinc were detected. According to the sample

description logs, both of these samples were collected from locations of fill material (e.g., plastic bag, bricks, or asphalt). The following are the samples in which the highest concentrations of the other significant analytes were detected: arsenic (24.1 ppm) at M12-1, cadmium (2 ppm) at SS-05, cobalt (24.9 ppm) and magnesium (6,830 ppm) at SS-32, and selenium (2 ppm) at SS-11.

Several surface soil samples were also collected from the face of the site fill material along the western site shoreline. This included the Phase II surface soil samples SS-29, SS-30, SS-31, and SS-32. Samples SS-29 and SS-30 were collected from the side of the elevated fill area at the southern end of the site, whereas samples SS-31 and SS-32 were collected from the side of the weathered shale bedrock face at the northern end of the site. A review of this inorganics data does not indicate any significant concerns or trends with samples SS-29 and SS-30. However, the data for samples SS-31 and SS-32 do indicate generally elevated levels for aluminum, cobalt, iron, magnesium, and nickel in the two samples. As presented above, the highest surface soil concentrations for cobalt and magnesium were detected in sample SS-32. In addition to these elements being present in site soils, they were also detected at similar concentrations in the off-site background surface soil samples. Based upon these findings and the absence of any signs of site-related contamination (e.g., fill, debris, trash, staining, odors) in these samples, it appears that these analytes are common naturally-occurring minerals of the shale and area soils. In addition, this soil data supports the findings of naturally-occurring background levels of these minerals in the area ground water as discussed in Section 4.2.4.

Detected lead concentrations in the surface soils were also compared to the state's direct exposure criterion of soil lead of 500 ppm as shown in Table 4-6. This guidance level was exceeded in only two of the surface soil samples, SS-08 (362 ppm) and SS-17 (314 ppm). Sample SS-08 was noted to have been collected from on-site fill materials. However, sample SS-17 is one of the Phase I background samples collected from off of the site. Although, due to the small scale of the site maps, it may appear on site maps that sample SS-17 was collected directly adjacent to the road, the sample location is actually 40 feet off of the road. In addition, another background surface sample collected in Phase II from that same area (M14-1) generally showed similar levels of all analytes except lead. The second highest background surface soil lead level of 283 ppm was detected in sample SS-16. Again, for the surface soil samples, only the lead level in on-site surface soil sample SS-08 exceeded this second highest detected background soil lead level. The next highest on-site lead levels detected in the surface soil were 156 ppm (SS-09) and 155 ppm (SS-05) collected from along the eastern edge of the site.

Subsurface Soils

During the RI, forty-eight (48) subsurface soil samples were collected under Phase I and twenty-nine (29) subsurface soil samples were collected under Phase II and analyzed for the TAL metals and cyanide. As described in the sample description logs, many of the subsurface soil samples contained fill and debris material. Numerous metals were detected in the subsurface soil and fill samples collected from this site. The levels of metals detected in the subsurface soil/fill materials were typically higher than those detected in the surface soil.

The inorganic analytes common to each of the subsurface samples collected on the site included arsenic (1.4 to 61.4 ppm), chromium (4.7 to 111 ppm), cobalt (1.5 to 32.2 ppm), lead (2.1 to 4,720 ppm), nickel (2.7 to 333 ppm), and zinc (13.2 to 9,750 ppm). Copper (2.9 to 3,130 ppm) was detected in all but two of the subsurface soil samples. Barium (2.3 to 506 ppm) was detected in all but three of the subsurface soil samples. Other metals detected in many of the subsurface soil samples included beryllium (0.21 to 2.3 ppm) and vanadium (4.1 to 630 ppm). Other inorganics common to each of the subsurface soil samples included aluminum, calcium (in all but one sample), iron, magnesium, and manganese. As with the surface soil samples, thallium was not detected in any of the subsurface soil samples collected from the site. Table 4-8 provides a summary of the maximum detected inorganic compounds in the subsurface soil samples collected from the site.

In order to perform a relative evaluation of the subsurface soil inorganic data, the site-specific background surface soil inorganic data was used for comparison purposes. As presented in the surface soil assessment, these background inorganic levels are provided in Table 4-10. This comparison indicates that elevated levels of metals were detected in many of the subsurface soil/fill samples. Those subsurface samples whose analyte concentrations exceeded many (at least 10 analytes) of the surface soil background levels include the following seventeen samples: B2-2, B3-2, B5-2, B7-2, B9-2, B12-1, B12-2, B12-3, B19-2, B21-2, M2-2, M3-3, M4-1, M8-1, M8-2, M10-1, M11-1, and M11-2. These samples were collected from fourteen different locations across the site. Each of these samples were collected from sample intervals which were documented to contain fill and/or debris materials (e.g., wood, plastic, brick, metal, paper, cloth). The majority of these sample locations (11 of 14) are located in the central portion of the site. Two of the sample locations (well borings M-2 and M-8) are located in the north central area and one of the locations (test boring B-9) is located in the southern area.

To aid in evaluating the subsurface soil inorganics data, a map of the metals concentrations of select metals above the mean site-specific background values was developed. This map is presented as

Figure 4-6. Given the large number of metals detected in the site soils, a reduced list of metals was selected to make the map more legible and useful. As with the surface soils, the metals shown on this map are arsenic, beryllium chromium, copper, lead, mercury, and nickel. These metals were considered to be the key metals of concern based upon other RI media results and the findings of the human health risk and ecological risk assessments performed for the site.

The greatest numbers of background analyte concentrations were exceeded in samples B19-2 (18 analytes), M08-2 (15 analytes), B5-2 (14 analytes), B07-2 (14 analytes), and B21-2 (14 analytes). Four of these samples are from four different borings (B-5, B-7, B-19, and B-21) completed in the central portion of the site. The other sample was collected from the boring for well MW-8 in the north central site area. Each one of these borings was documented to have been completed in large amounts of fill and debris. The sample from boring B-5 was also noted to contain a "white pasty substance".

As shown in Table 4-8, the majority of the highest subsurface soil analyte concentrations were detected in two samples, samples M08-2 and B19-2. Both of these samples were collected from borings where large amounts of trash and debris were observed. Sample B19-2 was also observed to be moist and at the approximate depth of the ground water table. Between these two samples, the highest concentrations for antimony, cadmium, calcium, cobalt, iron, lead, magnesium, potassium, silver, sodium, and vanadium were detected in the subsurface samples. The highest concentrations of other significant analytes were detected in the following subsurface samples: arsenic (61.4 ppm) at B22-1, barium (506 ppm) at M11-1, beryllium (2.3 ppm) and chromium (111 ppm) at B05-2/B05-4, copper (3,130 ppm) and nickel (333 ppm) at B12-2, and mercury (2.9 ppm) at B09-2, and zinc (9,750 ppm) at B12-1.

Generally, elevated levels of several other inorganics were commonly detected in subsurface samples which either consisted entirely of the native grey shale bedrock material or contained shale fragments. Many of the lower boring samples collected beyond the bottom of the observed fill in Phase I were collected from the shale bedrock formation. Similar to the surface soil assessment discussion, those subsurface samples which contained shale typically had higher concentrations for several common elements, including aluminum, cobalt, iron, magnesium, and nickel. As presented in the ground water discussion, it is likely that these minerals are common and naturally occurring in the native shale bedrock formation.

Lead was detected in four subsurface soil samples at concentrations exceeding the state's direct exposure criterion of 300 ppm for lead in soils. The highest detected background surface soil lead level of 314 ppm was also exceeded at each of these sixteen locations. These sample locations and lead

concentrations are summarized in Table 4-7. Significantly elevated lead concentrations (greater than 1,000 ppm) were detected in six samples collected from the five locations B-5, B-7, B-12, B-19, and M-8. Large amounts of fill and debris were observed at each of these locations. Four of these five locations (B-5, B-7, B-12, and B-19) are all in the central portion of the site. The remaining location (M-8) is located in the north central site area. The two greatest lead concentrations were detected in samples B19-2 (4,720 ppm) and B5-2 (3,610 ppm).

Shoreline Soils

A total of four soil samples (SS-12, SS-13, SS-14, and SS-15) were collected from the shoreline area in Phase I for TAL metals and cyanide analysis. These samples were collected from the surface of the beach area which runs from the south central portion of the site to beyond the southern end of the site. These soil samples characteristically consisted of medium to coarse sand mixed with stones and cobbles.

A comparison of the shoreline soil data to the site-specific background surface soil data indicates that elevated concentrations of many analytes were detected in the shoreline samples. Although the site-specific background surface soil samples do not likely provide representative background data for the shoreline soils and sediments, they do provide an indication of the relative levels of inorganics detected in these samples. This comparison indicates high levels of calcium, cadmium, copper, iron, nickel, lead, antimony, vanadium, and zinc in nearly all of these shoreline samples. In addition, silver and cyanide were detected in sample SS-15. The significantly elevated level of calcium in all of these samples and sodium in several of these samples indicates the likely influence of the bay seawater on the associated sample locations.

Each of these four shoreline samples also exceeded the RIDEM soil lead action level of 300 ppm. The lead levels detected at each of these locations sample are the following: SS-12 at 474 ppm, SS-13 at 384 ppm, SS-14 at 447 ppm, and SS-15 at 1,980 ppm. Typically, the highest metals shoreline sample concentrations were detected in sample SS-15 which was collected from an area of the shoreline where large amounts of rusted scrap metal is present.

4.1.5 Dioxin/Furans

Surface Soils

A total of five surface soil samples and one duplicate sample were collected under the Phase II RI and analyzed for chlorinated dibenzo-p-dioxins and furans. None of the Phase I surface soil samples were analyzed for dioxins and furans. The Phase II samples included surface soil samples collected from the northern portion of the site where an ash material was observed at the surface. This is the area of the site where a movable incinerator reportedly operated.

The results of the dioxins/furans analysis indicates the presence of low levels (less than 1 ng/g or 1 ppb) of dioxins or furans in the four samples, SS-22, SS-23, SS-24, and SS-40 (duplicate of SS-25). Samples SS-23, SS-24, and SS-40 were noted to contain some ash material. The dioxins/furans levels detected in the samples were the following: SS-22 with total octachlorodibenzodioxins (OCDDs) at 0.32 ppb, SS-23 with total OCDDs at 1.0 ppb, SS-24 with total OCDDs at 0.29, and SS-40 with total tetrachlorodibenzofurans (TCDFs) at 0.36 ppb.

In order to evaluate the dioxins/furans data, 2,3,7,8-tetrachlorinated dibenzo-p-dioxin (2,3,7,8-TCDD) toxicity equivalency factors (TEFs) were calculated for each of the four samples having positive detects. Consistent with US EPA guidance, the calculation of TEFs equates all of the detected dioxins/furans results with the most known toxic dioxin isomer 2,3,7,8-TCDD. The TEFs for all of the site samples analyzed for dioxins/furans are shown in Table 4-11. The 2,3,7,8-TCDD equivalent concentrations for those samples having detected levels of dioxins or furans are shown on Figure 4-7. The surface soil sample data indicates that the 2,3,7,8-TCDD equivalents for SS-22, SS-23, SS-24, and SS-40 are 0.00032 ppb, 0.001 ppb, 0.00029 ppb, and 0 ppb, respectively. These levels are much lower than the typically applied US EPA action level of 1 ppb for dioxin (2,3,7,8-TCDD) in residential soils. The very low (0.001) to zero TEFs for the two dioxins/furans homologue groups detected in the two samples indicates a much lower relative toxicity of those dioxins/furans as compared to that of the 2,3,7,8-TCDD isomer.

Subsurface Soils

Five of the Phase I subsurface soil samples and one Phase II subsurface soil sample were analyzed for dioxins and furans. Based upon the results of the other Phase I sample analyses of these samples and recorded field observations (e.g., presence of ash), it was decided at the completion of Phase I to have five of the Phase I archived sample aliquots also analyzed for dioxins and furans. These samples

included samples of the ash material observed in the northern portion of the site and samples of the fill material from the central mounded portion. The samples of the central fill material included some of the most contaminated samples collected in Phase I.

The results of the dioxins/furans analysis indicates the presence of levels (less than 1 ng/g or 1 ppb) of dioxins or furans in each of the five Phase I samples, M02-1, M03-1, M05-1, M07-1, and M07-2 and the one Phase II sample B17-1. The results of those analyses are summarized in Table 4-11. At least one or more dioxin or furan homologue was detected in the six subsurface samples. Generally, those samples which were reported to contain ash material, M02-1, M03-1, and B17-1, had the highest detected total 2,3,7,8-TCDD equivalent levels. However, sample M05-1 which also had some of the highest dioxins/furans levels detected was not reported to contain any ash material.

In order to evaluate the dioxins/furans data, 2,3,7,8 tetrachlorinated dibenzo-p-dioxin (2,3,7,8-TCDD) toxicity equivalency factors (TEFs) were calculated for each of the soil samples. Consistent with US EPA guidance, the calculation of TEFs equates all of the detected dioxins/furans results with the most known toxic dioxin isomer 2,3,7,8-TCDD. The TEFs for all of the site samples analyzed for dioxins/furans are shown in Table 4-11. The 2,3,7,8-TCDD equivalent concentrations for those samples having detected levels of dioxins or furans are shown on Figure 4-7. The subsurface soil sample data indicates that the 2,3,7,8-TCDD equivalents for M02-1, M03-1, M05-1, B07-1, B07-2 and B17-1 as 0.031 ppb, 0.0377 ppb, 0.0361 ppb, 0.017 ppb, 0.013 ppb, and 0.0023 ppb, respectively. These levels are much lower than the typically applied US EPA action level of 1 ppb for dioxin (2,3,7,8-TCDD) in residential soils. The very low (0.001) to zero TEFs for the two homologue groups detected in the two samples indicates a much lower relative toxicity of those dioxins/furans as compared to that of the 2,3,7,8-TCDD isomer.

4.2 GROUND WATER ASSESSMENT

Ground water samples were collected from nine shallow monitoring wells screened within the overburden material and from twelve deep monitoring wells screened within the bedrock material. Figure 2-8 provides the locations of the McAllister Point Landfill site monitoring wells. In Phase I, ground water samples were collected from eleven monitoring wells and analyzed for the full TCL/TAL. Under Phase II, ground water samples were collected from the twenty-one monitoring wells and analyzed for TCL VOCs, TCL SVOCs, TAL metals, cyanide, and total chloride. The Phase II sampling included resampling of all Phase I wells. Due to the absence of pesticides/PCBs in the Phase I ground water samples collected from the remainder of the site, only the Phase II ground water samples collected from monitoring wells MW-5S, MW-5R, MW-12S, and MW-13S were analyzed for TCL

pesticides/PCBs. In addition, monitoring well MW-2S could only be sampled for TCL VOCs due to the low volume of ground water in the well; and monitoring wells MW-8S and MW-11S could not be sampled at all due to the lack of ground water in these wells. Five of the Phase II ground water samples (MW-3S, MW-3R, MW-8R, MW-13S, and MW-15R) were also analyzed for dissolved metals (filtered), BOD, COD, and TSS.

One leachate spring sample was also collected in Phase I from the western edge of the landfill. During Phase II, three leachate spring samples were collected from the same area and analyzed for full TCL/TAL parameters. An assessment of the leachate spring sample results is included with the ground water discussion for each compound group. The analytical results of the Phase I and Phase II ground water and leachate spring samples are provided in data summary tables in Appendices L and M, respectively. Detection summary or "hits" tables for the Phase II ground water samples and leachate samples are presented as Tables 4-12 and 4-13, respectively.

In addition to the ground water and leachate samples, a surface water sample was collected in Phase II from Narragansett Bay adjacent to the site for use in the evaluation of the site ground water data. The analytical results for the Phase II surface water sample are provided in Appendix O. A detection summary or "hits" table for the surface water sample is presented as Table 4-17. The following sections discuss the presence and nature of ground water contamination detected in the ground water, leachate spring, and surface water samples. The ground water assessment discussion is presented in the order of the following chemical compound classes: VOCs, SVOCs, pesticides/PCBs, and inorganic analytes. Ground water contaminant levels were compared to federal maximum contaminant levels (MCLs) and secondary maximum contaminant levels (SMCLs) established under the Safe Drinking Water Act, and to the Rhode Island DEM Rules and Regulations for Ground Water Quality. Contaminant-specific comparisons of detected levels to RIDEM and federal ground water standards for the Phase I and Phase II ground water samples are presented in Tables 4-13 and 4-14, respectively. The surface water sample data is compared to USEPA Ambient Water Quality Criteria (AWQC) for marine waters. Contaminant-specific comparisons of compounds or analytes detected in the leachate and surface water levels to the AWQC are presented in Tables 4-16 and 4-17, respectively.

4.2.1 Volatile Organic Compounds (VOCs)

During the Phase I RI, ground water samples were collected from six shallow monitoring wells screened in the overburden material and five monitoring wells installed in the underlying bedrock. Results of the Phase I ground water sampling indicated that VOCs were detected in four of the shallow monitoring wells (MW-3S, MW-4S, MW-5S, and MW-21S) and in one of the bedrock monitoring wells (MW-3R).

Petroleum-related VOCs (benzene, xylenes) were detected in these four shallow wells at total VOC concentrations ranging from 2 to 163 ppb and in the one bedrock well at a concentration of 1 ppb (benzene). The concentration of benzene detected at shallow monitoring well MW-3S (6 ppb) exceeded the RIDEM and federal ground water quality standard of 5 ppb. Also note that several months after the Phase I sampling, a floating oil layer was observed in monitoring well MW-5S.

During the Phase II investigation, ground water samples were collected from ten shallow monitoring wells and eleven bedrock monitoring wells and analyzed for TCL VOCs. Results of the Phase II ground water sampling confirmed the presence of VOCs in monitoring wells MW-3S, MW-4S, and MW-21S; however, no detectable concentrations of VOCs were present in monitoring well MW-5S during the Phase II RI. In addition, the oil layer previously discovered in monitoring well MW-5S was not observed during the Phase II sampling. Monitoring wells MW-9R, MW-12S, and MW-13S were the only wells installed during the Phase II investigation which contained detectable concentrations of VOCs. Monitoring well MW-2S, which was dry and thus not sampled during the Phase I RI, also contained detectable concentrations of VOCs. Aromatic VOCs detected during the Phase II ground water sampling round include benzene, chlorobenzene, ethylbenzene, toluene, xylene, and carbon disulfide. 1,2-Dichloroethene, a chlorinated solvent, was detected in the bedrock well MW-9R. Figure 4-8 summarizes the VOC concentrations detected in the monitoring wells in Phase II.

Ground water VOC contamination appears to be limited to three areas of the site. In the southern portion of the site, where oily soils were observed during drilling and test pit activities, chlorobenzene (29 ppb), ethylbenzene (4 ppb), and xylene (14 ppb) were detected in monitoring well MW-12S and chlorobenzene (3 ppb) was detected in monitoring well MW-13S, which is located somewhat upgradient of well nest MW-5. Low levels of ethylbenzene (2 ppb) and xylene (14 ppb) were also detected in a subsurface soil sample collected at well MW-13S; however, no VOCs were detected in the subsurface soil sample collected at well MW-12S. Aromatic VOCs were also detected under the Phase II soil gas survey completed in this area. As mentioned previously, an oil layer was also observed at one time in a well (MW-5S) in this area.

In the central portion of the site, benzene (2 ppb), chlorobenzene (10 ppb), ethylbenzene (6 ppb), and xylene (7 ppb) were detected in monitoring well MW-4S and benzene (2 ppb) was detected in monitoring well MW-3S. While petroleum-related compounds were detected at these two wells during the Phase I RI, the Phase II RI VOC concentrations are either lower or the compound was not detected at all. As discussed in Section 4.1.1, the highest levels of subsurface soil VOC contamination detected during both phases of the RI were in test borings and monitoring well borings completed in the central portion of the site. The highest levels of petroleum-related VOCs detected in the subsurface soil during

the Phase II RI were present in monitoring well boring MW-10R. However, the ground water table at this location of the site is within the weathered bedrock and does not come into contact with the fill material. No VOCs were present in the ground water collected from MW-10R. During the Phase II RI, a low concentration of toluene (24 ppb) was detected in monitoring well MW-21S, also located in the central portion of the site. Toluene was not detected in this well during the Phase I RI and was not detected in any of the other wells sampled during the Phase II RI.

Bedrock well MW-9R, also located in the central portion of the site, contained an estimated ("J" qualifier) level of 1,2-dichloroethene of 1 ppb. This was the only ground water sample collected during either of the phases which contained a detectable concentration of a chlorinated solvent.

In the northern portion of the site, low concentrations of ethylbenzene (3 ppb) and xylene (15 ppb) were detected in monitoring well MW-2S. These compounds were not detected in well MW-7S located upgradient of this well or in well MW-8R located directly downgradient of the well. Ethylbenzene and xylene were detected in a subsurface soil sample collected at well MW-2S during the Phase I RI at concentrations of 7 ppb and 26 ppb, respectively. Monitoring well MW-2S was not sampled during the Phase I RI due to a lack of ground water in the well.

No VOCs were detected in the four leachate spring samples collected during the Phase I and Phase II RI. In addition, no VOCs were detected in the surface water sample collected in Phase II.

While VOC contamination does exist in the shallow ground water at the McAllister Point Landfill, it appears that the low concentrations have diminished over the four years between the two sampling rounds. As shown in Table 4-14, none of the VOCs detected in the ground water samples during the Phase II RI exceeded any of the federal MCLs or RIDEM ground water quality standards.

4.2.2 Semivolatile Organic Compounds (SVOCs)

The ground water samples collected from the seven shallow monitoring wells and the four bedrock monitoring wells during the Phase I RI were analyzed for SVOCs. Results of the Phase I sampling indicated that low level concentrations of SVOCs were present in three of the shallow monitoring wells (MW-3S, MW-4S, and MW-5S) and in none of the bedrock monitoring wells. The SVOCs detected in the three ground water samples consisted primarily of PAHs and phenols. However, low levels (< 10 ppb) of phthalates, 1,4-dichlorobenzene, benzoic acid, and dibenzofuran were also detected in the ground water. The highest concentration of total SVOCs (407 ppb) was detected in monitoring well MW-3S, located in the central portion of the landfill. The SVOCs detected in this well consisted almost

entirely of PAHs. As shown in Table 4-13, none of the Phase I ground water sample SVOC concentrations exceeded any established ground water standards.

During the Phase II RI, ground water samples were collected from nine shallow monitoring wells and eleven bedrock monitoring wells and analyzed for SVOCs. Results of the Phase II RI ground water investigation indicate that SVOCs are present in the ground water at several of the site monitoring wells. SVOCs detected during the Phase II RI ground water sampling include PAHs, phthalate esters, dichlorobenzene, phenols, dibenzofuran, and carbazole. Figure 4-9 summarizes the SVOC concentrations detected in the monitoring wells in Phase II.

PAH compounds were detected in six monitoring wells in Phase II including MW-3S, MW-3R, MW-4S, MW-11R, MW-12S, and MW-13S. The highest concentrations of PAHs were detected in monitoring well MW-3S located in the central portion of the site. High concentrations were also detected in the subsurface soils in this portion of the site. Monitoring well MW-3S had a total PAH concentration of 190 ppb. The total PAH concentration detected in MW-3R was 4.6 ppb. Total PAH concentrations at MW-4S (upgradient well) and MW-11R (downgradient well) were 4 ppb and 22 ppb, respectively. Low concentrations of PAHs were also detected in two of the monitoring wells in the southern portion of the site. Naphthalene and 2-methylnaphthalene were detected in monitoring wells MW-12S and MW-13S at concentrations of 3 ppb and 1 ppb at MW-12S and at concentrations of 0.9 ppb and 1 ppb at MW-13S. Pyrene (also a PAH compound) was also detected in well MW-12S at a concentration of 1 ppb.

Phthalate esters were detected in nine of the site ground water monitoring wells. Phthalate esters detected in the site ground water include diethylphthalate, di-n-butyl phthalate, and bis(2-ethylhexyl)phthalate. The highest concentration of phthalate esters were detected in monitoring well MW-8R. Bis(2-ethylhexyl)phthalate was detected in the ground water at this location at a concentration of 240 ppb. As shown in Table 4-14, the bis(2-ethylhexyl)phthalate concentration of 240 ppb significantly exceeds the MCL of 6 ppb for this compound. As shown on Figure 4-10, this was the only SVOC detected in the Phase II ground water samples which exceeded any ground water quality standards. The remaining wells which contained detectable concentrations of phthalate esters include MW-3S, MW-3R, MW-4S, MW-9R, MW-10R, MW-11R, and MW-15R. The concentrations of phthalate esters detected in the ground water at these wells ranged from 0.5 ppb to 4 ppb.

Phenolic compounds detected in the site ground water include 4-methylphenol, 2-methylphenol, and 2,4-dimethylphenol. Phenols were detected at low concentrations in monitoring wells MW-3S, MW-4S, and MW-21S in the central portion of the site, and in monitoring wells MW-12S and MW-13S in

the southern portion of the site. The highest concentration of phenols were detected at monitoring well MW-4S, which had a concentration of 11 ppb of 4-methylphenol. Concentrations of phenols detected in the other four wells ranged from 1 ppb to 4 ppb.

Dichlorobenzene was detected in four ground water monitoring well samples during the Phase II RI. These monitoring wells include MW-4S, MW-12S, MW-13S, and MW-21S. The concentrations of 1,4-dichlorobenzene detected in these four wells were 12 ppb, 13 ppb, 2 ppb, and 0.5 ppb, respectively. 1,3-Dichlorobenzene was detected in monitoring wells MW-12S and MW-13S at concentrations of 2 ppb and 0.5 ppb, respectively. As shown in Table 4-14, none of the detected dichlorobenzene concentrations exceeded established ground water quality standards. 1,4-Dichlorobenzene was detected in several of the subsurface soil samples collected across the site, including at MW-4S, which contained the highest concentration of 1,4-dichlorobenzene in subsurface soils at the site. The subsurface soil sample (M04-1) was collected from the interval just above the ground water table. 1,3-Dichlorobenzene was not detected in any of the subsurface soils collected during the Phase I or II investigations.

Dibenzofuran and carbazole was detected infrequently in the site ground water samples. Dibenzofuran was detected in monitoring wells MW-3S and MW-11R at concentrations of 15 ppb and 2 ppb, respectively. Concentrations of dibenzofurans detected in subsurface soils collected at MW-3S ranged from 850 ppb to 56,000 ppb. High concentrations of dibenzofurans (16,000 ppb and 22,000 ppb) were also detected in subsurface soil samples collected at MW-11R. Carbazole was detected in monitoring well MW-3S at a concentration of 24 ppb. This was the only monitoring well which contained detectable concentrations of carbazole. Of the subsurface soil samples collected in the vicinity of MW-3S, only test boring sample B19-2 contained a detectable concentration (83 ppb) of carbazole. Subsurface soils collected from monitoring well MW-3S during the Phase I investigation were not analyzed for carbazole (not in TCL at that time).

No semivolatile organic compounds were detected in the four leachate spring samples collected during the Phase I and Phase II RI. In addition, no SVOCs were detected in the one surface water sample collected in Phase I.

4.2.3 Pesticides/PCBs

During the Phase I RI, ground water samples were collected from seven shallow monitoring wells and four bedrock monitoring wells and analyzed for TCL pesticides/PCBs. Results of the Phase I RI indicated that pesticides were not present in the site ground water and that PCBs were present in only

one of the shallow monitoring wells sampled. The PCB Aroclor-1254 was detected in monitoring well MW-5S at a concentration of 0.73 ppb which exceeds the PCB ground water quality standard of 0.5 ppb, as shown in Table 4-13. This well is located at the southern end of the landfill. This is also the well where an oil layer was observed shortly after the Phase I sampling. Petroleum-contaminated subsurface soil was also observed in this area under both investigations.

Based on the results of the Phase I RI ground water analyses (i.e., no pesticides and only limited PCB contamination in ground water), pesticide/PCB analyses was only conducted on the ground water samples from monitoring wells MW-5S and MW-5R, MW-12S, and MW-13S installed in the southern portion of the site. The results of the Phase II ground water sample analyses indicate that the pesticide 4,4'-DDD and the PCB Aroclor-1254 were detected in the ground water in the southern portion of the site. The PCB Aroclor-1254 was detected in monitoring wells MW-5S, MW-12S, and MW-13S at concentrations ranging from 0.76 to 1.8 ppb, with the highest level being detected in well MW-13S. As shown in Table 4-14 and on Figure 4-10, these levels exceed the federal MCL and state ground water standard of 0.5 ppb for PCBs. The PCB level of 1.0 ppb detected in well MW-5S in Phase II was slightly greater than that detected in this well in Phase I (0.73 ppb). PCBs were not detected in bedrock monitoring well MW-5R which is paired with well MW-5S. PCBs were also detected in soil samples from this area. The highest PCB soil levels were observed near or below the depth of the ground water table. The detection of PCBs in this southern portion of the site may be related to the oily soils and ground water observed in this area during site investigation activities. In addition, the pesticide 4,4'-DDD was detected in monitoring well MW-12S at a concentration of 0.18 ppb. This pesticide compound was also detected in the duplicate sample (MW-17S) collected from MW-12S at a concentration of 0.20 ppb.

Although pesticides and PCBs were detected in the ground water, pesticides and PCBs have a strong affinity for organic materials in soils and low water solubility which tends to reduce their mobility in soil and ground water. The expected fate process of pesticides and PCBs is abiotic and biotic degradation. The primary migration pathways for pesticides and PCBs in soil include transport of soil particulates in surface water runoff and via wind erosion.

Results of the leachate spring samples collected during the RI indicate that a few pesticides were present in two of the Phase II samples at very low parts per billion (actually parts per trillion) levels. A summary of the leachate sample pesticide results is presented in Table 4-16. In leachate spring sample LS-1, dieldrin and alpha-chlordane was detected at concentrations of 0.0019 ppb and 0.0096 ppb, respectively. Endrin was detected in sample LS-3 at a concentration of 0.0034 ppb. As shown in Tables 4-16, each of the detected pesticides detected equalled or exceeded published federal marine

(saltwater) water quality chronic criteria. No pesticides or PCBs were detected in the surface water sample collected near the site in Phase II.

4.2.4 Inorganic Compounds

During the Phase I RI, ground water samples were collected from seven shallow monitoring wells and four bedrock monitoring wells and analyzed for TAL metals and cyanide. Results of the Phase I ground water sampling indicated that each of the monitoring wells, with the exception of deep well MW-5R, contained at least one analyte at a concentration which exceeded the RIDEM and/or federal ground water quality standard. As summarized in Table 4-13, arsenic, beryllium, cadmium, chromium, copper, mercury, nickel, lead, and antimony were detected at concentrations exceeding the RIDEM and/or federal ground water quality standard. The highest concentrations of inorganic ground water contamination were detected in monitoring well MW-3S, located in the central portion of the site. In addition, elevated levels of aluminum, arsenic, beryllium, iron, manganese, and lead were detected in an off-site upgradient well considered to be representative of background conditions.

During the Phase II RI, ground water samples were collected from nine shallow monitoring wells and eleven deep monitoring wells and analyzed for TAL metals, cyanide and total chloride. Five of these monitoring wells (MW-3S, MW-3R, MW-8R, MW-13S, and MW-15R) were also analyzed for dissolved metals (i.e., another aliquot was field filtered). Results of the Phase II ground water sampling indicate that each analyte, with the exception of selenium and thallium, were detected in at least one ground water sample from the site. Cyanide was detected in two of the ground water samples. Inorganics detected in each of the Phase II RI ground water samples include aluminum, barium, calcium, chromium, copper, iron, magnesium, manganese, potassium, and zinc. As shown in Table 4-14 and on Figure 4-10, the inorganic analytes which were detected above federal MCLs and/or state ground water quality standards in Phase II include antimony, arsenic, beryllium, cadmium, chromium, copper, mercury, lead, and nickel. Aluminum, copper, iron, manganese, and zinc were detected above federal SMCLs in ground water samples collected across the site. As presented previously in the soils assessment, several of these metals appear to be naturally-occurring minerals of the site soils. This issue is discussed further in the background ground water quality presented later in this section. The highest concentrations of inorganic contamination were detected in monitoring wells MW-3S located in the central portion of the site and at monitoring well MW-13S located in the southern portion of the site. The highest concentrations of each inorganic analyte were detected at MW-3S with the exception of manganese and nickel. Many of the highest inorganic analyte concentrations detected in Phase I were also in the well MW-3S samples. In addition, the highest levels of subsurface soil inorganic

contamination were generally detected in the central site area; especially at boring B-19 just downgradient of well location MW-3.

In comparing the Phase I and Phase II inorganics ground water data for the eleven wells sampled in Phase I and Phase II, overall lower or similar levels of inorganic compounds were detected in these wells in Phase II. Significant concentration decreases were observed in Phase II for several of the elevated inorganics (aluminum, arsenic, beryllium, cadmium, iron, manganese, nickel, and antimony) detected in Phase I in well MW-5S. The overall lower metals levels in the ground water may indicate a decreased leaching of contaminants from the landfill with time. Although, the decreased metals concentrations may also in part be due to a lower amount of suspended solids in the Phase II samples, since the ground water at the Phase I wells was allowed to stabilize over a long period and likely become more representative of the ground water in the surrounding formation.

Metals analyses were conducted on five filtered ground water samples collected in Phase II from monitoring wells MW-3S, MW-3R, MW-8R, MW-13S, and MW-15R. As shown in Table 4-15, a comparison of the filtered versus non-filtered sample results indicates that generally the inorganic concentrations in the filtered samples are far below the concentration of the non-filtered samples. The only inorganic analytes which did not have significantly different concentrations between the filtered and non-filtered samples are calcium, iron, potassium, magnesium, and sodium.

It appears from the filtered data that the high concentrations of inorganic contamination detected in the site ground water may be due to the high amount of silt which was observed in the ground water sampled from many of the wells during the Phase II sampling. This finding is further substantiated by comparing the inorganic results with the turbidity values measured at the time of the sampling (Table 2-7) and the total suspended solids results for several of the ground water samples (see Appendix O, Table O4.E). This comparison indicates that those ground water samples which had the lower turbidity and suspended solids values also had the lower concentrations of inorganic analytes. Although filtered or dissolved metals ground water analysis is not typically accepted for comparison to ground water standards, this data along with the associated turbidity and total suspended solids information should be considered when evaluating the site ground water data.

In Phase II, three wells were installed and sampled in the off-site area, upgradient of the site, to assess the background ground water quality. In addition, another well which was previously installed in the same off-site area was sampled. Given that the upgradient ground water table is in the shallow bedrock, all four of these wells are bedrock wells. The Phase I sampling results of the one well indicated elevated concentrations of aluminum, arsenic, beryllium, iron, lead, manganese, and nickel.

There are not any known sources of man-made contamination in this area. Thus, this information was considered representative of the upgradient background ground water quality for the site. The analytical results for the Phase II sampling of the three new Phase II wells and the resampling of the other well are provided with the site ground water data in Table 4-12. Once again this data indicates the presence of elevated levels of several inorganic analytes in the off-site upgradient ground water. In Phase II, elevated levels were detected for aluminum, arsenic, beryllium, iron, lead, manganese, and nickel in some of the background well samples. In addition, antimony was detected at an elevated concentration in one of the background wells. A review of other site ground water data, indicates that there also appears to be elevated concentrations of the analytes aluminum, iron, lead, manganese, and nickel in the deep bedrock wells located near the western edge of the site and Narragansett Bay. As discussed in Section 4.1.4, the soils data (especially the shale samples) also supports this finding that these elements are naturally-occurring minerals of the site soils.

Each of the Phase II ground water samples was also analyzed for total chloride and salinity to assess the presence of any salt water intrusion from the adjacent bay on the site ground water. The total chloride results are presented with the Phase II ground water "hits tables" in Table 4-12. Salinity values for the Phase II ground water samples are presented in Table 2-7. Results of these Phase II analyses indicate that chloride was detected in each of the ground water samples at concentrations ranging from 13.4 ppm to 1,110 ppm. The highest concentrations of total chloride were detected in monitoring wells MW-8R (1,110 ppm), MW-11R (134 ppm), and MW-21S (383 ppm) located along the western edge of the site and at monitoring well MW-3S (136 ppm) located in the central portion of the site. A total chloride value of 26,000 ppm was measured for the surface water collected from Narragansett Bay adjacent to the site. The highest levels of salinity (ranged from 0.4‰ to 1.7‰) and conductivity (1.077 mmhos/cm to 5.717 mmhos/cm) were also detected in these four near-shore well samples. Salinity values were also observed in other site wells (MW-3R, MW-4S, MW-7S, MW-9R, MW-10R, MW-12S, and MW-22S), including several along the eastern edge of the site. The salinity of the surface water sample collected near the site was reported by the laboratory to be 29.8‰. The highest concentrations of several inorganics, including calcium, potassium, magnesium, and sodium, were also detected in the shoreline wells and the three leachate samples collected from along the shoreline. As expected, these same four inorganics were detected at even higher levels in the surface water sample. This information supports the finding that there is salt water intrusion in the ground water at this site.

Results of both the Phase I and Phase II leachate spring sampling indicate that calcium, magnesium, potassium, and sodium were each detected at very high concentrations in each of the leachate samples. The concentrations of these compounds in the leachate samples were very similar to those

detected in the surface water sample. This information along with the findings discussed above indicates that the water which was sampled from the springs may not have been landfill leachate, but rather seawater flowing from the intertidal bank area at low tide. This is further supported by the fact that none of these water samples had a noticeable color or odor which would be expected of a landfill leachate. Only one analyte, antimony, was detected in the leachate samples at concentrations exceeding federal ground water MCLs. Antimony was detected in leachate sample LS-3 at a concentration of 137 ppb which exceeds the federal MCL of 6 ppb. However, antimony was also detected in the surface water sample at a concentration of 87.1 ppb. As shown in Tables 4-16 and 4-17, none of the metals detected in the leachate samples or the surface water sample exceeded published federal marine (saltwater) water quality criteria.

Metals Fate Discussion

To assess the environmental fate properties of inorganic constituents detected at the site, brief statistical profiles and summaries of oxidation/reduction potential information were developed for the following seven elements:

- arsenic,
- beryllium,
- chromium,
- copper,
- iron,
- lead, and
- mercury.

These elements were selected to represent general environmental transport properties of inorganics at the site as a whole. Specific rationale for selection of the referenced elements follows.

- Informal discussions with EPA and RIDEM personnel (technical review committee meeting on June 16, 1994) indicated that selection of inorganic contaminants to assess potential environmental fate characteristics of contaminated ground water/leachate from the site was a reasonable course of action.
- Concentrations of lead, copper, and mercury drove potential future risk to ecological receptors in Narragansett Bay as reported in the April,

1994 Draft Leachate Generation, Fate and Transport and Ecological Assessment report.

- A review of inorganic contaminant distribution and the number and percentage of exceedances of regulatory criteria for individual "toxic" contaminants indicated that the presence of arsenic, beryllium, and chromium may be of potential concern in unfiltered ground water at the site. Additionally, based on past experience, these particular contaminants tend to significantly contribute to potential risk calculations.
- Given the nature of inorganic contaminant movement in ground water and the fact that ground water samples were collected and acidified without filtering, per EPA protocol, the inclusion of iron within the list of contaminants was deemed prudent in order to help assess potential coprecipitation and/or adsorption considerations relative to other contaminants.

Data provided in Appendix P includes information on the statistical distribution of elements in both unfiltered and filtered ground water samples collected at the site. In general, concentrations of the seven elements of interest were substantially lower in filtered ground water samples (5) as opposed to the same set of unfiltered samples as illustrated below:

<u>Element</u>	<u>Mean Unfiltered Conc.</u>	<u>Mean Filtered Conc.</u>	<u>Reduction due to Filtering</u>
Arsenic	71 ppb	1.4 ppb	50-fold
Beryllium	3 ppb	not detected	N/A
Chromium	104 ppb	3.7 ppb	28-fold
Copper	441 ppb	5.4 ppb	82-fold
Iron	158,060 ppb	8,303 ppb	19-fold
Lead	1,212 ppb	2.8 ppb	433-fold
Mercury	1.01 ppb	0.1 ppb	10-fold

The 10 to 433-fold reduction in inorganic concentrations between unfiltered and filtered ground water samples is generally consistent with the oxidation/reduction chemistry and adsorption reactions described in literature for inorganic constituents present in the natural environment. Both the oxidation/reduction chemistry and available information on adsorption provided as background information in Appendix P are intended to form a conceptual basis for the discussion of inorganic fate and transport properties of the seven select inorganic constituents at the site.

In general, inorganic constituent fate in the subsurface environment is a extremely complex subject under natural conditions where a large number of ionic species and organic complexing agents compete to either solubilize or retard contaminant movement. In addition, complicating processes such as those resulting from non-equilibrium conditions, coprecipitation, and adsorption further complicate potential inorganic fate processes. However, notwithstanding the complicated nature of inorganic transport in ground water, several general trends may be drawn from the data and environmental fate information presented in Appendix P. These trends are most apparent in the large difference between filtered and unfiltered ground water data. Such data supports the general hypothesis that, with the exception of iron, most of the selected inorganic contaminants are present in solid form; either as a precipitate, or coprecipitated (with ferric hydroxide) or adsorbed onto surface active sites such as that offered by clay particles.

Another possible trend from equilibrium Eh-pH data suggests that with the exception of chromium, and to a lesser extent arsenic, modest variations in either Eh or pH which are typically encountered in natural systems will not significantly alter the likely valence state and therefore the solubility of the elements of interest. A third possible trend indicated from available literature suggests that adsorption of inorganic constituents onto surface active (electrically charged) sites is a significant factor in the retardation of many inorganic elements in the subsurface ground water environment. Cation exchange soil data obtained from the Phase II RI indicates that, in general, the natural subsurface environment at the site has a moderate to high cation exchange capacity (average of 107 meq/100g for four samples) further corroborating the likelihood that the subject inorganic compounds are primarily present in solid form. Given these conditions, it is anticipated that flux of inorganic contaminants from ground water to Narragansett Bay would be limited by the natural filtering provided by the heterogenous nature of the site subsurface materials and the shale bedrock. Erosional processes may be a significant contributor from near-shore soils and fill. However, these factors were substantially reduced following the placement of shoreline revetment and the RCRA Subtitle C cover over the landfill in 1996.

4.3 SEDIMENT AND BIVALVE ASSESSMENT

Sediment and bivalve samples were collected between the Phase I and Phase II site investigations to determine if any contamination had migrated from the landfill into the adjacent Narragansett Bay. The bivalve sampling included the collection of both mussel and clam samples. The locations of the off-shore sampling stations are shown on Figure 2-11. A detailed report of the off-shore investigation activities is presented in Appendix R in a report prepared by Battelle Ocean Sciences (Battelle, 1994).

A total of seven (7) near shore composite sediment samples and nine (9) off-shore discrete sediment samples were collected near the site for laboratory analysis. The bivalve sampling included the collection of seven near-shore blue mussel samples, three near-shore soft shell clam samples, and seven off-shore hard shell clam samples. The sediment samples were analyzed for PAHs, PCBs, TAL metals, acid volatile sulfides (AVS) and simultaneously extracted metals (SEM), total organic carbon (TOC) and grain size. The bivalve samples were analyzed for PAHs, PCBs, and TAL metals. In addition, the mussel samples were analyzed for butyltins.

Presented in this section of the report is a summary of the nature and extent of sediment and bivalve contamination detected under this investigation. The findings of this initial investigation provided the information necessary to determine the need and scope of any additional off-shore investigations, which were conducted under the Marine Ecological Risk Assessment (SAIC/URI, 1997). This discussion is presented in the order of the following chemical compound classes: PAHs, PCBs, metals, and butyltins. A full detailed discussion of the sample results is presented in the Battelle report in Appendix R.

4.3.1 Polynuclear Aromatic Hydrocarbons (PAHs)

All of the sediment and bivalve samples were analyzed for PAHs. The results of the PAH analyses are presented in the Battelle report in Table 3-1 of Appendix R. The PAH data in this table are presented in terms of total PAH, defined as the sum of the 40 individual PAH parameters determined in this study, and as the sum of the 16 priority pollutant PAHs (referred to as ppPAH hereafter), as listed in Table 2-6 of the Appendix R report. As with the Appendix R report, this discussion will concentrate on summarizing the results of the 40 PAHs (hereafter referred to as total PAHs). In addition, an overall comparison of the key similarities and differences in the data trends for the total 40 PAHs data and 16 ppPAHs data will be provided for each medium. Concentrations of the individual PAH compounds detected in each sample are given in the PAH data tables in Appendix A of the Battelle report. The low analytical detection limits allowed for the determination of PAHs in all of the sediment and bivalve samples.

The levels of PAHs measured in the site sediment samples varied with the locations of the samples along the shoreline. Figure 4-11 depicts the total PAH concentrations detected in the sediment samples. The highest total PAH concentrations were generally detected in the sediment samples collected from the off-shore stations. However, the PAH concentrations of two of the near-shore sediment samples (NS-16/17/18 duplicate and NS-19/20/21) were also much higher than those detected in all of the near-shore and most of the off-shore samples. These two near-shore stations

are the two southern-most shoreline stations located adjacent to the south central and southern portions of the site. Total PAH concentrations of 10,000/12,000 ppb (duplicates) and 14,300 were detected in sediment samples NS-16/17/18 and NS-19/20/21, respectively. The highest total PAH concentration of 30,000 ppb was detected in off-shore sample OS-28 collected approximately 300 feet out in the bay from near-shore station 18. A considerably lower total PAH concentration of 3,870 ppb, similar to the other off-shore stations, was detected in off-shore sample OS-29 collected approximately 300 feet out from station OS-28. Although increased total PAH concentrations (11,100 ppb) were detected in off-shore station OS-30 collected approximately 960 feet out from station OS-29. The relative concentrations (i.e., highs and lows) of both the total PAHs and ppPAHs detected in the sediment samples were very similar.

The sediment PAH data is also presented as normalized to TOC in Figures 4-1 and 4-2 of the Battelle report. The plots on these figures once again show the most elevated PAH concentrations at stations NS-16/17/18 and NS-19/20/21. Figure 4-1 of Appendix R also shows elevated total PAH concentrations at stations NS-10/11/12 and NS-13/14/15. Figure 4-2 shows the overall higher off-shore sediment PAH concentrations and the significantly elevated PAH sediment concentration at station OS-28.

The relative composition of petrogenic PAH (primarily petroleum product originating PAH) and pyrogenic PAH (primarily combustion and/or creosote/coal-tar originating PAH) at the sediment stations is presented in Figure 4-3(a) of the Battelle report. The pyrogenic PAHs dominate the PAH makeup of nearly all of the sediment samples. This is reportedly similar to most coastal sediments, including most of Narragansett Bay, that have not been impacted by significant petroleum contamination (Hurtt and Quinn, 1979; Pruell et al., 1984; Pruell and Quinn, 1985). This trend is also the case for the reference site sediments (see Figure 4-3(b) of Battelle report). For most coastal sediments with a pyrogenic PAH composition that atmospheric deposition, sewage effluent, combined sewer overflow discharges, and/or urban runoff are the potential sources of the PAHs (Lake et al., 1979; Hurtt and Quinn 1979; Hoffman et al., 1984). Although relatively lower petrogenic PAHs were generally detected in the sediment samples, elevated petrogenic PAH levels are present in site sediment samples NS-13/14/15, NS-16/17/18, and NS-19/20/21.

Further evaluation of the 40 individual PAH compounds in sample NS-13/14/15 (see Figures 4-4 and 4-5(a) of Battelle report), indicates a relative abundance of naphthalene PAHs and slightly elevated fluorene and phenanthrenes, suggesting a partial contribution of a petroleum product, such as a fuel or oil product, to the PAH contamination at this location. This data appears to indicate an input of petroleum in the area over which these three near-shore samples were collected. The PAH data for

all sediment samples (includes other two NETC sites) is also plotted on Figure 4-6 of the Battelle report using selected key diagnostic ratios that are commonly useful for fingerprinting and identifying/characterizing petrogenic contamination. The study samples cluster neatly in a region of the PAH ratio plot that is highly characteristic of combustion products.

The mussel PAH data was fairly consistent for all sample locations. Mussels were collected from all of the near-shore stations. A summary of the mussels total PAHs data is presented on Figure 4-11. The total PAHs concentration detected in the near-shore mussel samples ranged from 677 ppb at station NS-1/2/3 to 804 ppb at station NS-7/8/9. As you proceed from north to south along the sites shoreline, the total PAH levels detected in the mussel samples increased slightly at station NS-7/8/9 to 804 ppb, decreased slightly back to 681 ppb at station NS-10/11/12, increased slightly once again to 719 ppb and 737 ppb at stations NS-13/14/15 and NS-16/17/18, respectively, and then decreased slightly to 699 ppb at station NS-19/20/21. The PAH levels detected in the mussel samples collected near this site were slightly higher than those detected in the mussels from the three reference stations; with the highest total PAH reference mussel sample concentration being 649 ppb. The relative concentrations (i.e., highs and lows) of both the total PAHs and ppPAHs detected in the mussel samples were very similar.

The mussel PAH data is presented in Figure 4-7 of the Battelle report normalized to lipid content. The mussel PAH petrogenic and pyrogenic class distribution is presented in Figure 4-8 of the Battelle report. The PAH composition in the mussels had a greater proportion of petrogenic PAHs than did the sediments, which is consistent with the higher solubility of the petrogenic PAHs and the fact that mussels obtain most of the PAHs from the overlying water and not the underlying sediment. The high molecular weight, pyrogenic PAH will, relatively speaking, concentrate more in the fatty tissue of the mussel than the lower molecular weight PAH. As with the sediment samples, a diagnostic ratio plot of the site mussel samples (see Figure 4-10 of Battelle report) shows a cluster in an area of the plot which is indicative of the samples being exposed to combustion-related PAHs that are common to Narragansett Bay, and most coastal areas, and not to a PAH that directly originates in a petroleum source.

The clam PAH data was fairly consistent for all of the sample locations. Hard shell clams were collected from all but two of the off-shore stations (OS-29 and OS-30). In addition, hard shell clams were present and collected from near-shore station NS-19/20/21 and soft shell clams were collected from two of the near-shore stations (NS-1/2/3 and NS-4/5/6). A summary of the total PAHs clam data is presented on Figure 4-11. The total PAH concentration detected in the off-shore clam samples ranged from 593 ppb at station OS-27 to a high of 1,310 ppb at station OS-25. Station OS-25

(highest) is located off of the north central portion of the site and station OS-27 (lowest) is located off of the central portion of the site. Note that at station OS-28 where the highest mussel PAH concentrations were detected, one of the lowest total PAH clam concentrations were detected. In addition, the second highest total PAH clam concentration (1,020 ppb) was detected at near shore station NS-19/20/21 (the only near-shore clam station) where the second highest total PAH sediment concentration (14,300 ppb) was also detected. The PAH concentrations detected in the reference clam samples were generally slightly lower than those detected in the site clam samples; with the highest total PAH reference clam sample concentration being 1,040 ppb. The relative concentrations (i.e., highs and lows) of both the total PAHs and ppPAHs detected in the clam samples were very similar.

The normalized clam PAH data is presented in Figure 4-11 of the Battelle report. The petrogenic and pyrogenic PAH distribution for the clams is presented in Figure 4-12 of the Battelle report. As with the mussel data, the PAH class distribution was nearly evenly distributed between petrogenic and pyrogenic PAHs. A diagnostic rasion plot again shows the site clam PAH composition data as being similar to that of Narragansett Bay and other coastal area sediments.

The Battelle report provides a comparison of the site sediment and bivalve PAH data to other reported values for Narragansett Bay. Table 4-1 of the Battelle report summarizes data from three Narragansett Bay NOAA Mussel Watch Project sites. This comparison indicates that the site sediment and bivalve PAH data is generally comparable to those reported for Narragansett Bay by other investigators. A more detailed discussion of other reported PAH data for Narragansett Bay is provided in the Battelle report. Furthermore, as is previously presented, significantly elevated PAH concentrations were detected in the sediments at two near-shore stations along the site.

4.3.2 Polychlorinated Biphenyls (PCBs)

All of the sediment and bivalve samples were analyzed for PCBs. The results of the PCB analyses are presented in the Battelle report in Table 3-2 of Appendix R. The PCB data are presented in terms of total PCBs, defined as Aroclor 1254 equivalents because this aroclor was consistently the PCB formulation the PCB data most closely resembled. Additionally, the sums of the concentrations of the 20 individual PCB congeners that were determined, as listed in Table 2-6 of the report, are presented. Individual PCB congener concentrations in each sample are given in the PCB data tables in Appendix A of the report.

PCBs were detected in all of the samples but the levels of total PCBs varied greatly from sample to sample, especially in the sediment samples. One of the samples had a total PCB concentration that was below the detection limit by the Aroclor quantification method, and thus is qualified with a "J" in the data summary table.

The levels of PCBs detected in the sediment samples varied with the locations of the samples along the shoreline. A summary of the total PCB levels detected in the sediment samples is provided on Figure 4-12. The total PCBs concentrations detected in the near-shore sediment samples ranged from 3.59 ppb in sample NS-1/2/3 to 582 ppb in sample NS-13/14/15. The PCB levels detected in the near-shore sediments increase as you proceed from north to south along the site shoreline. Elevated PCB levels were detected in the sediment samples from the three adjacent stations NS-13/14/15 (582 ppb), NS-16/17/18 (184/215 ppb, duplicate), and NS-19/20/21 (221 ppb). The PCB levels detected in these three sample were significantly higher than those detected in the other site near-shore sediment samples. The PCB levels detected in the off-shore sediment samples were generally similar along the site. Two off-shore sediment sample which had slightly higher total PCB concentrations were samples OS-25 and OS-28. Station OS-28, where the highest total off-shore PCB concentration of 63.3 ppb was detected, is located approximately 300 feet out in the bay from near-shore station NS-18. The PCB levels detected in the sediment samples collected at this site were generally higher than those detected in the sediments at the reference stations.

The normalization of the PCB sediment data to TOC is presented on Figures 4-15 and 4-16 of the Battelle report. As shown on Figure 4-15 of Appendix R, the normalization does not significantly change the near-shore sediment PCB pattern. Elevated levels of PCBs are still evident in the three near-shore sample NS-13/14/15, NS-16/17/18, and NS-19/20/21. Slightly elevated PCB sediment levels are also shown in the next two northern stations NS-7/8/9 and NS-10/11/12. However, the TOC normalization of the off-shore PCB sediment data does level out the PCB levels in these samples, indicating that there does not appear to be any significantly elevated PCB contamination in these sediments.

Figure 4-17 of the Battelle report presents the PCB data, both as total PCB and the sum of the 20 PCB congeners for the near-shore sediment samples, which appear to have a localized PCB contamination problem. The overall distribution of the 20 individual PCB congeners are also presented in Figures 4-18(a) for a selected representative sample and for sample NS-13/14/15, the sample with the highest PCB sediment concentration. A review of these figures indicates that the PCB composition for sediment sample NS-13/14/15 is somewhat different than other study sediment samples. The PCB composition for this sample clearly has more low molecular weight congeners than "typical" NETC or

reference samples, suggesting that there might be a different, or additional, source of PCB contamination contributing to the PCBs measured in this sample.

The mussel PCB data also varied along the site, with the highest total PCB mussel concentrations being detected at the southernmost stations. The mussel total PCB data is also presented on Figure 4-12. Similar to the sediment data, elevated mussel PCB concentrations were detected in the samples from stations NS-13/14/15 (2,110 ppb), NS-16/17/18 (864/836 ppb), and NS-19/20/21 (1,170 ppb). In addition, elevated mussel PCB concentrations were detected at station NS-10/11/12 (1,120 ppb). The PCB levels detected in the site mussel samples were generally higher than those detected in the mussels at the reference stations. The lipid normalized PCB mussel data (see Figure 4-19 of Battelle report) also indicates elevated PCB concentrations in the mussels collected from station NS-13/14/15. The PCB congener distribution data for the mussel samples (see Figures 4-21(a)(b) and 4-22 of Battelle report) also indicate a different source of PCB contamination at this station location.

As shown on Figure 4-12, the clam PCB data was fairly consistent along the site for all sample locations. The total PCB concentrations detected in the off-shore clams samples ranged from 90.2 ppb at station OS-27 to 156 ppb at station OS-22. Station OS-27 (lowest) is located of the central portion of the site and station OS-22 (highest) is located off the northern end of the site. Although the site clam PCB data is generally higher than that detected at the reference stations, the highest clam total PCB concentration of 168 ppb was detected at reference station R-3. The lipid normalized clam PCB data (see Figure 4-23 of Battelle report) also indicates generally similar levels of PCBs in the clams along the site and do not indicate any obvious locations of PCB contamination.

The Battelle report also provides a comparison of the site sediment and bivalve PCB data to other reported values for Narragansett Bay. Table 4-1 of the Battelle report summarizes such data from three Narragansett Bay NOAA Mussel Watch Project sites. This comparison indicates with the exception of the elevated PCB levels measured along the near-shore central portion of the site (the "Point" area), that the other site sediment and bivalve data is generally comparable to those reported for Narragansett Bay by other investigators. A more detailed discussion of other reported PCB data for Narragansett Bay is provided in the Battelle report.

4.3.3 Butyltins

All of the site mussel samples were analyzed for butyltins. Butyltins analysis were not performed on the clam samples because butyltin analysis are commonly performed on mussels as a conservative indicator of assessing the presence and bioaccumulation effects of butyltins in biota. Butyltins are

primarily an ecological concern in water-borne organisms such as mussels and not sediment dwelling organisms or clams. In addition, given that butyltins analysis has typically been performed on mussels in other studies, this provides a comparable data set with other marine studies. The results of the butyltin analyses for the mussel samples are presented in the Battelle report in Table 3-3 of Appendix R. The butyltin data in this table is presented in concentrations of each of the four individual butyltins measured and as the sum of the four analytes.

Butyltins were detected in only one of the site mussel samples. Tributyltin (TBT) was reported at a concentration (2.05 ppb) below the laboratory's method detection limit ("J" qualifier) in near-shore sample NS-10/11/12. Non-detected concentrations of butyltins were reported in all other site mussel samples and the reference station mussel samples.

4.3.4 Metals

All of the sediment and bivalve samples were analyzed for TAL metals. The results of the sediments, mussels, and clams metals analysis are presented in the Battelle report in Tables 3-4, Table 3-5, and Table 3-6 of Appendix R. The data for all 24 TAL metals was reviewed and it was determined by Battelle that the sample data for 10 of these metals would be fully evaluated based upon the magnitude of their relative concentration elevation at the NETC sites as compared to the reference sites. Although a few other elements also appear to be elevated in the same locations as the 10 primary elements, the levels and presence of the other elements is considered to be of less environmental importance. The sample data for all of the 24 TAL metals is presented in the data tables in the appendix of the Battelle report. To aid in determining if elevated metals levels are of anthropogenic origin, the metals sediment data was normalized to aluminum and grain size. The percent mud, defined as the silt plus the clay fraction, was used for the grain size normalization.

The rationale for normalizing to aluminum is to detect variability in the data that are unrelated to the natural geology. Similarly, the anthropogenically contributed elements can often be isolated by normalizing to grain size. Metal contaminants are expected to associate with fine sediment to a greater degree than coarse sediment. The near-shore site sediments were not found to be as uniform as the off-shore sediments because they contained significant amounts of shells and debris, and had a highly variable grain size composition. Therefore, the near-shore relationship between the anthropogenic metals contamination and aluminum and/or grain size was not as useful as that for the off-shore sediments.

The metals concentration levels expectedly varied greatly from element-to-element; however, there are also some significant sample-to-sample concentration differences for many of the metals, especially for the sediment samples. In the sediment samples, the most elevated metals levels were detected in near-shore samples NS-10/11/12, NS-13/14/15, and NS-16/17/18 located next to each other along the central portion of the landfill. The two metals, lead and mercury, showed the most significant concentration elevation over the other sample locations. Other metals detected at elevated concentrations include antimony, copper, zinc, silver, and nickel. Somewhat lower, but still notable, elevated concentrations were also detected for cadmium, chromium, and arsenic. Sample NS-13/14/15 was consistently reported as having the greatest metals sediment concentrations for the data normalized to aluminum. Whereas, the highest metals concentrations were more evenly distributed between sediment samples NS-10/11/12 and NS-13/14/15 for the data normalized to grain size (or percent mud). This change is a result of the a slightly higher percent mud in sample NS-13/14/15 (6.5 % mud) as compared to sample NS-10/11/12 (1.6 % mud). The sediment metals data normalized to aluminum generally shows similar levels of metals in the near-shore and off-shore sediments, not including the three near-shore stations having elevated metals levels. Whereas, the sediment metals data normalized to grain size generally shows elevated metals concentrations in the near-shore sediments as compared to the off-shore sediments. This difference is due to the overall much greater percent mud contained in the off-shore sediments (maximum of 44.6% mud) as compared to the near-shore sediments (maximum of 13.6% mud). Overall, metals levels detected in the reference site sediments are similar to the metals levels detected at all but the three elevated metals near-shore sediment locations.

The AVS/SEM results for the sediment samples is provided in Table 3-7 of the Battelle report in Appendix R. A discussion of the relevance of AVS/SEM analysis is also presented on pages 4-51 through 4-52 of the Battelle report. As reported in the Battelle report, the theory is that the toxicity of chemicals in sediments is strongly influenced by the extent to which the chemicals bind to the sediment, and that sulfide, and in particular acid volatile sulfide (AVS), is the sediment phase that determines the toxicity of some metals in sediment. The metals that are solubilized during the AVS analysis, referred to as simultaneously extracted metals (SEM), are an estimation of the quantity of metals that react with AVS. If the equivalent concentration of SEM exceeds AVS, then, potentially, sediment toxicity may occur.

At this site, the AVS is generally higher than the sum of the seven SEM metals at the off-shore stations. All but one of the near-shore stations have SEM metals concentrations that are higher than the AVS concentration; however, very low metals concentrations were detected at most of these near-shore stations and, therefore, they likely do not pose a significant metals toxicity risk for that reason

alone. Exceptions to this includes near-shore stations NS-10/11/12, NS-13/14/15, and NS-16/17/18. However, as explained further in the Battelle report, these high SEM concentrations are due to uncharacteristically high copper and zinc data, and are possibly not a true representation of these sediments. The sum of the seven SEM metals is also higher than the AVS at two of the three near-shore reference stations. However, these reference site concentrations are relatively low and comparable to several of the site stations (NS-1/2/3 and NS-4/5/6).

The metals concentrations in the mussels and clams varied less dramatically than in the sediments. However, there are several sample stations which appear to have relatively elevated levels of metals. In the mussel samples, the highest levels of several metals (chromium, copper, mercury, nickel, lead, and antimony) were detected in sample NS-13/14/15 along the central site portion. The highest metals concentrations were no more than approximately twice the generally observed metals concentrations in any of the mussel samples. In the clam samples, the highest levels of metals were generally detected in samples NS-19/20/21 and OS-22, both located at opposite ends of the site. The silver and lead concentrations in clams were only slightly elevated for sample OS-22 and sample NS-19/20/21, respectively, as compared with the average site clam sample concentrations. Overall, similar metals levels were detected in a majority of the site bivalve samples and reference site bivalve samples.

The Battelle report also provides a comparison of the site sediment and bivalve metals data to other reported values for Narragansett Bay. Table 4-1 of the Battelle report summarizes such data from three Narragansett Bay NOAA Mussel Watch Project sites. This comparison indicates with the exception of the elevated metals levels measured along the near-shore central portion of the site (the "Point" area), that the other site sediment and bivalve metals data is generally comparable to those reported for Narragansett Bay by other investigators. A more detailed discussion of other reported metals data for Narragansett Bay is provided in the Battelle report.

4.4 MARINE ECOLOGICAL RISK ASSESSMENT INVESTIGATION RESULTS

Sediment and biota sampling were conducted in 1994 and 1995 to support the Marine Ecological Risk Assessment. Additional sediment sampling was conducted in 1996 to assess the impact of observed erosion in the intertidal zone. Figure 4-13 presents the sampling locations and the ecological exposure zones.

Analytical results from 1994 and 1995 investigations indicated that surface sediment samples collected at five of seven nearshore (NSB) stations contained total PCBs concentrations that exceeded the

corresponding NOAA's upper adverse effects benchmark value for PCBs (Effect Range-Median or ER-M, 180 ng/g), while total PCBs concentrations in samples from most of the off-shore stations only exceeded NOAA's lower benchmark value (Effects Range-Low or ER-L, 22.7 ng/g). For total PAHs, four of the nearshore stations exceeded the corresponding ER-L value (4,022 ng/g) and none exceeded the ER-M value (44,792 ng/g); similarly, only a few off-shore stations exceeded the ER-L value for total PAHs and none exceeded the ER-M value. The ER-L value for the pesticide p,p'-DDE (2.2 ng/g) was exceeded only by four nearshore stations; no other nearshore or offshore station exceeded the ER-L or ER-M values for this pesticide. The proposed EPA screening value for tributyltin in marine sediments (20 ng Sn/g) was not exceeded by any of the nearshore or offshore stations, where detected concentrations ranged between <1 to 5.3 ng Sn/g. Concentrations of total PCBs, total PAHs, p,p'-DDE, and tributyltin in sediment samples from the reference location (Jamestown Cranston Cove) did not exceed benchmark concentrations, except for one sediment reference sample exceeding the ER-L for total PAHs.

Analytical results from 1994 and 1995 also indicated that the highest metal concentrations in surface sediments were generally found at the nearshore stations, where copper, lead, mercury, nickel, and zinc exceeded ER-M values, while cadmium and chromium only exceeded ER-L values. Trace metals in surface sediments at most of the off-shore stations were determined to be present at concentrations below the corresponding ER-L values. Metal concentrations did not exceed benchmark values at the reference location samples. The spatial pattern of metal distribution and concentrations in the surface sediments was generally similar to those determined in previous investigations, and strongly implicate the McAllister Point Landfill as a dominant source of metals into the marine environment.

Additional sediment samples (surface and core) were collected in 1996 to assess changes in contaminant exposure conditions due to sediment erosion in the nearshore area caused by the construction of the landfill revetment. The 1996 sediment samples were analyzed for PCBs, PAHs, and metals, and the analytical results were compared to the previous analytical data. For total PCBs, significant concentration increases and values above the ER-M benchmark were associated with nearshore surface sediments from stations NSB-4, NSB-5 and NSB-7, and both surficial and subsurface sediment at offshore station MCL-12. Increased concentrations to levels above the ER-L were observed for PCBs at nearshore stations NSB-1 and NSB-2, and for PAHs at nearshore station NSB-6 and off-shore station MCL-12 (surface and core).

Metal concentrations measured in sediments during 1996 were generally higher than those measured previously within the study area. The concentrations of copper, lead, and zinc exhibited the greatest degree of change. Surface sediment concentrations of copper increased to levels above the ER-M at

nearshore stations NSB-2, NSB-3, and NSB-4. Concentrations of lead also exhibited elevations to levels above ER-M at nearshore stations NSB-2, NSB-4 and NSB-5. Similar increases above ER-M were noted for zinc at nearshore stations NSB-2, NSB-4, NSB-5, and NSB-7, as well as offshore stations MCL-10 and MCL-14. Off-shore 1996 concentrations of copper and zinc increased above ER-L values at stations MCL-10 and MCL-12, respectively. The increase in surficial sediment concentrations, particularly at nearshore stations NSB-2, NSB-3, NSB-4, and NSB-5, indicate that erosion at the shore of the McAllister Point Landfill has increased the potential for adverse exposure to trace metals in contaminated sediments.

Sediment cores were not collected in the nearshore area prior to 1996, so comparison of pre-erosion and post-erosion sediment core data was not possible for this area. However, the 1996 data for the nearshore area indicated that stations NSB-2 through NSB-4 had higher concentrations of PCBs and PAHs in the core samples (0 to 18 cm) relative to the surface sediments (0 to 2 cm). Concentrations of metals in the nearshore sediment core samples were generally comparable to surface sediment concentrations. In offshore core samples, elevated metal concentrations to levels somewhat above the ER-L were detected at stations MCL-10 and MCL-12 in relation to pre-erosion surface sediment concentrations.

During 1995 studies, thirty-eight biota tissue samples were analyzed for contaminant concentrations. Tissue samples included blue mussels (*Mytilus edulis*; depurated and non-depurated), hard clams (*Mercenaria mercenaria*; depurated and non-depurated), cunner (*Tautoglabrus adspersus*), and lobster (*Homarus americanus*; muscle and hepatopancreas). Blue mussels were considered to represent bivalve exposure to contaminants in the nearshore (intertidal) area. Spatial patterns for organic contaminant concentrations in mussel tissue differed depending on the contaminant. Total PCBs concentrations in mussels were highest at station NSB-3; p,p'-DDE residues were highest at stations NSB-6 and NSB-7; tributyltin was highest at stations NSB-1 and NSB-3; and total PAHs were highest at station NSB-1. For total PCBs, p,p'-DDE, and total PAHs, the comparison of lower concentrations detected in depurated mussels to higher concentrations in non-depurated mussels indicated that sediment in the mussel gut contributed about 10 to 30 percent of the total chemical load of the animal. In contrast, higher (7 to 40 percent) tributyltin concentrations were detected in depurated mussels in relation to non-depurated mussels.

Hard clams were considered to represent infaunal conditions in the offshore (subtidal) environment. When compared to the mussel results, hard clam tissue concentrations of PCBs, PAHs, and p,p'-DDE were about five times lower and also were more spatially uniform among stations. Sediments in the gut of hard clams contributed 5 to 10 percent to the PCBs, PAHs, and p,p'-DDE contained in the

animal. As with mussels, tributyltin concentrations were higher in depurated hard clams than in the non-depurated samples. Differences in organic contaminant concentrations between mussels and clams may partially be the result of differences in sediment excretion rates between the two species.

Analytical results for organic contaminants in cunner tissue samples were available only for nearshore stations NSB-1, NSB-3, NSB-4, and NSB-6. In general, all the samples had measurable concentrations of the contaminants, but no one station had elevated values for all the contaminants. Total PAHs were five- to thirty-fold lower than bivalve residues, which may result from the greater capacity of fish to metabolize PAHs. Tributyltin concentrations in fish were also five- to ten-fold lower than those detected in bivalves. Total PCBs and p,p'-DDE concentrations in fish tissue were many times higher than in bivalves, reflecting possible food web biomagnification of these lipophilic contaminants.

Lobsters were considered to represent subtidal epibenthic invertebrates. Concentrations of organic contaminants in lobster tissues were, in general, two times higher at offshore stations MCL-13 and MCL-14 as compared to other offshore stations. Higher levels of the lipophilic contaminants PCBs, p,p'-DDE, and PAHs were detected in the lobster hepatopancreas samples when compared to those in the lobster muscle tissue, which would be expected based on the higher lipid content of hepatopancreas tissue. Tributyltin, however, did not show this tissue-specific trend.

Tissue samples of blue mussels, hard clams, and lobster muscle and hepatopancreas were also analyzed for trace metals; however, sufficient sample material was not available to conduct metal analysis in fish tissue. The distributions of arsenic, iron, chromium, zinc, manganese and nickel did not appear to exhibit either spatial- or species-dependent patterns. In addition, little difference was observed between metal content in depurated and non-depurated bivalves, except for lead and aluminum, of which a significant proportion is lost by sediment gut purging. Cadmium, copper, and silver were approximately ten-fold higher in lobster hepatopancreas than in lobster muscle, whereas mercury was highest in lobster muscle, possibly reflecting biomagnification of this metal at higher trophic levels.

The 1995 bivalve tissue residue results were compared to those of the samples collected by TRC in 1993. In general, a good agreement in concentrations and spatial distribution existed for PCBs and tributyltin in mussels and clams between the two data sets. However, PAHs concentrations in mussels reported by TRC were at the low end of the range of concentrations from the 1995 studies, and PAHs concentrations in clams reported by TRC were two to four times higher than those detected in 1995. Metal tissue concentrations in mussels were, in general, similar between the TRC data and the 1995 studies with the exceptions of chromium and nickel, which were approximately five times higher in the

TRC data. A similar pattern was identified for hard clam data, in which TRC results for chromium and nickel were approximately 50 and 10 times higher, respectively, than those from the 1995 investigation.

A more comprehensive presentation and discussion of the investigations conducted by SAIC and URI from 1994 to 1996 can be found in the SAIC/URI (1997) Marine Ecological Risk Assessment Report.

5.0 SUMMARY AND CONCLUSIONS

This section of the report provides a brief summary of the nature and extent of the contamination detected at the McAllister Point Landfill during the Phases I and II field investigations as presented in Section 4.0. Conclusions regarding the site contamination are also provided.

5.1 PHASES I AND II CONTAMINATION ASSESSMENT SUMMARY

The following contamination assessment summary is based upon the information presented in Section 4.0 and the Phase I RI report. The first section provides a media-specific summary for each medium investigated at the site, including soil, ground water, and sediment and bivalves. The second sections provides an overall summary of the site contamination for different sections of the site.

Soils

During the Phase I and Phase II RI, a total of forty-one (41) surface soil and seventy-six (76) subsurface soil samples were collected from the site. This included the collection of eight nearby off-site background samples. In general, the soil samples were analyzed for the full TCL/TAL. In some instances, insufficient sample volume for several subsurface soil/fill samples did not allow for the completion of all TCL/TAL analyses. Several soil samples were also analyzed for dioxins and furans. Maps summarizing the soil VOC, SVOC (namely PAH), PCBs, metals, and dioxins/furans data are presented as Figures 4-1 through 4-7.

VOCs, BNAs, pesticides, PCBs, metals, and dioxins/furans were detected in the site soils and fill. Low levels of VOC contamination were detected in the subsurface soils and fill material in the central portion of the site. In addition, visible signs of petroleum-related contamination (e.g., staining, odors) were observed in the subsurface soils in the southern portion of the site. SVOCs were detected in the surface soils sampled at the site. Significantly elevated levels of SVOCS, primarily PAHs, were detected in the soil and fill material in the central and southern site areas. Pesticides were detected at elevated levels in the soil/fill across much of the site. PCBs were detected in the site soil/fill and shoreline soils at low levels (generally less than 1 ppm). Metals were detected in the site soils/fill and shoreline soils at levels exceeding site-specific surface soil background levels. The highest metals concentrations were detected in surface soils in the southern area and subsurface soil/fill in the central and northern areas of the site. The soil samples having the highest levels of metals typically contained significant amounts of trash or debris.

~~Currently, the landfill has been capped and there are no longer any exposed landfill materials or soils.~~

Ground Water

During the Phase II RI, ten shallow monitoring wells and eleven bedrock monitoring wells were sampled and analyzed for full TCL/TAL parameters less pesticide/PCBs. Based on the results of the Phase I RI, TCL pesticide/PCB analyses were only conducted on monitoring wells MW-5S, MW-5R, MW-12S, and MW-13S, located in the southern portion of the site.

Phase II ground water sample results indicated the presence of VOCs, SVOCs, pesticides, PCBs, and inorganics in the shallow ground water monitoring wells, and VOCs, SVOCs and inorganics were detected in the deep (bedrock) monitoring wells sampled at the site.

In the shallow ground water monitoring wells, the PCB Aroclor-1254 and several inorganic analytes were detected at concentrations exceeding the federal MCLs and/or the state ground water quality standards. The PCB Aroclor-1254 was detected in each of the shallow ground water samples collected (MW-5S, MW-12S, and MW-13S) at concentrations ranging from 0.76 ppb to 1.8 ppb. These levels exceed the federal MCL and state ground water quality standard of 0.5 ppb. Inorganics detected in the site shallow ground water exceeding federal MCLs and/or state ground water quality standards include antimony, arsenic, beryllium, cadmium, chromium, copper, mercury, lead, and nickel. At least one of these analytes were detected in each of the wells at concentrations exceeding the federal MCL and/or state ground water quality standard, with the exception of monitoring wells MW-5S and MW-23S, at which only federal SMCLs were exceeded. The highest inorganic contamination in the site ground water was detected in monitoring well MW-3S.

VOCs, SVOCs, and pesticides were also detected in the site shallow monitoring wells at low concentrations which did not exceed any water quality standards. VOCs and SVOCs were detected at monitoring wells MW-3S, MW-4S, and MW-21S located in the central portion of the site, and in monitoring wells MW-12S and MW-13S located in the southern portion of the site. No VOCs were detected in monitoring well MW-5S during the Phase II RI. Monitoring well MW-5S was observed to have an oil layer shortly after the Phase I RI. VOCs were also detected in MW-2S located in the north central portion of the site. VOCs detected in the site shallow ground water primarily consisted of petroleum-related VOCs (i.e., benzene, ethylbenzene, etc.) while SVOCs primarily consisted of PAHs. The pesticide compound 4,4'-DDD was detected in only one shallow ground water monitoring well (MW-12S) at a concentration of 0.18 ppb.

In the bedrock ground water monitoring wells, one SVOC and several inorganic analytes were detected at concentrations exceeding the federal MCLs and/or state ground water quality standards. Bis(2-ethylhexyl)phthalate was detected in monitoring well MW-8R at a concentration of 240 ppb, exceeding the federal MCL of 6 ppb. Inorganics detected in the bedrock ground water monitoring well samples at concentrations exceeding federal MCLs and/or state ground water quality standards include arsenic, beryllium, chromium, lead and nickel. At least one of these analytes were detected in each of the bedrock monitoring wells at concentrations exceeding the federal MCLs and/or state ground water quality standards.

Other SVOCs detected in the bedrock monitoring wells primarily included PAHs and phthalate esters at low concentrations. Phthalate esters were detected in monitoring wells MW-3R, MW-9R, MW-10R, MW-11R, and MW-15R at low concentrations (< 4 ppb) with the exception of MW-8R. PAH compounds were also detected in monitoring wells MW-3R and MW-11R located in the central portion of the site. No pesticide or PCB compounds were detected in the one bedrock monitoring well (MW-5R) analyzed for these constituents.

A fate and transport assessment of the pesticides, PCB, and several metals detected in the ground water indicated that there is a low potential for the transport of these contaminants via ground water to the adjacent bay. The assessment was performed as part of a 1994 computer modeling effort by TRC of a landfill cap system to assess the potential reduction of precipitation infiltration and resultant reduction of leachate generation. The cap was complete in October 1996. In March 1997, the Navy initiated a long-term groundwater monitoring program to assess the status of groundwater contamination and to assess potential impacts to surface water and sediments in the portion of Narragansett Bay adjacent to the capped landfill. Once current real time long-term monitoring data are available for evaluation, an assessment will be made to ascertain the need for further remedial actions to address potential chemical migration via groundwater flow.

Sediment and Bivalves

Sediment and bivalve samples were collected between Phase I and Phase II along the shoreline of the site and from Narragansett Bay adjacent to the site. The off-shore investigation included the collection of seven (7) near-shore composite sediment and mussel samples, nine (9) off-shore discrete sediment and clam samples, and three near-shore soft shell clam samples. In addition, sediment, mussel, and clam samples were collected from three reference stations in Narragansett Bay. The sediment samples were analyzed for PAH, PCBs, TAL metals, AVS/SEM, total organic carbon, and grain size. The bivalve

samples were analyzed for PAHs, PCBs, and TAL metals. In addition, the mussel samples were analyzed for butyltins.

Elevated PAHs were detected in the near-shore sediments at the two southern-most stations (NS-16/17/18 and NS-19/20/21) along the sites shoreline. The highest total PAH concentrations were detected at an off-shore stations (OS-28) located off the south central portion of the site. Elevated petrogenic PAH concentrations (primarily combustion and/or creosote/coal tar originating PAH) were detected in the sediment samples from stations NS-13/14/15, NS-16/17/18, and NS-19/20/21. The individual PAH data for sample NS-13/14/15 suggests a partial contribution of petroleum product to the PAH contamination at this location. The mussel and clam PAH data indicates fairly consistent PAH levels similar along the site. Slightly elevated PAH levels were detected in two clam samples collected off the southern area of the site. The PAH class distribution for the mussel and clams was nearly evenly distributed between petrogenic and pyrogenic PAHs. The PAH sediment and bivalve data for the site generally indicates comparable PAH levels to published PAH sediment and bivalve data for Narragansett Bay.

Significantly elevated PCB levels were detected in the sediments collected from the three near-shore adjacent stations NS-13/14/15, NS-16/17/18, and NS-19/20/21. The PCB congener data for sample NS-13/14/15 indicates that there appears to be a different or additional source of PCB contamination at this location as compared to the PCBs detected in other site sediment samples and reference stations. The mussel PCB data varied along the site, with the highest total PCB mussel concentrations being detected at the southern-most stations NS-13/14/15, NS-16/17/18, and NS-19/20/21. The clam PCB data was fairly consistent along the site and did not indicate any obvious locations of PCB contamination. The PCB sediment and mussel data along the "Point" of the site was elevated in comparison to published PCB sediment and mussel levels in Narragansett Bay.

Butyltins were analyzed for in all of the site mussel samples. The butyltins, tributyltin (TBT) was detected at a very low concentration (2.05 ppb) in the near-shore mussel sample NS-10/11/12. Non-detected concentrations were reported for butyltins in all other site and reference mussel samples.

Significantly elevated metals concentrations were detected in the sediment samples from the three near-shore stations NS-10/11/12, NS-13/14/15, and NS-16/17/18. Lead and mercury showed some of the most significantly elevated metals concentrations over the other sample locations. Other metals detected at elevated levels in the sediment include antimony, copper, zinc, silver, and nickel. The metals concentrations in the mussels and clams varied less dramatically than in the sediments. In the mussel samples, the highest levels of several metals were detected in mussel sample NS-13/14/15

collected from along the central portion of the site. In the clam samples, the highest metals levels were generally detected in samples NS-19/20/21 and OS-22, located at opposite ends of the site. The metals sediment and bivalve concentrations along the "Point" of the site were elevated in comparison to published metals levels for Narragansett Bay.

5.1.1 Phases I and II RI Site Summary

Elevated levels of organic and inorganic contamination are present in the soil and fill at the site. Overall, the greatest amount of soil and fill contamination is present in the fill in the central portion or main landfill area of the site. Elevated concentrations of SVOCs (namely PAHs) and metals were detected in subsurface soil/fill samples from the central portion. Elevated metals contamination was also detected in the ground water in this area. Large amounts of trash and debris were observed in the central site area. Under the off-shore investigation, elevated metals and PCB levels were detected in the sediments and mussel samples collected near this central portion of the site. However, only low level PCB contamination was detected in the soil/fill in the central portion of the site.

An area of trash/debris fill having elevated levels of SVOCs (namely PAHs) and metals in the soil/fill is also present in the north central site area. This is the area of the site where an incinerator reportedly once operated. Fill/ash samples from this area were shown to have low levels of dioxins and furans. The ground water in this area also has elevated levels of metals and phthalate contamination. A slightly elevated level of PAHs were detected in the mussels collected near this portion of the site.

Elevated SVOCs and metals levels were detected in the fill in the southern portion of the site. The fill in this area consisted primarily of construction/demolition-like debris materials. Petroleum-related contamination was observed in the subsurface soils in the southern portion of the site. A floating oil layer was also once observed in a well in this area of the site in Phase I. VOC and PCB contamination was also detected in the ground water in this area. Low level PCB contamination was detected in the soil in the southern area of the site. Elevated PCB levels were detected in the sediments and mussels collected along the southern portion of the site.

Although elevated levels of several other metals (aluminum, iron, lead, manganese, and nickel) were detected in the site soil and ground water samples, these common elements were also detected in off-site background soil and off-site upgradient ground water, indicating that these are naturally-occurring minerals in the area soils and ground water. Other site ground water data, including salinity and total chloride measurements, also indicates the occurrence of some degree of salt water intrusion on the site.

5.2 SAIC/URI MARINE ECOLOGICAL RISK ASSESSMENT INVESTIGATION

Following the Phases I and II RI performed in 1994, by TRC, an investigation of potential impacts to marine sediments and biota was initiated by SAIC and URI in the portion of Narragansett Bay adjacent to the McAllister Point Landfill. The detailed presentation of investigation objectives, sampling methodology, results, and interpretations are provided in the Final Marine Ecological Risk Assessment Report (SAIC/URI, March 1997).

5.3 CONCLUSIONS

Phases I and II RI

In assessing the presence or absence of any specific "hot spot" contamination or areas of concern at the site, two areas may be considered of potential concern. These areas include ground water at the southern end of the site and the near-shore sediments along the central and southern portions of the site. The findings of the site RI indicate that the ground water at the southern end of the site has evidence of petroleum-related contamination with VOCs, SVOCs, PCB, and metals. In addition, in 1990, a light non-aqueous phase liquid (LNAPL) or oil product was observed in one ground water monitoring well located in this area during one of the seven sampling/measurement events. However, recent monitoring and sampling indicates that now the LNAPL is not present. The findings of the RI also indicate that the soil near the depth of the ground water table in this area indicates the presence of petroleum-related contamination. However, no specific source for the petroleum-related contamination has been discovered on the site.

Long-term monitoring of site ground water was initiated as part of the operations and maintenance of the source control remedy (capping) for the McAllister Point Landfill. Once analytical and hydraulic data become available, the Navy will review the results to assess current ground water conditions and assess the need for further remedial actions to address ground water.

The other area of potential concern may be the near-shore sediments along the central and southern portions of the site. The findings of the off-shore investigation indicate that elevated levels of PAHs, PCBs, and several metals are present in the sediments along this portion of the site. Bivalve data for this area also indicated some elevated levels of contaminants. The findings of the site human health risk assessment indicated potential increased human health risks related to the contaminated sediments and bivalves. The site ecological risk assessment indicates a general, but low potential for risk to marine organisms.

The area along the shoreline with the greatest levels of contaminants was the central area which was scattered with assorted debris (e.g., metal, concrete, asphalt) and the connecting wide, beach-like depositional area along the southern portion of the site. In addition, the face of the landfill was exposed along the central portion of the site, likely allowing for an increased erosion of the site soils and fill material. The results of the leachate generation study (TRC, September 1994) indicated that any ground water contaminant inputs into the bay will be substantially reduced with the planned capping of the site. As part of the cap installation, the shoreline debris was cleaned up, the exposed shoreline was cut back and capped, and stone revetment was placed along the entire shoreline of the site, thereby eliminating any potential erosion of landfill materials into the bay. Furthermore, additional monitoring is planned in Narragansett Bay along the NETC which will aid in assessing this condition.

Thus, based upon these findings and implemented source control remedial measures, it appears that the remaining primary pathway of contaminant exposure and migration at the site is related to the near-shore sediments and any fill/debris material that remain outside the limits of the cap. The degree of this near-shore sediment impact was addressed under the Marine Ecological Risk Assessment performed by SAIC and URI during 1994 through 1996.

Marine Ecological Risk Assessment

The Marine ERA conducted by SAIC and URI incorporated the assessment of several exposure and effects endpoints within a weight of evidence framework. Based on the numerous exposure and effects weights of evidence for the stations within each of the ecological exposure zones, the overall risk probabilities in the study area were ranked as follows:

Zone 2 was identified as a *high* risk probability zone in the study area. Zones 1, 3, 3A, 4 and 6 were identified as *intermediate* risk probability zones. Zone 5 and Zone 7 (Reference) were identified as *low* risk probability zones.

Detailed information on the methodology, results and conclusions are presented in the Marine Ecological Risk Assessment Report (SAIC/URI, 1997).

After long-term groundwater data become available and have been reviewed in conjunction with the marine ecological risk assessment results, the need for any further actions will be assessed.

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TABLE 1-1
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SUMMARY OF NETC HAZARDOUS WASTE SITES

No.	Site	Characteristics/Studies/Plan of Action
1	McAllister Point Landfill	<u>1955-1970s</u> - The landfill received all waste generated at the Newport Naval Complex. This site contains wastes from operation (machine shops, electroplating, etc.), Navy housing, and ships homeported in Newport. Materials disposed of at this site would be mostly domestic-type refuse but also include spent acids, paints, solvents, waste oils (lube, diesel, and fuel), and PCB-contaminated oil. An IAS and CS were conducted of the site. Site is being investigated under the current RI/FS.
4	Coddington Cove Rubble Fill	<u>1978-1982</u> - Rubble dump which contains inert items including scrap lumber, tires, wire, cable, and empty paint cans. An IAS conducted of the site recommended no further action. The site is being investigated under a Study Area Screening Evaluation (SASE).
7	Tank Farm #1	<u>WWII-1970</u> - Located in Melville North. Contains six 60,000-barrel underground storage tanks (USTs) for diesel oil, fuel oil, jet fuel, 100 octane gasoline, and aviation fuel. Tank bottom sludge generated from cleaning the tanks was placed in on-site pits. Approximately 6,000 gallons of tank bottom oil sludge was reportedly disposed of at the site. An IAS and CS were conducted of the site. The site is currently being investigated under a DFSP contract.
8	NUSC Disposal Area	<u>Early 1970s</u> - Located in Coddington Cove. Contains rubble, inert materials including scrap lumber, tires, wire, cable, and empty paint cans. An IAS conducted on the site recommended no further action. The site is being investigated under a SASE.
9	Old Fire Fighting Training Area	<u>WWII-1972</u> - Located on Coaster's Harbor Island. Waste oils were used at the site to train personnel in fire fighting operations. Site has been excavated to remove contaminated soils. An IAS conducted of the site recommended no further action. Oil discovered at the site during a recent geotechnical investigation for the expansion of an operating facility on the site indicated the need for further investigation of the site. The site is being investigated under the current RI/FS.
10	Tank Farm #2	<u>WWII-1970</u> - Located in Melville. Contains eleven 60,000-barrel USTs for fuel. Approximately 100,000-175,000 gallons of sludge were disposed in on-site pits. An IAS was conducted of the site. The site is being investigated under a DFSP contract.
11	Tank Farm #3	<u>WWII-1970</u> - Located in Melville. Contains seven 60,000-barrel USTs for fuel. Tank sludge bottoms were disposed in burning chambers. The burning chambers had steel sides and sand bottoms. An IAS was conducted on the site. The site is currently being investigated under a DFSP contract.

No.	Site	Characteristics/Studies/Plan of Action
12	Tank Farm #4	<u>WWII-1970</u> - Located in Melville. Contains twelve 60,000-barrel USTs for fuel. Approximately 10,000-190,000 gallons of tank sludge bottoms were disposed of on site. An IAS and CS were conducted of the site. Site is being investigated under the current RI/FS.
13	Tank Farm #5	<u>WWII-1970</u> - Located in the mid portion of the Newport Naval Base. Contains eleven 60,000-barrel USTs for fuel. Tank bottom sludge was burned on site. Approximately 10,000-175,000 gallons of oily sludge was disposed of on site. A tank closure investigation is being conducted for two USTs at the site. An IAS was conducted of the site. Site is being investigated under the current RI/FS.
14	Gould Island Disposal Area	<u>WWII</u> - All wastes generated on the island consisting of domestic trash, metal scrap, wood, pipes, rusted drums, two diesel oil tanks, and concrete. Wastes from electroplating and degreasing operations may also have been disposed of at the site. An IAS and CS were conducted of the site. Site will be investigated by the Army Corps of Engineers.
15	Gould Island Bunker #11	<u>WWII</u> - Site had drums containing possible hazardous waste from electroplating operations. An IAS was conducted on the site. NETC cleaned the site under a removal action.
16	Gould Island Incinerator	<u>WWII</u> - Six-ton capacity incinerator. An IAS conducted on the site concluded that no action is required at site.
17	Gould Island Electroplating Shop	<u>WWII</u> - Wastes generated from electroplating and degreasing operations. Wastes included muriatic acid, chromic acid, copper cyanide, sodium cyanide, sodium hydroxide, nickel sulfate, Anodex leaner and degreasing solvents. An IAS and CS were conducted of the site. The site is being investigated under a SASE.

TABLE 1-2
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SUMMARY OF NETC FORMERLY USED DEFENSE SITES (FUDS)

No.	Site	Characteristics/Studies/Plan of Action
2	Melville North Landfill	<u>WWII-1955</u> - The landfill received mostly domestic-type refuse and also spent acids, waste paints, solvents, waste oils, and PCBs. Several areas are covered with oil and oily sludge on the site. The site has been excessed and is owned by Melville Marine Industries. An IAS and CS were conducted of the site. Site is being investigated under a separate RI/FS as a Formerly Used Defense Site (FUDS).
3	Structure #214 - Melville North	<u>1980-1982</u> - Substation #214. The site has been excessed and is considered a Formerly Used Defense Site (FUDS). NETC cleaned the site under a removal action.
5	Melville North Area	<u>1978-1982</u> - Twenty barrels of waste oil stored on an asphalted area. Oil was spilled in the area. The site has been excessed and is considered a Formerly Used Defense Site (FUDS). An IAS was conducted of the site. NETC cleaned the site under a removal action.
6	STP Sludge Drying Bed	<u>1982-1983</u> - Site is located in Melville North at the old sewage treatment plant. Oily waste has been disposed of at this site. Site has been excessed. An IAS was conducted of the site. NETC cleaned the site under a removal action.
18	Structure #214 - Melville North	<u>1980-1982</u> - Area adjacent to structure #214. Drums of waste oil and oily spillage. Site has been excessed and is considered a Formerly Used Defense Site (FUDS). NETC cleaned the site under a removal action.

TABLE 1-3

STATUS SUMMARY OF NETC NEWPORT HAZARDOUS WASTE SITES

No.	Site	Present Owner	Action
1	McAllister Point Landfill	Navy	IAS/CS, RI/FS
2	Melville North Landfill	Private	IAS/CS, RI/FS ⁽¹⁾
3	Transformer Vault Substation #214 - Melville North	Private	Navy Clean-Up ⁽²⁾
4	Coddington Cove Rubble Fill	Navy	IAS, SASE ⁽²⁾
5	Melville North Area	Private	IAS, Navy Clean-up ⁽³⁾
6	STP Sludge Drying Bed	Private	IAS, Navy Clean-up ⁽³⁾
7	Tank Farm One	Navy	IAS/CS ⁽³⁾
8	NUSC Disposal Area	Navy	IAS, SASE ⁽²⁾
9	Old Fire Fighting Training Area	Navy	IAS, RI/FS ⁽⁴⁾
10	Tank Farm Two	Navy	IAS ⁽³⁾
11	Tank Farm Three	Navy	IAS ⁽³⁾
12	Tank Farm Four	Navy	IAS/CS, RI/FS
13	Tank Farm Five	Navy	IAS, RI/FS
14	Gould Island Disposal Area	State	IAS/CS, RI/FS ⁽⁵⁾
15	Gould Island Bunker #11	State	IAS, Navy Clean-Up ⁽⁵⁾
16	Gould Island Incinerator	State	No Action ⁽⁵⁾
17	Gould Island Electroplating Shop	Navy	IAS/CS, SASE ⁽²⁾
18	Structure #214 - Melville North	Private	IAS, Navy Clean-Up

⁽¹⁾ The RI/FS for this site will be conducted as part of a separate investigation

⁽²⁾ A Study Area Screening Evaluation (SASE) will be performed on each of these sites to determine need for an RI/FS.

⁽³⁾ These Tank Farms are currently being investigated under a DFSP contract. SASE's of these sites are awaiting findings of the DFSP investigations.

⁽⁴⁾ A Confirmation Study was not performed. During a geotechnical investigation of the site, evidence of oil-contaminated soil was found thus, the site is being studied under the RI/FS.

⁽⁵⁾ This site will be investigated by the Army Corps of Engineers (ACE).

⁽⁶⁾ An oily soil pile removal action was completed at this site.

⁽⁷⁾ Tanks 53 and 56 at this site have been emptied and cleaned and the construction of the interim ground water remedial measure at Tank 53 has been initiated. In addition, a removal of oily soils in the ring drain of Tank 53 is planned.

TABLE 2-1
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 09 - OLD FIRE FIGHTING TRAINING AREA
LIST OF TCL COMPOUNDS

TCL Volatiles	TCL Semivolatiles		TCL Pesticides/PCBs
Chloromethane	Phenol*	Acenaphthene*	alpha-BHC
Bromomethane	bis(2-Chloroethyl)ether	2,4-Dinitrophenol	beta-BHC
Vinyl Chloride	2-Chlorophenol	4-Nitrophenol	delta-BHC
Methylene Chloride	1,3-Dichlorobenzene	Dibenzofuran	gamma-BHC(Lindane)
Acetone	1,4-Dichlorobenzene	2,4-Dinitrotoluene	Heptachlor
Carbon Disulfide	1,2-Dichlorobenzene	Diethyl Phthalate	Aldrin
1,1-Dichloroethane	2-Methyl Phenol	4-Chlorophenyl-phenylether	Heptachlor Epoxide
1,1-Dichloroethane	2,2'-oxybis(1-chloropropane)	Fluorene*	Endosulfan I
1,2-Dichloroethane (Total)	4-Methyl Phenol	4-Nitroaniline	Dieldrin
Chloroform	n-Nitro-di-n-Propylamine	4,6-Dinitro-2-methylphenol	4-4-DDE
1,2-Dichloroethane	Hexachloroethane	n-Nitrosodiphenylamine	Endrin
2-Butanone	Nitrobenzene	4-Bromophenyl-phenylether	Endosulfan II
1,1,1-Trichloroethane	Isophorone	Hexachlorobenzene	4,4-DDD
Carbon Tetrachloride	2-Nitrophenol	Pentachlorophenol	Endosulfan Sulfate
Bromodichloromethane	2,4-Dimethylphenol	Phenanthrene*	4,4-DDT
1,2-Dichloropropane	Benzoic Acid	Anthracene*	Methoxychlor
cis-1,3-Dichloropropene	2,4-Dichlorophenol	Carbazole	Endrin Ketone
Trichloroethene	1,2,4-Trichlorobenzene	di-n-Butyl Phthalate	Endrin Aldehyde
Dibromochloromethane	Naphthalene*	Fluoranthene*	alpha-Chlordane
1,1,2-Trichloroethane	4-Chloroaniline	Pyrene*	gamma-Chlordane
Benzene	Hexachlorobutadiene	Butyl Benzyl Phthalate	Toxaphene
Trans-1,3-Dichloropropene	4-Chloro-3-methylphenol	3,3'-Dichlorobenzidine	Aroclor - 1016
Bromoform	2-Methylnaphthalene*	Benzo(a)anthracene**	Aroclor - 1221
4-Methyl-2-Pentanone	Hexachlorocyclopentadiene	Chrysene**	Aroclor - 1232
2-Hexanone	2,4,6-Trichlorophenol	bis(2-Ethylhexyl) Phthalate	Aroclor - 1242
Tetrachloroethene	2,4,5-Trichlorophenol	di-n-Octyl Phthalate	Aroclor - 1248
1,1,2,2-Tetrachloroethane	2-Chloronaphthalene*	Benzo(b)fluoranthene**	Aroclor - 1254
Toluene	2-Nitroaniline	Benzo(k)fluoranthene**	Aroclor - 1260
Chlorobenzene	Dimethyl Phthalate	Benzo(a)pyrene**	
Ethylbenzene	Acenaphthylene*	Indeno(1,2,3-cd)pyrene**	
Styrene	2,6-Dinitrotoluene	Dibenzo(a,h)anthracene**	
Xylene(Total)	3-Nitroaniline	Benzo(g,h,i)perylene**	

NOTES:

* = PAH

** = Carcinogenic PAH

TABLE 2-2
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
LIST OF TAL ANALYTES

TAL Analytes	
Aluminum	Magnesium
Antimony	Manganese
Arsenic	Mercury
Barium	Nickel
Beryllium	Potassium
Cadmium	Selenium
Calcium	Silver
Chromium	Sodium
Cobalt	Thallium
Copper	Vanadium
Iron	Zinc
Lead	Cyanide

TABLE 2-3
NETC – NEWPORT
U.S. NAVY – NORTHERN DIVISION
SITE 01 – McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE DESCRIPTIONS

Sample I.D.	Date Sampled	Time Sampled	Soil Description
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Surface Soil Samples

MP-SS18	11/3/93	1415	Brown fine SAND and ORGANICS, little silt and gravel, dry, no odor, 0" to 10".
MP-SS19	11/3/93	1430	Brown fine SAND, little silt & organics, trace gravel, dry, no odor, 0" to 12".
MP-SS20	11/2/93	0840	Brown fine SAND and ORGANICS, little medium sand, dry, no odor, 0" to 11".
MP-SS21	11/2/93	1100	Brown fine SAND and ORGANICS, little silt & rock fragments, dry, no odor, 0" to 9".
MP-SS22	11/2/93	0815	Grey FILL, fine sand, silt, and organics, little medium sand & gravel, trace rock fragments, wet, no odor, 0" to 11".
MP-SS23	11/2/93	0745	Grey FILL, fine-medium sand and ash, little silt & gravel, trace rock fragments & organics, dry, no odor, 0" to 10".
MP-SS24	11/2/93	0915	Grey FILL, fine sand, silt and ash, little gravel, trace rock fragments & organics, dry, no odor, 0" to 12".
MP-SS25	11/2/93	1000	Grey FILL, fine sand and silt, some ash, little medium sand & organics, trace gravel, dry, no odor, 0" to 12".
MP-SS26	11/2/93	1200	Grey FILL, fine sand and silt, some gravel & organics, little rock fragments, dry, no odor, 0" to 8".
MP-SS27	11/2/93	1315	Brown FILL, fine sand, little silt & organics, trace rock fragments & glass, dry, no odor, 0" to 10".
MP-SS29	11/4/93	1440	Brown FILL, fine-medium sand, some rock fragments, little organics, dry, no odor, 0" to 12".
MP-SS30	11/4/93	1505	Brown FILL, fine sand, some medium sand, organics, & rock fragments, dry, no odor, 0" to 10".
MP-SS31	11/5/93	1705	Grey/brown weathered SHALE fragments, dry, no odor, 0" to 12".
MP-SS32	11/5/93	1720	Grey/brown weathered SHALE fragments, dry, no odor, 0" to 12".

Soil Boring Surface Soil Samples

MP-B141	11/22/93	1115	Brown fine SAND and SILT, some gravel, no odor, dry, 0" to 10"
MP-B151	11/10/93	1533	Brown FILL, topsoil, dry, no odor, 0" to 2". Grey/brown FILL, fine sand, trace silt, plastic, & rock fragments, dry, no odor, 2" to 10".
MP-B161	11/11/93	0710	Brown FILL, fine-medium sand & silt, some cobbles, 0-6". Grey FILL, ash, dry, no odor, 6" to 12".
MP-B181	11/11/93	0950	Brown FILL, fine sand, trace silt & cobbles, dry, no odor, 0" to 12".
MP-B231	11/10/93	0840	Brown FILL, medium-fine sand & organics, little gravel, 0" to 3". Grey FILL, shale fragments & asphalt, trace organics, 3" to 5". Grey FILL, fine sand and silt, some shale fragments, trace debris (brick), dry, no odor, 5" to 18".
MP-B241	11/8/93	1540	Dark brown FILL, fine sand, little silt & gravel, trace shale fragments, dry, no odor, 0" to 12".
MP-B251	11/8/93	1000	Brown FILL, fine-medium sand and organics, 0" to 6". Brown FILL, fine-medium sand, some shale fragments, trace wood & organics, dry, no odor, 6" to 12".
MP-B261	11/8/93	1020	Brown FILL, fine-medium sand, some gravel, little cobbles, dry, no odor, 0" to 12".
MP-B271	11/22/93	1145	Brown fine-medium SAND, some silt, dry, no odor, 0" to 12".

TABLE 2-3
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE DESCRIPTIONS

Sample I.D.	Date Sampled	Time Sampled	Soil Description
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Well Boring Surface Soil Samples

MP-M121	11/11/93	0705	Brown FILL, fine-medium sand and organics, some rock fragments, dry, no odor, 0" to 4". Grey FILL, shale fragments, dry, no odor, 4" to 12".
MP-M131	11/10/93	1209	Dark brown FILL, organics, moist, no odor, 0" to 4". Brown FILL, medium sand and gravel, trace silt, moist, no odor, 4" to 12".
MP-M141	11/17/93	1020	Brown fine SAND and SILT (topsoil), dry, no odor, 0" to 6". Grey fine SAND and SILT, dry, no odor, 6" to 12".
MP-M151	11/16/93	0952	Brown fine-medium SAND, some silt, little weathered shale, dry, no odor, 0" to 12".
MP-M161	11/16/93	1522	TOPSOIL, dry, no odor, 0" to 3". Brown fine SAND, little rock fragments, dry, no odor, 3" to 12".

TABLE 2-4

NETC - Newport
Site 01 - McAllister Point Landfill
Test Pit Log MP-TP1
January 12, 1994

Rationale: To characterize the fill material in the southern portion of the landfill.

Date: January 12, 1994

Dimensions: 21' X 4' X 7.5' (L X W X D).

TRC Inspector: Tom McMorrow & John Coykendall

Excavation Subcontractor: Clean Harbors

Sample ID: MP-TP11 collected as a composite sample from the excavated material.

DEPTH (FT)	DESCRIPTION
0 - 2'	FILL, dk brown F to M SAND, little gravel, trace organics.
2 - 3'	FILL, lt brown M to C SAND, little gravel and brick fragments.
3 - 7.5'	FILL, dk brown F to M SAND, little gravel, scrap metal and wood fragments (ground water approx. 7.5' below grade). A slight garbage odor with OVA readings ranging from 10 - 85 ppm were detected in the excavated soils.

CONCLUSIONS

Construction debris was encountered from 2 to 7.5 feet below grade. A slight sheen was noted on the ground water in the bottom of the test pit.

TABLE 2-4

NETC - Newport
Site 01 - McAllister Point Landfill
Test Pit Log MP-TP2
January 12, 1994

Rationale: To characterize the fill material in the southern portion of the landfill.

Date: January 12, 1994

Dimensions: 23' X 4' X 8.5' (L X W X D).

TRC Inspector: Tom McMorrow & John Coykendall

Excavation Subcontractor: Clean Harbors

Sample ID: MP-TP21 collected as a composite sample from the excavated material.

DEPTH (FT)	DESCRIPTION
0 - 3'	FILL, brown/tan F-M SAND, little gravel, cobbles, and weathered shale fragments.
3 - 5.5'	FILL, black M SAND and GRAVEL, bricks, scrap metal, and wood fragments. Petroleum odor noted. Empty 10 gallon metal drum carcass encountered.
5.5 - 8.5'	Lt brown TILL, F-M sand, some gravel, little silt. Black oil gobbule staining noted in material (ground water approx. 8 feet below grade). A petroleum odor with OVA reading ranging from 10 to 500 ppm were noted in the soils excavated from the 3 to 5.5 foot interval.

CONCLUSIONS

Construction debris encountered in the 3 to 5.5 foot interval. Slight oil staining noted in the till material at the ground water surface.

TABLE 2-4

NETC - Newport
Site 01 - McAllister Point Landfill
Test Pit Log MP-TP3
January 12, 1994

Rationale: To characterize the fill material in the southern portion of the landfill.

Date: January 12, 1994

Dimensions: 18' X 4' X 8' (L X W X D).

TRC Inspector: Tom McMorrow & John Coykendall

Excavation Subcontractor: Clean Harbors

Sample ID: MP-TP31 (and duplicate sample MP-TP33) collected from a depth of 8 feet from the center of the test pit. Soils exhibited a slight odor.

MP-TP32 collected as a composite sample of the excavated material.

DEPTH (FT)	DESCRIPTION
0 - 4'	FILL, brown F to M SAND, some rock fragments, little cobbles and gravel, tr wood.
4 - 5'	FILL, wood, plastic, metal, cloth with sample brown F-M sand.
5 - 8'	Brown F-M SAND, little rock fragments (ground water not encountered)
	No elevated OVA readings were detected from the excavated soils. Slight odor noted in soils from 7 to 8 feet.

CONCLUSIONS

One foot layer of debris encounter in test pit at a depth of 4 to 5 feet. No visible signs of staining noted in soils, however, slight odor noted in soils at bottom of test pit.

TABLE 2-5
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
WELL DEVELOPMENT PARAMETERS

Well Number	Date	Pump Type/ Total Gal. Pumped	Time	pH	Temp (oC)	Conductivity (mmhos/cm)	Turbidity (NTU)	Observations
MW-8R	12/6/93	Watterra 80 gallons	9:00	6.43	11.3	1.549	>200	Dark grey, silty, odorless
			9:35	6.67	11.3	2.77	>200	
			9:45	6.60	15.6	2.85	>200	
			9:55	6.56	14.6	1.53	>200	
			10:05	6.66	16.3	2.60	>200	
			10:15	6.73	16.2	2.42	>200	
			10:25	6.86	17.1	2.43	>200	
			10:35	7.25	13.7	2.38	>200	
			10:45	6.67	14.8	2.35	>200	
			10:55	6.65	15.0	2.28	>200	
MW-9R	12/8/93	Bailer 15 gallons	8:50	5.94	10.4	0.870	>200	
			9:10	5.96	11.0	0.801	>200	
			9:50	6.09	10.1	0.809	>200	
			10:25	6.09	9.7	0.494	>200	
			10:35	6.06	11.1	0.414	>200	
			10:55	6.12	11.4	0.809	>200	
			11:15	5.91	11.8	0.793	>200	
			11:25	5.88	11.6	0.518	>200	
			11:50	5.84	11.8	0.802	>200	
			12:00	5.81	11.7	0.674	>200	
MW-10R	12/6/93	Watterra 50 gallons	15:15	6.59	12.1	0.590	>200	Gray, silty, trash odor
			15:25	6.69	12.0	0.537	>200	
			15:35	6.61	12.0	0.528	>200	
			15:45	6.86	14.2	0.469	>200	
			15:55	6.75	10.9	0.492	>200	
			16:05	6.70	10.9	0.448	>200	
			16:15	6.57	10.8	0.459	>200	
			16:25	6.22	11.6	0.465	>200	
			16:35	6.47	11.5	0.494	>200	
			16:45	6.32	11.5	0.487	>200	

TABLE 2-5
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
WELL DEVELOPMENT PARAMETERS

Well Number	Date	Pump Type/ Total Gal. Pumped	Time	pH	Temp (°C)	Conductivity (mmhos/cm)	Turbidity (NTU)	Observations
MW-11R	12/6/93	Wattera 75 gallons	12:55	7.44	18.4	1.229	>200	Dark grey, silty, odorless
			13:05	6.40	15.5	1.073	>200	
			13:20	7.06	15.4	0.557	>200	
			13:30	6.49	17.6	1.067	>200	
			13:42	6.33	15.2	1.086	>200	
			13:55	6.35	16.6	1.138	>200	
			14:10	6.48	14.7	1.130	>200	
			14:25	6.63	14.4	1.119	>200	
			14:35	6.40	14.6	0.617	>200	
MW-12S	12/7/93	Centrifugal 55 gallons	7:40	5.91	10.2	0.237	>200	Sheen, strong petroleum odor
			7:50	6.10	12.5	0.427	>200	
			7:55	6.15	13.8	0.427	143.1	
			8:00	6.05	12.8	0.260	134.4	
			8:05	6.12	12.7	0.384	107.4	
			8:10	6.04	12.8	0.481	86.8	
			8:20	6.09	13.1	0.483	64.8	
			8:25	6.06	13.1	0.472	57.9	
			8:30	6.08	13.3	0.449	59.7	
			8:35	6.06	13.1	0.437	58.1	
8:40	6.03	13.1	0.433	58.7				
MW-13S	12/7/93	Centrifugal 55 gallons	8:45	6.48	14.2	0.327	>200	
			9:05	5.96	12.1	0.201	>200	
			9:20	5.94	10.9	0.109	108.0	
			9:30	5.79	11.5	0.163	>200	
			9:40	5.82	11.7	0.154	191.5	
			9:55	5.83	11.0	0.158	117.7	
			10:10	5.85	11.2	0.084	181.7	
			10:25	5.73	11.7	0.157	182.0	
			10:35	5.79	12.0	0.157	153.0	
			10:50	5.77	12.0	0.155	186.1	
			11:00	5.74	11.9	0.155	140.6	
			11:15	5.72	11.8	0.158	150.6	

TABLE 2-5
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
WELL DEVELOPMENT PARAMETERS

Well Number	Date	Pump Type/ Total Gal. Pumped	Time	pH	Temp (oC)	Conductivity (mmhos/cm)	Turbidity (NTU)	Observations	
MW-14R	12/7/93	Centrifugal/Bailer 55 gallons	15:45	6.22	11.6	0.232	>200		
			15:55	6.30	10.8	0.272	>200		
			16:05	6.53	10.6	0.270	>200		
			16:15	6.50	10.7	0.269	>200		
	12/8/93			7:10	6.34	9.7	0.263	1.4	
				7:20	6.36	9.7	0.264	15.8	
				7:30	6.75	9.0	0.309	25.0	
				7:40	6.76	9.7	0.147	105.8	
				7:50	6.47	9.1	0.261	187.1	
				8:00	6.46	8.9	0.257	189.0	
			8:10	6.35	9.6	0.251	181.2		
MW-15R	12/7/93	Centrifugal 55 gallons	14:20	8.42	14.8	0.283	>200		
			14:30	6.73	14.2	0.159	>200		
			14:40	6.43	14.2	0.238	>200		
			14:50	6.07	13.5	0.224	>200		
			15:00	5.94	12.6	0.199	>200		
			15:10	5.90	13.4	0.198	>200		
			15:20	5.91	12.7	0.198	>200		
			15:30	5.88	12.7	0.191	>200		
			15:40	5.89	12.8	0.193	>200		
MW-16R	12/7/93	Centrifugal 55 gallons	12:20	6.66	12.0	0.198	>200		
			12:30	6.49	12.1	0.193	>200		
			12:40	6.77	16.1	0.187	>200		
			12:50	6.63	13.6	0.186	181.9		
			13:00	6.40	14.8	0.168	87.4		
			13:10	6.31	14.8	0.166	64.2		
			13:20	6.49	14.4	0.167	68.1		
			13:30	6.33	14.9	0.162			

TABLE 2-6
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
MONITORING WELL HEADSPACE READINGS

Well Number	HNu (ppm)	OVA (ppm)	Well Number	HNu (ppm)	OVA (ppm)
MW-1R	ND	ND	MW-10R	0.5	>1000
MW-2S	ND	>1000	MW-11S	ND	>1000
MW-3S	ND	>1000	MW-11R	ND	700
MW-3R	ND	11	MW-12S	2	300
MW-4S	2	30	MW-13S	ND	>1000
MW-5S	ND	>1000	MW-14R	1	8
MW-5R	ND	ND	MW-15R	1	1
MW-6S	ND	>1000	MW-16R	0.5	7
MW-7S	ND	>1000	MW-21S	ND	ND
MW-8S	ND	ND	MW-22S	ND	ND
MW-8R	ND	2	MW-23R	ND	ND
MW-9R	ND	>1000			

TABLE 2-7
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
GROUND WATER PARAMETERS

Page 1 of 2

Well Number	Date Sampled	pH	Temp (°C)	Conductivity (mmhos/cm)	Turbidity (NTU)	Diss. Oxygen (mg/l)	Salinity (ppt)	Eh (mV)
MW-1R	12/20/93	5.21	11.8	0.278	978	6.90	0.00	131
MW-2S	12/22/93	No parameters taken due to only 3" of water in well.						
MW-3S	12/21/93	6.42	13.2	1.077	>1000	3.03	0.4	50
MW-3R	12/21/93	5.97	13.2	0.593	193	3.92	0.2	7
MW-4S	12/21/93	5.96	15.5	0.558	96	2.34	0.2	-34
MW-5S	12/20/93	5.60	12.5	0.283	22	3.45	0.00	71
MW-5R	12/20/93	5.84	13.1	0.203	184	5.67	0.00	69
MW-6S	12/20/93	5.26	13.3	0.237	347	8.00	0.00	90
MW-7S	12/20/93	5.70	11.6	0.460	>1000	5.21	0.1	24
MW-8S	DRY							
MW-8R	12/21/93	6.40	13.3	5.717	>1000	5.10	1.7	-4
MW-9R	12/22/93	6.18	11.5	0.853	>1000	7.10	0.3	27
MW-10R	12/21/93	6.55	14.7	0.610	848	2.92	0.2	-27

TABLE 2-7
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
GROUND WATER PARAMETERS

Page 2 of 2

Well Number	Date Sampled	pH	Temp (°C)	Conductivity (mmhos/cm)	Turbidity (NTU)	Diss. Oxygen (mg/l)	Salinity (ppt)	Eh (mV)
MW-11S	DRY							
MW-11R	12/21/93	6.32	16.3	1.301	575	2.49	0.5	-20
MW-12S	12/21/93	6.20	13.5	0.412	584	2.36	0.1	-36
MW-13S	12/21/93	5.65	13.4	0.163	870	5.47	0.00	26
MW-14R	12/22/93	6.59	9.1	0.242	534	8.65	0.00	15
MW-15R	12/21/93	5.66	13.5	0.208	670	5.98	0.00	40
MW-16R	12/21/93	6.32	13.8	0.173	892	4.76	0.00	29
MW-21S	12/20/93	6.84	11.7	2.28	300	4.00	0.6	-58
MW-22S	12/20/93	6.31	13.1	0.596	141	4.25	0.2	-11
MW-23R	12/20/93	6.24	12.2	0.244	410	7.19	0.00	-10

TABLE 2-8
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
LEACHATE SAMPLE PARAMETERS

Leachate Number	Date Sampled	Time Sampled	pH	Temp (°C)	Conductivity (mmhos/cm)	Observations
LS-1	11/4/93	15:55	8.64	9.5	14.05	Clear water, rust & metal in sediments.
LS-2	11/4/93	16:05	8.18	9.5	14.31	Clear water, rust & metal in sediments.
LS-3	11/4/93	16:15	8.28	9.0	50.9	Clear water, rust & metal in sediments.

TABLE 2-9
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
MONITORING WELL DATA

Well Number	Date Installed	Rhode Island Grid Coordinates		Ground Elev.	Inner Casing Elev.	Screen Depth (from ground surface)		Screen Elevation (MLW)	
		North	East			Top	Bottom	Top	Bottom
MW-1R	1/24/90	169222	551882	29.66	32.37	20.00	35.00	9.66	-5.34
MW-2S	1/12/90	168801	551723	33.82	36.26	5.00	18.00	28.82	15.82
MW-3S	1/16/90	168241	551860	31.59	34.04	12.50	22.50	19.09	9.09
MW-3R	1/22/90	168246	551857	31.76	34.75	27.00	42.00	4.76	-10.24
MW-4S	1/10/90	168325	552018	25.90	28.97	3.00	7.50	22.90	18.40
MW-5S	1/9/90	167704	552358	17.75	20.93	4.00	14.00	13.75	3.75
MW-5R	1/18/90	167702	552355	18.09	21.14	27.50	42.50	-9.41	-24.41
MW-6S	6/19/90	167927	552263	19.74	23.14	4.00	14.00	15.74	5.74
MW-7S	6/20/90	168844	551888	30.16	33.11	10.00	30.00	20.16	0.16
MW-8S	11/16/93	168802.85	551663.81	30.11	32.65	15.00	25.00	15.11	5.11
MW-8R	11/15/93	168801.99	551654.89	30.04	32.59	28.00	38.00	2.04	-7.96
MW-9R	11/11/93	168354.32	551812.38	32.06	34.55	18.00	33.00	14.06	-0.94
MW-10R	11/12/93	168057.54	551982.26	23.81	26.09	17.00	27.00	6.81	-3.19
MW-11S	11/16/93	168206.61	551691.19	29.01	31.87	17.00	27.00	12.01	2.01
MW-11R	11/16/93	168206.86	551683.59	28.37	31.30	30.00	40.00	-1.63	-11.63
MW-12S	11/11/93	167776.13	552288.63	18.07	20.52	5.00	15.00	13.07	3.07
MW-13S	11/10/93	167759.79	552354.07	18.67	21.03	6.00	16.00	12.67	2.67
MW-14R	11/17/93	168913.05	552038.47	43.21	42.88	25.00	40.00	18.21	3.21
MW-15R	11/16/93	168351.44	552179.87	34.15	33.74	17.00	27.00	17.15	7.15
MW-16R	11/16/93	167945.95	552432.78	18.60	18.41	9.00	19.00	9.60	-0.40
MW-21S	9/11/84	168055.85	551747.12	25.04	27.50	28.00	38.00	-2.96	-12.96
MW-22S	9/13/84	167901.93	551966.15	15.63	17.76	15.00	25.00	0.63	-9.37
MW-23R	9/13/84	168497.13	552273.74	40.29	40.71	30.00	40.00	10.29	0.29

TABLE 2-9 (continued)
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
PIEZOMETER WELL DATA

Well Number	Date Installed	Rhode Island Grid Coordinates		Ground Elev.	Inner Casing Elev.	Screen Depth (from ground surface)		Screen Elevation (MSL)	
		North	East			Top	Bottom	Top	Bottom
PZ-1A	11/19/93	168613.99	551756.80	32.32	34.91	27.50	30.00	4.82	2.32
PZ-1B	11/18/93	168308.67	551757.40	32.25	34.88	42.50	45.00	-10.25	-12.75
PZ-2A	11/18/93	168117.79	551717.67	27.79	29.93	23.50	26.00	4.29	1.79
PZ-2B	11/18/93	168111.41	551716.88	27.01	28.72	32.50	35.00	-5.49	-7.99
PZ-2C	11/17/93	168105.62	551714.94	26.68	29.25	42.50	45.00	-15.82	-18.32
PZ-3A	11/19/93	168112.42	551899.86	27.50	29.96	25.50	28.00	2.00	-0.50
PZ-3B	11/18/93	168106.23	551908.54	27.11	29.55	35.50	38.00	-8.39	-10.89
PZ-4A	11/20/93	167961.42	551883.95	21.26	23.65	18.50	21.00	2.76	0.26
PZ-4B	11/19/93	167956.77	551879.78	21.55	24.00	28.50	31.00	-6.95	-9.45
PZ-4C	11/19/93	167951.31	551873.97	21.43	23.89	38.50	41.00	-17.07	-19.57

TABLE 3-1

WATER QUALITY CLASSIFICATIONS FOR
NARRAGANSETT BAY

<u>SECTION</u>	<u>CLASSIFICATION</u>
The waters within 500 feet of the firing pier of the US Navy Torpedo Testing Station, Gould Island	SA
The waters in the area easterly from a line drawn from Coggeshall Point southwesterly to the southeastermost point of Dyer Island and the area easterly from a line drawn from Carr Point northwesterly to the southeastermost point of Dyer Island	SC
The waters in the vicinity of Taylor Point which are within a 300 foot radius of the Jamestown marine outfall sewer (7 acres)	SC
The waters in the vicinity of Taylor Point, exclusive of those waters described above, south of a line from the northernmost extremity of Taylor Point to Can Buoy 13, north of a line from a point of land approximately 1000 feet south of the Newport Bridge to the northernmost extremity of Rose Island, and within 1000 feet of the shoreline of Jamestown (49 acres)	SB
Unnamed Brook from Greene Lane, Middletown, Rhode Island to East Passage, Narragansett Bay (1-1/2 mile)	B
Unnamed Brook upstream of Greene Lane to headwaters	B
East of a line from Ida Lewis Rock to the southern extremity of Goat Island, east of the line from the northern extremity of Goat Island to the west shore of Coasters Harbor Island, east of a line from the west shore of Coasters Harbor Island to the western extremity of Coddington Point and south and east of a line from the southwestern extremity of Coddington Point to the northern most point of the Coddington Cove breakwater	SC
The area within 1000 feet off of Monroe Street (in the Fort Adams Naval housing complex) on the west shore of Fort Adams, east of line from Fort Adams Light to Rose Island Light to Buoy (FLR) Bell 14 and a line from Buoy (FLR) Bell 14 through Nun Buoy 16 at Coddington Point and its extension to the end (southeastern most point) of the Coddington Cove breakwater	SB
Waters within a 600 foot radius of Greene Lane, Middletown	SB
The waters in the vicinity of Fort Adams, Newport, which are within a 300 foot radius of the Fort Adams marine outfall sewer (4.1 acres)	SC
The waters in the vicinity of Coasters Harbor which are within 500 feet of the Newport marine outfall sewer (18 miles)	SC

(Rhode Island Water Quality Standards, 1988)

TABLE 3-2
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
SUMMARY OF MEASURED GROUND WATER LEVEL ELEVATIONS

Well Number	Confirmation Study Water Levels									Phase I Water Levels				Phase II Water Levels			Average Water Level	Maximum Variation
	09/12/84	09/14/84	11/20/84	12/17/84	12/18/84	01/07/85	01/08/85	01/28/85	4/3/80	7/18/90	9/20/90	1/31/91	12/20/93	12/29/93	04/29/94			
MW-1R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.45	4.51	4.80	7.09	7.19	7.95	7.04	6.43	3.44	
MW-2S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	DRY	DRY	DRY	DRY	16.17	17.89	18.32	17.39	2.15	
MW-3S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13.56	13.17	12.74	13.30	12.01	12.24	13.65	12.65	1.64	
MW-3R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11.89	10.14	9.00	11.04	10.20	11.58	14.48	11.18	5.48	
MW-4S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20.48	DRY	DRY	20.19	20.42	21.38	22.01	20.90	1.82	
MW-5S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11.5	9.66	8.84	11.79	10.47	11.65	13.08	11.00	4.24	
MW-5R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.83	3.96	4.10	6.60	5.51	6.20	6.98	5.47	3.02	
MW-6S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.85	9.85	13.85	11.29	12.91	15.33	10.55	5.68	
MW-7S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13.68	12.15	19.85	18.68	21.33	19.72	15.24	8.18	
MW-8S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	DRY	DRY	5.18	5.18	--	
MW-8R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.48	3.47	3.84	4.96	3.99	
MW-9R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.50	7.19	9.62	7.77	3.12	
MW-10R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.74	8.95	12.40	9.70	4.68	
MW-11S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	DRY	DRY	4.08	4.08	--	
MW-11R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.40	3.11	3.79	3.43	0.67	
MW-12S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.08	11.17	12.97	11.41	2.89	
MW-13S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.58	12.11	14.17	12.28	3.61	
MW-14R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	28.89	30.44	31.29	30.20	2.43	
MW-15R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20.60	22.09	23.47	22.05	2.67	
MW-16R	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11.55	13.38	16.53	13.62	4.98	
MW-21S	4.9	NM	3.7	NM	3.8	4.5	NM	3.8	NM	NM	NM	NM	3.52	N/A	3.98	4.03	1.4	
MW-22S	NM	6.8	3.3	6.0	NM	NM	3.9	3.1	3.82	NM	NM	4.10	3.58	3.18	3.98	4.18	3.7	
MW-23R	NM	17.9	18.7	19.4	NM	22.5	NM	21.9	NM	NM	NM	NM	23.59	N/A	28.29	21.75	10.4	

N/A: Well is not available (installed) at this time.
 NM: Water level is not measured at this time.
 DRY: Well was dry on this date.
 Elevations relative to Mean Low Water (MLW).

TABLE 3-2 (continued)
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
SUMMARY OF MEASURED GROUND WATER
ELEVATIONS IN PIEZOMETERS

Well Number	Phase II Water Levels		Average Water Level	Maximum Variation
	12/29/93	04/29/94		
PZ-1A	4.24	5.7	4.97	1.45
PZ-1B	4.31	5.98	5.15	1.67
PZ-2A	3.41	4.00	3.71	0.59
PZ-2B	3.35	3.79	3.57	0.44
PZ-2C	3.61	3.74	3.68	0.13
PZ-3A	7.92	8.70	8.31	0.78
PZ-3B	7.48	8.28	7.88	0.80
PZ-4A	3.03	3.47	3.25	0.44
PZ-4B	3.09	3.40	3.25	0.31
PZ-4C	NM	4.17	4.17	--

NM: Water level is not measured at this time.
 Elevations relative to Mean Low Water (MLW).

TABLE 3-3
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
SUMMARY OF MONITORING WELL SLUG TEST ANALYSIS

Well I.D.	Type of Test	Screen Depth (ft from ground surface)		Hydraulic Conductivity (K, ft/day)	Transmissivity (T, ft ² /day)
		Top	Bottom		
<u>Wells Screened in Fill/Soil Material</u>					
MW-3S	Rising Head	12.5	22.5	30.46/24.96	141.6/116.0
MW-6S	Rising Head	4.0	14.0	57.11/59.58	752.1/784.7
MW-12S	Rising Head	5.0	15.0	15.03	148.8
MW-13S	Rising Head	6.0	16.0	33.21/42.04	313.5/396.8
<u>Wells Screened in Weathered Bedrock (Shale)</u>					
MW-3R	Rising Head	27.0	42.0	.40	8.76
MW-8R	Rising Head	28.0	38.0	3.66/2.01	41.60/22.83
MW-8R	Falling Head	28.0	38.0	2.01	23.45
MW-9R	Rising Head	18.0	33.0	6.40	67.96
MW-10R	Rising Head	17.0	27.0	1.85/3.03	22.48/36.75
MW-11R	Rising Head	30.0	40.0	3.70/3.34	54.49/49.17
MW-11R	Falling Head	30.0	40.0	2.98	45.32
MW-14R	Falling Head	25.0	40.0	0.139	3.79
MW-14R	Rising Head	25.0	40.0	0.094	2.56
MW-15R	Rising Head	17.0	27.0	5.54/5.13	82.80/76.70
MW-15R	Falling Head	17.0	27.0	4.39	69.03
MW-16R	Rising Head	9.0	19.0	68.44/68.66	1165/1169

NOTE: For wells where two slug tests were completed, both analysis are presented.

TABLE 3-4
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
MONITORING WELL VERTICAL HYDRAULIC GRADIENTS

Well Cluster I.D.	Vertical Distance (feet) ⁽¹⁾						Head Difference (feet) ⁽²⁾						Gradient (feet/foot)					
	4/3/90	7/18/90	9/20/90	1/31/91	12/29/93	04/29/94	4/3/90	7/18/90	9/20/90	1/31/91	12/29/93	04/29/94	4/3/90	7/18/90	9/20/90	1/31/91	12/29/93	04/29/94
MW-3	16.30	15.91	15.48	16.04	14.98	16.39	-1.87	-3.03	-3.74	-2.26	-0.66	0.83	-0.115	-0.190	-0.242	-0.141	-0.044	0.051
MW-5	28.41	28.57	25.75	28.70	28.56	29.99	-6.57	-5.70	-4.74	-5.19	-5.45	-6.10	-0.231	-0.215	-0.184	-0.181	-0.191	-0.203
PZ-1 (A-B)	NM	NM	NM	NM	15.74	15.07	NM	NM	NM	NM	0.07	0.29	NM	NM	NM	NM	0.004	0.019
PZ-2 (A-C)	NM	NM	NM	NM	20.48	21.07	NM	NM	NM	NM	0.20	-0.28	NM	NM	NM	NM	0.010	-0.012
PZ-2 (A-B)	NM	NM	NM	NM	10.15	10.74	NM	NM	NM	NM	-0.06	-0.21	NM	NM	NM	NM	-0.006	-0.020
PZ-2 (B-C)	NM	NM	NM	NM	10.33	10.33	NM	NM	NM	NM	0.26	-0.05	NM	NM	NM	NM	0.025	-0.005
PZ-3 (A-B)	NM	NM	NM	NM	10.39	10.39	NM	NM	NM	NM	-0.44	-0.42	NM	NM	NM	NM	-0.042	-0.040
PZ-4 (A-C)	NM	NM	NM	NM	NM	19.83	NM	NM	NM	NM	NM	0.70	NM	NM	NM	NM	NM	0.035
PZ-4 (A-B)	NM	NM	NM	NM	9.71	9.71	NM	NM	NM	NM	0.06	-0.07	NM	NM	NM	NM	0.006	-0.007
PZ-4 (B-C)	NM	NM	NM	NM	NM	10.12	NM	NM	NM	NM	NM	0.77	NM	NM	NM	NM	NM	0.076

Notes: (1) The vertical distance is the difference in elevation between the water table in the shallow well and the middle of the screened interval in the deep well.
(2) The head difference is the elevation of the deep well piezometric level minus the shallow well water table elevation. Thus, negative signs represent downward gradients.
NM The water level was not measured in the well at this time.
The method for calculating vertical hydraulic gradients is explained in Appendix J.

TABLE 3-5
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
AVERAGE HORIZONTAL HYDRAULIC GRADIENTS AND LINEAR VELOCITIES

Location	Average Horizontal Gradients (ft/ft)			Average Linear Velocity (ft/day)		
	12/20/93	12/29/93	4/29/94	12/20/93	12/29/93	4/29/94
<u>Shallow Ground Water</u>						
Northern Inland (RR Tracks to MW-2)	0.022	0.022	0.009	5.50	5.50	2.25
Northern Nearshore (MW-2 to Bank)	0.149	0.145	0.219	37.23	36.23	54.72
North-Central Area	0.063	0.067	0.061	15.74	16.74	15.24
South-Central Area	0.046	0.050	0.054	11.49	12.49	13.49
Southern Area (MW-6 to Bank)	0.056	0.063	0.080	13.99	15.74	19.99
Southern Area (MW-13 to Bank)	0.073	0.095	—	18.24	23.74	—
<u>Bedrock Ground Water</u>						
Northern Area (RR Tracks to Bank)	0.100	0.114	0.105	2.94	3.36	3.09
Northern Area (By MW-2)	0.053	0.075	0.070	1.56	2.21	2.06
North-Central Area	0.038	0.057	0.067	1.12	1.68	1.97
South-Central Area	0.033	0.031	0.048	0.98	0.91	1.41
Southern Area (By MW-6)	0.033	0.040	0.056	0.98	1.18	1.65
Southern Area (By MW-13)	0.027	0.033	0.063	0.78	0.98	1.85

Notes:

- * The shallow and deep hydraulic conductivities for the site (37.48 ft/day and 2.94 ft/day, respectively) are the mean values derived from the Phase II slug tests.
- * Effective porosities of 0.15 and 0.10 were assumed for the shallow and bedrock ground water, respectively.
- * The method for calculating average horizontal hydraulic gradients and average linear velocities is explained in Appendix J.

TABLE 4-1
NETC – NEWPORT
U.S. NAVY – NORTHERN DIVISION
SITE 01 – McALLISTER POINT LANDFILL
PHASE II RI SAMPLE SUMMARY

Sample Matrix	Number and Type of Sample					Analysis ⁽²⁾
	Environmental	Duplicate	Field Blank	Trip Blank ⁽¹⁾	EPA Split	
<u>Surface Soils</u>	5	1	–	–	2	A,B,C,D,E
	23	4	2	–	2	A,B,C,D
	–	–	–	2	–	A
<u>Subsurface Soils</u>	1	–	1	–	–	A,B,C,D,E
	4	1	–	–	–	A,B,C,D,F
	24	–	3	–	–	A,B,C,D
	1	–	–	–	–	A,B,C
	3	–	–	6	–	A
<u>Groundwater</u>	4	1	2	–	–	A,B,C,D,G
	16	1	–	–	–	A,B,D,G
	1	–	–	3	–	A
<u>Leachate</u>	3	–	–	–	1	A,B,C,D,G
<u>Source Water⁽³⁾</u>	1	–	–	–	–	A,B,C,D
<u>Surface Water</u>	1	–	–	–	–	A,B,C,D,G

NOTES:

1. Trip blanks analyzed for volatile organic compounds only.
2. Analysis performed as follows:
 - A). Target Compound List Volatile Organic Compounds
 - B). Target Compound List Base/Neutral/Acid Extractable Compounds
 - C). Target Compound List Pesticide/PCB Compounds
 - D). Target Analyte List (Metals & Cyanide)
 - E). Dioxins/Furans
 - F). Total Petroleum Hydrocarbons
 - G). Total Chloride
3. Source water was used for equipment decontamination.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-SS18	MP-SS19	MP-SS20	MP-SS21	MP-SS22	MP-SS23
Sample Collection Date:	03 NOV 93	03 NOV 93	02 NOV 93	02 NOV 93	02 NOV 93	02 NOV 93
Volatile Organic Compounds (µg/kg)						
Methylene chloride	—	—	1 J	2 J	—	2 J
Acetone	—	—	—	—	—	—
2-Butanone	—	—	1 J	—	—	—
1,1,1-Trichloroethane	5 J	—	—	—	—	—
4-Methyl-2-Pentanone	—	—	—	—	—	—
Tetrachloroethene	2 J	—	—	—	—	—
Toluene	—	—	—	—	—	—
Xylenes (total)	—	—	—	—	—	—
Total VOCs	7	0	2	2	0	2
Semivolatile Organic Compounds (µg/kg)						
Acenaphthene*	—	93 J	—	—	—	—
Acenaphthylene*	—	—	—	—	—	—
Anthracene*	45 J	150 J	—	—	—	—
9H-Carbazole	—	130 J	—	—	—	—
Benzo(a)anthracene**	230 J	780	120 J	—	—	51 J
Benzo(a)pyrene**	200 J	630	100 J	—	57 J	50 J
Benzo(b)fluoranthene**	440	1300	280 J	110 J	100 J	100 J
Benzo(g,h,i)perylene**	150 J	350 J	60 J	—	55 J	—
Chrysene**	290 J	770	160 J	60 J	—	57 J
Di-n-butyl phthalate	—	—	—	—	—	150 J
Dibenz(a,h)anthracene**	47 J	180 J	—	—	—	—
Dibenzofuran	—	—	—	—	—	—
1,4-Dichlorobenzene	—	—	—	—	—	—
3,3'-Dichlorobenzidine	—	—	—	—	—	—
Diethyl phthalate	—	—	—	—	—	—
bis(2-Ethylhexyl) phthalate	82 BJ	92 BJ	—	—	—	—
Fluoranthene*	560	1600	280 J	120 J	67 J	89 J
Fluorene*	—	81 J	—	—	—	—
Indeno(1,2,3-cd)pyrene**	140 J	370	69 J	—	—	—
2-Methylnaphthalene*	—	—	—	—	—	—
Naphthalene*	—	—	—	—	—	—
N-Nitrosodiphenylamine	—	—	—	—	—	—
Phenanthrene*	290 J	850	170 J	56 J	—	41 J
Pyrene*	440	1300	210 J	85 J	60 J	85 J
Total SVOCs	2914	8676	1449	431	339	623
* Total PAHs	2832	8454	1449	431	339	473
** Total Carcinogenic PAHs	1497	4380	789	170	212	258

-- = Non-Detect

J = Estimated Concentration

D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-SS18 03 NOV 93	MP-SS19 03 NOV 93	MP-SS20 02 NOV 93	MP-SS21 02 NOV 93	MP-SS22 02 NOV 93	MP-SS23 02 NOV 93
Pesticides/PCBs (µg/kg)						
alpha-BHC	--	--	--	--	0.26 NJ	--
beta-BHC	--	--	--	--	--	1.7 J
gamma-BHC (Lindane)	--	--	0.48 J	--	--	--
Heptachlor	--	--	--	0.99 J	--	--
Heptachlor epoxide	0.17 J	0.57 J	0.78 J	0.19 J	--	1.0 J
Endosulfan I	--	--	--	--	1.6 J	--
Dieldrin	--	--	--	1.4 NJ	3.3 J	--
4,4'-DDE	2.5 J	21 J	4.7 J	--	1.1 J	5.4 J
Endrin	3.5 J	7.5 NJ	5.9 J	2.1 J	3.6 J	6.3
Endosulfan II	0.43 J	2.3 J	1.2 J	0.57 J	0.80 J	1.6 J
4,4'-DDD	2.7 J	11 J	1.3 J	--	4.7 J	4.1 J
Endosulfan sulfate	--	--	1.8 J	1.1 J	--	1.6 J
4,4'-DDT	2.5 J	34 J	7.1 J	3.5 J	5.9 J	15
Methoxychlor	--	--	--	--	--	2.1 NJ
Endrin ketone	--	--	--	--	--	--
Endrin aldehyde	--	--	--	--	--	--
alpha-Chlordane	--	--	0.47 J	0.74 J	1.7 J	5.2
gamma-Chlordane	--	--	--	--	1.7 J	3.1
Aroclor 1016	--	--	--	--	--	--
Aroclor 1254	--	--	--	--	--	--
Aroclor 1260	--	--	--	--	--	--
Inorganics (mg/kg)						
Aluminum	8840	9410	9360	9210	7770	5520
Antimony	--	--	--	--	--	--
Arsenic	5.8 J	9.5 J	3.8 J	2.6 J	2.2 J	3.0 J
Barium	28.5	23.3	47.0	12.8	20.9	18.0
Beryllium	0.41	0.41	0.44	0.27	0.28	0.28
Cadmium	--	--	--	--	--	--
Calcium	434	346	1160	405	765	907
Chromium	8.1	10.2	9.9	12.6	9.6	8.2
Cobalt	3.7	4.4	6.0	9.4	5.4	5.1
Copper	15.8 J	21.9 J	24.7 J	46.8 J	13.0 J	10.6 J
Iron	10600	14000	19000	20000	14100	12200
Lead	28.6	68.8	54.8	22.4	17.8	29.8
Magnesium	1110	1410	1410	2840	2850	1940
Manganese	318	240	678	267	185	248
Mercury	0.22	0.26	0.25	0.10	--	--
Nickel	10.4	13.7	15.0	22.3	12.6	9.5
Potassium	247	194	179	--	581	418
Selenium	0.54	0.57	0.61	--	--	--
Silver	--	--	--	--	--	--
Sodium	--	--	--	--	--	--
Vanadium	33.7	44.5	25.7	22.5	12.8	10.0
Zinc	41.1	45.2	109	56.1	40.8	64.5

"--" = Non-Detect
J = Estimated Concentration
D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-SS24 02 NOV 93	MP-SS25 02 NOV 93	MP-SS40 (Dup of SS-25)	MP-SS26 02 NOV 93	MP-SS27 02 NOV 93	MP-SS29 04 NOV 93
Volatile Organic Compounds (µg/kg)						
Methylene chloride	--	1900	--	3 J	2 J	3 J
Acetone	--	39000 D	33000 D	--	--	--
2-Butanone	--	--	110 B	--	--	--
1,1,1-Trichloroethane	--	--	--	--	--	--
4-Methyl-2-Pentanone	--	--	3 J	--	--	--
Tetrachloroethene	--	--	--	--	--	--
Toluene	--	--	1 J	--	--	--
Xylenes (total)	--	--	--	--	--	--
Total VOCs	0	40900	33114	3	2	3
Semivolatile Organic Compounds (µg/kg)						
Acenaphthene*	580 J	--	--	46 J	--	140 J
Acenaphthylene*	--	--	--	--	--	--
Anthracene*	570 J	--	--	89 J	70 J	280 J
9H-Carbazole	390 J	--	--	78 J	--	170 J
Benzo(a)anthracene**	1800 J	--	--	460	220 J	880
Benzo(a)pyrene**	1200 J	--	--	420	220 J	790
Benzo(b)fluoranthene**	2500 J	--	--	950	480 J	1500
Benzo(g,h,i)perylene**	300 J	--	--	210 J	140 J	240 J
Chrysene**	1500 J	--	--	550	300 J	830
Di-n-butyl phthalate	47 J	--	--	--	--	--
Dibenz(a,h)anthracene**	330 J	--	--	85 J	52 J	110 J
Dibenzofuran	180 J	--	--	--	--	51 J
1,4-Dichlorobenzene	--	79 J	64 J	--	--	--
3,3'-Dichlorobenzidine	--	--	--	--	--	--
Diethyl phthalate	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	--	--	--	--	--	--
Fluoranthene*	2900 J	63 J	--	1100	470 J	1700
Fluorene*	400 J	--	--	--	--	120 J
Indeno(1,2,3-cd)pyrene**	560 J	--	--	250 J	150 J	340 J
2-Methylnaphthalene*	60 J	--	--	--	--	--
Naphthalene*	80 J	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--
Phenanthrene*	2100 J	--	--	520	220 J	1100
Pyrene*	2300 J	--	--	870	390 J	1500
Total SVOCs	17797	142	64	5628	2712	9751
* Total PAHs	17180	63	0	5550	2712	9530
** Total Carcinogenic PAHs	8190	0	0	2925	1562	4690

*-- = Non-Detect
J = Estimated Concentration
D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-SS24 02 NOV 93	MP-SS25 02 NOV 93	MP-SS40 (Dup of SS-25)	MP-SS26 02 NOV 93	MP-SS27 02 NOV 93	MP-SS29 04 NOV 93
Pesticides/PCBs (µg/kg)						
alpha-BHC	1.4	--	--	--	--	0.79 J
beta-BHC	--	--	--	--	--	--
gamma-BHC (Lindane)	--	--	--	--	--	--
Heptachlor	--	--	--	--	--	0.78 NJ
Heptachlor epoxide	--	--	--	0.41 J	--	1.6 J
Endosulfan I	--	--	--	--	--	--
Dieldrin	--	--	1.2 J	--	3.2 J	--
4,4'-DDE	0.70 J	0.20 J	0.42 J	8.2 J	23 J	6.6 J
Endrin	--	1.0 J	5.4 J	6.5 NJ	7.2 J	10 NJ
Endosulfan II	0.29 J	0.56 J	--	1.5 J	2.2 J	--
4,4'-DDD	0.64 J	0.81 J	1.3 NJ	4.0 J	5.1 NJ	8.6 J
Endosulfan sulfate	--	--	2.3 J	--	--	--
4,4'-DDT	1.3 J	--	--	35 J	46 J	22 J
Methoxychlor	--	--	--	--	--	--
Endrin ketone	--	--	--	--	--	--
Endrin aldehyde	0.10 J	--	--	--	--	--
alpha-Chlordane	--	0.25 J	--	0.64 J	--	--
gamma-Chlordane	--	--	--	--	--	1.1 J
Aroclor 1016	--	34 J	--	--	--	--
Aroclor 1254	--	--	--	--	--	--
Aroclor 1260	--	--	--	--	--	--
Inorganics (mg/kg)						
Aluminum	9520	4730	5420	14600	8900	6510
Antimony	--	--	--	--	--	--
Arsenic	2.7 J	2.2 J	2.5 J	16.4 J	12.8 J	5.7 J
Barium	29.6	13.9	16.6	13.1	45.0	20.3
Beryllium	0.30	--	--	0.34	0.37	0.25
Cadmium	--	--	--	--	0.92	--
Calcium	727	1080	1150	1020	4630	6850 J
Chromium	12.7	7.1	7.7	26.6	15.5	10.6
Cobalt	7.3	5.2	5.4	19.1	11.1	--
Copper	12.3 J	10.0 J	11.0 J	44.2 J	145 J	15.9
Iron	17300	10500	12800	45800	22300	15700
Lead	10.3	6.4	6.8	32.1	103	10.8 J
Magnesium	3610	1960	2160	5130	2990	2440
Manganese	304	277	233	529	355	236
Mercury	--	--	--	0.16	0.40	0.26
Nickel	15.6	9.1	9.7	38.9	24.2	14.0
Potassium	806	627	599	265	267	394
Selenium	--	--	--	--	--	--
Silver	--	--	--	--	--	--
Sodium	436	--	--	--	--	--
Vanadium	13.7	8.4	10.0	31.5	35.1	21.2
Zinc	49.6	25.9	28.8	337	171	67.0

"--" = Non-Detect
J = Estimated Concentration
D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-SS30 04 NOV 93	MP-SS31 04 NOV 93	MP-SS41 (Dup of SS-31)	MP-SS32 04 NOV 93	MP-B141 22 NOV 93	MP-B151 10 NOV 93
Volatile Organic Compounds (µg/kg)						
Methylene chloride	5 J	4 J	4 J	4 J	--	--
Acetone	31	--	--	--	--	--
2-Butanone	--	--	--	--	3J	--
1,1,1-Trichloroethane	--	--	--	--	--	--
4-Methyl-2-Pentanone	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--
Toluene	--	--	--	--	3J	--
Xylenes (total)	--	--	--	--	--	--
Total VOCs	36	4	4	4	6	0
Semivolatile Organic Compounds (µg/kg)						
Acenaphthene*	91 J	--	--	--	--	--
Acenaphthylene*	--	--	--	--	--	--
Anthracene*	140 J	--	--	--	--	110 J
9H-Carbazole	85 J	--	--	--	--	53 J
Benzo(a)anthracene**	500	--	--	--	--	350 J
Benzo(a)pyrene**	410	--	--	--	--	300 J
Benzo(b)fluoranthene**	790	--	--	--	--	590
Benzo(g,h,i)perylene**	180 J	--	--	--	--	120 J
Chrysene**	480	--	--	--	--	330 J
Di-n-butyl phthalate	--	--	--	--	--	--
Dibenz(a,h)anthracene**	75 J	--	--	--	--	59 J
Dibenzofuran	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--	--
3,3'-Dichlorobenzidine	--	--	--	--	--	--
Diethyl phthalate	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	--	--	--	--	--	360 J
Fluoranthene*	1100	--	--	--	--	600
Fluorene*	74 J	--	--	--	--	--
Indeno(1,2,3-cd)pyrene**	230 J	--	--	--	--	140 J
2-Methylnaphthalene*	--	--	--	--	--	--
Naphthalene*	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--
Phenanthrene*	740	--	--	--	--	320 J
Pyrene*	860	--	--	--	--	470
Total SVOCs	5755	0	0	0	0	3802
* Total PAHs	5670	0	0	0	0	3389
** Total Carcinogenic PAHs	2665	0	0	0	0	1889

"--" = Non-Detect

J = Estimated Concentration

D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-SS30 04 NOV 93	MP-SS31 04 NOV 93	MP-SS41 (Dup of SS-31)	MP-SS32 04 NOV 93	MP-B141 22 NOV 93	MP-B151 10 NOV 93
Pesticides/PCBs (µg/kg)						
alpha-BHC	2.7 J	--	0.026 J	--	--	15 J
beta-BHC	--	--	--	--	--	--
gamma-BHC (Lindane)	0.29 J	0.19 J	0.12 J	0.096 J	--	--
Heptachlor	1.0 NJ	0.23 NJ	0.21 J	0.25 J	--	--
Heptachlor epoxide	0.91 J	--	--	--	--	--
Endosulfan I	--	--	--	--	--	--
Dieldrin	--	0.038 NJ	0.058 J	--	--	--
4,4'-DDE	16 J	0.096 J	0.098 J	0.14 J	--	--
Endrin	14 J	--	--	--	--	9.1 J
Endosulfan II	--	--	--	--	--	--
4,4'-DDD	28 J	0.11 NJ	0.46 J	--	--	--
Endosulfan sulfate	--	0.27 J	0.34 J	--	--	--
4,4'-DDT	120 J	0.33 J	0.55 J	0.30 J	--	--
Methoxychlor	110 J	--	--	--	--	8.6 NJ
Endrin ketone	--	--	--	--	--	--
Endrin aldehyde	--	0.38 NJ	0.26 NJ	--	--	--
alpha-Chlordane	3.9 J	--	--	--	--	1.6 J
gamma-Chlordane	1.8 J	--	--	--	--	--
Aroclor 1016	--	--	--	--	--	--
Aroclor 1254	--	--	--	--	--	210 J
Aroclor 1260	--	--	--	--	--	--
Inorganics (mg/kg)						
Aluminum	8910	13700	15200	16500	12400	7170
Antimony	--	--	--	--	--	--
Arsenic	11.4 J	23.8 J	23.8 J	13.2 J	1.9	3.0 J
Barium	23.4	3.1	4.0	4.1	21	30.2
Beryllium	0.31	0.28	0.33	0.43	0.39	0.42
Cadmium	--	--	--	--	--	--
Calcium	1030 J	1210 J	1230 J	1240 J	348	836 J
Chromium	12.9	20.0	20.9	22.8	12.4	11.5
Cobalt	9.8	16.6	18.7	24.9	10.2	5.8
Copper	25.9	29.4	32.9	35.7	11.6	64.5
Iron	20700	36400	40000	43900	19300	13000
Lead	50.8 J	40.4 J	31.7 J	9.6 J	8.1	62.8 J
Magnesium	2570	4810	5370	6830	2680	2410
Manganese	296	334	393	517	416	173
Mercury	0.24	--	--	--	--	0.16
Nickel	19.8	27.2	31.1	41.3	21.4	19.9
Potassium	284	--	--	--	251	638
Selenium	--	--	--	--	--	--
Silver	--	--	--	--	--	--
Sodium	--	--	--	--	--	--
Vanadium	24.0	23.8	25.6	21.7	15.9	12.2
Zinc	97.3	60.2	65.1	86.2	49.3	131

-- = Non-Detect
J = Estimated Concentration
D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-B161 11 NOV 93	MP-B181 11 NOV 93	MP-B183 (Dup of B181)	MP-B231 10 NOV 93	MP-B233 (Dup of B231)	MP-B241 08 NOV 93
Volatile Organic Compounds (µg/kg)						
Methylene chloride	--	--	--	--	--	3 J
Acetone	--	--	--	--	--	--
2-Butanone	1 J	--	--	--	--	--
1,1,1-Trichloroethane	--	--	--	--	--	--
4-Methyl-2-Pentanone	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--
Toluene	--	--	--	--	--	--
Xylenes (total)	--	--	--	--	--	--
Total VOCs	1	0	0	0	0	3
Semivolatile Organic Compounds (µg/kg)						
Acenaphthene*	180 J	--	--	--	--	830
Acenaphthylene*	--	--	--	--	--	110 J
Anthracene*	310 J	--	--	42 J	51 J	1500
9H-Carbazole	210 J	--	--	--	--	1200
Benzo(a)anthracene**	1300	--	48 J	150 J	130 J	8400 D
Benzo(a)pyrene**	1100	--	--	130 J	120 J	6500 D
Benzo(b)fluoranthene**	1800	--	59 J	230 J	200 J	11000 D
Benzo(g,h,i)perylene**	480	--	--	60 J	59 J	900
Chrysene**	1000	--	58 J	130 J	130 J	6500 D
Di-n-butyl phthalate	--	--	--	--	--	--
Dibenz(a,h)anthracene**	290 J	--	--	--	--	890
Dibenzofuran	67 J	--	--	--	--	300 J
1,4-Dichlorobenzene	--	--	--	--	--	--
3,3'-Dichlorobenzidine	--	--	--	--	--	--
Diethyl phthalate	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	48 J	--	--	38 J	52 J	140 J
Fluoranthene*	1900	--	84 J	280 J	220 J	12000 D
Fluorene*	150 J	--	--	--	--	680
Indeno(1,2,3-cd)pyrene**	530	--	--	57 J	50 J	1900
2-Methylnaphthalene*	--	--	--	--	--	83 J
Naphthalene*	--	--	--	--	--	100 J
N-Nitrosodiphenylamine	--	--	--	--	--	--
Phenanthrene*	1200	--	51 J	170 J	150 J	7400 D
Pyrene*	1700	--	75 J	230 J	190 J	11000 D
Total SVOCs	12265	0	375	1517	1352	71433
* Total PAHs	11940	0	375	1479	1300	69683
** Total Carcinogenic PAHs	6500	0	165	757	689	36090

"--" = Non-Detect

J = Estimated Concentration

D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location: Sample Collection Date:	MP-B161 11 NOV 93	MP-B181 11 NOV 93	MP-B183 (Dup of B181)	MP-B231 10 NOV 93	MP-B233 (Dup of B231)	MP-B241 08 NOV 93
Pesticides/PCBs (µg/kg)						
alpha-BHC	--	0.099 J	--	--	--	--
beta-BHC	--	--	--	--	--	--
gamma-BHC (Lindane)	--	--	--	--	--	--
Heptachlor	--	--	0.43 J	--	--	--
Heptachlor epoxide	--	--	--	--	--	7.8 J
Endosulfan I	--	--	--	--	--	--
Dieldrin	--	--	--	--	--	--
4,4'-DDE	1.5 J	2.9 J	3.2 J	--	9.9 J	45 J
Endrin	--	--	--	--	--	60 NJ
Endosulfan II	--	--	--	--	--	--
4,4'-DDD	1.4 J	2.3 J	2.9 J	--	94 J	97 J
Endosulfan sulfate	--	--	--	--	--	--
4,4'-DDT	--	--	--	--	--	250 J
Methoxychlor	--	--	--	--	--	--
Endrin ketone	--	--	--	3.0 J	--	39 J
Endrin aldehyde	2.3 J	1.2 J	2.1 J	--	--	--
alpha-Chlordane	--	--	--	--	--	16 J
gamma-Chlordane	--	--	--	--	--	10 J
Aroclor 1016	--	--	--	--	--	--
Aroclor 1254	--	--	--	350 J	260 J	--
Aroclor 1260	--	--	--	--	--	--
Inorganics (mg/kg)						
Aluminum	6990 J	5590 J	5630 J	16200	12100	10900
Antimony	--	--	--	73.9 J	p1831 24.9 J	5.9 J
Arsenic	3.6 J	2.9 J	3.0 J	14.4 J	13.8 J	15.4 J
Barium	20.0	13.5	11.8	17.4	19.0	19.5
Beryllium	0.30	--	--	0.53	0.57	0.50
Cadmium	--	--	--	0.76	0.89	0.96
Calcium	589	804	723	1650 J	1430 J	1150
Chromium	8.3	7.0	7.6	28.0	22.2	18.0
Cobalt	8.1	5.0	5.0	17.0	13.0	13.6
Copper	16.2	11.0	11.9	293	110	60.8
Iron	13400	12600	12900	41800	36900	26700
Lead	20.2	8.1	7.8	49.5 J	128 J	124
Magnesium	1960	2150	2210	5730	4240	3950
Manganese	253 J	199 J	193 J	462	333	421 J
Mercury	--	--	--	0.31	1.9	0.40
Nickel	13.6	8.8	10.0	38.8	38.3	29.2
Potassium	325	448	424	387	197	410
Selenium	--	--	--	--	--	--
Silver	--	--	--	--	2.0	--
Sodium	--	--	--	--	--	--
Vanadium	11.5	8.7	9.1	33.2	51.3	41.1
Zinc	50.2	25.5	26.0	186	377	131

"--" = Non-Detect
J = Estimated Concentration
D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-B251 08 NOV 93	MP-B261 08 NOV 93	MP-B271 22 NOV 93	MP-M121 11 NOV 93	MP-M131 10 NOV 93	MP-M141 17 NOV 93
Volatile Organic Compounds (µg/kg)						
Methylene chloride	--	--	--	--	--	--
Acetone	--	--	--	--	--	--
2-Butanone	2 J	--	--	--	--	--
1,1,1-Trichloroethane	--	--	--	--	--	--
4-Methyl-2-Pentanone	--	--	--	2 J	--	--
Tetrachloroethene	--	--	--	--	--	--
Toluene	--	--	1 J	--	--	--
Xylenes (total)	--	--	--	--	--	--
Total VOCs	2	0	1	2	0	0
Semivolatile Organic Compounds (µg/kg)						
Acenaphthene*	--	7100	--	--	--	--
Acenaphthylene*	--	2200	--	--	56 J	--
Anthracene*	--	11000	--	--	45 J	--
9H-Carbazole	--	--	--	--	--	--
Benzo(a)anthracene**	--	43000 D	--	--	110 J	83 J
Benzo(a)pyrene**	440 J	27000 D	--	--	100 J	65 J
Benzo(b)fluoranthene**	200 J	40000 D	--	--	210 J	150 J
Benzo(g,h,i)perylene**	--	4000	--	--	60 J	38 J
Chrysene**	480 J	33000 D	--	--	120 J	96 J
Di-n-butyl phthalate	--	--	--	--	--	--
Dibenz(a,h)anthracene**	--	4000	--	--	--	--
Dibenzofuran	--	810 J	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--	--
3,3'-Dichlorobenzidine	--	360 J	--	--	--	--
Diethyl phthalate	--	--	55 J	--	--	--
bis(2-Ethylhexyl) phthalate	--	--	--	--	--	140 J
Fluoranthene*	--	56000 D	--	--	170 J	180 J
Fluorene*	--	5100	--	--	--	--
Indeno(1,2,3-cd)pyrene**	--	6800	--	--	58 J	38 J
2-Methylnaphthalene*	--	630 J	--	--	--	--
Naphthalene*	--	410 J	--	--	--	--
N-Nitrosodiphenylamine	--	1500 J	--	--	--	--
Phenanthrene*	--	39000 D	--	--	53 J	86 J
Pyrene*	220 J	67000 D	--	--	220 J	140 J
Total SVOCs	1340	348910	55	0	1202	1016
* Total PAHs	1340	344040	0	0	1146	876
** Total Carcinogenic PAHs	1120	157800	0	0	658	470

"--" = Non-Detect
J = Estimated Concentration
D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-B251 08 NOV 93	MP-B261 08 NOV 93	MP-B271 22 NOV 93	MP-M121 11 NOV 93	MP-M131 10 NOV 93	MP-M141 17 NOV 93
Pesticides/PCBs (µg/kg)						
alpha-BHC	--	5.9 NJ	--	--	0.80 J	1.1 J
beta-BHC	--	--	--	--	--	--
gamma-BHC (Lindane)	--	--	--	0.066 J	1.1 J	--
Heptachlor	--	--	2.4 J	--	--	--
Heptachlor epoxide	0.67 J	93 J	0.78 J	--	2.1 J	--
Endosulfan I	--	--	0.69 NJ	--	2.5 J	--
Dieldrin	--	--	--	--	--	--
4,4'-DDE	5.1 J	--	--	0.042 NJ	3.9 J	--
Endrin	9.7 J	420 NJ	--	--	25 J	4.5
Endosulfan II	2.1 J	--	--	--	6.8 J	0.27 NJ
4,4'-DDD	29 J	170 J	--	--	--	--
Endosulfan sulfate	--	--	--	--	--	--
4,4'-DDT	110 J	290 J	3.7 J	--	43 J	1.9 J
Methoxychlor	--	160 NJ	--	--	37 J	--
Endrin ketone	--	88 NJ	--	--	--	--
Endrin aldehyde	--	--	--	--	--	--
alpha-Chlordane	--	--	--	--	0.94 J	--
gamma-Chlordane	--	5.8 NJ	--	--	1.3 J	--
Aroclor 1016	--	--	--	--	--	--
Aroclor 1254	--	--	--	--	--	--
Aroclor 1260	--	--	--	--	--	--
Inorganics (mg/kg)						
Aluminum	9880	6680	11900	15400 J	12900	10400
Antimony	--	--	--	--	--	--
Arsenic	18.2 J	6.4 J	2.8	24.1 J	18.7 J	0.47 J
Barium	14.0	31.5	27.7	6.1	13.1	10.1
Beryllium	0.45	0.45	0.46	--	0.46	0.45
Cadmium	--	--	--	--	--	--
Calcium	289	3290	282	1540	973 J	1050 J
Chromium	9.3	11.0	9.4	21.2	24.8	16.1
Cobalt	3.9	7.1	8.1	8.0	13.9	17.3
Copper	7.1	26.1	16.9	23.1	43.0	27.2
Iron	12400	16500	16300	38700	41400	26500
Lead	25.4	68.9	12.4	8.7	23.2 J	6.3 J
Magnesium	1400	2390	1780	5380	4620	4160
Manganese	94.0 J	399 J	531	322 J	472	478
Mercury	--	0.10	--	--	0.12	--
Nickel	11.6	15.4	13.5	26.1	35.0	28.4
Potassium	274	574	299	167	279	295
Selenium	--	--	--	--	--	--
Silver	--	--	--	--	--	--
Sodium	--	--	--	--	--	--
Vanadium	14.2	27.5	14.7	19.2	22.0	15.5
Zinc	36.3	75.4	37.1	59.3	123	58.1

-- = Non-Detect
J = Estimated Concentration
D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-M142 (Dup of M14-1)	MP-M151 16 NOV 93	MP-M161 16 NOV 93
<u>Volatile Organic Compounds (µg/kg)</u>			
Methylene chloride	--	--	1 J
Acetone	--	--	--
2-Butanone	--	--	--
1,1,1-Trichloroethane	--	--	--
4-Methyl-2-Pentanone	--	--	--
Tetrachloroethene	--	--	--
Toluene	--	3 J	2 J
Xylenes (total)	--	3 J	2 J
Total VOCs	0	6	5
<u>Semivolatile Organic Compounds (µg/kg)</u>			
Acenaphthene*	--	--	--
Acenaphthylene*	--	--	--
Anthracene*	--	--	79 J
9H-Carbazole	--	--	43 J
Benzo(a)anthracene**	39 J	--	290 J
Benzo(a)pyrene**	--	--	200 J
Benzo(b)fluoranthene**	61 J	--	490 J
Benzo(g,h,i)perylene**	--	--	130 J
Chrysene**	38 J	--	280 J
Di-n-butyl phthalate	--	--	--
Dibenz(a,h)anthracene**	--	--	74 J
Dibenzofuran	--	--	--
1,4-Dichlorobenzene	--	--	--
3,3'-Dichlorobenzidine	--	--	--
Diethyl phthalate	--	--	--
bis(2-Ethylhexyl) phthalate	110 J	--	--
Fluoranthene*	83 J	--	610 J
Fluorene*	--	--	--
Indeno(1,2,3-cd)pyrene**	--	--	160 J
2-Methylnaphthalene*	--	--	--
Naphthalene*	--	--	--
N-Nitrosodiphenylamine	--	--	--
Phenanthrene*	44 J	--	330 J
Pyrene*	60 J	--	450 J
Total SVOCs	435	0	3136
* Total PAHs	325	0	3093
** Total Carcinogenic PAHs	138	0	1624

*-- = Non-Detect
J = Estimated Concentration
D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-2
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-M142 (Dup of M14-1)	MP-M151 16 NOV 93	MP-M161 16 NOV 93
Pesticides/PCBs (µg/kg)			
alpha-BHC	0.59 J	-	-
beta-BHC	0.27 J	-	-
gamma-BHC (Lindane)	-	0.069 J	-
Heptachlor	-	-	-
Heptachlor epoxide	0.80 J	-	-
Endosulfan I	-	-	-
Dieldrin	-	-	-
4,4'-DDE	-	1.1 J	6.0
Endrin	0.49 J	-	-
Endosulfan II	-	0.61 J	-
4,4'-DDD	-	-	5.8 J
Endosulfan sulfate	-	-	-
4,4'-DDT	-	1.3 J	14 J
Methoxychlor	-	-	-
Endrin ketone	-	-	-
Endrin aldehyde	-	1.3 J	-
alpha-Chlordane	-	-	0.93 J
gamma-Chlordane	0.082 J	-	-
Aroclor 1016	-	-	-
Aroclor 1254	-	-	-
Aroclor 1260	-	-	33 J
Inorganics (mg/kg)			
Aluminum	10500	11500	9110
Antimony	-	-	-
Arsenic	2.3 J	6.1 J	14.7 J
Barium	10.6	18.2	18.0
Beryllium	0.42	0.34	0.36
Cadmium	-	-	-
Calcium	1150 J	460	837
Chromium	14.8	13.5	13.2
Cobalt	17.6	14.6	11.1
Copper	21.8	19.3	32.2
Iron	28600	25600	24700
Lead	7.8 J	59.3	42.5
Magnesium	4220	3550	2640
Manganese	659	389 J	430 J
Mercury	-	0.06	0.14
Nickel	29.2	22.1	22.8
Potassium	173	224	362
Selenium	-	0.70	-
Silver	-	-	-
Sodium	-	-	-
Vanadium	14.6	18.8	20.7
Zinc	62.0	77.5	87.2

"-" = Non-Detect
J = Estimated Concentration
D = Sample diluted prior to analysis

NJ - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-3
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SUBSURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-B142	MP-B152	MP-B162	MP-B171	MP-B172	MP-B182
Sample Collection Date:	22 NOV 93	10 NOV 93	11 NOV 93	10 NOV 93	10 NOV 93	11 NOV 93
Sample Depth:	4-6' (unk)	14-16' (a)	10-12'	2-4'	8-10'	8-10' (a)
Volatile Organic Compounds (µg/kg)						
Methylene chloride	--	--	--	--	--	--
Acetone	--	--	130 J	--	--	--
Carbon disulfide	--	--	--	--	--	--
1,2-Dichloroethene (cis/trans)	--	--	--	--	--	--
2-Butanone	--	--	150	--	--	--
Benzene	--	--	--	--	--	--
4-Methyl-2-Pentanone	--	--	110	--	--	--
2-Hexanone	--	--	3 J	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--
Toluene	--	--	--	2 J	--	--
Chlorobenzene	--	18	--	9 J	--	--
Ethylbenzene	--	--	--	--	--	--
Xylenes (total)	--	--	12	--	--	6 J
Total VOCs	0	18	405	11	0	6
Semivolatile Organic Compounds (µg/kg)						
Acenaphthene *	--	54 J	--	330 J	610	46 J
Acenaphthylene *	--	--	--	210 J	78 J	--
Anthracene *	--	--	--	990	1300	110 J
9H-Carbazole	--	--	--	300 J	400	45 J
Benzo(a)anthracene **	--	--	--	2400	3200	270 J
Benzo(a)pyrene **	--	--	--	1800	2300	230 J
Benzo(b)fluoranthene **	--	--	--	3100	4600 D	470
Benzo(g,h,i)perylene **	--	--	--	500	660	74 J
Benzo(k)fluoranthene **	--	--	--	--	--	--
Butyl benzyl phthalate	--	--	--	--	64 J	--
2-Chloronaphthalene *	--	--	--	--	--	--
Chrysene **	--	--	--	2000	2500	250 J
Di-n-butyl phthalate	--	--	--	--	74 J	--
Dibenz(a,h)anthracene **	--	--	--	94 J	97 J	--
Dibenzofuran	--	--	--	210 J	240 J	--
1,2-Dichlorobenzene	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	100 J	43 J	--
Diethyl phthalate	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--
Di-n-octyl phthalate	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	--	--	56 J	120 J	300 J	95 J
Fluoranthene *	--	--	--	5100 D	7800 D	530
Fluorene *	--	--	--	450	620	64 J
Indeno(1,2,3-cd)pyrene **	--	--	--	660	870	110 J
2-Methylnaphthalene *	--	74 J	52 J	48 J	70 J	61 J
4-Methylphenol	--	--	1100	--	73 J	--
Naphthalene *	--	600	820	77 J	69 J	51 J
N-Nitrosodiphenylamine	--	--	--	--	--	--
Phenanthrene *	--	--	--	3000	5600 D	390
Phenol	--	--	160 J	--	--	--
Pyrene *	--	--	--	5200 D	6200 D	520
Total SVOCs	0	728	2188	26689	37768	3316
* Total PAHs	0	728	872	25959	36574	3176
** Total Carcinogenic PAHs	0	0	0	10554	14227	1404

TABLE 4-3
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SUBSURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-B142	MP-B152	MP-B162	MP-B171	MP-B172	MP-B182
Sample Collection Date:	22 NOV 93	10 NOV 93	11 NOV 93	10 NOV 93	10 NOV 93	11 NOV 93
Sample Depth:	4-6' (unk)	14-16' (a)	10-12'	2-4'	8-10'	8-10' (a)
Pesticides/PCBs (µg/kg)						
alpha-BHC	--	1.2 J	0.38 J	--	2.8 J	1.9 J
beta-BHC	--	--	--	--	--	--
delta-BHC	--	--	--	--	4.1 NJ	3.2 J
gamma-BHC (Lindane)	--	--	0.52 J	--	--	3.0 J
Heptachlor	2.8 J	--	0.37 J	--	--	--
Heptachlor epoxide	1.1 J	--	0.31 J	--	--	--
Endosulfan I	2.0 J	--	--	--	--	--
Dieldrin	--	1.2 J	--	2.3 NJ	--	2.1 NJ
4,4'-DDE	--	--	0.28 J	--	13 J	23 J
Endrin	--	--	--	--	20 J	16 J
Endosulfan II	1.5 J	--	--	4.5 J	6.4 J	--
4,4'-DDD	--	3.3 J	0.28 J	13 J	33 J	20 J
Endosulfan sulfate	3.6 J	--	--	--	8.3 NJ	--
4,4'-DDT	5.2 J	3.6 J	--	8.8 J	53 J	150 J
Methoxychlor	--	--	--	--	110 J	--
Endrin ketone	2.6 J	--	--	--	--	--
Endrin aldehyde	--	--	--	--	--	52 J
alpha-Chlordane	0.79 J	--	--	--	3.4 J	4.5 J
gamma-Chlordane	0.42 J	--	--	1.5 J	5.8 J	1.3 NJ
Aroclor 1242	--	--	--	130 J	1000 J	--
Aroclor 1254	--	--	--	--	--	--
Aroclor 1260	--	--	--	--	--	--
Inorganics (mg/kg)						
Aluminum	12200	13900	15700 J	6130	N/A	15400 J
Antimony	--	--	--	--	N/A	--
Arsenic	1.4	18.3 J	25.0 J	3.9 J	N/A	13.6 J
Barium	8.4	7.5	6.5	18.3	N/A	16.1
Beryllium	--	0.46	0.34	0.37	N/A	0.39
Cadmium	--	--	--	--	N/A	--
Calcium	145	1200 J	1570	1150 J	N/A	2170
Chromium	18.0	21.4	23.5	9.4	N/A	22.8
Cobalt	17.1	31.7	29.3	4.3	N/A	19.8
Copper	22.4	34.5	31.1	12.3	N/A	38.7
Iron	31500	36300	38900	12300	N/A	39900
Lead	4.3	25.7 J	12.6	50.7 J	N/A	29.1
Magnesium	5140	4840	5510	2140	N/A	5690
Manganese	328	479	906 J	176	N/A	595 J
Mercury	--	--	0.060	0.080	N/A	0.090
Nickel	30.8	34.9	41.4	10.4	N/A	35.3
Potassium	--	250	267	345	N/A	337
Selenium	--	--	--	--	N/A	--
Silver	--	--	--	--	N/A	--
Sodium	--	--	--	--	N/A	--
Vanadium	17.7	16.7	17.3	9.9	N/A	29.9
Zinc	67.5	63.3	68.8	64.2	N/A	105

"--" = Non-Detect

J = Estimated Value

D = Sample Diluted Prior to Analysis

unk = unknown whether sample collected below water table; a = sample collected approx. at water table; b = sample collected below water table

NJ = Presumptive evidence for the presence of the material at an estimated value

N/A = Not Analyzed

TABLE 4-3
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SUBSURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-B191	MP-B192	MP-B201	MP-B211	MP-B212	MP-B221
Sample Collection Date:	10 NOV 93	10 NOV 93	09 NOV 93	11 NOV 93	11 NOV 93	09 NOV 93
Sample Depth:	2-4'	18-20' (a)	10-12'	2-4'	17-19' (b)	6-8'
Volatile Organic Compounds (µg/kg)						
Methylene chloride	--	--	--	--	9 J	--
Acetone	--	110 J	--	50	5 J	7 J
Carbon disulfide	--	--	--	--	--	--
1,2-Dichloroethene (cis/trans)	--	--	--	4 J	--	--
2-Butanone	--	23 J	41	12	--	--
Benzene	--	4 J	2 J	3 J	--	2 J
4-Methyl-2-Pentanone	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--
Tetrachloroethene	--	--	2 J	--	--	--
Toluene	--	1 J	26	4 J	--	2 J
Chlorobenzene	--	--	--	--	--	--
Ethylbenzene	--	--	11	21	--	--
Xylenes (total)	5 J	--	26	83	--	6 J
Total VOCs	5	138	108	177	14	17
Semivolatile Organic Compounds (µg/kg)						
Acenaphthene *	--	82 J	--	N/A	65000 DJ	780
Acenaphthylene *	--	--	--	N/A	2300 J	110 J
Anthracene *	--	160 J	170 J	N/A	220000 D	1400
9H-Carbazole	--	83 J	--	N/A	100000 DJ	890
Benzo(a)anthracene **	68 J	290 J	450 J	N/A	370000 D	2400
Benzo(a)pyrene **	54 J	200 J	440 J	N/A	280000 D	1500
Benzo(b)fluoranthene **	120 J	370 J	950 J	N/A	470000 D	2500
Benzo(g,h,i)perylene **	--	92 J	120 J	N/A	150000 D	550
Benzo(k)fluoranthene **	--	--	--	N/A	--	--
Butyl benzyl phthalate	--	--	--	N/A	--	48 J
2-Chloronaphthalene *	--	--	--	N/A	--	--
Chrysene **	77 J	270 J	530 J	N/A	330000 D	1600
Di-n-butyl phthalate	--	--	--	N/A	--	--
Dibenz(a,h)anthracene **	--	55 J	--	N/A	19000 J	340 J
Dibenzofuran	--	61 J	--	N/A	58000 DJ	530
1,2-Dichlorobenzene	--	--	--	N/A	--	--
1,4-Dichlorobenzene	--	--	--	N/A	--	48 J
Diethyl phthalate	--	--	--	N/A	--	--
2,4-Dimethylphenol	--	--	--	N/A	430 J	--
Di-n-octyl phthalate	--	--	--	N/A	--	--
bis(2-Ethylhexyl) phthalate	--	190 J	--	N/A	--	59 J
Fluoranthene *	130 J	630	910 J	N/A	770000 D	4900 D
Fluorene *	--	120 J	--	N/A	85000 DJ	970
Indeno(1,2,3-cd)pyrene **	--	86 J	150 J	N/A	150000 D	680
2-Methylnaphthalene *	--	--	210 J	N/A	13000 J	270 J
4-Methylphenol	--	--	610 J	N/A	680 J	61 J
Naphthalene *	--	56 J	3500	N/A	25000 J	700
N-Nitrosodiphenylamine	--	--	--	N/A	--	--
Phenanthrene *	55 J	640	600 J	N/A	660000 D	5600 D
Phenol	--	--	140 J	N/A	--	--
Pyrene *	110 J	480	940 J	N/A	560000 D	4800 D
Total SVOCs	614	3865	9720		4328410	30736
* Total PAHs	614	3531	8970		4169300	29100
** Total Carcinogenic PAHs	319	1363	2640		1769000	9570

TABLE 4-3
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SUBSURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-B191	MP-B192	MP-B201	MP-B211	MP-B212	MP-B221
Sample Collection Date:	10 NOV 93	10 NOV 93	09 NOV 93	11 NOV 93	11 NOV 93	09 NOV 93
Sample Depth:	2-4'	18-20' (a)	10-12'	2-4'	17-19' (b)	6-8'
Pesticides/PCBs (µg/kg)						
alpha-BHC	0.081 J	2.6 J	--	N/A	--	--
beta-BHC	--	--	--	N/A	--	--
delta-BHC	--	5.2 J	--	N/A	--	--
gamma-BHC (Lindane)	--	--	--	N/A	--	--
Heptachlor	--	--	--	N/A	--	--
Heptachlor epoxide	--	--	1.2 J	N/A	31 J	--
Endosulfan I	--	--	1.3 J	N/A	--	--
Dieldrin	--	11 J	0.092 J	N/A	--	--
4,4'-DDE	2.9 J	22 J	--	N/A	--	85 J
Endrin	--	21 J	7.0 J	N/A	--	26 NJ
Endosulfan II	4.7 J	23 J	2.5 J	N/A	--	4.9 J
4,4'-DDD	20	53 J	--	N/A	--	120 J
Endosulfan sulfate	--	--	--	N/A	--	5.4 NJ
4,4'-DDT	9.5 J	230	10	N/A	--	37 J
Methoxychlor	--	110 J	--	N/A	--	--
Endrin ketone	--	25 J	--	N/A	210 P	--
Endrin aldehyde	--	--	--	N/A	--	--
alpha-Chlordane	1.6 J	--	--	N/A	--	17 J
gamma-Chlordane	1.9 J	--	0.78 J	N/A	--	5.6 NJ
Aroclor 1242	--	--	--	N/A	--	--
Aroclor 1254	--	810 J	--	N/A	--	--
Aroclor 1260	--	--	--	N/A	--	--
Inorganics (mg/kg)						
Aluminum	12600	15800	2510	N/A	8940 J	12400
Antimony	--	83.2 J	--	N/A	23.3	--
Arsenic	26.4 J	10.4 J	2.3 J	N/A	10.3 J	12.8 J
Barium	14.0	328	2.3	N/A	26.1	60.8
Beryllium	0.54	0.78	0.34	N/A	--	0.56
Cadmium	--	22.3	--	N/A	1.6	--
Calcium	552 J	22700 J	893 J	N/A	13000	5700 J
Chromium	17.4	94.3	8.7	N/A	30.7	22.9
Cobalt	18.2	32.2	2.3	N/A	18.7	11.9
Copper	25.4	865	3.5	N/A	509	52.1
Iron	32900	95800	5610	N/A	47300	28800
Lead	14.0 J	4720	18.4 J	N/A	722	612
Magnesium	4140	4360	1940	N/A	3420	4170
Manganese	449	912	126	N/A	351 J	398
Mercury	--	0.60	--	N/A	0.50	0.17
Nickel	31.4	124	4.9	N/A	54.1	27.6
Potassium	284	1530	291	N/A	404	554
Selenium	--	--	--	N/A	--	--
Silver	--	35.5	--	N/A	--	--
Sodium	--	2230	--	N/A	366	--
Vanadium	18.1	148	7.5	N/A	45.7	24.9
Zinc	69.2	4700	15.5	N/A	666	402

"--" = Non-Detect

J = Estimated Value

D = Sample Diluted Prior to Analysis

unk = unknown whether sample collected below water table; a = sample collected approx. at water table; b = sample collected below water table

NJ = Presumptive evidence for the presence of the material at an estimated value

N/A = Not Analyzed

TABLE 4-3
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SUBSURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-B222	MP-B232	MP-B242	MP-B252	MP-B262	MP-B272
Sample Collection Date:	09 NOV 93	10 NOV 93	08 NOV 93	08 NOV 93	08 NOV 93	22 NOV 93
Sample Depth:	14-16'	8-10' (a)	14-16' (b)	8-10'	10-11' (a)	2-4' (unk)
Volatile Organic Compounds (µg/kg)						
Methylene chloride	--	--	--	2 J	2 J	--
Acetone	5 J	41	110	55	--	--
Carbon disulfide	--	--	--	--	--	--
1,2-Dichloroethene (cis/trans)	--	--	--	--	4 J	--
2-Butanone	--	11	--	--	7 J	2 J
Benzene	1 J	--	--	--	--	--
4-Methyl-2-Pentanone	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--
1,1,1,2-Tetrachloroethane	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--
Toluene	2 J	--	--	1 J	2 J	--
Chlorobenzene	--	--	--	--	--	--
Ethylbenzene	--	--	19 J	--	--	--
Xylenes (total)	--	--	260	--	--	--
Total VOCs	8	52	389	58	15	2
Semivolatile Organic Compounds (µg/kg)						
Acenaphthene *	100 J	--	N/A	--	240 J	--
Acenaphthylene *	--	--	N/A	--	76 J	--
Anthracene *	160 J	--	N/A	--	400	--
9H-Carbazole	--	--	N/A	--	--	--
Benzo(a)anthracene **	370 J	--	N/A	--	1200	--
Benzo(a)pyrene **	290 J	--	N/A	--	760	--
Benzo(b)fluoranthene **	570 J	--	N/A	--	1100	--
Benzo(g,h,i)perylene **	92 J	--	N/A	--	220 J	--
Benzo(k)fluoranthene **	--	--	N/A	--	--	--
Butyl benzyl phthalate	--	--	N/A	55 J	--	--
2-Chloronaphthalene *	--	--	N/A	--	--	--
Chrysene **	380 J	--	N/A	--	980	--
Di-n-butyl phthalate	--	--	N/A	40 J	--	--
Dibenz(a,h)anthracene **	--	--	N/A	--	180 J	--
Dibenzofuran	--	--	N/A	--	--	--
1,2-Dichlorobenzene	--	--	N/A	--	--	--
1,4-Dichlorobenzene	--	--	N/A	--	--	--
Diethyl phthalate	--	--	N/A	--	--	--
2,4-Dimethylphenol	--	--	N/A	--	--	--
Di-n-octyl phthalate	--	--	N/A	--	--	--
bis(2-Ethylhexyl) phthalate	--	--	N/A	95 J	120 J	--
Fluoranthene *	670 J	--	N/A	--	1800	--
Fluorene *	110 J	--	N/A	--	170 J	--
Indeno(1,2,3-cd)pyrene **	87 J	--	N/A	--	290 J	--
2-Methylnaphthalene *	--	--	N/A	55 J	--	--
4-Methylphenol	--	--	N/A	--	--	--
Naphthalene *	150 J	--	N/A	44 J	--	--
N-Nitrosodiphenylamine	--	--	N/A	--	97 J	--
Phenanthrene *	550 J	--	N/A	--	1100	--
Phenol	--	--	N/A	--	--	--
Pyrene *	660 J	--	N/A	--	2100	--
Total SVOCs	4189	0		289	10833	0
* Total PAHs	4189	0		99	10616	0
** Total Carcinogenic PAHs	1789	0		0	4730	0

TABLE 4-3
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SUBSURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-B222	MP-B232	MP-B242	MP-B252	MP-B262	MP-B272
Sample Collection Date:	09 NOV 93	10 NOV 93	08 NOV 93	08 NOV 93	08 NOV 93	22 NOV 93
Sample Depth:	14-16'	8-10' (a)	14-16' (b)	8-10'	10-11' (a)	2-4' (unk)
Pesticides/PCBs (µg/kg)						
alpha-BHC	0.097 J	--	N/A	--	--	--
beta-BHC	--	--	N/A	--	--	--
delta-BHC	--	--	N/A	--	--	--
gamma-BHC (Lindane)	--	--	N/A	--	--	1.9 NJ
Heptachlor	--	--	N/A	--	--	2.4 J
Heptachlor epoxide	1.2 J	--	N/A	--	--	0.23 NJ
Endosulfan I	--	0.20 J	N/A	--	--	0.80 NJ
Dieldrin	--	--	N/A	4.1 NJ	--	--
4,4'-DDE	--	0.33 J	N/A	25 J	--	2.0 J
Endrin	8.0 J	--	N/A	1.6 J	8.3 J	--
Endosulfan II	--	--	N/A	--	--	--
4,4'-DDD	9.4 J	1.2 J	N/A	220 J	1.6 J	--
Endosulfan sulfate	--	--	N/A	--	--	1.6 NJ
4,4'-DDT	14 J	--	N/A	8.0 J	--	3.9 J
Methoxychlor	--	--	N/A	--	--	--
Endrin ketone	9.8 J	--	N/A	--	--	--
Endrin aldehyde	--	--	N/A	12 J	--	--
alpha-Chlordane	--	0.24 J	N/A	--	--	--
gamma-Chlordane	--	0.24 NJ	N/A	--	--	--
Aroclor 1242	--	--	N/A	--	--	--
Aroclor 1254	--	--	N/A	--	--	--
Aroclor 1260	--	--	N/A	--	--	--
Inorganics (mg/kg)						
Aluminum	4510	6370	N/A	14500	11100	11600
Antimony	--	--	N/A	--	21.5 J	--
Arsenic	61.4 J	7.7 J	N/A	5.6 J	6.5 J	3.9
Barium	10.3	8.6	N/A	13.2	28.4	19.2
Beryllium	0.50	0.38	N/A	0.54	0.48	0.36
Cadmium	--	--	N/A	--	--	--
Calcium	2460 J	653 J	N/A	1050	1240	253
Chromium	8.9	8.1	N/A	25.5	24.2	14.2
Cobalt	15.1	5.7	N/A	15.6	13.4	14.0
Copper	26.2	10.1	N/A	46.9	63.1	20.4
Iron	33300	15000	N/A	43700	31500	27200
Lead	20.9 J	5.8 J	N/A	6.6	74.4	6.2
Magnesium	3530	2050	N/A	4900	3620	3490
Manganese	551	225	N/A	461 J	365 J	381
Mercury	--	--	N/A	--	0.21	--
Nickel	28.6	15.1	N/A	38.5	30.9	23.1
Potassium	417	272	N/A	356	311	278
Selenium	--	--	N/A	--	--	--
Silver	--	--	N/A	--	--	--
Sodium	--	--	N/A	--	--	--
Vanadium	13.0	10.0	N/A	30.0	18.6	18.2
Zinc	59.4	31.8	N/A	105	237	51.1

"--" = Non-Detect

J = Estimated Value

D = Sample Diluted Prior to Analysis

unk = unknown whether sample collected below water table; a = sample collected approx. at water table; b = sample collected below water table

NJ = Presumptive evidence for the presence of the material at an estimated value

N/A = Not Analyzed

TABLE 4-3
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SUBSURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-M81	MP-M82	MP-M91	MP-M92	MP-M93	MP-M101
Sample Collection Date:	15 NOV 93	15 NOV 93	11 NOV 93	11 NOV 93	11 NOV 93	12 NOV 93
Sample Depth:	8-10'	16-18'	2-4'	8-10'	14-16'	12-14'
Volatile Organic Compounds (µg/kg)						
Methylene chloride	--	--	--	--	--	--
Acetone	--	--	20	460	32	18
Carbon disulfide	--	--	--	--	--	--
1,2-Dichloroethene (cis/trans)	--	--	--	--	--	--
2-Butanone	--	--	--	660	9 J	9 J
Benzene	--	--	--	--	--	2 J
4-Methyl-2-Pentanone	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	16 J	7 J	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--
Toluene	--	--	--	--	--	11 J
Chlorobenzene	--	--	--	--	--	40
Ethylbenzene	--	--	--	--	--	63
Xylenes (total)	--	--	7 J	12 J	--	280
Total VOCs	16	7	27	1132	41	423
Semivolatile Organic Compounds (µg/kg)						
Acenaphthene *	--	450 J	N/A	--	--	540 J
Acenaphthylene *	--	--	N/A	--	--	--
Anthracene *	--	1900 J	N/A	--	--	2300
9H-Carbazole	--	550 J	N/A	--	--	280 J
Benzo(a)anthracene **	--	15000 D	N/A	63 J	--	3700
Benzo(a)pyrene **	--	15000 D	N/A	40 J	--	2200
Benzo(b)fluoranthene **	--	27000 D	N/A	82 J	--	4500
Benzo(g,h,i)perylene **	--	--	N/A	--	--	760 J
Benzo(k)fluoranthene **	--	--	N/A	--	--	550 J
Butyl benzyl phthalate	--	--	N/A	--	--	870 J
2-Chloronaphthalene *	--	--	N/A	--	--	--
Chrysene **	--	--	N/A	53 J	--	2600
Di-n-butyl phthalate	--	--	N/A	--	--	670 J
Dibenz(a,h)anthracene **	--	--	N/A	--	--	460 J
Dibenzofuran	--	--	N/A	--	--	310 J
1,2-Dichlorobenzene	--	--	N/A	--	--	--
1,4-Dichlorobenzene	--	--	N/A	--	--	410 J
Diethyl phthalate	--	--	N/A	--	--	280 J
2,4-Dimethylphenol	--	--	N/A	--	--	--
Di-n-octyl phthalate	--	--	N/A	--	--	700 J
bis(2-Ethylhexyl) phthalate	--	--	N/A	--	--	41000 D
Fluoranthene *	--	21000 D	N/A	130 J	--	6600
Fluorene *	--	19000 D	N/A	--	--	850 J
Indeno(1,2,3-cd)pyrene **	--	--	N/A	--	--	1300
2-Methylnaphthalene *	--	--	N/A	--	--	250 J
4-Methylphenol	--	--	N/A	1300	--	260 J
Naphthalene *	--	--	N/A	--	--	510 J
N-Nitrosodiphenylamine	--	--	N/A	--	--	240 J
Phenanthrene *	--	5500	N/A	92 J	--	6200
Phenol	--	--	N/A	170 J	--	--
Pyrene *	--	--	N/A	99 J	--	5600
Total SVOCs	0	105400		2029	0	83940
* Total PAHs	0	104850		559	0	36920
** Total Carcinogenic PAHs	0	57000		238	0	16070

TABLE 4-3
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SUBSURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-M81	MP-M82	MP-M91	MP-M92	MP-M93	MP-M101
Sample Collection Date:	15 NOV 93	15 NOV 93	11 NOV 93	11 NOV 93	11 NOV 93	12 NOV 93
Sample Depth:	8-10'	16-18'	2-4'	8-10'	14-16'	12-14'
Pesticides/PCBs (µg/kg)						
alpha-BHC	--	--	N/A	--	--	--
beta-BHC	--	--	N/A	--	--	--
delta-BHC	--	--	N/A	--	--	--
gamma-BHC (Lindane)	--	--	N/A	0.16 J	--	--
Heptachlor	--	--	N/A	--	0.39 J	--
Heptachlor epoxide	--	--	N/A	0.20 J	--	--
Endosulfan I	--	--	N/A	--	--	--
Dieldrin	--	35 NJ	N/A	--	--	--
4,4'-DDE	--	150 J	N/A	0.39 J	0.074 J	36 J
Endrin	--	--	N/A	--	--	19 J
Endosulfan II	--	--	N/A	--	--	--
4,4'-DDD	--	190 J	N/A	2.0 J	0.16 J	22 NJ
Endosulfan sulfate	--	--	N/A	--	--	--
4,4'-DDT	--	480 J	N/A	--	--	6.3 J
Methoxychlor	--	--	N/A	--	0.49 J	--
Endrin ketone	--	--	N/A	--	--	--
Endrin aldehyde	--	--	N/A	1.5 J	--	--
alpha-Chlordane	1.1 J	21 NJ	N/A	--	--	--
gamma-Chlordane	--	--	N/A	--	--	--
Aroclor 1242	--	--	N/A	--	--	2200 J
Aroclor 1254	--	--	N/A	--	--	--
Aroclor 1260	170 J	1100 J	N/A	--	--	--
Inorganics (mg/kg)						
Aluminum	10700	12400	N/A	11900 J	15800 J	8780 J
Antimony	12.3 J	148 J	N/A	--	--	--
Arsenic	8.6 J	11.3 J	N/A	10.1 J	16.0 J	16.2 J
Barium	51.6	260	N/A	21.8	14.4	26.8
Beryllium	0.33	1.0	N/A	0.41	0.48	--
Cadmium	1.4	6.3	N/A	--	--	3.1
Calcium	4330	38200	N/A	761	516	1660
Chromium	45.7	96.9	N/A	16	22.1	20.6
Cobalt	14.8	16.6	N/A	15.2	23.1	8.4
Copper	197	450	N/A	26.3	38.7	87.5
Iron	77400	41100	N/A	31600	45500	22600
Lead	487	2600	N/A	18	14.0	80.5
Magnesium	3300	13700	N/A	3700	5460	2820
Manganese	536 J	600 J	N/A	310 J	598 J	219 J
Mercury	--	--	N/A	--	--	0.94
Nickel	68.6	149	N/A	27.1	34.7	26.1
Potassium	596	877	N/A	614	514	560
Selenium	--	--	N/A	0.48	--	--
Silver	2.2	--	N/A	--	--	--
Sodium	--	1340	N/A	--	--	913
Vanadium	69.3	630	N/A	18.1	22	54
Zinc	770	4770	N/A	62.4	77.7	278

"--" = Non-Detect

J = Estimated Value

D = Sample Diluted Prior to Analysis

unk = unknown whether sample collected below water table; a = sample collected approx. at water table; b = sample collected below water table

NJ = Presumptive evidence for the presence of the material at an estimated value

N/A = Not Analyzed

TABLE 4-3
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SUBSURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-M102	MP-M111	MP-M112	MP-M122	MP-M132
Sample Collection Date:	12 NOV 93	15 NOV 93	15 NOV 93	11 NOV 93	10 NOV 93
Sample Depth:	16-18' (b)	8-10'	14-16'	6-8'	8-10' (b)
Volatil Organic Compounds (µg/kg)					
Methylene chloride	--	2 J	5 J	--	--
Acetone	27	37 J	82	--	--
Carbon disulfide	--	38 J	--	--	--
1,2-Dichloroethene (cis/trans)	--	--	--	--	--
2-Butanone	--	13 J	28	--	--
Benzene	--	2 J	--	--	--
4-Methyl-2-Pentanone	--	--	--	--	--
2-Hexanone	--	--	--	--	--
1,1,1,2-Tetrachloroethane	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--
Toluene	4 J	3 J	3 J	--	--
Chlorobenzene	31	--	--	--	--
Ethylbenzene	20	13 J	39	--	20 J
Xylenes (total)	100	8 J	200	--	14
Total VOCs	182	116	357	0	34
Semivolatil Organic Compounds (µg/kg)					
Acenaphthene *	--	15000 J	25000 J	250 J	--
Acenaphthylene *	--	380 J	490 J	--	--
Anthracene *	43 J	--	50000 J	--	--
9H-Carbazole	--	1100 J	22000 J	--	--
Benzo(a)anthracene **	110 J	2200 J	63000 J	220 J	--
Benzo(a)pyrene **	81 J	2300 J	55000 J	--	--
Benzo(b)fluoranthene **	140 J	4000 J	86000 J	--	--
Benzo(g,h,i)perylene **	47 J	710 J	5300 J	--	--
Benzo(k)fluoranthene **	--	--	--	--	--
Butyl benzyl phthalate	--	3600 J	--	--	--
2-Chloronaphthalene *	--	310 J	--	--	--
Chrysene **	97 J	2500 J	51000 J	290 J	--
Di-n-butyl phthalate	50 J	470 J	--	--	--
Dibenz(a,h)anthracene **	--	580 J	5400 J	--	--
Dibenzofuran	--	16000 J	22000 J	220 J	--
1,2-Dichlorobenzene	--	--	--	210 J	--
1,4-Dichlorobenzene	48 J	310 J	--	220 J	--
Diethyl phthalate	--	380 J	--	--	--
2,4-Dimethylphenol	--	1400 J	--	--	--
Di-n-octyl phthalate	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	5400 D	210000 J	6900 J	440 J	110 J
Fluoranthene *	220 J	7600 J	120000	320 J	--
Fluorene *	41 J	34000 D	49000 J	460 J	--
Indeno(1,2,3-cd)pyrene **	44 J	970 J	8600 J	--	--
2-Methylnaphthalene *	95 J	6300 J	6900 J	1700 J	--
4-Methylphenol	63 J	390 J	--	--	--
Naphthalene *	110 J	4600 J	2400 J	640 J	--
N-Nitrosodiphenylamine	--	1600 J	--	--	--
Phenanthrene *	210 J	110000 J	180000 J	1100 J	--
Phenol	--	--	--	--	--
Pyrene *	150 J	5200 J	110000 J	500 J	--
Total SVOCs	6949	431900	868990	6570	110
* Total PAHs	1388	196650	818090	5480	0
** Total Carcinogenic PAHs	519	13260	274300	510	0

TABLE 4-3
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SUBSURFACE SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-M102	MP-M111	MP-M112	MP-M122	MP-M132
Sample Collection Date:	12 NOV 93	15 NOV 93	15 NOV 93	11 NOV 93	10 NOV 93
Sample Depth:	16-18' (b)	8-10'	14-16'	6-8'	8-10' (b)
Pesticides/PCBs (µg/kg)					
alpha-BHC	--	--	--	--	--
beta-BHC	--	--	--	--	--
delta-BHC	--	--	--	--	--
gamma-BHC (Lindane)	--	--	--	--	--
Heptachlor	--	--	--	--	--
Heptachlor epoxide	--	--	--	2.9 J	--
Endosulfan I	--	--	--	--	--
Dieldrin	6.4 J	15 NJ	--	1.5 NJ	5.5 J
4,4'-DDE	43 J	75 J	--	11 J	--
Endrin	--	19 J	--	5.3	11 J
Endosulfan II	3.4 J	14 J	89 J	--	13 J
4,4'-DDD	--	30 J	--	33 J	--
Endosulfan sulfate	--	--	--	--	--
4,4'-DDT	380 J	--	120 J	240	11 J
Methoxychlor	--	--	--	18	--
Endrin ketone	--	--	--	--	--
Endrin aldehyde	8.6 NJ	50 J	--	6.0 J	--
alpha-Chlordane	--	5.8 J	--	--	--
gamma-Chlordane	--	--	--	--	--
Aroclor 1242	560 J	640 J	650 J	--	--
Aroclor 1254	--	--	--	--	250 J
Aroclor 1260	--	--	--	--	--
Inorganics (mg/kg)					
Aluminum	18500 J	8220	9580	13500 J	2750
Antimony	42.7	23.4 J	22.2 J	--	--
Arsenic	21.9 J	8.3 J	11.1 J	11.7 J	6.8 J
Barium	23.9	506	49.8	22.9	4.1
Beryllium	0.40	0.35	0.25	0.41	0.21
Cadmium	1.8	0.78	2.4	--	--
Calcium	2990	4000	5910	2020	372 J
Chromium	28.6	36.5	30.6	19.7	4.9
Cobalt	17.9	10.1	10.4	18.4	1.6
Copper	68.4	31.5	257	31.9	2.9
Iron	49400	22800	48800	42500	4470
Lead	81.4	534	359	23.1	6.7 J
Magnesium	6590	2760	2980	4930	807
Manganese	530 J	285 J	465 J	528 J	49.0
Mercury	0.40	0.39	0.62	0.13	--
Nickel	44.3	19.3	41.7	33.6	8.5
Potassium	359	407	444	366	175
Selenium	--	--	0.53	0.67	--
Silver	1.7	--	2.2	--	--
Sodium	--	729	--	--	--
Vanadium	37.9	18.2	73.5	29.2	4.1
Zinc	235	2220	817	87.8	13.2

"--" = Non-Detect

J = Estimated Value

D = Sample Diluted Prior to Analysis

unk = unknown whether sample collected below water table; a = sample collected approx. at water table; b = sample collected below water table

NJ = Presumptive evidence for the presence of the material at an estimated value

N/A = Not Analyzed

TABLE 4-4
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
TEST PIT SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-TP11	MP-TP21	MP-TP31	MP-TP33	MP-TP32
Sample Collection Date:	12 JAN 94	12 JAN 94	12 JAN 94	(Dup of TP31)	12 JAN 94
Total Petroleum Hydrocarbons	209	1740	181	68.2	47.4
Volatile Organic Compounds (µg/kg)					
Toluene	--	4 J	--	1 J	--
Ethylbenzene	--	21 J	--	--	--
Xylenes (total)	--	87 J	37	31	--
Semivolatile Organic Compounds (µg/kg)					
4-Methylphenol	580 J	--	--	--	--
Naphthalene*	150 J	--	160 J	470 J	--
2-Methylnaphthalene*	130 J	--	240 J	900 J	--
Phenanthrene*	260 J	1600 J	190 J	280 J	130 J
Anthracene*	46 J	340 J	42 J	44 J	--
Fluoranthene*	350 J	1600 J	180 J	270 J	140 J
Pyrene*	290 J	1700 J	140 J	160 J	120 J
Benzo(a)anthracene**	130 J	790 J	--	87 J	--
Chrysene**	190 J	920 J	--	140 J	--
bis(2-Ethylhexyl)phthalate	320 J	--	470	530 J	--
Benzo(b)fluoranthene**	120 J	--	76 J	100 J	--
Benzo(k)fluoranthene**	98 J	--	66 J	84 J	--
Benzo(a)pyrene**	120 J	--	76 J	96 J	--
Indeno(1,2,3-cd)pyrene**	71 J	--	48 J	54 J	--
Dibenz(a,h)anthracene**	25 J	--	--	--	--
Benzo(g,h,i)perylene**	79 J	--	53 J	62 J	--
Total SVOCs	2959	6950	1741	3277	390
* Total PAHs	2059	6950	1271	2747	390
** Total Carcinogenic PAHs	833	1710	319	623	0
Pesticides/PCBs (µg/kg)					
Alpha-BHC	--	3.4 J	--	--	3 NJ
Endosulfan I	3.8 J	13	2.2 J	5.4 J	--
4,4'-DDE	25 J	140 J	--	33 J	5.9 J
Endrin	21 NJ	--	7 NJ	--	--
Endosulfan II	5.7 J	--	6.3 NJ	4.7 J	--
4,4'-DDD	59 J	100 J	130 J	89 J	12 J
4,4'-DDT	--	150 J	--	3.1 J	2.6 J
Aroclor-1254	210 J	130 J	150 J	95 J	--
Endosulfan II	3.8	--	--	--	5.1 J

TABLE 4-4
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
TEST PIT SOIL SAMPLE SUMMARY TABLE

Sample Location:	MP-TP11	MP-TP21	MP-TP31	MP-TP33	MP-TP32
Sample Collection Date:	12 JAN 94	12 JAN 94	12 JAN 94	(Dup of TP31)	12 JAN 94
Inorganics (mg/kg)					
Silver, Total	—	—	—	0.21 J	—
Aluminum, Total	11600	9430	8480	8100	11000
Arsenic, Total	10.2 J	7.6 J	6.8 J	7 J	6.2 J
Barium, Total	45.6	36.6	26.2	18.3	14.4
Beryllium, Total	0.65	0.38	0.27	—	0.33
Calcium, Total	2080	1800	1060	2520	1300
Cadmium, Total	1.8	0.95	0.33 J	0.37 J	—
Cobalt, Total	17.5	11.1	11.7	11.8	14.4
Chromium, Total	22.8 J	13.2 J	16 J	16.1 J	19.2 J
Copper, Total	135	29.5	29.1	21.2	47.9
Iron, Total	35700	25000	22200	29000	37300
Mercury, Total	1.3	0.24	0.18	0.099	—
Potassium, Total	272	270	315	273	238
Magnesium, Total	4100	2790	2480	2430	3610
Manganese, Total	629 J	294 J	290 J	439 J	330 J
Sodium, Total	137	126	79.9	88.2	—
Nickel, Total	35.5	18.3	20.7	16.2	29.7
Lead, Total	224 J	81.2 J	48.9 J	51.9 J	33.1 J
Antimony, Total	27.1	7.6	—	7.2	—
Selenium, Total	—	0.43 J	—	0.47 J	0.49 J
Vanadium, Total	46.9	16.1	21.7	15.7	9.6
Zinc, Total	499	122	123	100	95.6

"—" = Non-Detect

'J' = Estimated Value

"NJ" - Presumptive evidence for the presence of the material at an estimated value.

TABLE 4-5
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
SUMMARY OF SUBSURFACE SOIL SAMPLES EXCEEDING
ESTABLISHED SVOC CONTAMINANT COMPARISON LEVELS

Sample I.D.	Sample Depth (feet)	Total SVOCs (ppb)	Total PAHs (ppb)	Total CaPAHs (ppb)
<u>Northern Portion of Landfill</u>				
B01-1	(2-4)	6,669	3,169	1,520
<u>North-Central Portion of Landfill</u>				
B02-2	(8-10)	24,280	12,390	4,230
B03-1	(2-4)	3,915	3,705	1,570
B03-3	(22-24)	28,897	1,278	104
B17-1	(2-4)	26,789	26,059	10,654
B17-2	(8-10)	37,768	36,574	14,227
MW2-1	(10-12)	7,182	5,412	1,990
MW2-2	(16-18)	7,981	3,666	1,530
MW7-1	(2-4)	3,062	2,506	1,330
MW8-2	(16-18)	105,700	104,850	57,000
<u>Central Portion of Landfill</u>				
B04-1	(2-4)	4,161	4,044	1,710
B05-2	(14-16)	117,120	104,720	30,400
B06-1	(6-8)	19,070	16,210	5,800
B06-2	(8-10)	30,530	27,090	12,200
B06-3	(16-18)	71,300	69,440	21,500
B07-1	(6-8)	16,300	5,020	2,140
B07-2	(12-14)	56,960	32,760	6,950
B12-1	(10-12)	23,574	23,338	11,650
B12-2	(22-24)	40,667	40,603	21,970
B18-2	(8-10)	3,316	3,176	1,404
B19-2	(18-20)	3,865	3,531	1,363
B20-1	(10-12)	9,720	8,970	2,640
B21-2	(17-19)	4,328,410	4,169,300	1,769,000
B22-1	(6-8)	30,736	29,100	9,570
B22-2	(14-16)	4,189	4,189	1,789
MW3-1	(12-14)	67,230	66,380	23,370
MW3-2	(18-20)	1,943,400	1,887,400	526,400
MW3-3	(22-24)	505,800	465,800	91,800
MW4-1	(6-8)	21,559	15,649	6,110
MW10-1	(12-14)	83,940	38,920	16,070
MW11-1	(8-10)	431,900	196,650	13,260
MW11-2	(14-16)	868,990	818,090	274,300
<u>Southern Portion of Landfill</u>				
B08-1	(2-4)	6,410	6,410	1,620
B09-1	(4-6)	101,048	7,996	3,580
B09-2	(10-12)	25,540	7,260	390
B10-1	(2-4)	39,138	38,128	18,600
B26-2	(10-12)	10,833	10,616	4,730
MW6-2	(8-10)	40,677	36,504	2,620
TP2-1	(5.5-8.5)	6,950	6,950	1,710

Contaminant Comparison Levels:

Total SVOCs = 10 ppm

Total PAHs = 10 ppm

Total CaPAHs = 1 ppm

TABLE 4-6
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
COMPARISON OF SOIL CONTAMINANT LEVELS TO ACTION LEVELS
SURFACE SOIL SAMPLES

Parameter/ Sample Number	Surface Soil Concentration (ppm)	Federal Action Level (ppm)	Rhode Island Guidance Level (ppm)
PCBs			
TRC Sample ID			
SS12 (Shoreline Sample)	0.33 J	10 (1)	10/50 (3)
SS13 (Shoreline Sample)	0.18 J	10 (1)	10/50 (3)
SS14 (Shoreline Sample)	0.13 J	10 (1)	10/50 (3)
SS15 (Shoreline Sample)	0.61 J	10 (1)	10/50 (3)
SS25	0.034 J	10 (1)	10/50 (3)
B151	0.21 J	10 (1)	10/50 (3)
B231	0.35 J	10 (1)	10/50 (3)
B233 (Dup of B231)	0.26 J	10 (1)	10/50 (3)
M161	0.033 J	10 (1)	10/50 (3)
LEAD			
TRC Sample ID			
SS08	362	500 - 1,000 (2)	300 (4)
SS12 (Shoreline Sample)	474	500 - 1,000 (2)	300 (4)
SS13 (Shoreline Sample)	384	500 - 1,000 (2)	300 (4)
SS14 (Shoreline Sample)	447	500 - 1,000 (2)	300 (4)
SS15 (Shoreline Sample)	1980	500 - 1,000 (2)	300 (4)

(1) - TSCA (40 CFR 761); Requirements for decontaminating spills in nonrestricted areas.

(2) - USEPA, OSWER Directive 9355.4-02, Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites.

(3) - RIDEM Proposed Amendments to the Rules and Regulations for Solid Waste Management Facilities defines solid waste as including any soil debris or other material with a concentration of 10 ppm or greater PCBs.

RIDEM Proposed Amendments to the Rules and Regulations for Hazardous Waste Management defines Type 6 - extremely hazardous as including waste which contains 50 ppm or greater PCBs.

(4) - RIDEM and RI Dept. of Health - Risk Assessment Guidance Level.

J - The associated numerical value is an estimated quantity.

TABLE 4-7
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
COMPARISON OF SOIL CONTAMINANT LEVELS TO ACTION LEVELS
SUBSURFACE SOIL SAMPLES

Parameter	Subsurface Soil Concentration (ppm)	Federal Action Level (ppm)	Rhode Island Guidance Level (ppm)
PCBs			
TRC Sample ID			
B02-2	0.76 J	10 (1)	10/50 (3)
B03-1	0.15 J	10 (1)	10/50 (3)
B03-3	0.21 J	10 (1)	10/50 (3)
B04-1/B04-3	0.085 J / 0.043 J	10 (1)	10/50 (3)
B05-2/B05-4	0.53 J / 0.82 J	10 (1)	10/50 (3)
B05-3	0.085 J	10 (1)	10/50 (3)
B07-1	0.21	10 (1)	10/50 (3)
B09-3	0.27 J	10 (1)	10/50 (3)
B10-2	0.56	10 (1)	10/50 (3)
B10-3	0.44 J	10 (1)	10/50 (3)
B12-1	0.22 J	10 (1)	10/50 (3)
B12-2	1.1 J	10 (1)	10/50 (3)
B12-3	0.017 J	10 (1)	10/50 (3)
M01-1	0.13 J	10 (1)	10/50 (3)
M02-1	0.24	10 (1)	10/50 (3)
M02-2	0.093 J	10 (1)	10/50 (3)
M05-1	0.15	10 (1)	10/50 (3)
M06-1	0.043 J	10 (1)	10/50 (3)
M06-2	0.025 J	10 (1)	10/50 (3)
B171	0.13 J	10 (1)	10/50 (3)
B172	1 J	10 (1)	10/50 (3)
B192	0.81 J	10 (1)	10/50 (3)
M081	0.17 J	10 (1)	10/50 (3)
M082	1.1 J	10 (1)	10/50 (3)
M101	2.2 J	10 (1)	10/50 (3)
M102	0.56 J	10 (1)	10/50 (3)
M111	0.64 J	10 (1)	10/50 (3)
M112	0.65 J	10 (1)	10/50 (3)
M132	0.25 J	10 (1)	10/50 (3)
TP1-1	0.21 J	10 (1)	10/50 (3)
TP2-1	0.13 J	10 (1)	10/50 (3)
TP3-1/TP3-3	0.15 J / 0.095 J	10 (1)	10/50 (3)
LEAD			
TRC Sample ID			
B02-2	653	500 - 1,000 (2)	300 (4)
B03-1	886	500 - 1,000 (2)	300 (4)
B05-2	3610	500 - 1,000 (2)	300 (4)
B07-2	1340	500 - 1,000 (2)	300 (4)
B09-2	819	500 - 1,000 (2)	300 (4)
B12-1	2050	500 - 1,000 (2)	300 (4)
B12-2	1760	500 - 1,000 (2)	300 (4)
M02-2	390	500 - 1,000 (2)	300 (4)
M03-3	695	500 - 1,000 (2)	300 (4)
B192	4720	500 - 1,000 (2)	300 (4)
B212	722	500 - 1,000 (2)	300 (4)
B222	612	500 - 1,000 (2)	300 (4)
M081	487	500 - 1,000 (2)	300 (4)
M082	2600	500 - 1,000 (2)	300 (4)
M111	534	500 - 1,000 (2)	300 (4)
M112	359	500 - 1,000 (2)	300 (4)

(1) - TSCA (40 CFR 761); Requirements for decontaminating spills in nonrestricted areas.

(2) - USEPA, OSWER Directive 9355.4-02, Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites.

(3) - RIDEM Proposed Amendments to the Rules and Regulations for Solid Waste Management Facilities defines solid waste as including any soil debris or other material with a concentration of 10 ppm or greater PCBs.

RIDEM Proposed Amendments to the Rules and Regulations for Hazardous Waste Management defines Type 6 - extremely hazardous as including waste which contains 50 ppm or greater PCBs.

(4) - RIDEM and RI Dept. of Health - Risk Assessment Guidance Level.

J - The associated numerical value is an estimated quantity.

TABLE 4-8
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
MAXIMUM DETECTED INORGANIC ANALYTE CONCENTRATIONS IN SOIL

ANALYTE	Surface Soils		Subsurface Soils	
	Concentration (ppm)	Location	Concentration (ppm)	Location
Aluminum	18,900	@ SS-08	28,100	@ M01-1
Antimony	73.9	@ B23-1	148	@ M08-2
Arsenic	24.1	@ M12-1	61.4	@ B22-2
Barium	53.6	@ SS-08	506	@ M11-1
Beryllium	1.0	@ SS-08	2.3	@ B05-2
Cadmium	2.0	@ SS-05	22.3	@ B19-2
Calcium	6,850	@ SS-29	38,200	@ M08-2
Chromium	65	@ SS-08	111	@ B05-4
Cobalt	24.9	@ SS-32	32.2	@ B19-2
Copper	293	@ B23-1	3,130	@ B12-2
Iron	47,300	@ SS-08	95,800	@ B19-2
Lead	362	@ SS-08	4,720	@ B19-2
Magnesium	6,830	@ SS-32	13,700	@ M08-2
Manganese	678	@ SS-20	1,300	@ M04-2
Mercury	1.9	@ B23-3	2.9	@ M09-2
Nickel	49.1	@ SS-08	333	@ B12-2
Potassium	806	@ SS-24	1,530	@ B19-2
Selenium	2.0	@ SS-11	0.94	@ M05-1
Silver	2.0	@ B23-3	35.5	@ B19-2
Sodium	436	@ SS-24	2,230	@ B19-2
Thallium	N/D		N/D	
Vanadium	119	@ SS-08	630	@ M08-2
Zinc	622	@ SS-08	9,750	@ B12-1
Cyanide	N/D		N/D	

Notes: N/D - Non Detect

TABLE 4-9
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
SUMMARY OF SURFACE SOIL INORGANIC BACKGROUND DATA

ANALYTE	Phase I			Phase II						Range	Arithmetic Mean Conc.
	SS-16	SS-17	B13-1	SS-18	SS-19	SS-20	M14-1	M15-1	M16-1		
Aluminum	8810	15300	8520	8840	9410	9360	10400	11500	9110	8520 - 15300	1.0E+04
Antimony	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Arsenic	5	12.2	4.8	5.8	9.5	3.8	0.47	6.1	14.7	0.47 - 14.7	7.0E+00
Barium	19.2	62.1	19.9	28.5	23.3	47	10.1	18.2	18	10.1 - 62.1	2.7E+01
Beryllium	0.45	0.81	N/D	0.41	0.44	0.44	0.45	0.34	0.36	N/D - 0.81	4.6E-01
Cadmium	N/D	0.9	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D - 0.9	7.1E-01
Calcium	667	1860	126	434	346	1160	1050	460	837	126 - 1860	7.8E+02
Chromium	11.4	26.2	7.8	8.1	10.2	9.9	16.1	13.5	13.2	7.8 - 26.2	1.3E+01
Cobalt	8.8	13.8	6.1	3.7	4.4	6	17.3	14.6	11.1	3.7 - 14.6	9.6E+00
Copper	27.2	64	10.9	15.8	21.9	24.7	27.2	19.3	32.2	10.9 - 64	2.7E+01
Iron	18700	29400	12100	10600	14000	19000	26500	25600	24700	10600 - 29400	2.0E+04
Lead	283	314	25	28.6	68.8	54.8	6.3	59.3	42.5	6.3 - 314	9.8E+01
Magnesium	2270	4440	842	1110	1410	1410	4160	3550	2640	842 - 4160	2.4E+03
Manganese	365	578	177	318	240	678	478	389	430	177 - 678	4.2E+02
Mercury	N/D	N/D	N/D	0.22	0.26	0.25	N/D	0.06	0.14	N/D - 0.26	1.6E-01
Nickel	14.4	31.6	8.5	10.4	13.7	15	28.4	22.1	22.8	8.5 - 31.6	1.9E+01
Potassium	N/D	N/D	N/D	247	194	179	295	224	362	N/D - 362	3.9E+02
Selenium	N/D	0.63	N/D	0.54	0.57	0.61	N/D	0.7	N/D	N/D - 0.7	5.4E-01
Silver	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Sodium	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	2.6E+02
Thallium	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Vanadium	24.7	42.4	N/D	33.7	44.5	25.7	15.5	18.8	20.7	N/D - 44.5	2.7E+01
Zinc	174	276	26.8	41.1	45.2	109	58.1	77.5	87.2	26.8 - 276	1.0E+02
Cyanide	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	4.9E-01

Notes: N/D - Non Detect
 - Indicates highest concentration detected in background surface soil samples.
 - Indicates lowest concentration detected in background surface soil samples.
 Arithmetic Mean Data from Table 2-2 in Human Health Risk Assessment.

TABLE 4-10
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
BACKGROUND, SURFACE and SUBSURFACE SOIL SAMPLES
COMPARISON OF OBSERVED CONCENTRATIONS OF
ELEMENTS TO PUBLISHED VALUES

ELEMENT	PUBLISHED RANGES OF BACKGROUND ELEMENTS IN U.S. SOILS (ppm)		ON-SITE SURFACE SOIL RANGES	ON-SITE SUBSURFACE SOIL RANGES	OBSERVED BACKGROUND (3) SURFACE SOIL CONCENTRATION RANGES
	EPA (1)	USGS (2)	(ppm)	(ppm)	(ppm)
Aluminum	10,300 - 300,000	7,000 - 100,000	4,180 - 18,900	2,510 - 28,100	8,520 - 15,300
Antimony	2 - 10	ND - 8.8	N/D - 73.9	N/D - 148	N/D
Arsenic	1 - 50	ND - 73	N/D - 24.1	1.4 - 61.4	0.47 - 14.7
Barium	100 - 3,000	10 - 1,500	3.1 - 53.6	2.3 - 506	10.1 - 62.1
Beryllium	0.1 - 40	ND - 7	N/D - 1.7	N/D - 2.3	N/D - 0.81
Cadmium	0.01 - 0.7	-	N/D - 2	N/D - 22.3	N/D - 0.9
Calcium	-	100 - 280,000	282 - 6,850	145 - 38,200	126 - 1860
Chromium	1 - 1,000	1 - 1,000	5.2 - 65	4.9 - 111	7.8 - 26.2
Cobalt	1 - 40	ND - 70	N/D - 24.9	1.6 - 32.2	3.7 - 14.6
Copper	2 - 100	ND - 700	7.1 - 293	2.9 - 3,130	10.9 - 64
Iron	-	100 - 100,000	5,510 - 47,300	4,470 - 95,800	10,600 - 29,400
Lead	2 - 200	ND - 300	6.4 - 362	4.3 - 4,720	6.3 - 314
Magnesium	600 - 6,000	50 - 50,000	311 - 6,830	807 - 13,700	842 - 4,160
Manganese	20 - 3,000	ND - 7,000	94 - 678	49 - 1,300	177 - 678
Mercury	0.01 - 0.3	0.01 - 3.4	N/D - 1.9	N/D - 2.9	N/D - 0.26
Nickel	5 - 500	ND - 700	3.4 - 49.1	4.9 - 333	8.5 - 31.6
Potassium	-	50 - 37,000	N/D - 806	N/D - 1,530	N/D - 362
Selenium	0.1 - 2	ND - 3.9	N/D - 2	N/D - 0.94	N/D - 0.7
Silver	0.01 - 5	-	N/D - 2	N/D - 35.5	N/D
Sodium	-	ND - 50,000	N/D - 436	N/D - 2,230	N/D
Thallium	-	-	N/D	N/D	N/D
Vanadium	20 - 500	ND - 300	8.4 - 119	4.1 - 630	N/D - 44.5
Zinc	10 - 300	ND - 2,900	25.5 - 622	13.2 - 9,750	26.8 - 276
Cyanide	-	-	N/D	N/D	N/D

NOTES:

- (1) From "Hazardous Waste Land Treatment", SW-874, April 1983.
 - (2) From "Element Concentrations in soils and other Surficial Materials of the Conterminous United States", USGS Professional Paper 1270, 1984. Soils in the Eastern United States (east of 96th meridian).
 - (3) Site background ranges obtained from surface soil samples SS-18, SS-19, and SS-20, and from surface soil samples collected from monitoring well borings MW-14R, MW-15R, and MW-16R.
- Indicates that the data for that element was not presented in that reference.
ND Indicates that the element was not detected in the soil sample.

TABLE 4-11
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
DIOXIN/FURAN RESULTS

Sample ID: Depth Interval: (1)	Surface Soils						Subsurface Soils						2,3,7,8-TCDD Equivalency Factors - TEFs (2)
	SS-22 0-1'	SS-23 0-1'	SS-24 0-1'	SS-25 0-1'	SS-40 Dup of SS25	B16-1 0-1'	M02-1 10-12	M03-1 12-14	M05-1 6-8	B07-1 6-8	B07-2 12-14	B17-1 2-4	
Dioxins (ppb)													1.0
2,3,7,8-TCDD													0
TCDD													0.5
PeCDD													0.1
HxCDD													0.01
HpCDD							0.8	1.1	1.2	0.5			0.001
OCDD	0.32	1.0	0.29				21	6.7	22	12	13	23	
Furans (ppb)													0.1
2,3,7,8-TCDF								0.2					0
TCDF				0.36				0.5					0.5
PeCDF													0.1
HxCDF													0.01
HpCDF							0.2		0.2				0.001
OCDF									0.1				
Total 2,3,7,8-TCDD Equivalent	0.00032	0.001	0.00029	0	0	0	0.031	0.0377	0.0361	0.017	0.013	0.0023	

Notes:

- The depth interval is reported in feet below ground surface.
- The 2,3,7,8-TCDD Equivalency Factors (TEFs) were taken from the March 1989 update of "Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs) and 1989 Update". Where isomer specific results are not available, the most conservative equivalency factor (the highest) is applied to that isomer group.
- The following abbreviations are used:

2,3,7,8-TCDD = 2,3,7,8 Tetrachlorodibenzo-p-dioxin
 TCDD = Sum of all Tetrachlorodibenzodioxin isomers
 PeCDD = Sum of all Pentachlorodibenzodioxin isomers
 HxCDD = Sum of all Hexachlorodibenzodioxin isomers
 HpCDD = Sum of all Heptachlorodibenzodioxin isomers
 OCDD = Sum of all Octachlorodibenzodioxin isomers

2,3,7,8-TCDF = 2,3,7,8 Tetrachlorodibenzofuran
 TCDF = Sum of all Tetrachlorodibenzofuran isomers
 PeCDF = Sum of all Pentachlorodibenzofuran isomers
 HxCDF = Sum of all Hexachlorodibenzofuran isomers
 HpCDF = Sum of all Heptachlorodibenzofuran isomers
 OCDF = Sum of all Octachlorodibenzofuran isomers

TABLE 4-12
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
GROUND WATER SAMPLE SUMMARY

Sample Location= Sample Collection Date=	MP-MW-1R 20 DEC 93	MP-MW-2S 22 DEC 93	MP-MW-3S 21 DEC 93	MP-MW-3R 21 DEC 93	MP-MW-4S 21 DEC 93	MP-MW-5S 20 DEC 93	MP-MW-5R 20 DEC 93	MP-MW-6S 20 DEC 93
Volatile Organic Compound (µg/l)								
1,2-Dichloroethene (total)	--	--	--	--	--	--	--	--
Benzene	--	--	2 J	--	2 J	--	--	--
Toluene	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	--	--	--	--
Ethylbenzene	--	3 J	--	--	6 J	--	--	--
Xylene (total)	--	15	--	--	7 J	--	--	--
Semivolatile Organic Compound (µg/l)								
1,3-Dichlorobenzene	--	N/A	--	--	--	--	--	--
1,4-Dichlorobenzene	--	N/A	--	--	12	--	--	--
2-Methylphenol	--	N/A	3 J	--	--	--	--	--
4-Methylphenol	--	N/A	--	--	11	--	--	--
2,4-Dimethylphenol	--	N/A	1 J	--	--	--	--	--
Naphthalene	--	N/A	98	--	3 J	--	--	--
2-Methylnaphthalene	--	N/A	9 J	--	1 J	--	--	--
Acenaphthene	--	N/A	28	--	--	--	--	--
Dibenzofuran	--	N/A	15	--	--	--	--	--
Diethylphthalate	--	N/A	--	--	1 J	--	--	--
Fluorene	--	N/A	20	--	--	--	--	--
Phenanthrene	--	N/A	23	1 J	--	--	--	--
Anthracene	--	N/A	3 J	--	--	--	--	--
Carbazole	--	N/A	24	--	--	--	--	--
Di-n-butylphthalate	--	N/A	1 J	1 J	4 J	--	--	--
Fluoranthene	--	N/A	5 J	1 J	--	--	--	--
Pyrene	--	N/A	4 J	.9 J	--	--	--	--
Benzo(a)anthracene	--	N/A	--	.7 J	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	N/A	--	--	--	--	--	--
Pesticides/PCBs (µg/l)								
4,4'-DDD	N/A	N/A	N/A	N/A	N/A	--	--	N/A
Aroclor-1254	N/A	N/A	N/A	N/A	N/A	0.72 J	--	N/A

-- = Non-Detect
J = Estimated Concentration
N/A = Not Analyzed

TABLE 4-12
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
GROUND WATER SAMPLE SUMMARY

Sample Location= Sample Collection Date=	MP-MW-1R 20 DEC 93	MP-MW-2S 22 DEC 93	MP-MW-3S 21 DEC 93	MP-MW-3R 21 DEC 93	MP-MW-4S 21 DEC 93	MP-MW-5S 20 DEC 93	MP-MW-5R 20 DEC 93	MP-MW-6S 20 DEC 93
Inorganics (µg/l)								
Chloride (mg/l)	52.8	N/A	136	79	15.1	18.2	21.4	43.8
Cyanide, Total	--	N/A	--	23.3	--	--	--	--
Silver, Total	0.40	N/A	25 J	.5 J	0.40	--	--	1.8 J
Aluminum, Total	114000 J	N/A	127000 J	6070 J	1370 J	211 J	4420 J	71600 J
Arsenic, Total	27.9 J	N/A	176 J	34.4 J	11.7 J	12.0 J	19.2 J	24.3 J
Barium, Total	114	N/A	969 J	34.1	67.6	23.9	17.6	134
Beryllium, Total	4.1	N/A	5.9	1.1	--	--	1.1	4.1
Calcium, Total	26300 J	N/A	78700 J	35400 J	39800 J	12900 J	14400 J	19300 J
Cadmium, Total	1.2 J	N/A	28 J	3.6 J	6.2 J	--	--	1.4 J
Cobalt, Total	129 J	N/A	205 J	44.5 J	21.0	4.7 J	43.5 J	174 J
Chromium, Total	176 J	N/A	256 J	--	5.4 J	--	--	97.2 J
Copper, Total	189 J	N/A	1730 J	58.6 J	59.6 J	3.8 J	6.7 J	283 J
Iron, Total	262000 J	N/A	341000 J	42400 J	69100 J	19300 J	25600 J	246000 J
Mercury, Total	--	N/A	4.51	.12	0.19	0.14	0.17	0.46
Potassium, Total	5250	N/A	25900	5890	6290	6060	2340	5450
Magnesium, Total	45700 J	N/A	57000 J	15800 J	4580 J	5060 J	8520 J	28400 J
Manganese, Total	2540 J	N/A	7990 J	2400 J	2180 J	679 J	1200 J	5300 J
Sodium, Total	27300	N/A	91600 J	46200 J	8920 J	15900 J	9340 J	15700 J
Nickel, Total	256	N/A	386	106	48.0	10.7	61.2	234
Lead, Total	275 J	N/A	4060	91.2	42.3 J	--	--	440 J
Antimony, Total	--	N/A	176 J	--	--	--	--	--
Vanadium, Total	14.3 J	N/A	432	15.8 J	--	--	7.7 J	31.8 J
Zinc, Total	550 J	N/A	6800 J	1000 J	1030 J	50.3 J	39.9 J	623 J

-- = Non-Detect
J = Estimated Concentration
N/A = Not Analyzed

TABLE 4-12
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
GROUND WATER SAMPLE SUMMARY

Sample Location#	MP-MW-7S	MP-MW-8R	MP-MW-9R	MP-MW-10R	MP-MW-12S	MP-MW-17S	MP-MW-11R	MP-MW-13S
Sample Collection Date#	20 DEC 93	21 DEC 93	22 DEC 93	21 DEC 93	21 DEC 93	Dup of MW-12S	21 DEC 93	21 DEC 93
Volatile Organic Compound (µg/l)								
1,2-Dichloroethene (total)	--	--	1 J	--	--	--	--	--
Benzene	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	29	29	--	3 J
Ethylbenzene	--	--	--	--	4 J	5 J	--	--
Xylene (total)	--	--	--	--	14	16	--	--
Semivolatile Organic Compound (µg/l)								
1,3-Dichlorobenzene	--	--	--	--	2 J	3 J	--	0.5 J
1,4-Dichlorobenzene	--	--	--	--	13	21	--	2 J
2-Methylphenol	--	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	3 J	--	1 J
2,4-Dimethylphenol	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	3 J	9 J	8 J	0.9 J
2-Methylnaphthalene	--	--	--	--	1 J	7 J	1 J	1 J
Acenaphthene	--	--	--	--	--	--	2 J	--
Dibenzofuran	--	--	--	--	--	--	2 J	--
Diethylphthalate	--	--	0.5 J	--	--	--	--	--
Fluorene	--	--	--	--	--	--	2 J	--
Phenanthrene	--	--	--	--	--	5 J	5 J	--
Anthracene	--	--	--	--	--	--	1 J	--
Carbazole	--	--	--	--	--	--	--	--
Di-n-butylphthalate	--	--	--	1 J	--	--	1 J	--
Fluoranthene	--	--	--	--	--	0.8 J	2 J	--
Pyrene	--	--	--	--	1 J	2 J	1 J	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	--	--	--	--	--	--
Pesticides/PCBs (µg/l)								
4,4'-DDD	N/A	N/A	N/A	N/A	0.18 J	0.20 J	N/A	--
Aroclor-1254	N/A	N/A	N/A	N/A	0.76 J	0.76 J	N/A	1.8

-- = Non-Detect
J = Estimated Concentration
N/A = Not Analyzed

TABLE 4-12
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
GROUND WATER SAMPLE SUMMARY

Sample Location= Sample Collection Date=	MP-MW-7S 20 DEC 93	MP-MW-8R 21 DEC 93	MP-MW-9R 22 DEC 93	MP-MW-10R 21 DEC 93	MP-MW-12S 21 DEC 93	MP-MW-17S Dup of MW-12S	MP-MW-11R 21 DEC 93	MP-MW-13S 21 DEC 93
Inorganics (µg/l)								
Chloride (mg/l)	16.7	1110	47.4	56.1	23.4	23.8	134	73.0
Cyanide, Total	--	--	--	--	--	--	--	--
Silver, Total	--	--	--	1.1	11.6	17.7 J	1.3 J	2.0
Aluminum, Total	93600 J	18100 J	92600	18300 J	20300 J	44600 J	47800 J	104000
Arsenic, Total	114 J	24.4 J	84.3	22.1 J	51.6 J	41.6 J	22.5 J	117
Barium, Total	131	179	115	31.1	112	231	154	228
Beryllium, Total	4.3	1.8	3.3	--	1.0	2.1	2	4.9
Calcium, Total	57100 J	65400 J	69100	17500 J	16100 J	32400 J	76800 J	14800
Cadmium, Total	2.8 J	1.4 J	1.2	2.0 J	10.0 J	10.0 J	1.8 J	9.9
Cobalt, Total	743 J	258 J	287	31.7	43.8	92.3	116 J	127
Chromium, Total	153 J	24.1 J	163	29.4 J	67.9 J	143 J	82.8 J	146
Copper, Total	285 J	91.8 J	129	67.1 J	97.2 J	210 J	267 J	241
Iron, Total	216000 J	38900 J	262000	43400 J	87300 J	182000 J	128000 J	227000
Mercury, Total	0.12	--	--	0.15	1.7	1.8	.33	0.23
Potassium, Total	7310	110000	14700	1510	3070	6230	33500	8840
Magnesium, Total	39400 J	118000 J	52700	12100 J	10000 J	21200 J	53100 J	32700
Manganese, Total	17400 J	6330 J	24200	2380 J	2730 J	5410 J	15900 J	4020
Sodium, Total	14600 J	721000 J	38100	12700 J	7590 J	14200 J	76800 J	11600
Nickel, Total	501	235	267	56.5	97.0	197	122	250
Lead, Total	190 J	26.9	58.0	65.5 J	375 J	381 J	548	1860
Antimony, Total	--	--	--	--	26.5 J	42.3 J	--	34.1
Vanadium, Total	37.2 J	28.7 J	36.8	22.7	189	391	45.8 J	107
Zinc, Total	679 J	156 J	469	172 J	1440 J	2790 J	1060 J	856

-- = Non-Detect
J = Estimated Concentration
N/A = Not Analyzed

TABLE 4-12
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
GROUND WATER SAMPLE SUMMARY

Sample Location= Sample Collection Date=	MP-MW-14R 22 DEC 93	MP-MW-18 Dup of MW-14R	MP-MW-15R 21 DEC 93	MP-MW-16R 21 DEC 93	MP-MW-21S 20 DEC 93	MP-MW-22S 20 DEC 93	MP-MW-23R 20 DEC 93
Volatile Organic Compound (µg/l)							
1,2-Dichloroethene (total)	--	--	--	--	--	--	--
Benzene	--	--	--	--	--	--	--
Toluene	--	--	--	--	24	--	--
Chlorobenzene	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--
Xylene (total)	--	--	--	--	--	--	--
Semivolatile Organic Compound (µg/l)							
1,3-Dichlorobenzene	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	0.5 J	--	--
2-Methylphenol	--	--	--	--	2 J	--	--
4-Methylphenol	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--
Acenaphthene	--	--	--	--	--	--	--
Dibenzofuran	--	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	2 J	--	--
Fluorene	--	--	--	--	--	--	--
Phenanthrene	--	--	--	0.7 J	--	--	--
Anthracene	--	--	--	--	--	--	--
Carbazole	--	--	--	--	--	--	--
Di-n-butylphthalate	--	--	1 J	--	--	--	--
Fluoranthene	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	--	--	--	--	--
Pesticides/PCBs (µg/l)							
4,4'-DDD	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aroclor-1254	N/A	N/A	N/A	N/A	N/A	N/A	N/A

-- = Non-Detect
J = Estimated Concentration
N/A = Not Analyzed

TABLE 4-12
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
GROUND WATER SAMPLE SUMMARY

Sample Location= Sample Collection Date=	MP-MW-14R 22 DEC 93	MP-MW-18 Dup of MW-14R	MP-MW-15R 21 DEC 93	MP-MW-16R 21 DEC 93	MP-MW-21S 20 DEC 93	MP-MW-22S 20 DEC 93	MP-MW-23R 20 DEC 93
Inorganics (µg/l)							
Chloride (mg/l)	15.7	15.1	24.4	13.4	383	56.4	15.1
Cyanide, Total	--	--	--	--	--	54.8	10.4
Silver, Total	--	--	--	0.40	--	--	--
Aluminum, Total	8640	21500	46000	31600 J	5190 J	878 J	3960 J
Arsenic, Total	--	--	--	64.8 J	129 J	34.8 J	45.8 J
Barium, Total	27.8	48.1	112	166	59.1	43.3	15.1
Beryllium, Total	--	1.6	1.5	1.6	--	--	1.0
Calcium, Total	18800	19300	21700	30800 J	136000 J	33600 J	9480 J
Cadmium, Total	--	0.6	0.8	12.0 J	1.2 J	0.70 J	--
Cobalt, Total	15.7	33	82.8	103	21.1 J	17.1 J	39.9 J
Chromium, Total	16.7	47.9	76.5	50.8 J	--	--	--
Copper, Total	38.4	60.7	83.9	82.6 J	81.7 J	19.5 J	12.1 J
Iron, Total	23400	55400	141000	96500 J	19400 J	42100 J	58100 J
Mercury, Total	--	--	--	--	0.20	0.41	--
Potassium, Total	3220	3670	5030	3140	19600	7000	1030
Magnesium, Total	13000	18200	26600	16600 J	56800 J	11700 J	8670 J
Manganese, Total	1280	1690	4490	3970 J	908 J	4200 J	1130 J
Sodium, Total	9900	9960	11600	6050 J	201000 J	36000 J	13500 J
Nickel, Total	35.7	79.7	175	148	33.6	--	44.8
Lead, Total	3.9	--	21.9	144 J	56.6 J	34.1 J	12.6 J
Antimony, Total	--	--	--	19.0 J	--	--	--
Vanadium, Total	11	10.5	56.3	32.5	29.5 J	--	--
Zinc, Total	217	201	326	206 J	526 J	53.7 J	115 J

-- = Non-Detect
J = Estimated Concentration
N/A = Not Analyzed

TABLE 4-13
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
Comparison of Detected Ground Water Contaminants from Phase I RI Sampling to
Applicable or Relevant and Appropriate Requirements (ARARs) or To-be-Considered Requirements (TBCs)

Client ID:	MW-1R	MW-2S	MW-3S	MW-3R	MW-4S	MW-5S	FEDERAL ARARs/TBCs			RHODE ISLAND ARARs/TBCs Ground Water ⁴ Quality Standards (ppb)
							MCL ¹ (ppb)	MCLG ² (ppb)	SMCL ³ (ppb)	
VOLATILE ORGANIC COMPOUNDS (ug/l)										
Benzene	--	N/A	6	1 J	5	--	5	0		5
Toluene	--	N/A	1 J	--	1 J	--	1000	1000		1000
Chlorobenzene	--	N/A	--	--	11	--	100	100		100
Ethylbenzene	--	N/A	2 J	--	12	3 J	700	700		700
Xylenes (Total)	--	N/A	6 J	--	44 J	160 J	10000	10000		10000
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l)										
1,4-Dichlorobenzene	--	N/A	--	--	6 J	--	75	75		75
PESTICIDES/PCBS (ug/l)										
Aroclor-1254 (PCB)	--	N/A	--	--	--	0.73 J	0.5	0		0.5
INORGANICS (ug/l)										
Aluminum	130000 J	N/A	205000	8890 J	89500 J	284000 J			50-200	
Antimony	41.3 J	N/A	259 J	--	64.2 J	101 J	6	6		
Arsenic	18 J	N/A	85.8 J	6.4 J	26.9 J	71.4 J	50			50
Barium	153 J	N/A	1770 J	--	212 J	895 J	2000	2000		2000
Beryllium	3	N/A	9.5	--	2	12.8	1	0		
Cadmium	--	N/A	57.1 J	--	4.9 J	5.6 J	5	5		5
Chromium	R	N/A	R	16.9 J	R	R	100	100		100
Copper	R	N/A	3160 J	--	R	R	1300	1300	1000	
Iron	327000 J	N/A	500000 J	40300 J	339000 J	537000 J			300	
Mercury	--	N/A	8.4	--	0.79	1.3	2	2		2
Lead	60 J	N/A	4800 J	25.7 J	197 J	4.3 J	15*	0*		15
Manganese	2910 J	N/A	13500 J	2090	6550 J	4760 J			50	
Nickel	306	N/A	517	70.6	190	658	100	100		
Silver	--	N/A	126	--	--	--			100	
Zinc	588 J	N/A	12100 J	200 J	1260 J	2100 J			5000	
Cyanide	--	N/A	--	--	--	10	200	200		

1. MCL - Maximum Contaminant Level, National Primary Drinking Water Regulations.
2. MCLG - Maximum Contaminant Level Goal, based on health considerations only
3. SMCL - Secondary Maximum Contaminant Level, National Secondary Drinking Water Regulations.
4. Water Quality Standards, Class GAA and Class GA ground waters, Rhode Island Regulations, July 1993.

-- = NON-DETECT
J = ESTIMATED CONCENTRATION
* = DENOTES CONCENTRATION AT THE TAP

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TABLE 4-13
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
Comparison of Detected Ground Water Contaminants from Phase I RI Sampling to
Applicable or Relevant and Appropriate Requirements (ARARs) or To-be-Considered Requirements (TBCs)

Client ID:	MW-5R	MW-6S	MW-7S	MW-21S	MW-22S	MW-23R	FEDERAL ARARs/TBCs			RHODE ISLAND
							MCL ¹ (ppb)	MCLG ² (ppb)	SMCL ³ (ppb)	ARARs/TBCs Ground Water ⁴ Quality Standards (ppb)
VOLATILE ORGANIC COMPOUNDS (ug/l)										
Benzene	---	---	---	---	---	---	5	0		5
Toluene	---	---	---	---	---	---	1000	1000		1000
Chlorobenzene	---	---	---	---	---	---	100	100		100
Ethylbenzene	---	---	---	---	---	---	700	700		700
Xylenes (Total)	---	---	---	2 J	---	---	10000	10000		10000
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l)										
1,4-Dichlorobenzene	---	---	---	---	---	---	75	75		75
PESTICIDES/PCBS (ug/l)										
Aroclor-1254 (PCB)	---	---	---	---	---	---	2	0		2
INORGANICS (ug/l)										
Aluminum	412 J	112000 J	176000 J	4340 J	3270 J	4030 J			50-200	
Antimony	---	---	---	36.7 J	---	---	6	6		
Arsenic	2.1 J	15 J	84.4 J	89.4 J	54.2 J	97.2 J	50			50
Barium	---	245	305	---	---	---	2000	2000		2000
Beryllium	---	4.9	7.1	---	1	---	1	0		
Cadmium	---	8 J	3.7 J	---	---	---	5	5		5
Chromium	---	136 J	248 J	21.6 J	---	15.9 J	100	100		100
Copper	---	880 J	429 J	64.7	---	64.7	1300	1300		
Iron	702 J	399000	374000	16000 J	58800 J	14900 J			300	
Mercury	---	1.3	---	---	---	---	2	2		2
Lead	---	1000 J	260 J	53.6 J	42.8 J	45.2	15	0		15
Manganese	57.6	13700 J	21000 J	906 J	1140	970 J			50	
Nickel	16.7	524	678	30.6	40	34	100	100		
Silver	---	26.6 J	---	---	---	---			100	
Zinc	---	1630	1140	275 J	105 J	228 J			5000	
Cyanide	---	---	---	---	---	---	200	200		

1. MCL - Maximum Contaminant Level, National Primary Drinking Water Regulations.
2. MCLG - Maximum Contaminant Level Goal, based on health considerations only
3. SMCL - Secondary Maximum Contaminant Level, National Secondary Drinking Water Regulations.
4. Water Quality Standards, Class GAA and Class GA ground waters, Rhode Island Regulations, July 1993.

-- = NON-DETECT
J = ESTIMATED CONCENTRATION
* = DENOTES CONCENTRATION AT THE TAP

TABLE 4-14
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
Comparison of Detected Ground Water Contaminants from Phase II RI Sampling to
Applicable or Relevant and Appropriate Requirements (ARARs) or To-be-Considered Requirements (TBCs)

Client ID:	MW-1R	MW-2S	MW-3S	MW-3R	MW-4S	MW-5S	FEDERAL ARARs/TBCs			RHODE ISLAND ARARs/TBCs Ground Water ⁴ Quality Standards (ppb)
							MCL ¹ (ppb)	MCLG ² (ppb)	SMCL ³ (ppb)	
VOLATILE ORGANIC COMPOUNDS (ug/l)										
1,2-Dichloroethene	--	--	--	--	--	--	70	70		70
Benzene	--	--	2 J	--	2 J	--	5	0		5
Toluene	--	--	--	--	--	--	1000	1000		1000
Chlorobenzene	--	--	--	--	10	--	100	100		100
Ethylbenzene	--	3 J	--	--	6 J	--	700	700		700
Xylenes (Total)	--	15	--	--	7 J	--	10000	10000		10000
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l)										
1,3-Dichlorobenzene	--	N/A	--	--	--	--	600	600		600
1,4-Dichlorobenzene	--	N/A	--	--	12	--	75	75		75
Bis(2-ethylhexyl)phthalate	--	N/A	--	--	--	--	6	0		
PESTICIDES/PCBS (ug/l)										
Aroclor-1254 (PCB)	N/A	N/A	N/A	N/A	N/A	1	0.5	0.5		0.5
INORGANICS (ug/l)										
Aluminum	114000	N/A	127000	6070	1370	211				50-200
Antimony	--	N/A	176	--	--	--	6	6		
Arsenic	27.9	N/A	176	34.4	11.7	12	50			50
Barium	114	N/A	969	34.1	67.6	23.9	2000	2000		2000
Beryllium	4.1	N/A	5.9	1.1	--	--	1	0		
Cadmium	1.2	N/A	28	3.6	6.2	--	5	5		5
Chromium	176	N/A	256	15.1	5.4	9	100	100		100
Copper	189	N/A	1730	58.6	59.6	3.8	1300	1300		1000
Iron	262000	N/A	341000	42400	69100	19300				300
Mercury	--	N/A	4.5	0.12	0.19	0.14	2	2		2
Lead	275	N/A	4060	91.2	42.3	--	15	0		15
Manganese	2540	N/A	7990	2400	2180	679				50
Nickel	256	N/A	366	106	48	10.7	100	100		
Silver	0.4	N/A	25	0.5	0.4	--				100
Thallium	--	N/A	--	--	--	--	2	0.5		
Zinc	550	N/A	6800	1000	1030	50.3				5000
Cyanide	--	N/A	--	23.3	--	--	200	200		
Chloride (mg/l)	52.8	N/A	136	79	15.1	18.2				250

1. MCL - Maximum Contaminant Level, National Primary Drinking Water Regulations.

2. MCLG - Maximum Contaminant Level Goal, based on health considerations only

3. SMCL - Secondary Maximum Contaminant Level, National Secondary Drinking Water Regulations.

4. Water Quality Standards, Class GAA and Class GA ground waters, Rhode Island Regulations, July 1993.

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TABLE 4-14
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
Comparison of Detected Ground Water Contaminants from Phase II RI Sampling to
Applicable or Relevant and Appropriate Requirements (ARARs) or To-be-Considered Requirements (TBCs)

Client ID:	MW-5R	MW-6S	MW-7S	MW-8R	MW-9R	MW-10R	FEDERAL ARARs/TBCs			RHODE ISLAND ARARs/TBCs Ground Water ⁴ Quality Standards (ppb)
							MCL ¹ (ppb)	MCLG ² (ppb)	SMCL ³ (ppb)	
VOLATILE ORGANIC COMPOUNDS (ug/l)										
1,2-Dichloroethene	--	--	--	--	1 J	--	70	70		70
Benzene	--	--	--	--	--	--	5	0		5
Toluene	--	--	--	--	--	--	1000	1000		1000
Chlorobenzene	--	--	--	--	--	--	100	100		100
Ethylbenzene	--	--	--	--	--	--	700	700		700
Xylenes (Total)	--	--	--	--	--	--	10000	10000		10000
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l)										
1,3-Dichlorobenzene	--	--	--	--	--	--	600	600		600
1,4-Dichlorobenzene	--	--	--	--	--	--	75	75		75
Bis(2-ethylhexyl)phthalate	--	--	--	240	--	--	6	0		
PESTICIDES/PCBS (ug/l)										
Aroclor-1254 (PCB)	--	N/A	N/A	N/A	N/A	N/A	0.5	0.5		0.5
INORGANICS (ug/l)										
Aluminum	4420	71600	93600	18100	92600	18300			50-200	
Antimony	--	--	--	--	--	--	6	6		
Arsenic	19.2	24.3	114	24.4	84.3	22.1	50			50
Barium	17.6	134	131	179	115	31.1	2000	2000		2000
Beryllium	1.1	4.1	4.3	1.8	3.3	--	1	0		
Cadmium	--	1.4	2.8	1.4	1.2	2	5	5		5
Chromium	14.1	97.2	153	24.1	183	29.4	100	100		100
Copper	6.7	283	285	91.8	129	67.1	1300	1300		
Iron	25600	246000	216000	38900	262000	43400			300	
Mercury	0.17	0.46	0.12	--	--	0.15	2	2		2
Lead	--	440	190	26.9	58	65.5	15	0		15
Manganese	1200	5300	17400	8330	24200	2380			50	
Nickel	61.2	234	501	235	287	56.5	100	100		
Silver	--	1.8	--	--	--	1.1			100	
Thallium	--	--	--	--	--	--	2	0.5		
Zinc	39.9	623	679	156	469	172			5000	
Cyanide	--	--	--	--	--	--	200	200		
Chloride (mg/l)	21.4	43.8	16.7	1110	47.4	23.4			250	

1. MCL - Maximum Contaminant Level, National Primary Drinking Water Regulations.

2. MCLG - Maximum Contaminant Level Goal, based on health considerations only.

3. SMCL - Secondary Maximum Contaminant Level, National Secondary Drinking Water Regulations.

4. Water Quality Standards, Class GAA and Class GA ground waters, Rhode Island Regulations, July 1993.

-- = NON-DETECT

J = ESTIMATED CONCENTRATION

* - DENOTES CONCENTRATION AT THE TAP

TABLE 4-14
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
Comparison of Detected Ground Water Contaminants from Phase II RI Sampling to
Applicable or Relevant and Appropriate Requirements (ARARs) or To-be-Considered Requirements (TBCs)

Client ID:	MW-11R	MW-12S	MW-13S	MW-14R	MW-15R	MW-16R	FEDERAL ARARs/TBCs			RHODE ISLAND ARARs/TBCs Ground Water ⁴ Quality Standards (ppb)
							MCL ¹ (ppb)	MCLG ² (ppb)	SMCL ³ (ppb)	
VOLATILE ORGANIC COMPOUNDS (ug/l)										
1,2-Dichloroethene	---	---	---	---	1 J	---	70	70		70
Benzene	---	---	---	---	---	---	5	0		5
Toluene	---	---	---	---	---	---	1000	1000		1000
Chlorobenzene	---	29	3 J	---	---	---	100	100		100
Ethylbenzene	---	4 J	---	---	---	---	700	700		700
Xylenes (Total)	---	14	---	---	---	---	10000	10000		10000
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l)										
1,3-Dichlorobenzene	---	2 J	0.5 J	---	---	---	600	600		600
1,4-Dichlorobenzene	---	13	2 J	---	---	---	75	75		75
Bis(2-ethylhexyl)phthalate	---	---	---	---	---	---	6	0		
PESTICIDES/PCBS (ug/l)										
Aroclor-1254 (PCB)	N/A	0.76 J	1.8	N/A	N/A	N/A	0.5	0.5		0.5
INORGANICS (ug/l)										
Aluminium	47800	20300	104000	8640	46000	31600			50-200	
Antimony	---	26.5	34.1	---	---	19	6	6		
Arsenic	22.5	51.6	117	---	---	64.8	50			50
Barium	154	112	228	27.8	112	166	2000	2000		2000
Beryllium	2	1	4.9	---	1.5	1.8	1	0		
Cadmium	1.8	10	9.9	---	0.8	3.5	5	5		5
Chromium	82.8	67.9	146	16.7	76.5	50.8	100	100		100
Copper	267	97.2	241	38.4	83.9	82.6	1300	1300		
Iron	128000	87300	227000	23400	141000	96500			300	
Mercury	0.33	1.66	0.23	---	---	---	2	2		2
Lead	548	375	1860	3.9	21.9	144	15	0		15
Manganese	15900	2730	4020	1260	4490	3970			50	
Nickel	122	97	250	35.7	175	148	100	100		
Silver	1.3	11.6	2	---	---	0.4			100	
Thallium	---	---	---	---	---	---	2	0.5		
Zinc	1060	1440	856	217	326	206			5000	
Cyanide	---	---	---	---	---	---	200	200		
Chloride (mg/l)	134	23.4	73	15.7	15.1	24.4			250	

1. MCL - Maximum Contaminant Level, National Primary Drinking Water Regulations.
2. MCLG - Maximum Contaminant Level Goal, based on health considerations only
3. SMCL - Secondary Maximum Contaminant Level, National Secondary Drinking Water Regulations.
4. Water Quality Standards, Class GAA and Class GA ground waters, Rhode Island Regulations, July 1993.

-- = NON-DETECT
J = ESTIMATED CONCENTRATION
* = DENOTES CONCENTRATION AT THE TAP

TABLE 4-14
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
Comparison of Detected Ground Water Contaminants from Phase II RI Sampling to
Applicable or Relevant and Appropriate Requirements (ARARs) or To-be-Considered Requirements (TBCs)

Client ID:	MW-21S	MW-22S	MW-23R	FEDERAL ARARs/TBCs			RHODE ISLAND
				MCL ¹ (ppb)	MCLG ² (ppb)	SMCL ³ (ppb)	ARARs/TBCs Ground Water ⁴ Quality Standards (ppb)
VOLATILE ORGANIC COMPOUNDS (ug/l)							
1,2-Dichloroethene	--	--	--	70	70		70
Benzene	--	--	--	5	0		5
Toluene	24	--	--	1000	1000		1000
Chlorobenzene	--	--	--	100	100		100
Ethylbenzene	--	--	--	700	700		700
Xylenes (Total)	--	--	--	10000	10000		10000
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l)							
1,3-Dichlorobenzene	--	--	--	600	600		600
1,4-Dichlorobenzene	0.5 J	--	--	75	75		75
Bis(2-ethylhexyl)phthalate	--	--	--	6	0		
PESTICIDES/PCBS (ug/l)							
Aroclor-1254 (PCB)	N/A	N/A	N/A	0.5	0.5		0.5
INORGANICS (ug/l)							
Aluminum	5190	878	3960			50-200	
Antimony	--	--	--	6	6		
Arsenic	129	34.8	45.8	50			50
Barium	59.1	43.3	15.1	2000	2000		2000
Beryllium	--	--	1	1	0		
Cadmium	1.2	0.7	--	5	5		5
Chromium	10.7	4.1	7.6	100	100		100
Copper	81.7	19.5	12.1	1300	1300		
Iron	19400	42100	58100			300	
Mercury	0.2	0.41	--	2	2		2
Lead	56.6	34.1	12.6	15	0		15
Manganese	905	4200	1130			50	
Nickel	33.6	--	44.8	100	100		
Silver	--	--	--			100	
Thallium	--	--	--	2	0.5		
Zinc	526	53.7	115			5000	
Cyanide	--	54.8	10.4	200	200		
Chloride (mg/l)	383	56.4	15.1			250	

1. MCL - Maximum Contaminant Level, National Primary Drinking Water Regulations.
2. MCLG - Maximum Contaminant Level Goal, based on health considerations only
3. SMCL - Secondary Maximum Contaminant Level, National Secondary Drinking Water Regulations.
4. Water Quality Standards, Class GAA and Class GA ground waters, Rhode Island Regulations, July 1993

-- = NON-DETECT
J = ESTIMATED CONCENTRATION
* - DENOTES CONCENTRATION AT THE TAP

TABLE 4-15
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
Comparison of Filtered vs Unfiltered Inorganic Analytes

Client ID:	MW-3S	MW-3SF	MW-3R	MW-3RF	MW-8R	MW-8RF
INORGANICS (µg/l)						
Aluminum	127000	69	6070	23.2	18100	22.2
Antimony	176	--	--	--	--	30.9
Arsenic	176	18.1	34.4	6.4	24.4	4.4
Barium	969	314	34.1	20.1	179	66.2
Beryllium	5.9	--	1.1	--	1.8	--
Calcium	78700	50000	35400	33600	65400	67300
Cadmium	28	--	3.6	--	1.4	1.4
Cobalt	205	21.4	44.5	25.1	258	211
Chromium	256	--	15.1	4.4	24.1	--
Copper	1730	2.3	58.6	2.1	91.8	12.3
Iron	341000	19400	42400	21500	38900	80.9
Mercury	4.5	--	0.12	--	--	--
Lead	4060	--	91.2	--	26.9	--
Potassium	25900	21600	5890	3230	110000	113000
Magnesium	57000	20300	15800	13500	118000	118000
Manganese	7990	924	2400	1840	6330	6070
Sodium	91600	86700	46200	41300	721000	766000
Nickel	386	20.1	106	44.8	235	181
Selenium	--	--	--	--	--	--
Silver	25	--	0.5	--	--	--
Thallium	--	--	--	--	--	--
Vanadium	432	--	15.8	--	28.7	24.8
Zinc	6800	11.8	1000	29.5	156	43
Cyanide	--	N/A	23.3	N/A	--	N/A

-- = NON-DETECT
N/A - Not Analyzed for.

TABLE 4-15
NETC - NEWPORT
U.S. NAVY - NORTHERN DIVISION
SITE 01 - McALLISTER POINT LANDFILL
Comparison of Filtered vs Unfiltered Inorganic Analytes

Client ID:	MW-13S	MW-13SF	MW-15R	MW-15RF
INORGANICS (µg/l)				
Aluminum	104000	145	46000	--
Antimony	34.1	--	--	--
Arsenic	117	--	--	--
Barium	228	14.3	112	--
Beryllium	4.9	--	1.5	--
Calcium	14800	9250	21700	15000
Cadmium	9.9	2.7	0.8	--
Cobalt	127	7.9	82.8	--
Chromium	146	3.3	76.5	--
Copper	241	6.2	83.9	--
Iron	227000	371	141000	161
Mercury	0.23	--	--	--
Lead	1860	6	21.9	--
Potassium	8840	1440	5030	2200
Magnesium	32700	3650	26600	7390
Manganese	4020	940	4490	855
Sodium	11600	11100	11600	10300
Nickel	250	11.5	175	14.5
Selenium	--	--	--	--
Silver	2	--	--	--
Thallium	--	--	--	--
Vanadium	107	7.7	56.3	--
Zinc	856	77.7	326	47.1
Cyanide	--	N/A	--	N/A

TABLE 4-16
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
LEACHATE SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-LS1 04 NOV 93	MP-LS2 04 NOV 93	MP-LS3 04 NOV 93	MARINE ACUTE CRITERIA	MARINE CHRONIC CRITERIA
<u>Volatile Organic Compounds (µg/l)</u>					
<u>Semivolatile Organic Compounds (µg/l)</u>					
<u>Pesticides/PCBs (µg/l)</u>					
Dieldrin	0.0019 J	---	---	0.71	0.0019
Endrin	---	---	0.0034	0.037	0.0023
Alpha-Chlordane	0.0096 J	---	---	0.09 ⁽¹⁾	0.004 ⁽¹⁾
<u>Inorganics (µg/l)</u>					
Aluminum	---	---	341	NA	NA
Antimony	---	---	137	1,500	500
Barium	10.5	16	13.8	NA	NA
Calcium	325000	329000	321000	NA	NA
Iron	475	273	312	NA	NA
Magnesium	1100000	1120000	1090000	NA	NA
Potassium	336000	345000	334000	NA	NA
Sodium	9100000	9320000	9050000	NA	NA
Vanadium	67	---	---	NA	NA
Zinc	50.2	---	---	95	86

--- = Non-Detect

J = Estimated Concentration

NA = None Available

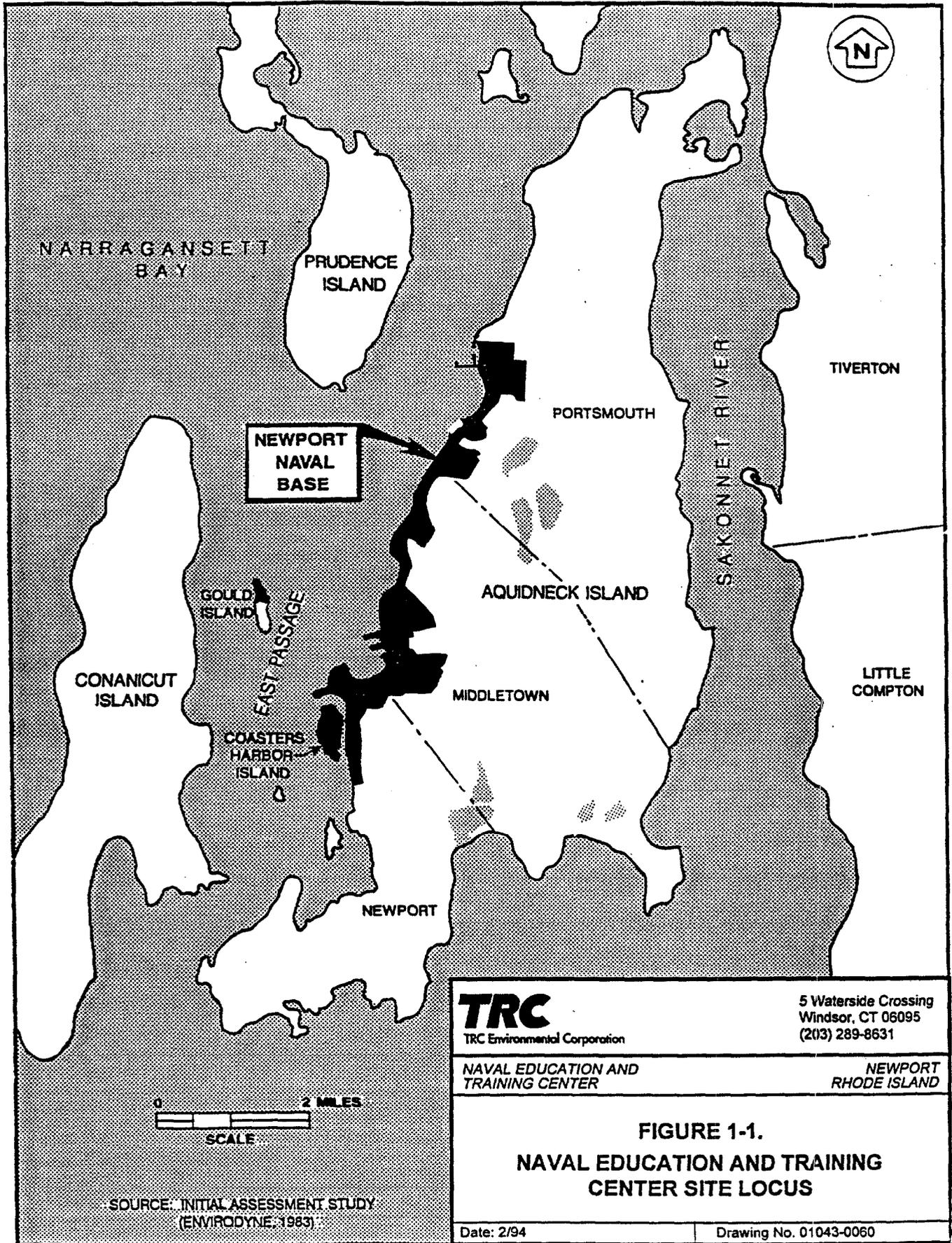
⁽¹⁾ = Value for Chlordane

█ Indicates a value which equals or exceeds marine water quality criteria.

TABLE 4-17
NETC NEWPORT - PHASE II RI
SITE 01 - McALLISTER POINT LANDFILL
SURFACE WATER SAMPLE SUMMARY TABLE

Sample Location= Sample Collection Date=	MP-SW1 06 JAN 94	MARINE ACUTE CRITERIA	MARINE CHRONIC CRITERIA
<u>Volatile Organic Compounds (µg/l)</u>			
<u>Semivolatile Organic Compounds (µg/l)</u>			
<u>Pesticides/PCBs (µg/l)</u>			
<u>Inorganics (µg/l)</u>			
Hardness	mg/l 5440	NA	NA
Hardness - Calcium	mg/l 840	NA	NA
Salinity	g/kg 29.8	NA	NA
Chloride	26000	NA	NA
Aluminum	137 J	NA	NA
Barium	9.9	NA	NA
Calcium	301000	NA	NA
Copper	11.9	2.9	NA
Iron	345 J	NA	NA
Potassium	311000	NA	NA
Magnesium	966000 J	NA	NA
Manganese	16.7 J	NA	NA
Sodium	8650000 J	NA	NA
Lead	2.1 J	220	8.5
Antimony	87.1	1500	500
Vanadium	120	NA	NA

-- = Non-Detect
J = Estimated Concentration
NA = None Available



NARRAGANSETT BAY

PRUDENCE ISLAND



TIVERTON

PORTSMOUTH

NEWPORT NAVAL BASE

SAKONNET RIVER

AQUIDNECK ISLAND

GOULD ISLAND

EAST PASSAGE

LITTLE COMPTON

CONANICUT ISLAND

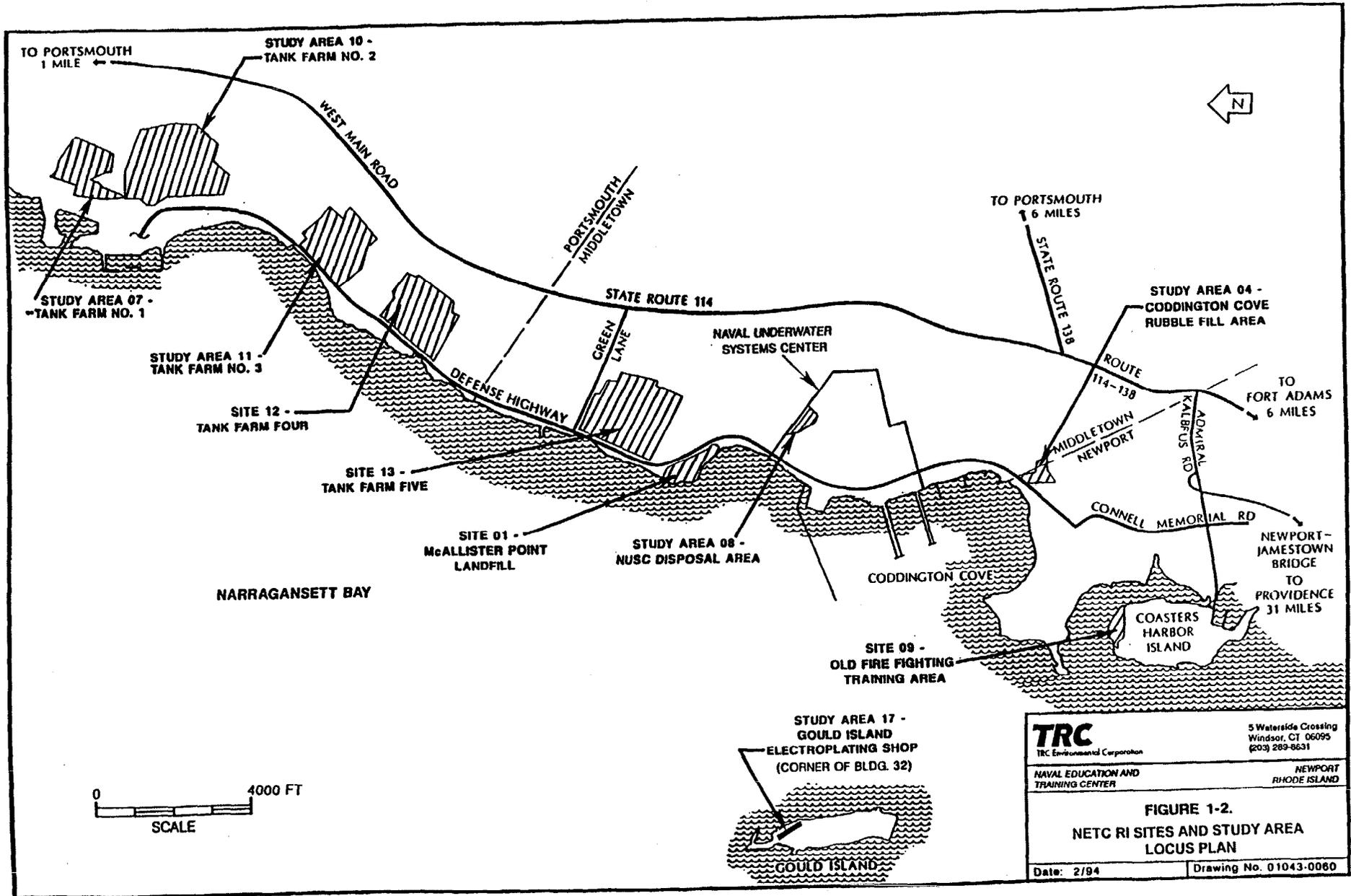
MIDDLETOWN

COASTERS HARBOR ISLAND

NEWPORT



SOURCE: INITIAL ASSESSMENT STUDY (ENVIRODYNE, 1983)



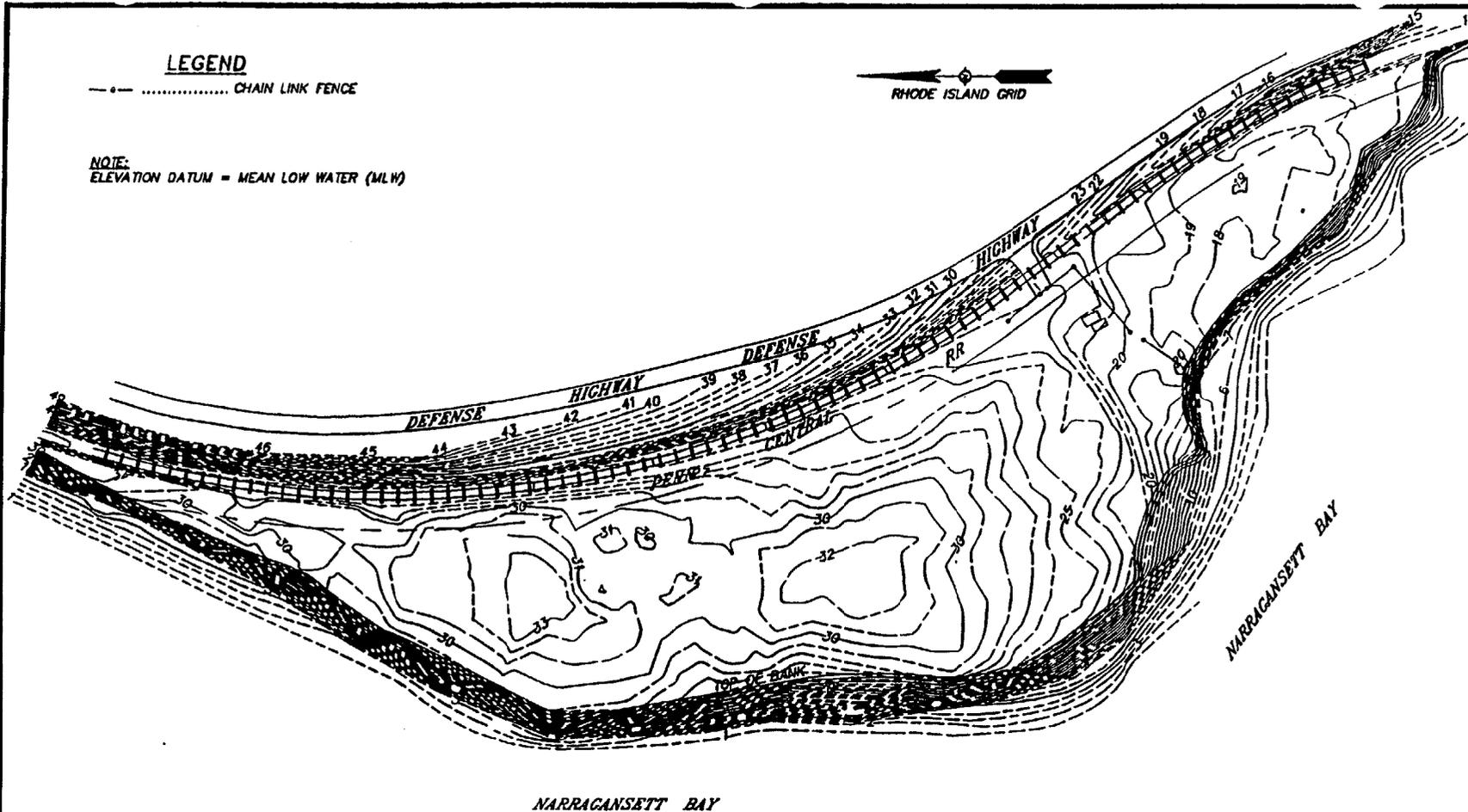
TRC TRC Environmental Corporation 5 Waterlids Crossing Windsor, CT 06095 (203) 289-8631	NEWPORT RHODE ISLAND
	FIGURE 1-2. NETC RI SITES AND STUDY AREA LOCUS PLAN
Date: 2/84	Drawing No. 01043-0080

LEGEND

--- CHAIN LINK FENCE



NOTE:
ELEVATION DATUM = MEAN LOW WATER (MLW)



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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NEWPORT
RHODE ISLAND

SITE 01 - McALLISTER POINT LANDFILL

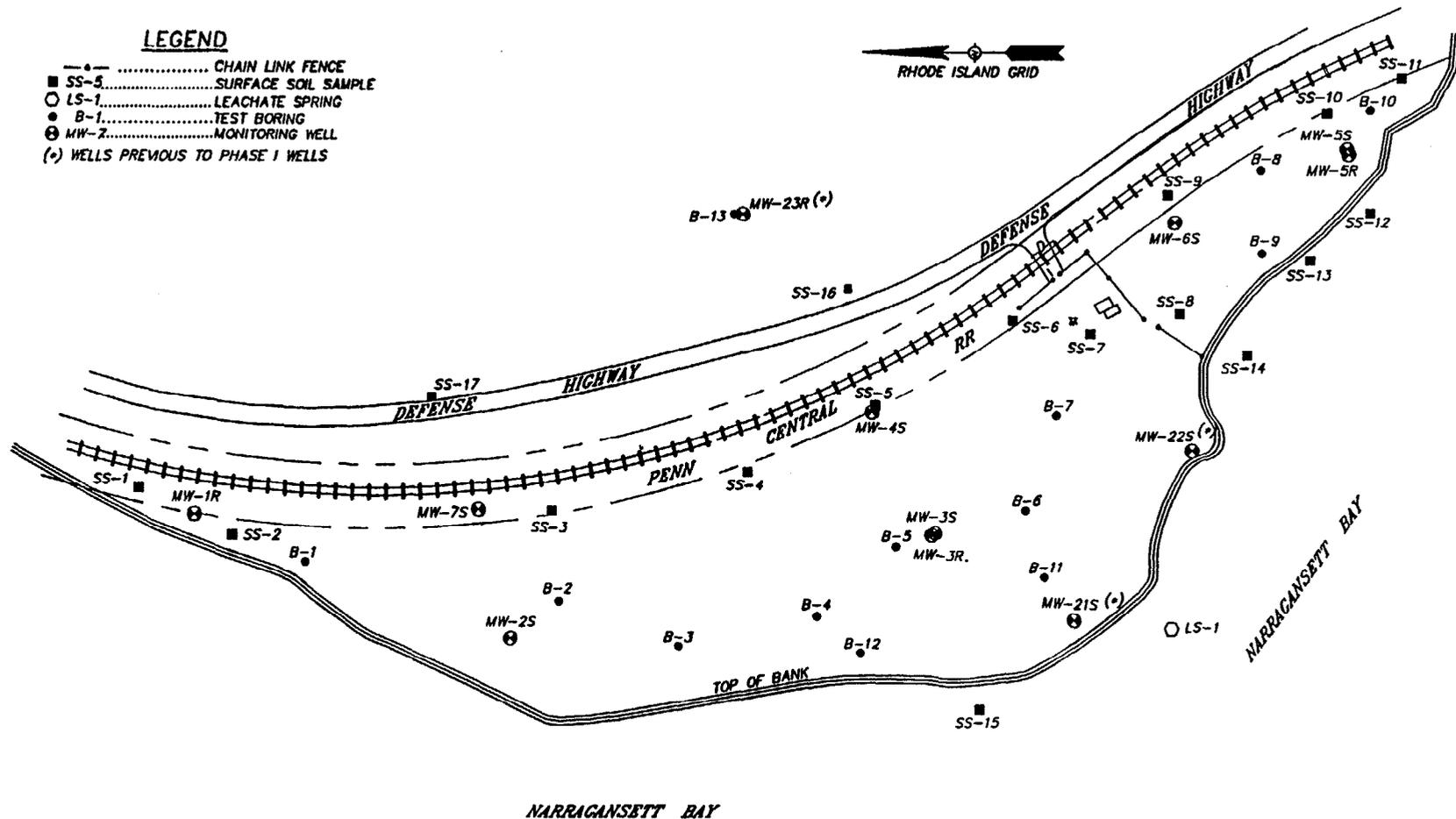
FIGURE 1-4
TOPOGRAPHIC SITE MAP

Date: 6/94

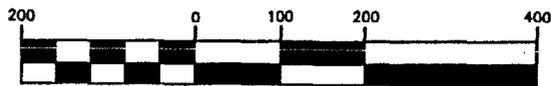
Drawing No. 01043-0060-0040

LEGEND

- CHAIN LINK FENCE
- SS-5.....SURFACE SOIL SAMPLE
- LS-1.....LEACHATE SPRING
- B-1.....TEST BORING
- ⊕ MW-7.....MONITORING WELL
- (*) WELLS PREVIOUS TO PHASE I WELLS



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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SITE 01 - McALLISTER POINT LANDFILL

FIGURE 1-5

PHASE I

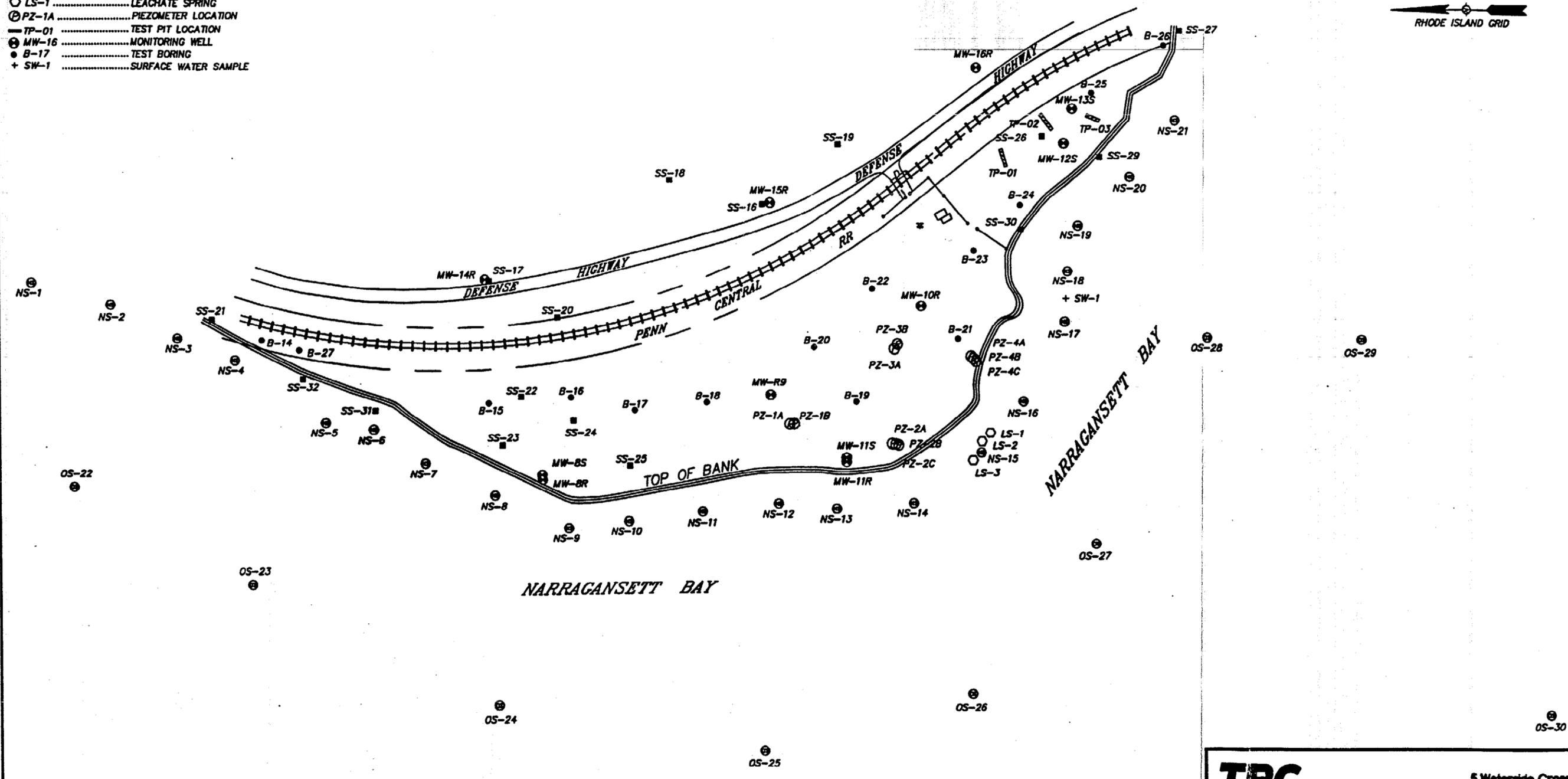
INVESTIGATION SUMMARY

Date: 6/94

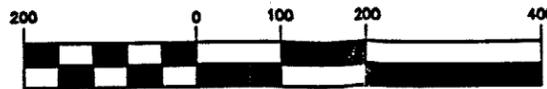
Drawing No. 01043-0060-0040

LEGEND

- CHAIN LINK FENCE
- ⊕ NS-1 NEAR SHORE SAMPLE
- ⊕ OS-1 OFF SHORE SAMPLE
- LS-1 LEACHATE SPRING
- ⊙ PZ-1A PIEZOMETER LOCATION
- TP-01 TEST PIT LOCATION
- ⊕ MW-16 MONITORING WELL
- B-17 TEST BORING
- + SW-1 SURFACE WATER SAMPLE



GRAPHIC SCALE



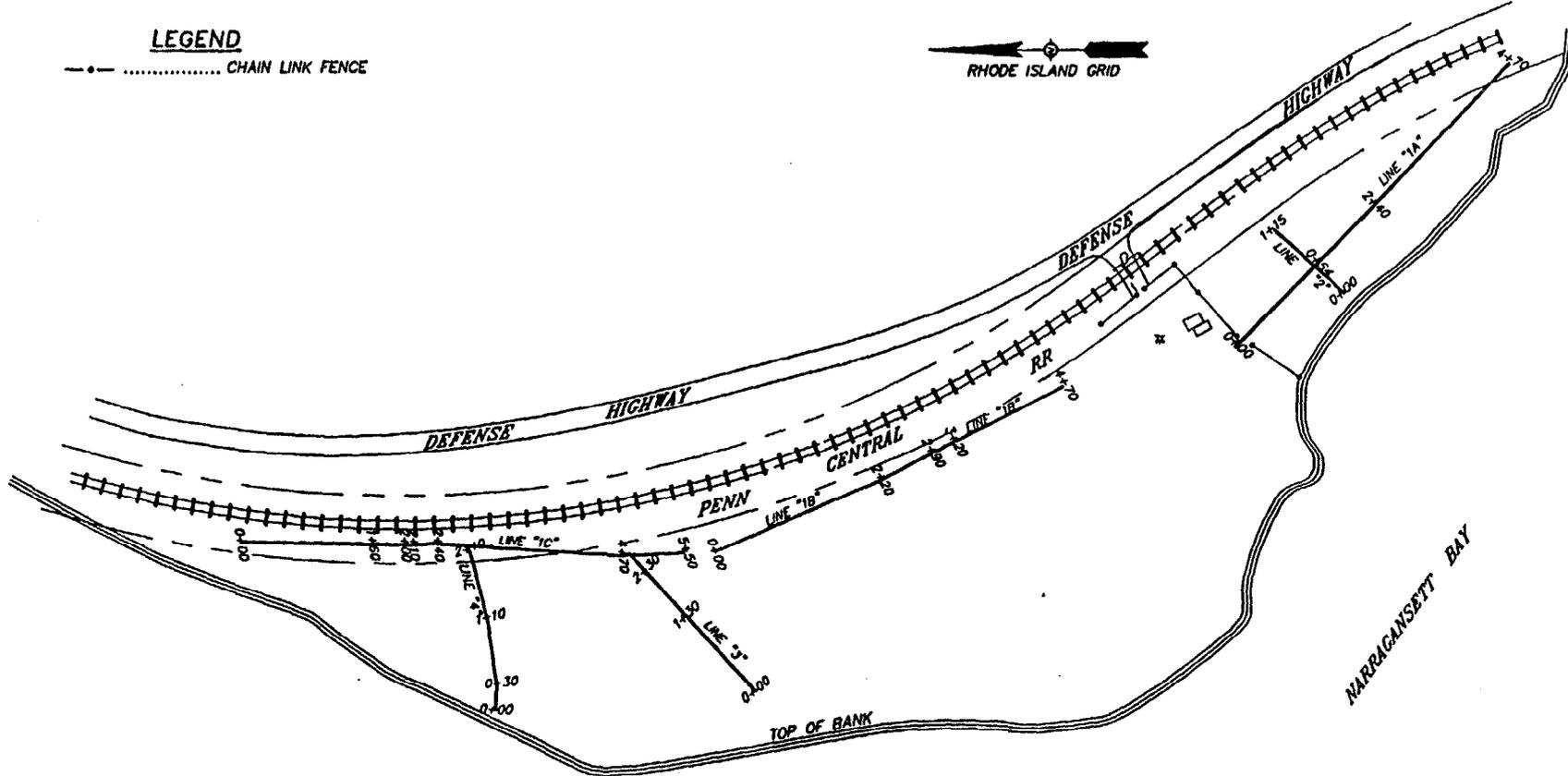
(IN FEET)
1 inch = 200 ft.

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<p>NAVAL EDUCATION AND TRAINING CENTER</p>	<p>NEWPORT RHODE ISLAND</p>
<p>SITE 01 - McALLISTER POINT LANDFILL</p>	
<p>FIGURE 2-1 PHASE II INVESTIGATION SUMMARY</p>	
<p>Date: 6/94</p>	<p>Drawing No. 01043-0060-0040</p>

00088K01Z

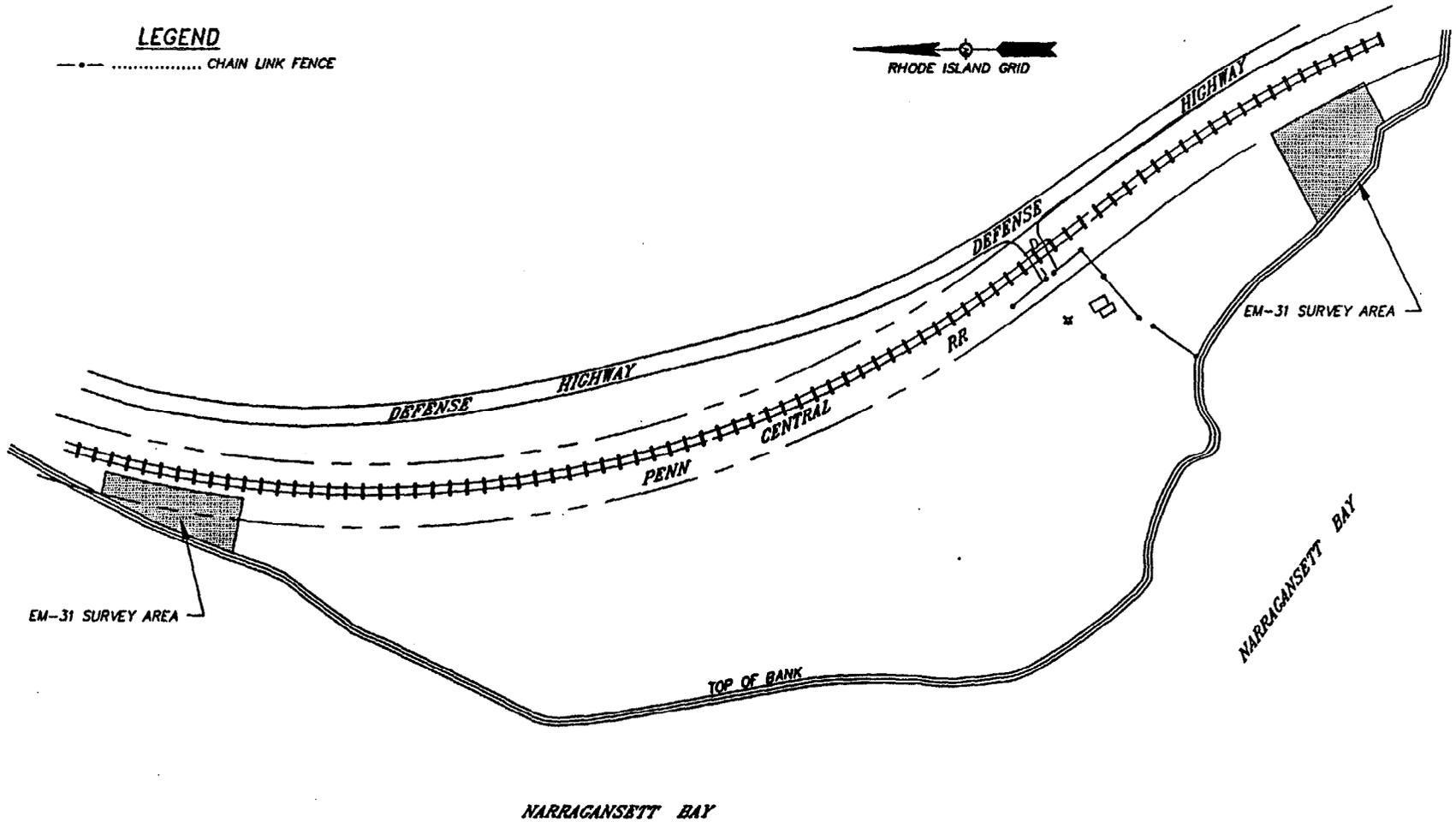
LEGEND

—•—•— CHAIN LINK FENCE



LEGEND

--- CHAIN LINK FENCE



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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SITE 01 - McALLISTER POINT LANDFILL

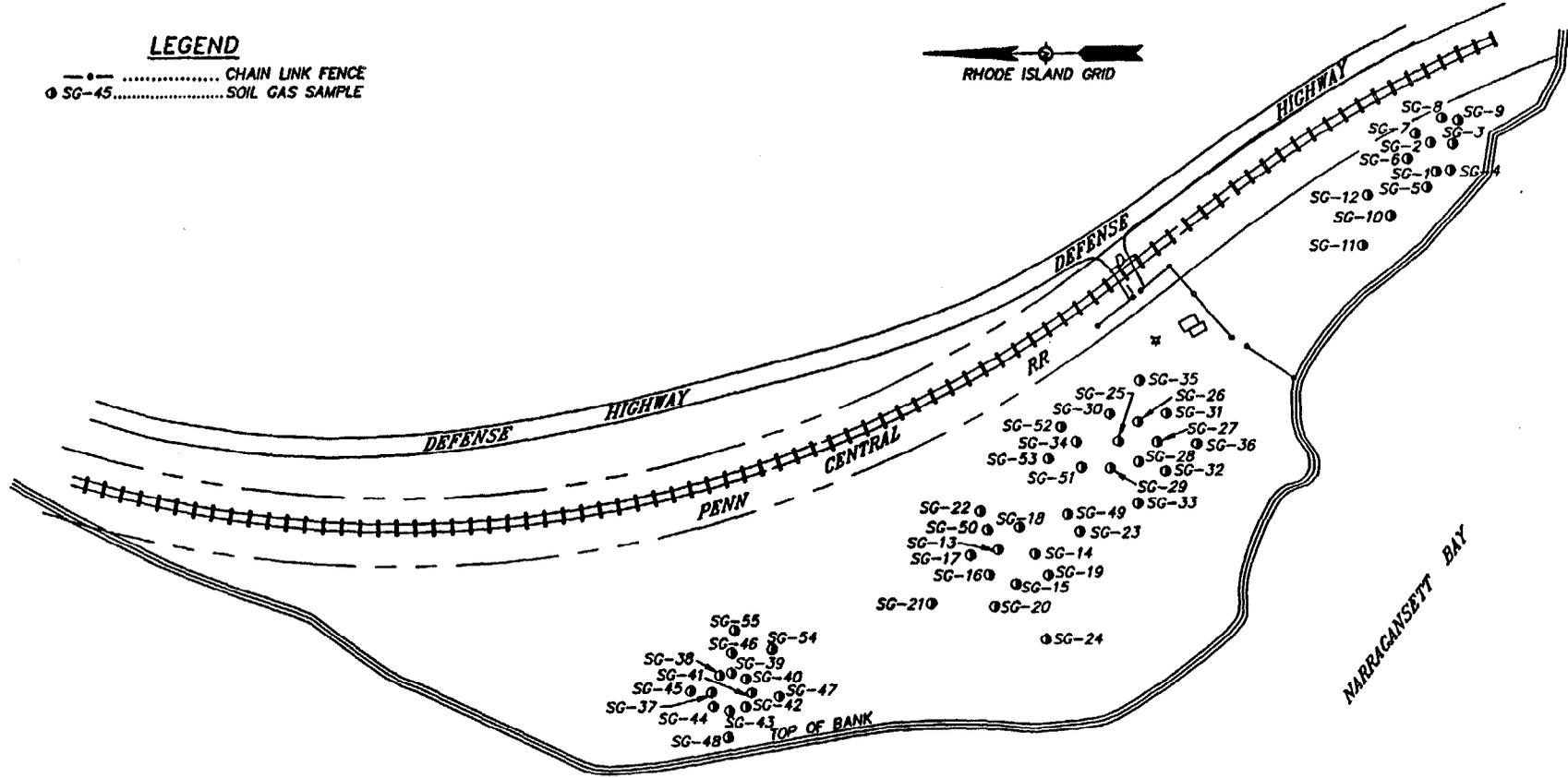
**FIGURE 2-3
EM-31 SURVEY AREA MAP**

Date: 2/94

Drawing No. 01043-0060-0040

LEGEND

- CHAIN LINK FENCE
- SG-45..... SOIL GAS SAMPLE



GRAPHIC SCALE



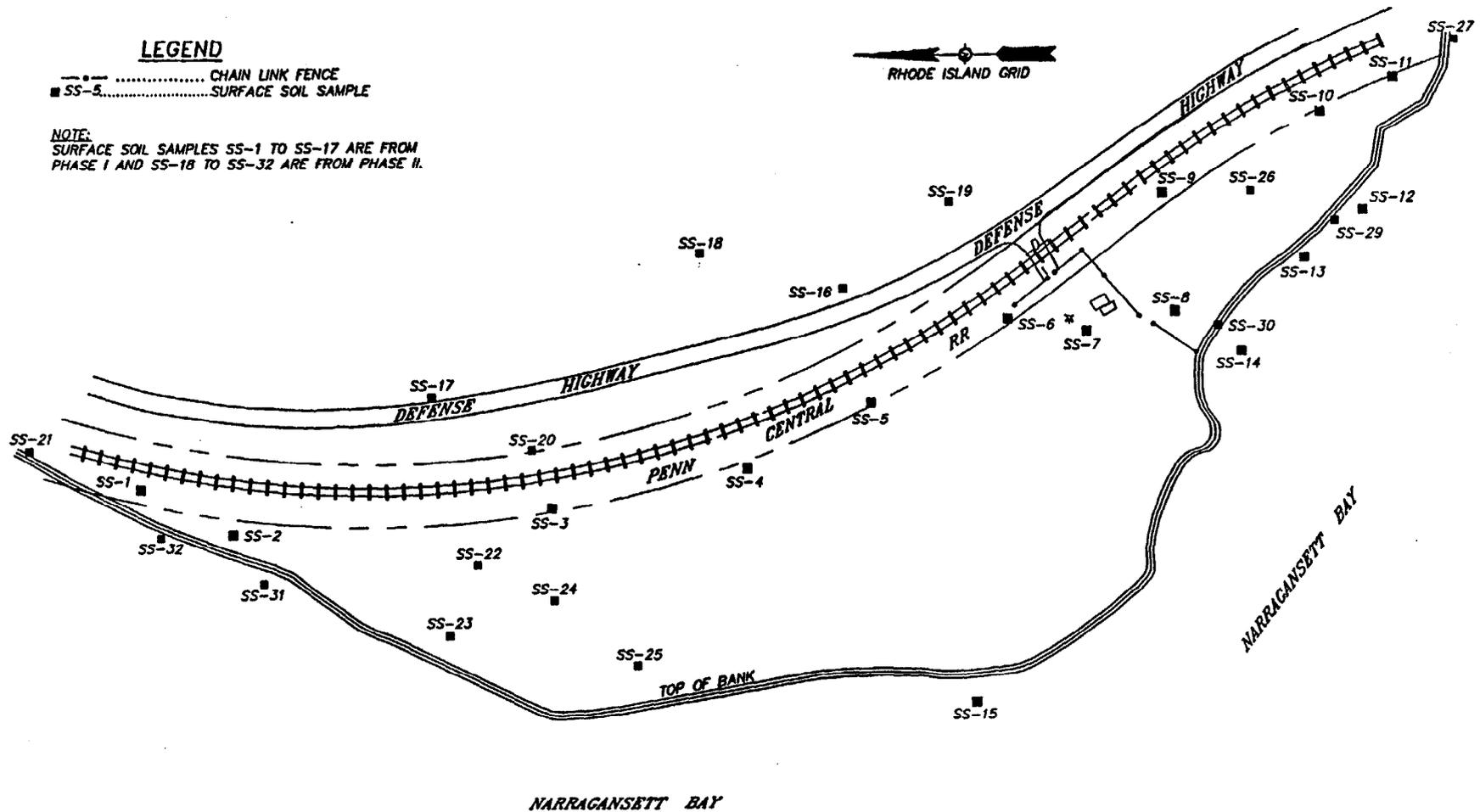
(IN FEET)
1 inch = 200 ft.

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SITE 01 - McALLISTER POINT LANDFILL	
FIGURE 2-4 PHASE II SOIL GAS SAMPLE LOCATIONS	
Date: 2/94	Drawing No. 01043-0060-0040

LEGEND

- CHAIN LINK FENCE
- SS-5..... SURFACE SOIL SAMPLE

NOTE:
SURFACE SOIL SAMPLES SS-1 TO SS-17 ARE FROM
PHASE I AND SS-18 TO SS-32 ARE FROM PHASE II.



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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SITE 01 - McALLISTER POINT LANDFILL

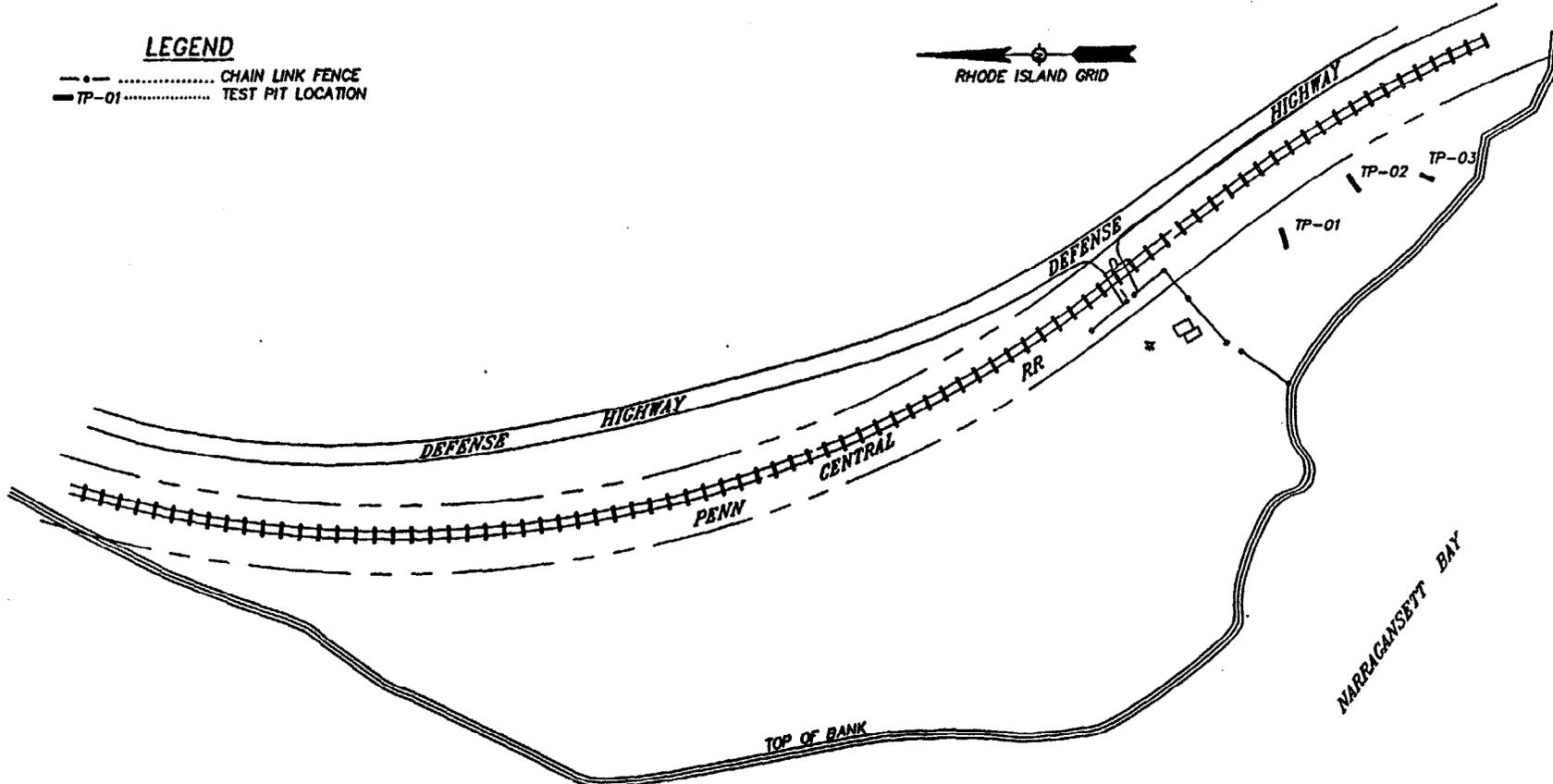
FIGURE 2-5
PHASE I AND II
SURFACE SOIL SAMPLE LOCATIONS

Date: 2/94

Drawing No. 01043-0060-0040

LEGEND

- - - - - CHAIN LINK FENCE
- TP-01 — TEST PIT LOCATION



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

NARRAGANSETT BAY

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SITE 01 - McALLISTER POINT LANDFILL

FIGURE 2-6
PHASE II
TEST PIT LOCATIONS

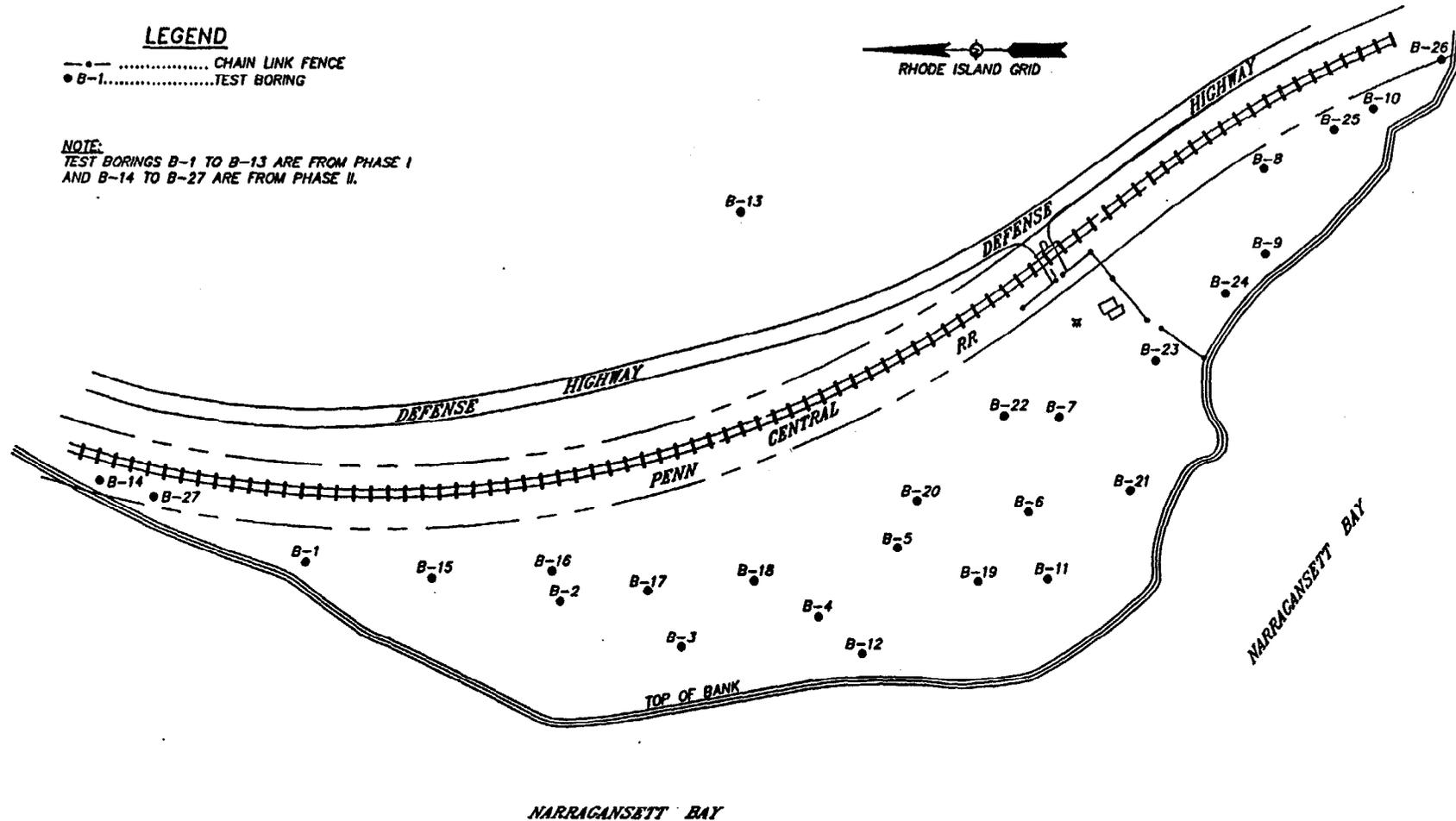
Date: 2/94

Drawing No. 01043-0060-0040

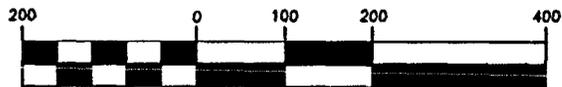
LEGEND

- CHAIN LINK FENCE
- B-1.....TEST BORING

NOTE:
TEST BORINGS B-1 TO B-13 ARE FROM PHASE I
AND B-14 TO B-27 ARE FROM PHASE II.



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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SITE 01 - McALLISTER POINT LANDFILL

FIGURE 2-7
PHASE I AND II
TEST BORING LOCATIONS

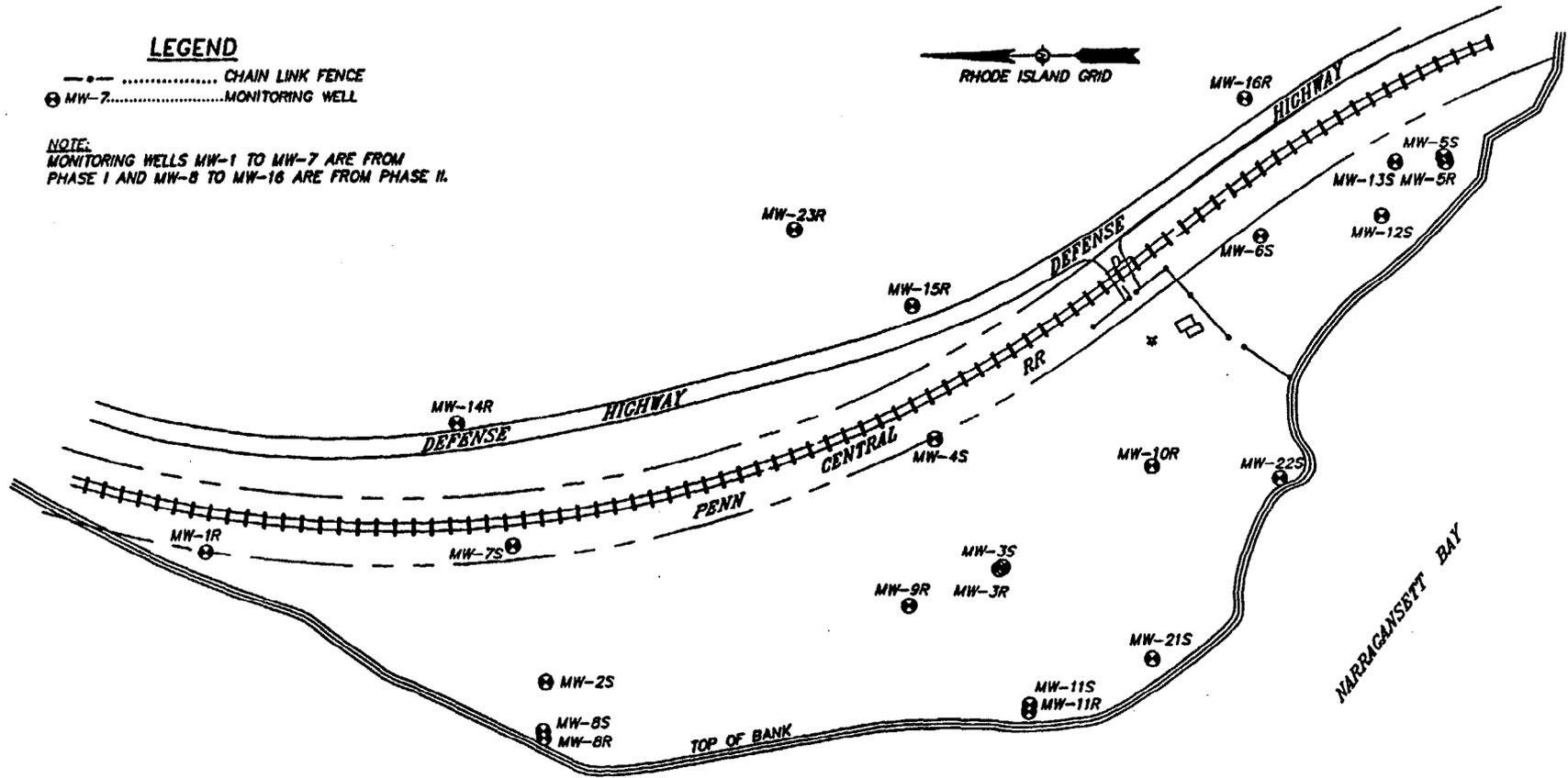
Date: 2/94

Drawing No. 01043-0060-0040

LEGEND

- - - - - CHAIN LINK FENCE
- ⊕ MW-7.....MONITORING WELL

NOTE:
MONITORING WELLS MW-1 TO MW-7 ARE FROM
PHASE I AND MW-8 TO MW-16 ARE FROM PHASE II.



GRAPHIC SCALE

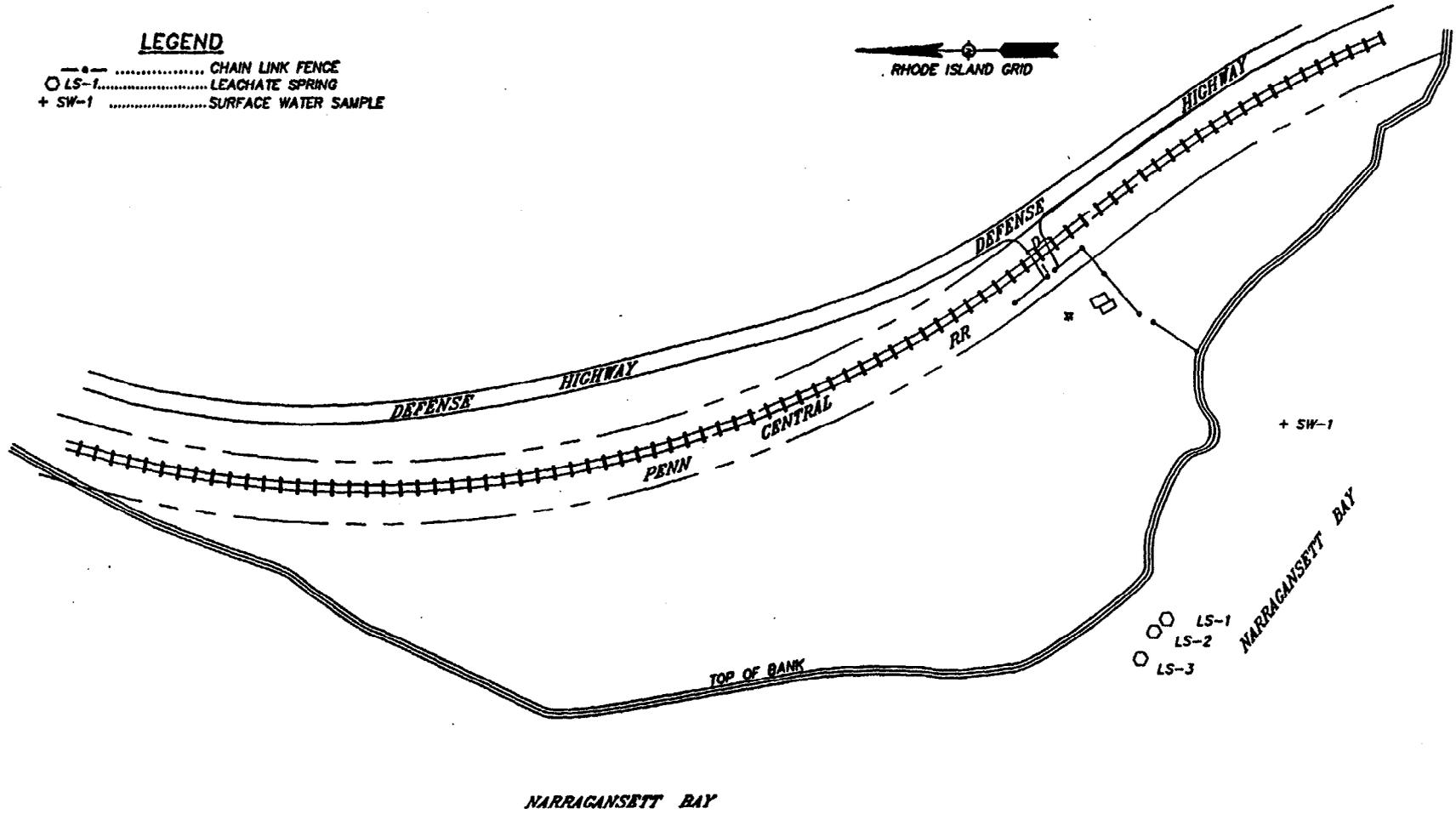


(IN FEET)
1/4 inch = 200 ft.

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	<p>NEWPORT RHODE ISLAND</p>
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<p>SITE 01 - McALLISTER POINT LANDFILL</p>	
<p>FIGURE 2-8 PHASE I AND II MONITORING WELL LOCATIONS</p>	
<p>Date: 6/94</p>	<p>Drawing No. 01043-0060-0040</p>

LEGEND

- CHAIN LINK FENCE
- LS-1..... LEACHATE SPRING
- + SW-1 SURFACE WATER SAMPLE



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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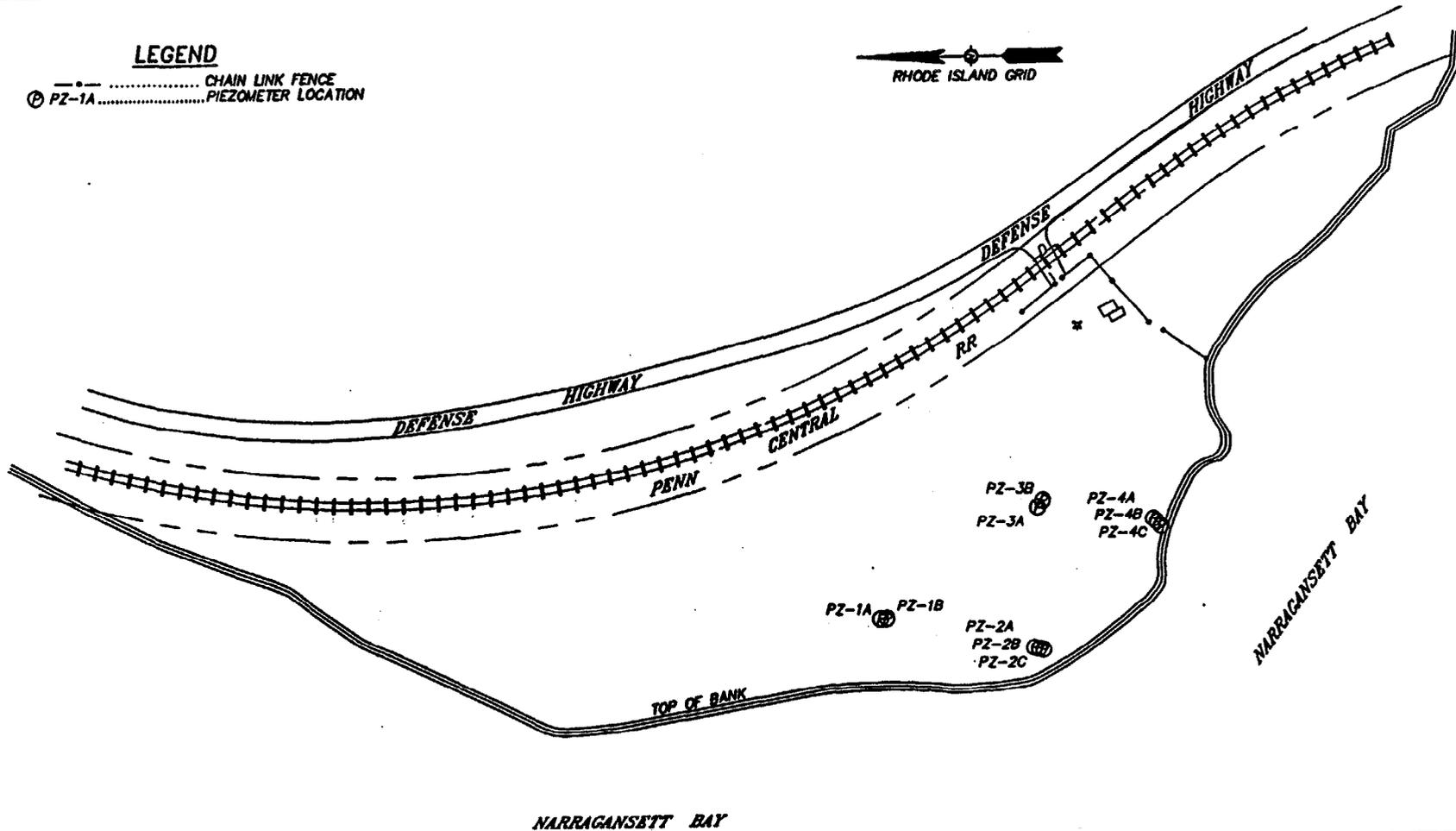
SITE 01 - McALLISTER POINT LANDFILL
FIGURE 2-9
PHASE II - LEACHATE AND
SURFACE WATER SAMPLE LOCATIONS

Date: 6/94

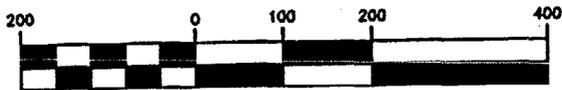
Drawing No. 01043-0060-0040

LEGEND

- CHAIN LINK FENCE
- ⊕ PZ-1A PIEZOMETER LOCATION



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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SITE 01 - McALLISTER POINT LANDFILL

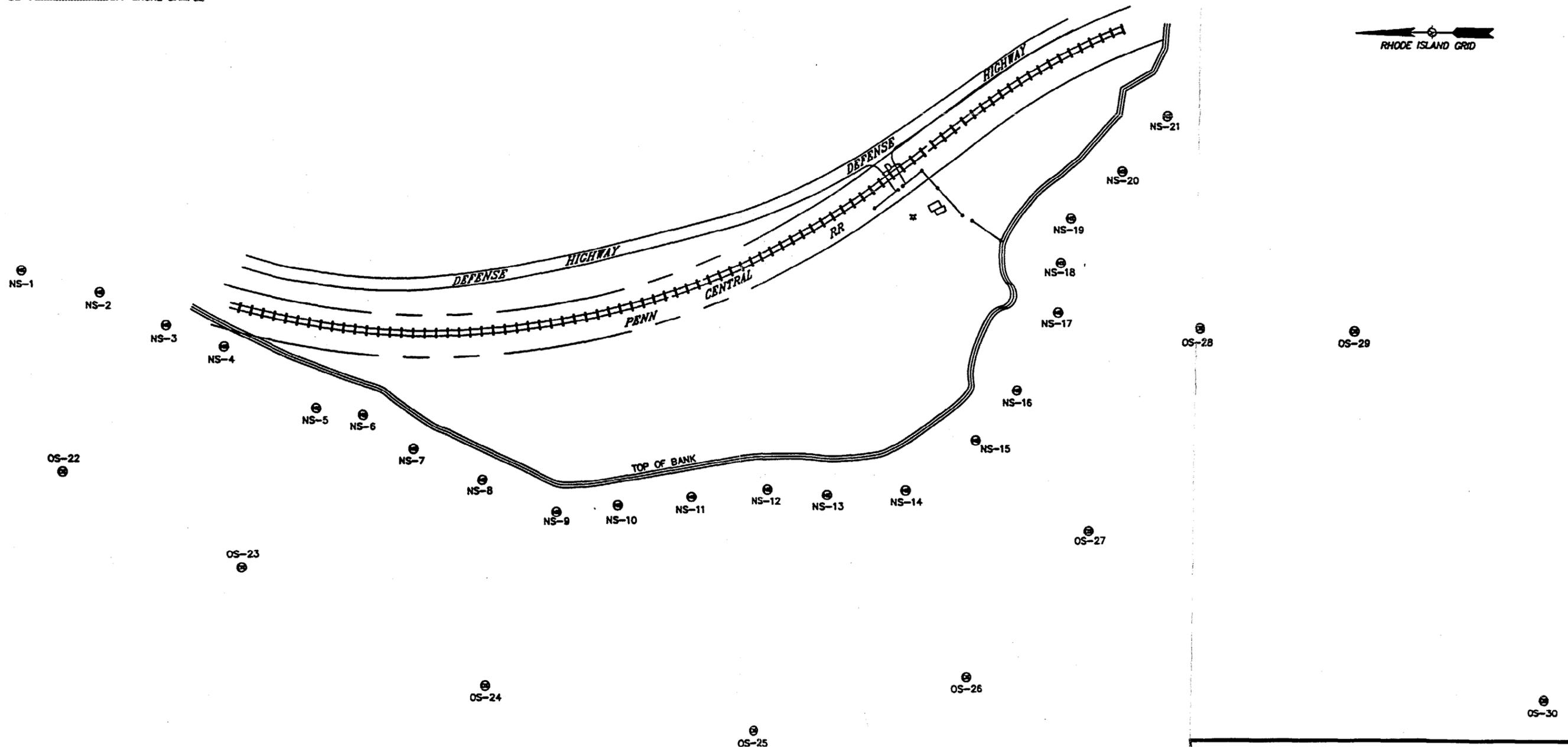
FIGURE 2-10
PHASE II
PIEZOMETER LOCATIONS

Date: 2/94

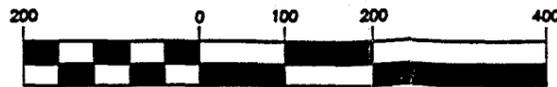
Drawing No. 01043-0060-0040

LEGEND

- CHAIN LINK FENCE
- ⊕ NS-1 NEAR SHORE SAMPLE
- ⊕ OS-1 OFF SHORE SAMPLE



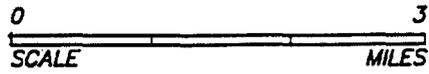
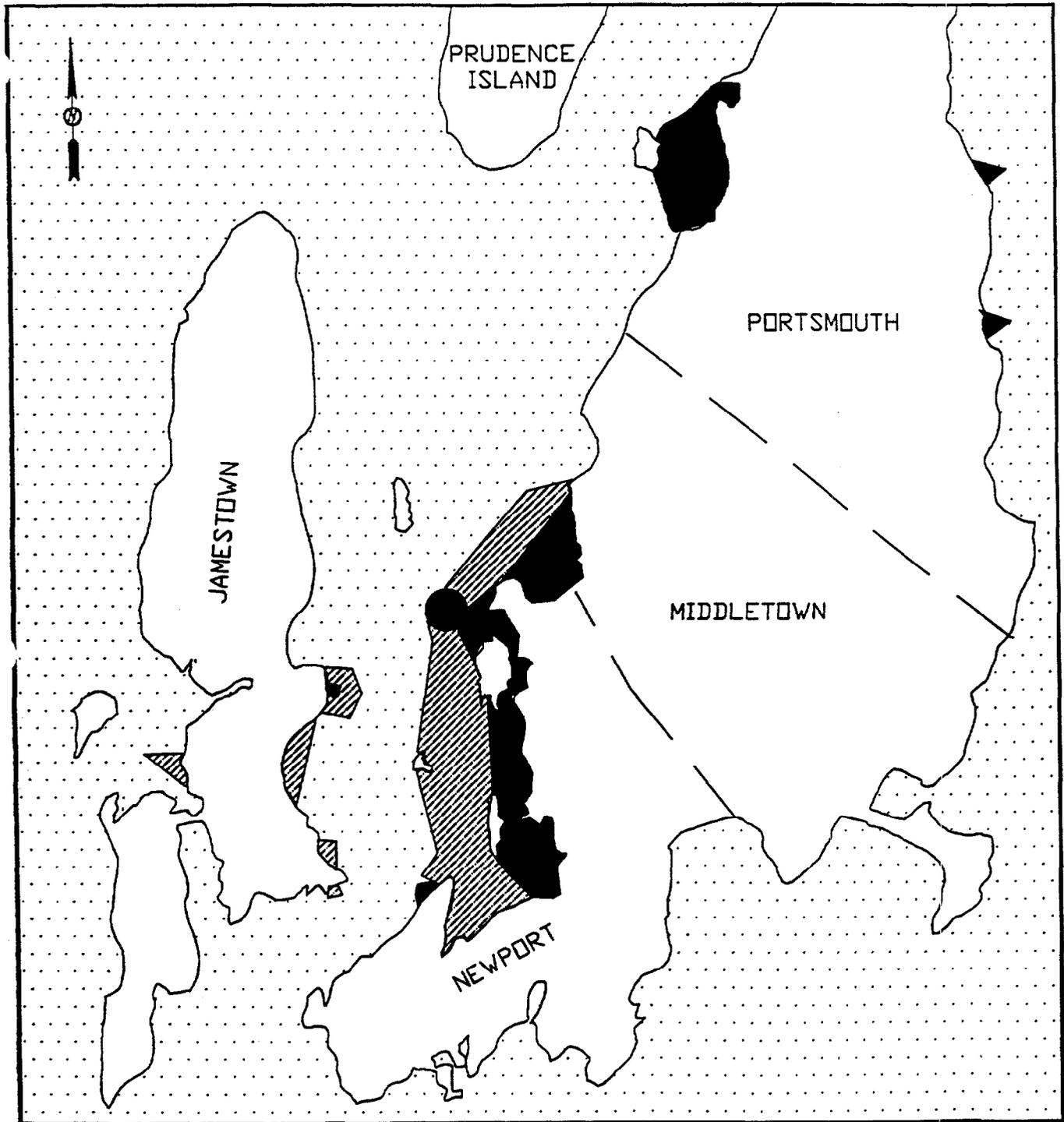
GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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<p>SITE 01 - McALLISTER POINT LANDFILL</p>	
<p>FIGURE 2-11 PHASE II</p>	
<p>NEAR SHORE/OFF SHORE SAMPLE LOCATIONS</p>	
<p>Date: 4/94</p>	<p>Drawing No. 01043-0060-0040</p>

00088K02Z



SALT WATER QUALITY CLASSES

- SA
 - SB
 - SC

Source: 1990 State of Rhode Island Water Quality Standard Map

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FIGURE 3-1
SURFACE WATER QUALITY MAP OF NARRAGANSETT BAY

Date: 6/94 | Drawing No. 01043-0060

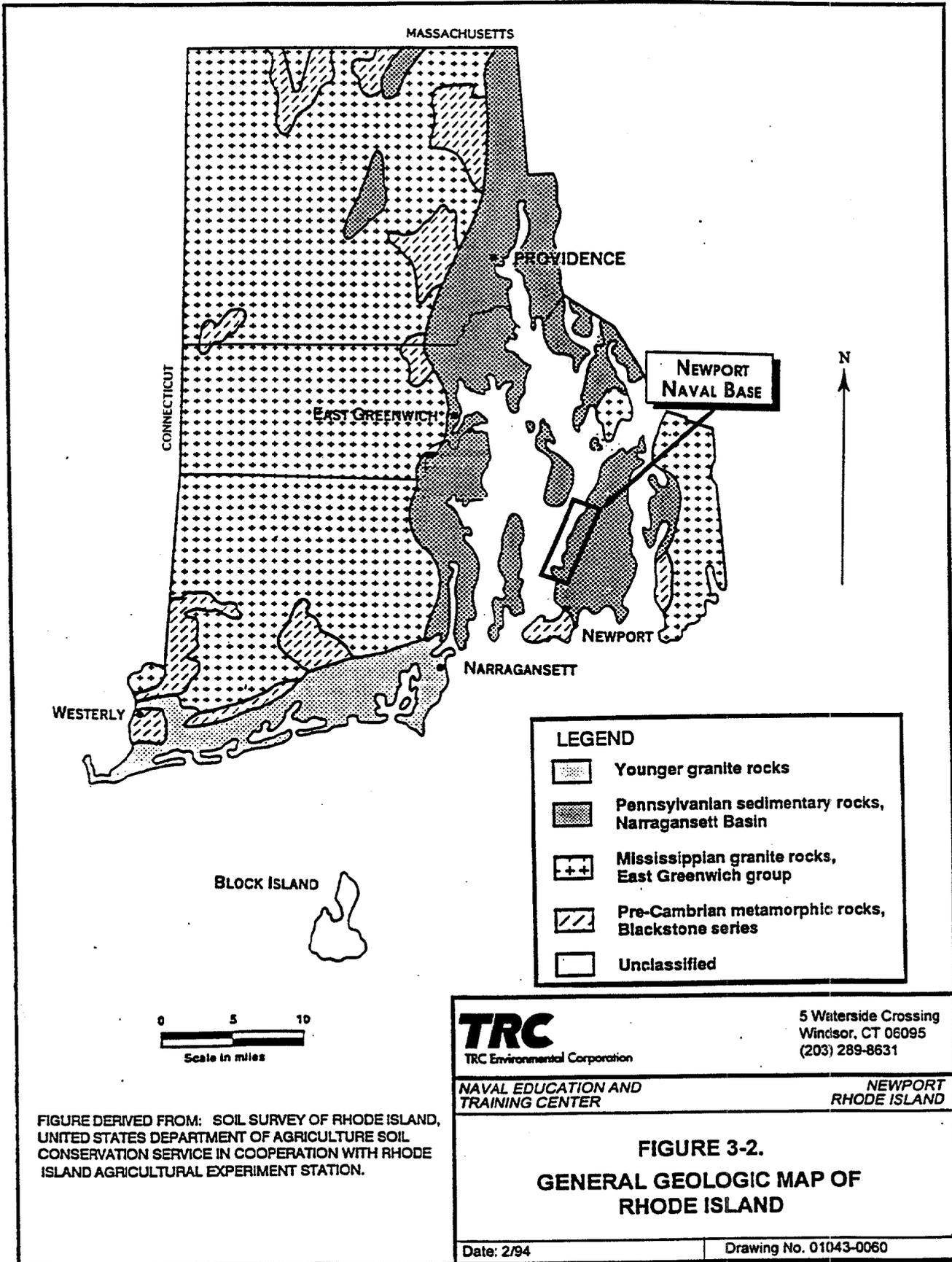


FIGURE DERIVED FROM: SOIL SURVEY OF RHODE ISLAND, UNITED STATES DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE IN COOPERATION WITH RHODE ISLAND AGRICULTURAL EXPERIMENT STATION.

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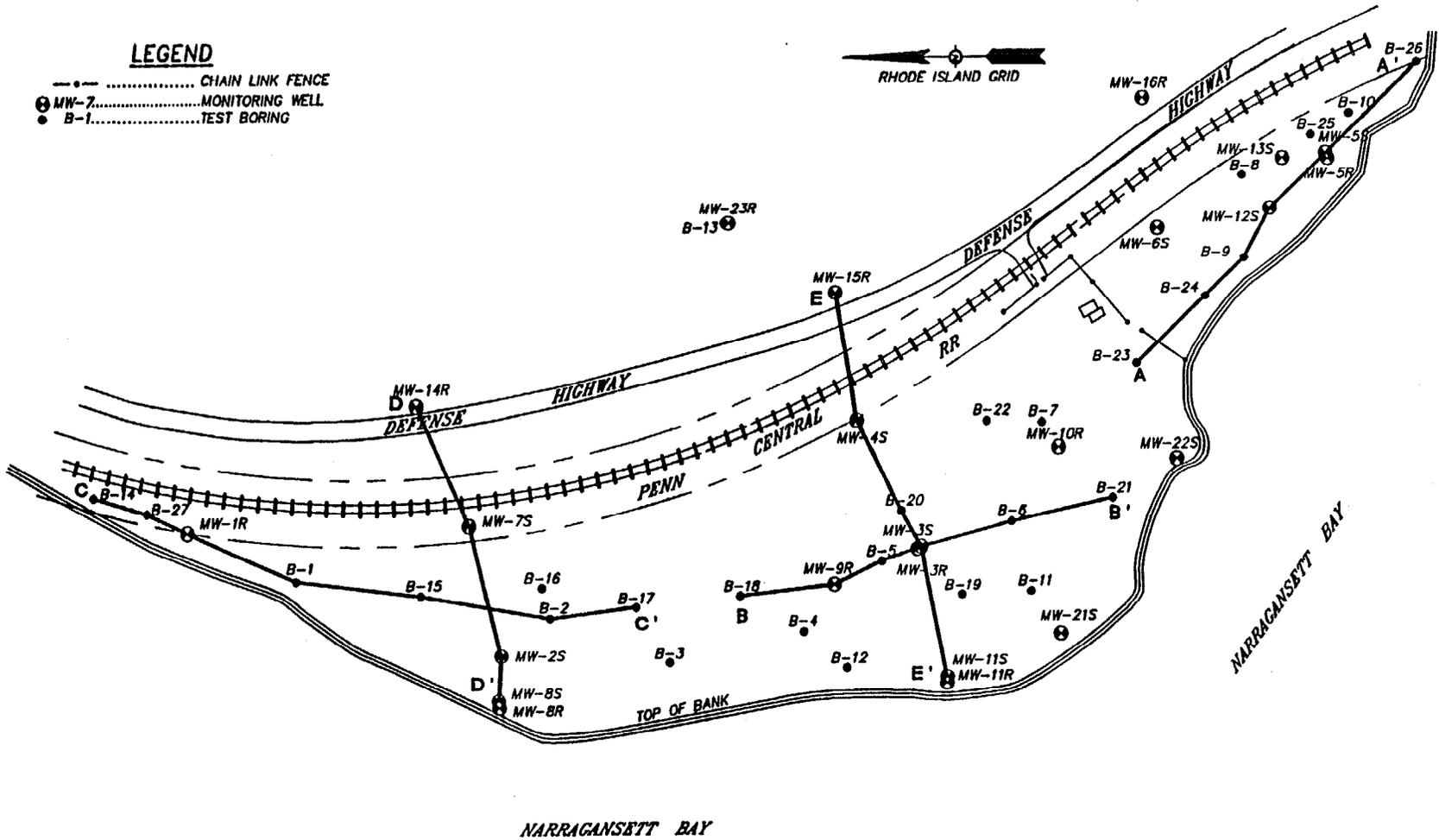
**FIGURE 3-2.
GENERAL GEOLOGIC MAP OF
RHODE ISLAND**

Date: 2/94

Drawing No. 01043-0060

LEGEND

- CHAIN LINK FENCE
- ⊕ MW-7.....MONITORING WELL
- B-1.....TEST BORING



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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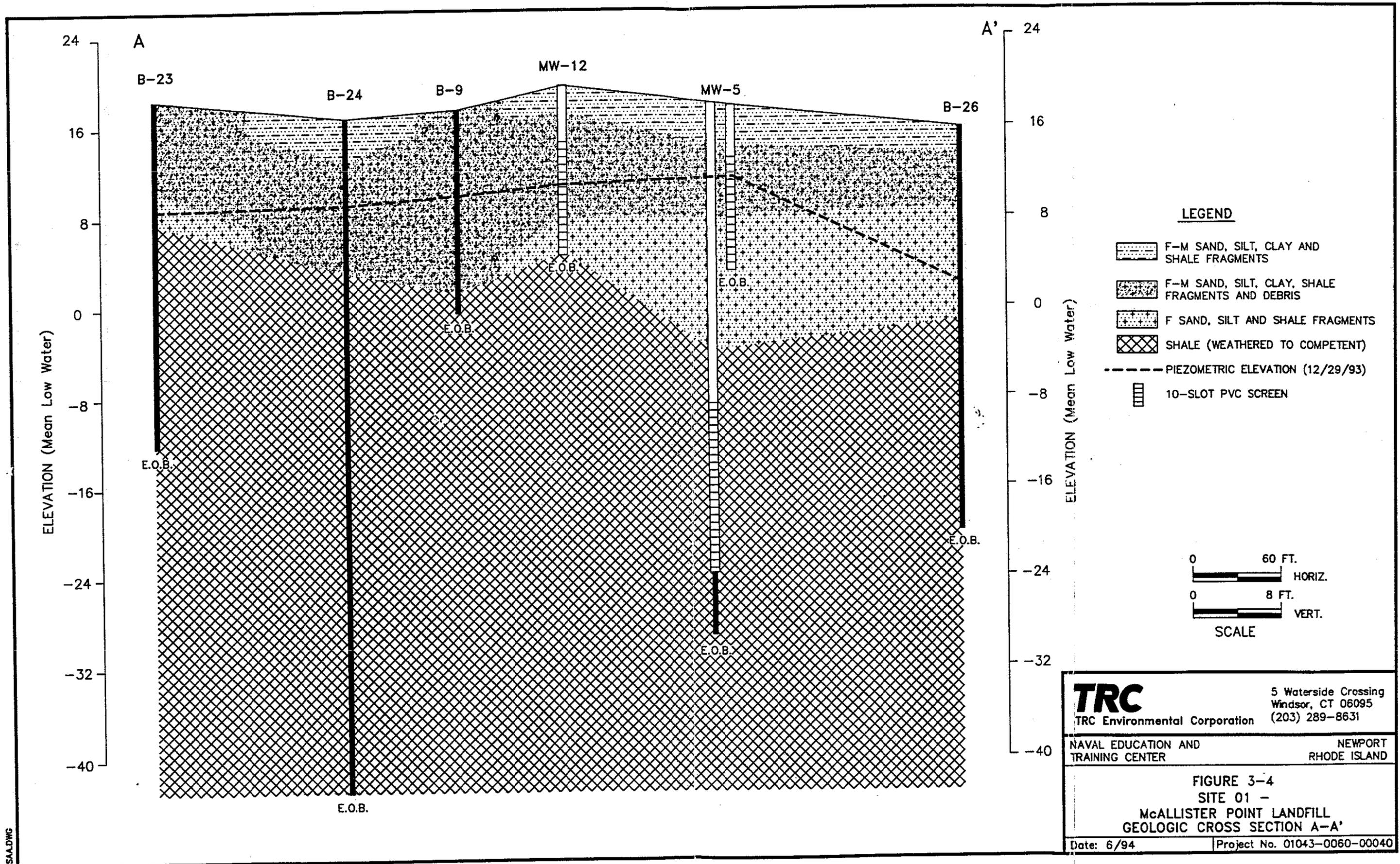
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SITE 01 - McALLISTER POINT LANDFILL

FIGURE 3-3
GEOLOGIC CROSS SECTION
LINE LOCATION MAP

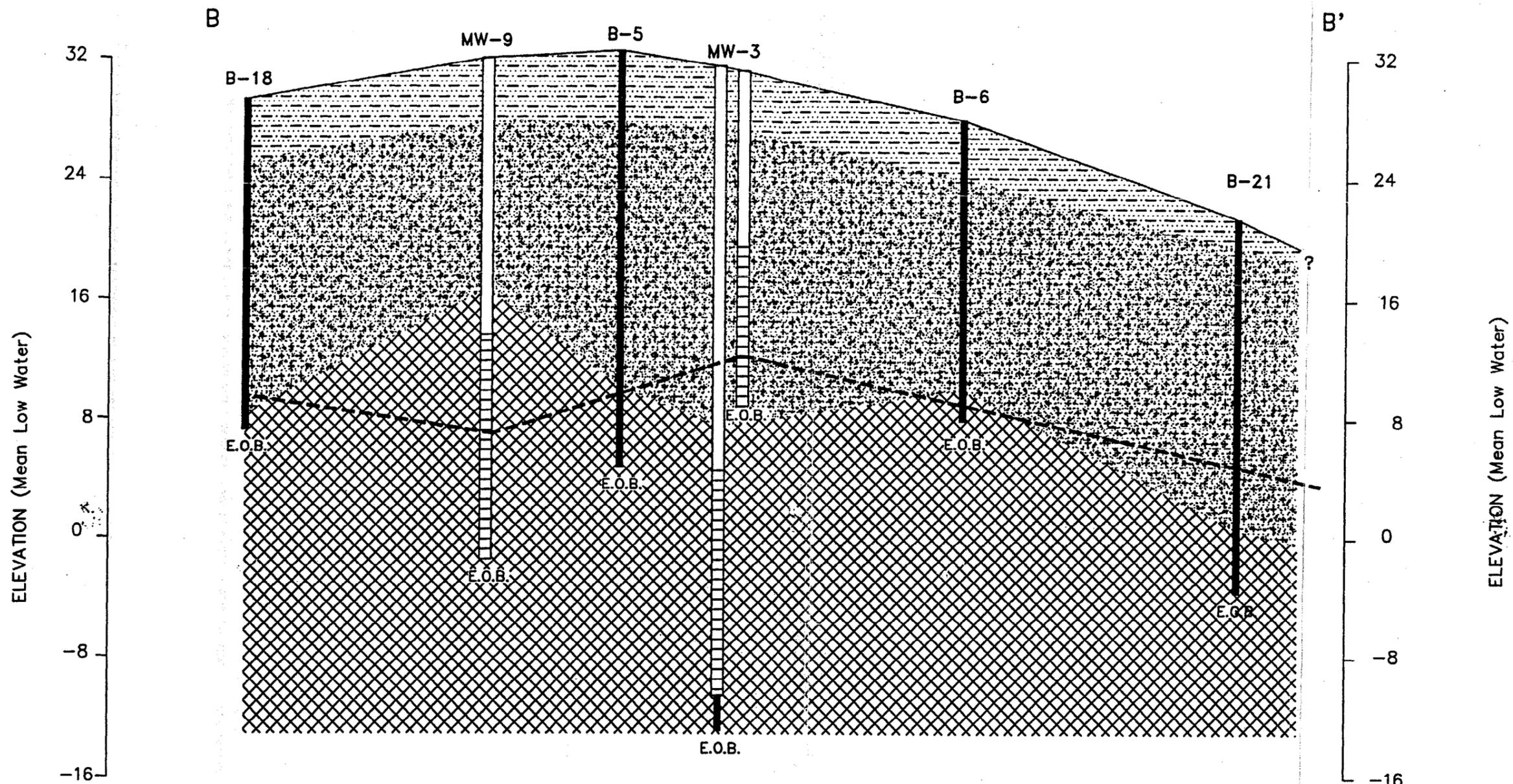
Date: 6/94

Drawing No. 01043-0060-0040



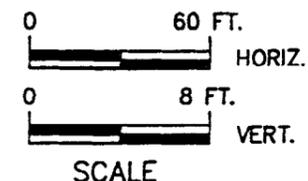
CSAA.DWG

00088KB32



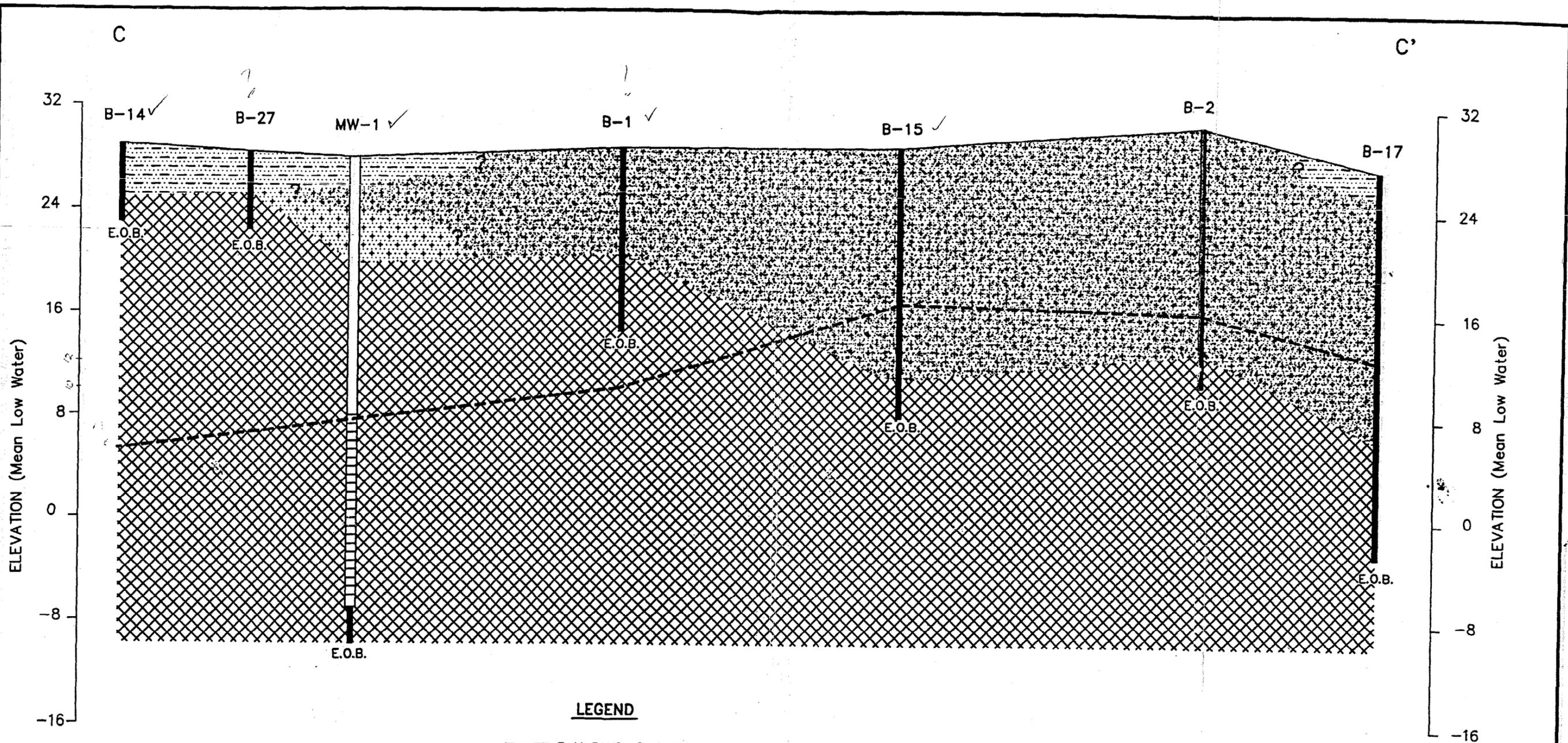
LEGEND

-  F-M SAND, SILT, CLAY AND SHALE FRAGMENTS
-  F-M SAND, SILT, CLAY, SHALE FRAGMENTS AND DEBRIS
-  F SAND, SILT AND SHALE FRAGMENTS
-  SHALE (WEATHERED TO COMPETENT)
- PIEZOMETRIC ELEVATION (12/29/93)
-  10-SLOT PVC SCREEN



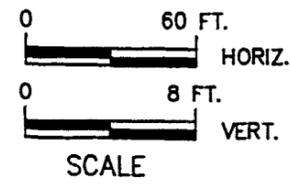
TRC	5 Waterside Crossing Windsor, CT 06095 (203) 289-8631
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FIGURE 3-5 SITE 01 - McALLISTER POINT LANDFILL GEOLOGIC CROSS SECTION B-B'	
Date: 6/94	Project No. 01043-0060-00040

CSBB.DWG



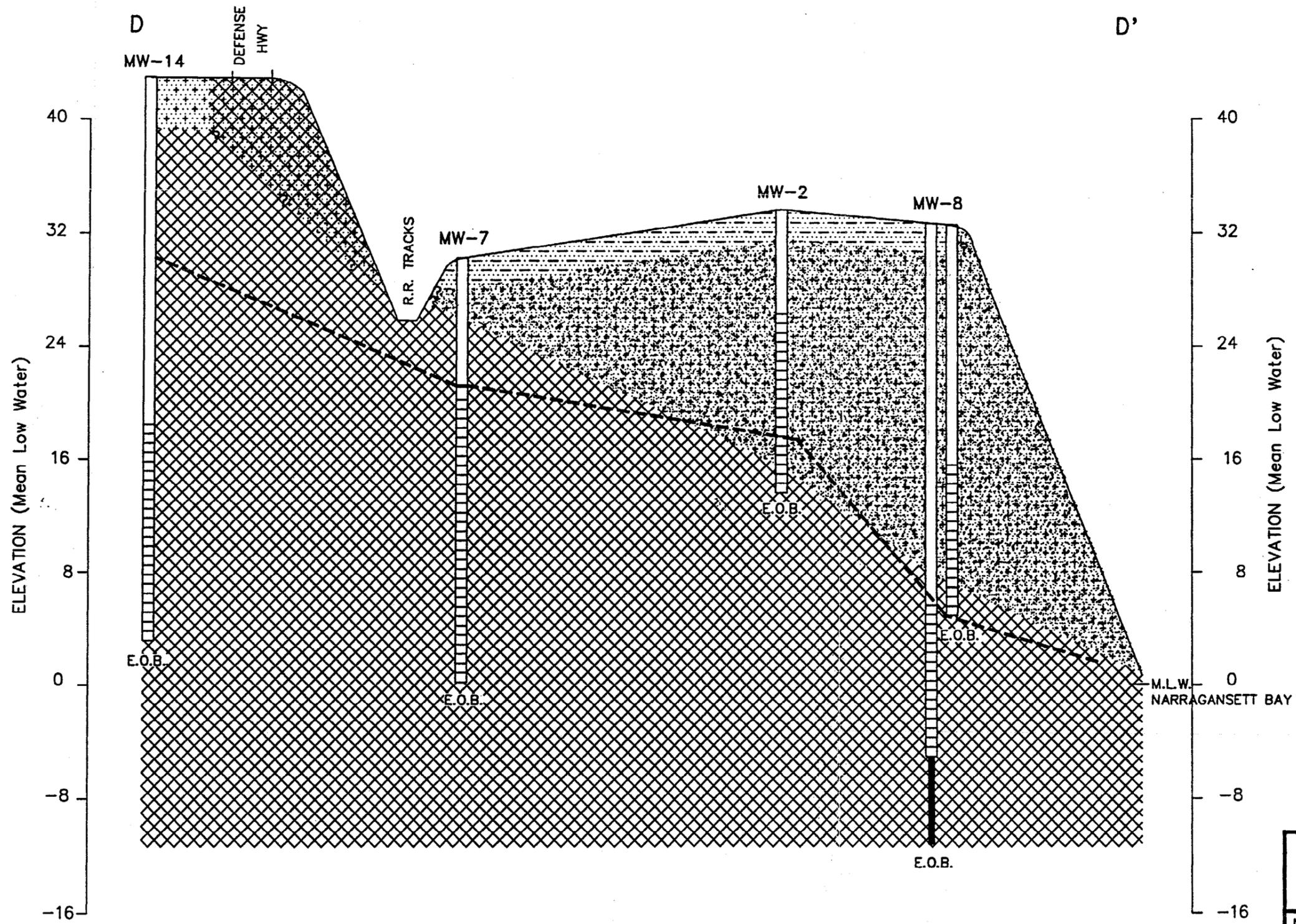
LEGEND

-  F-M SAND, SILT, CLAY AND SHALE FRAGMENTS
-  F-M SAND, SILT, CLAY, SHALE FRAGMENTS AND DEBRIS
-  F SAND, SILT AND SHALE FRAGMENTS
-  SHALE (WEATHERED TO COMPETENT)
-  PIEZOMETRIC ELEVATION (12/29/93)
-  10-SLOT PVC SCREEN



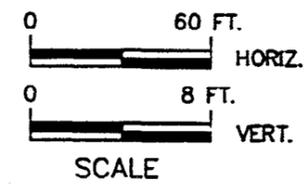
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FIGURE 3-6 SITE 01 - McALLISTER POINT LANDFILL GEOLOGIC CROSS SECTION C-C'	
Date: 6/94	Project No. 01043-0060-00040

CSCC.DWG



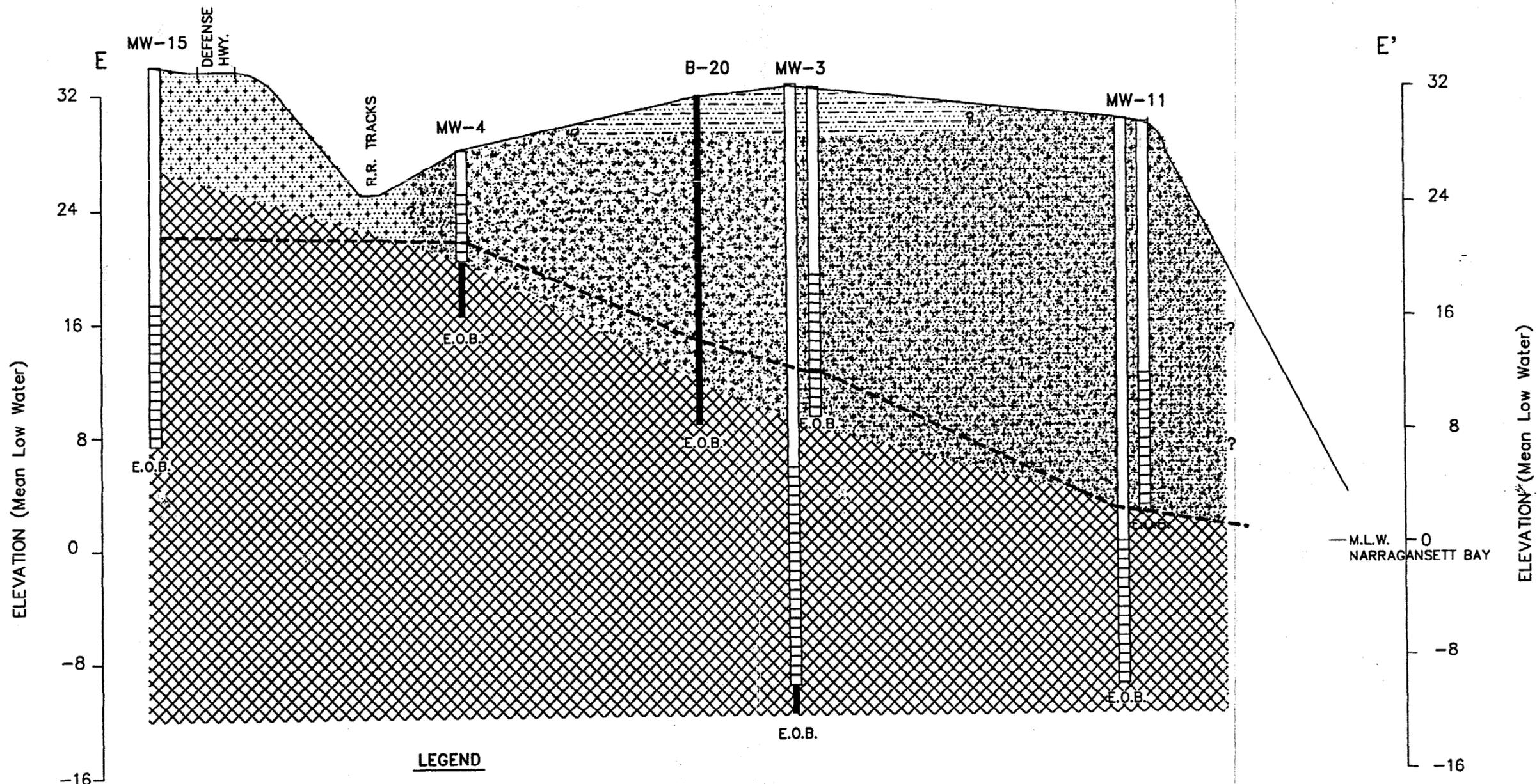
LEGEND

-  F-M SAND, SILT, CLAY AND SHALE FRAGMENTS
-  F-M SAND, SILT, CLAY, SHALE FRAGMENTS AND DEBRIS
-  F SAND, SILT AND SHALE FRAGMENTS
-  SHALE (WEATHERED TO COMPETENT)
-  PIEZOMETRIC ELEVATION (12/29/93)
-  10-SLOT PVC SCREEN

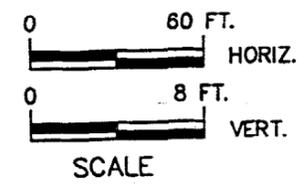


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FIGURE 3-7 SITE 01 - McALLISTER POINT LANDFILL GEOLOGIC CROSS SECTION D-D'	
Date: 6/94	Project No. 01043-0060-00040

CSDD.DWG



- LEGEND**
-  F-M SAND, SILT, CLAY AND SHALE FRAGMENTS
 -  F-M SAND, SILT, CLAY, SHALE FRAGMENTS AND DEBRIS
 -  F SAND, SILT AND SHALE FRAGMENTS
 -  SHALE (WEATHERED TO COMPETENT)
 -  --- PIEZOMETRIC ELEVATION (12/29/93)
 -  10-SLOT PVC SCREEN



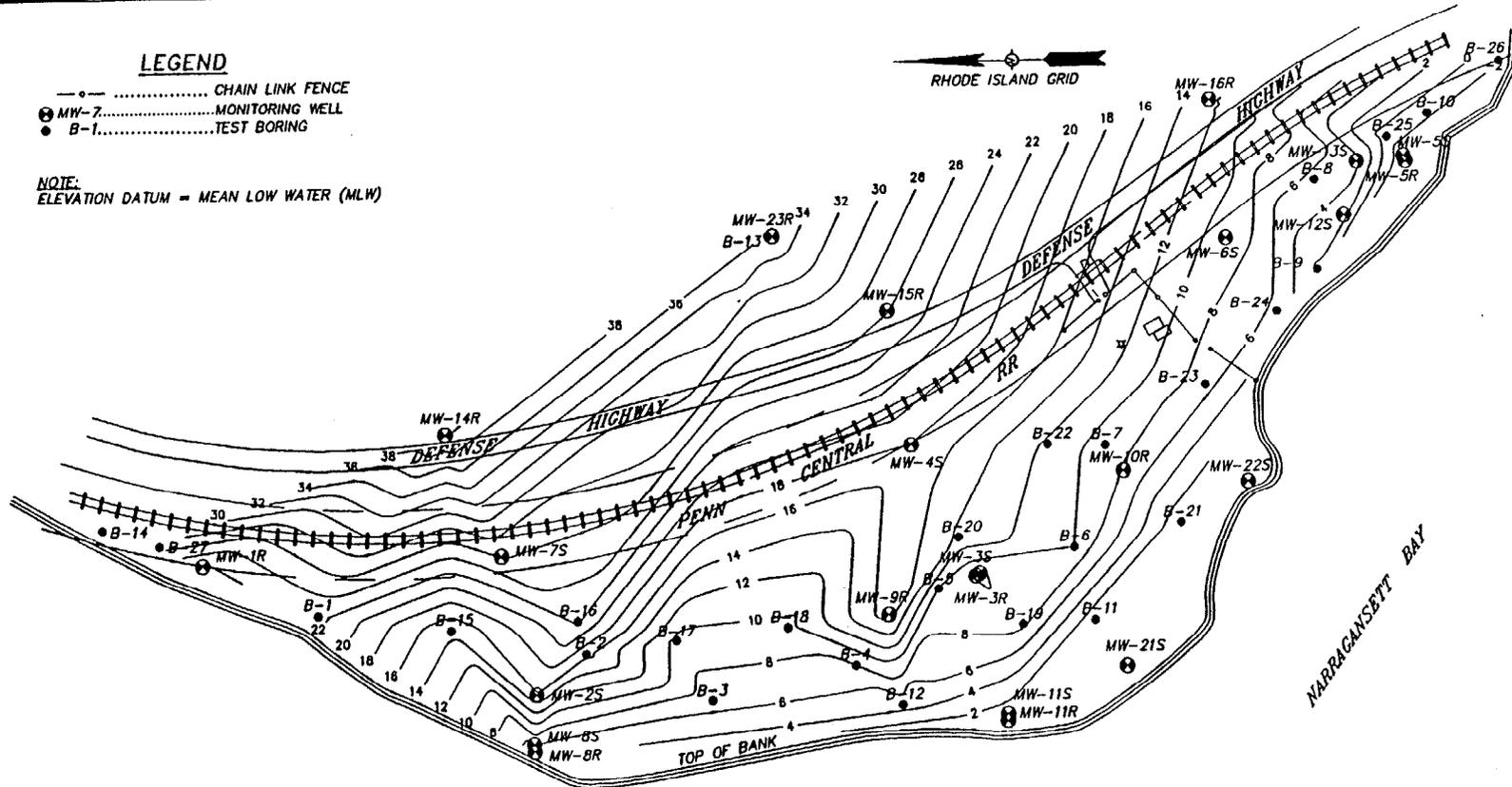
TRC TRC Environmental Corporation	5 Waterside Crossing Windsor, CT 06095 (203) 289-8631
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FIGURE 3-8 SITE 01 - McALLISTER POINT LANDFILL GEOLOGIC CROSS SECTION E-E'	
Date: 6/94	Project No. 01043-0050-00040

CSEED.WG

LEGEND

- CHAIN LINK FENCE
- ⊕ MW-7 MONITORING WELL
- B-1 TEST BORING

NOTE:
ELEVATION DATUM = MEAN LOW WATER (MLW)



NARRAGANSETT BAY

GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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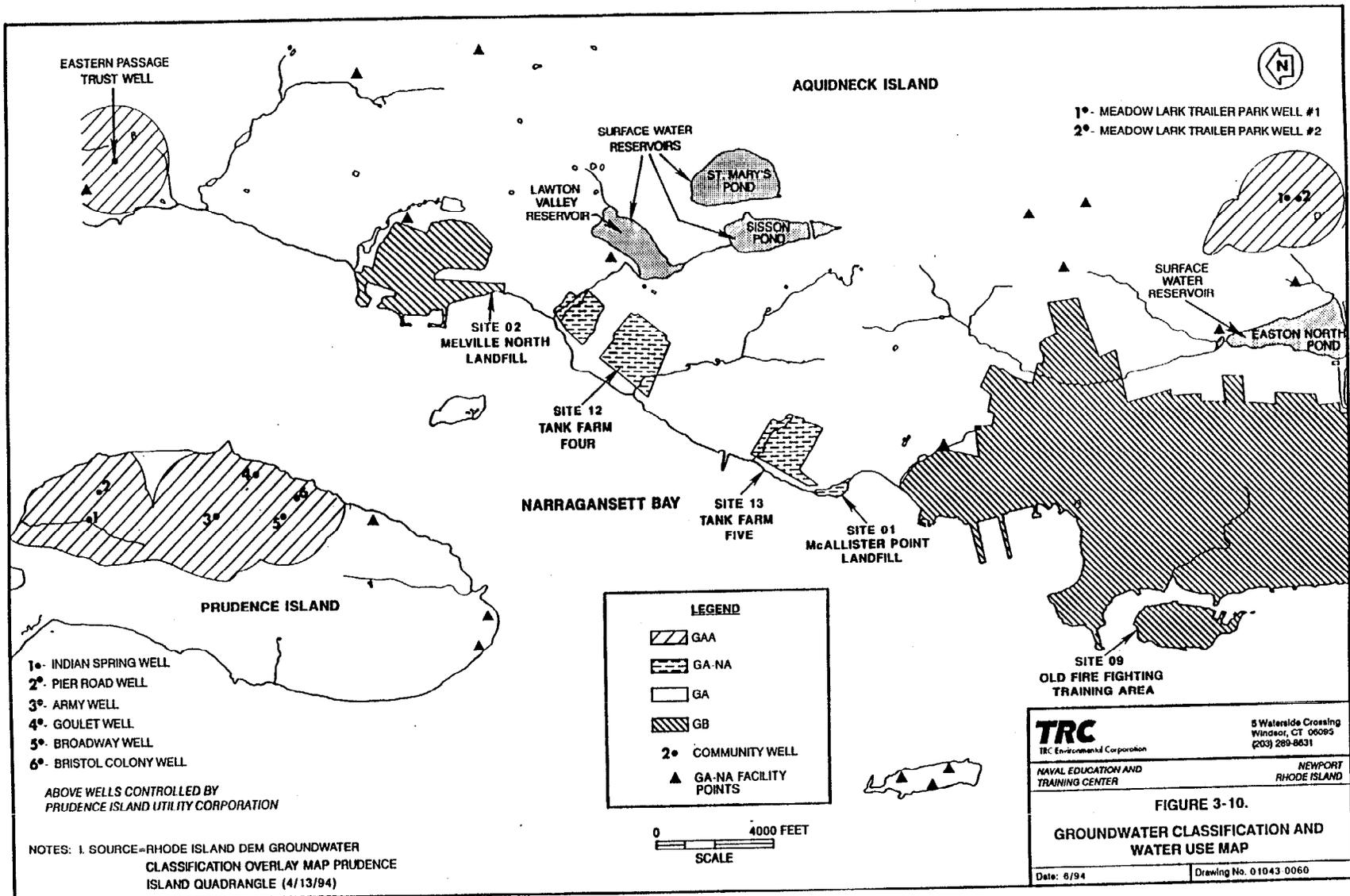
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SITE 01 - McALLISTER POINT LANDFILL

FIGURE 3-9
BEDROCK CONTOUR MAP

Date: 6/94

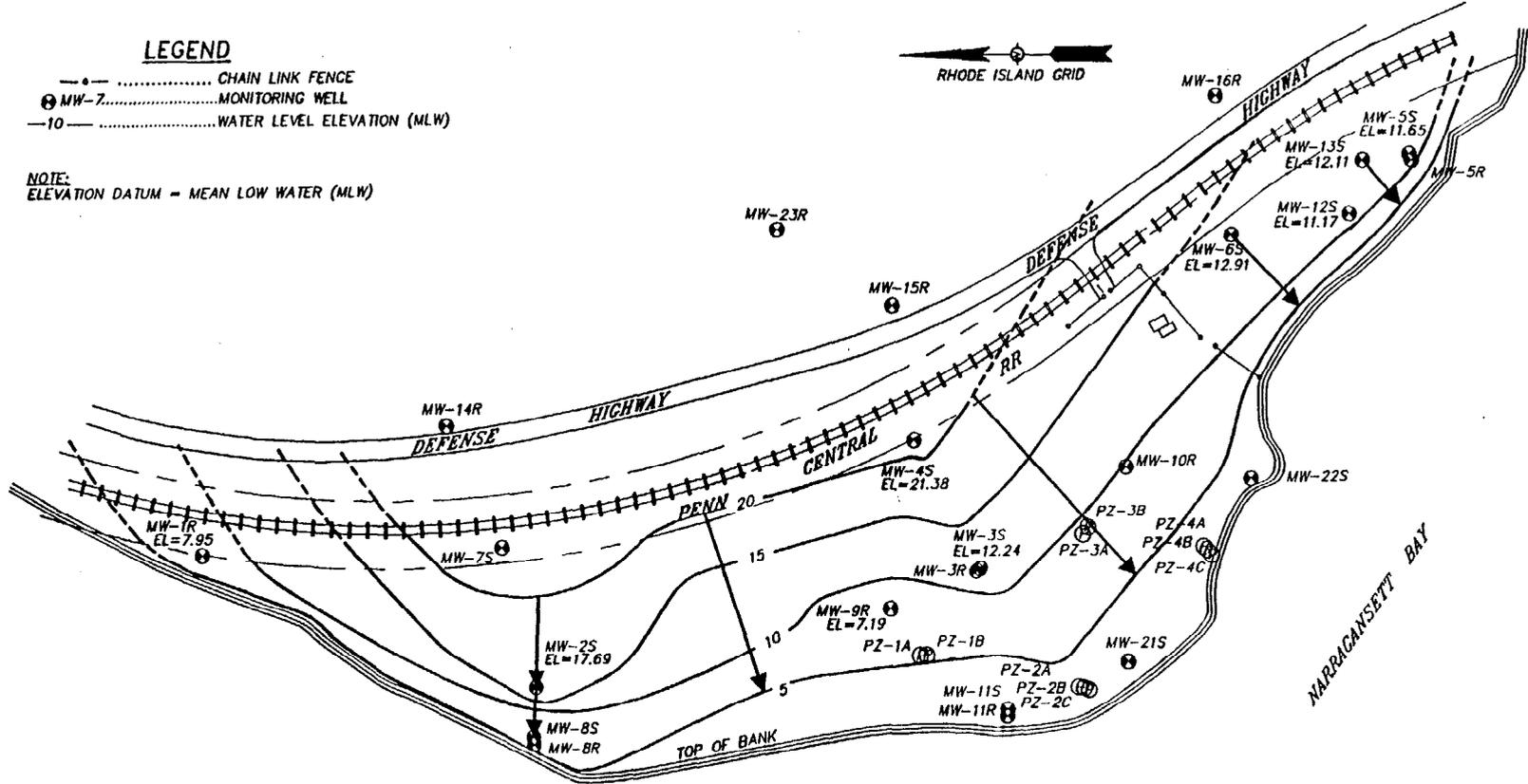
Drawing No. 01043-0060-0040



LEGEND

- - - CHAIN LINK FENCE
- ⊕ MW-7..... MONITORING WELL
- 10..... WATER LEVEL ELEVATION (MLW)

NOTE:
ELEVATION DATUM = MEAN LOW WATER (MLW)



NARRAGANSETT BAY

GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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SITE 01 - McALLISTER POINT LANDFILL

FIGURE 3-11
SHALLOW GROUND WATER CONTOUR MAP
(12/29/93)

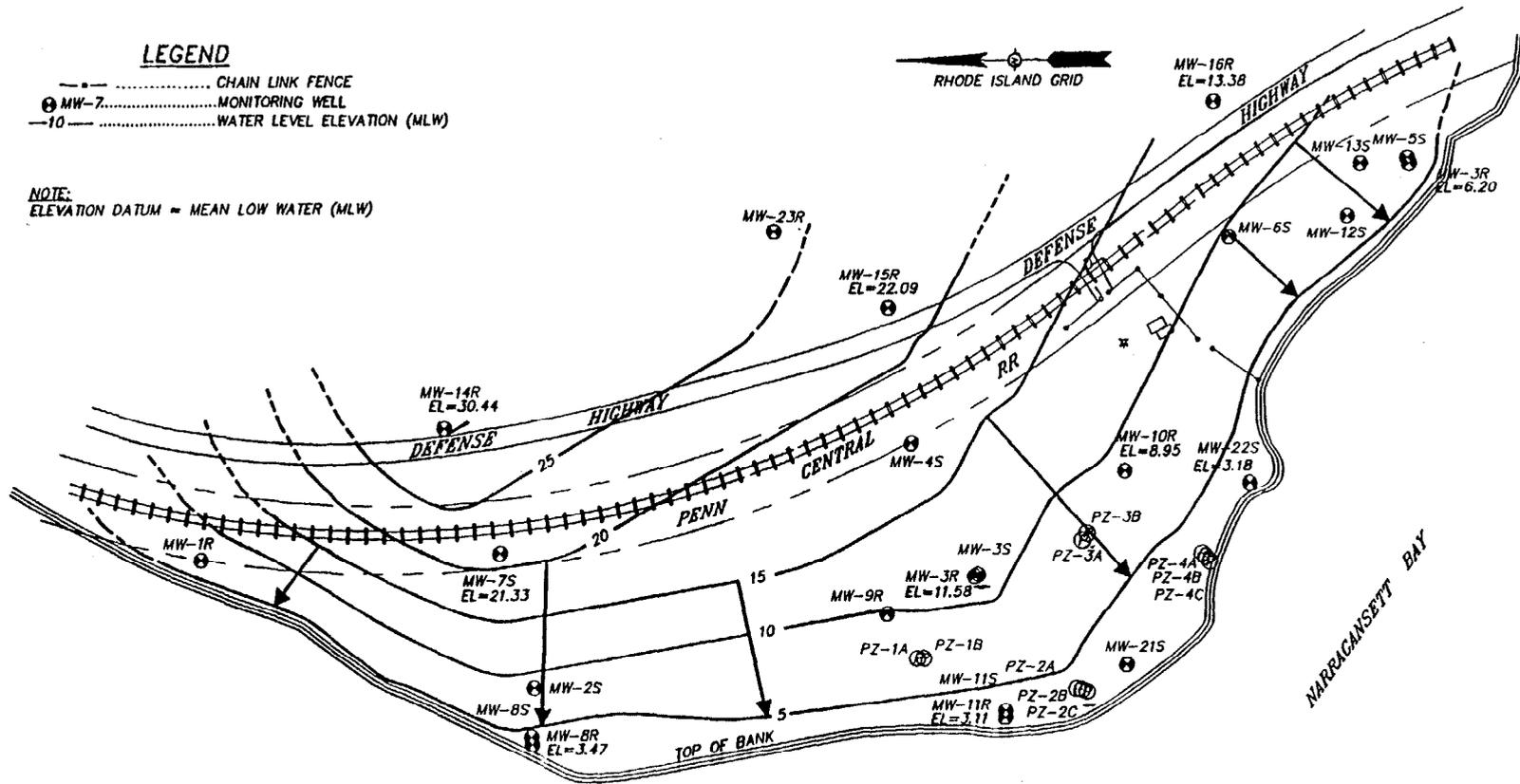
Date: 6/94

Drawing No. 01043-0060-0040

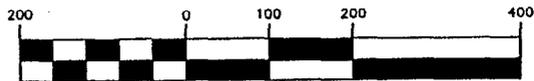
LEGEND

- - - CHAIN LINK FENCE
- ⊕ MW-7 MONITORING WELL
- 10- WATER LEVEL ELEVATION (MLW)

NOTE:
ELEVATION DATUM = MEAN LOW WATER (MLW)



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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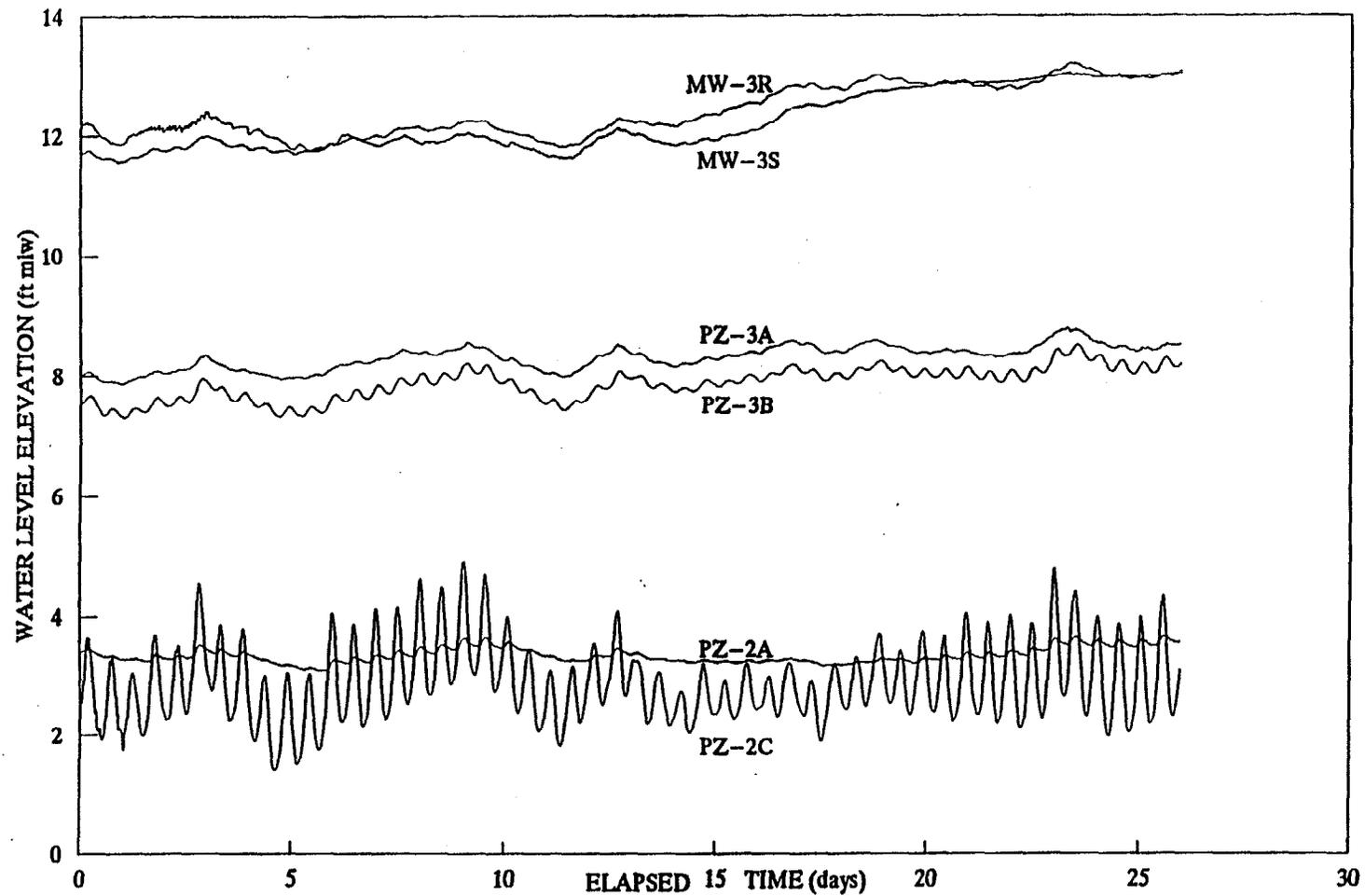
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FIGURE 3-12
DEEP GROUND WATER CONTOUR MAP
(12/29/93)

Date: 6/94

Drawing No. 01043-0060-0040



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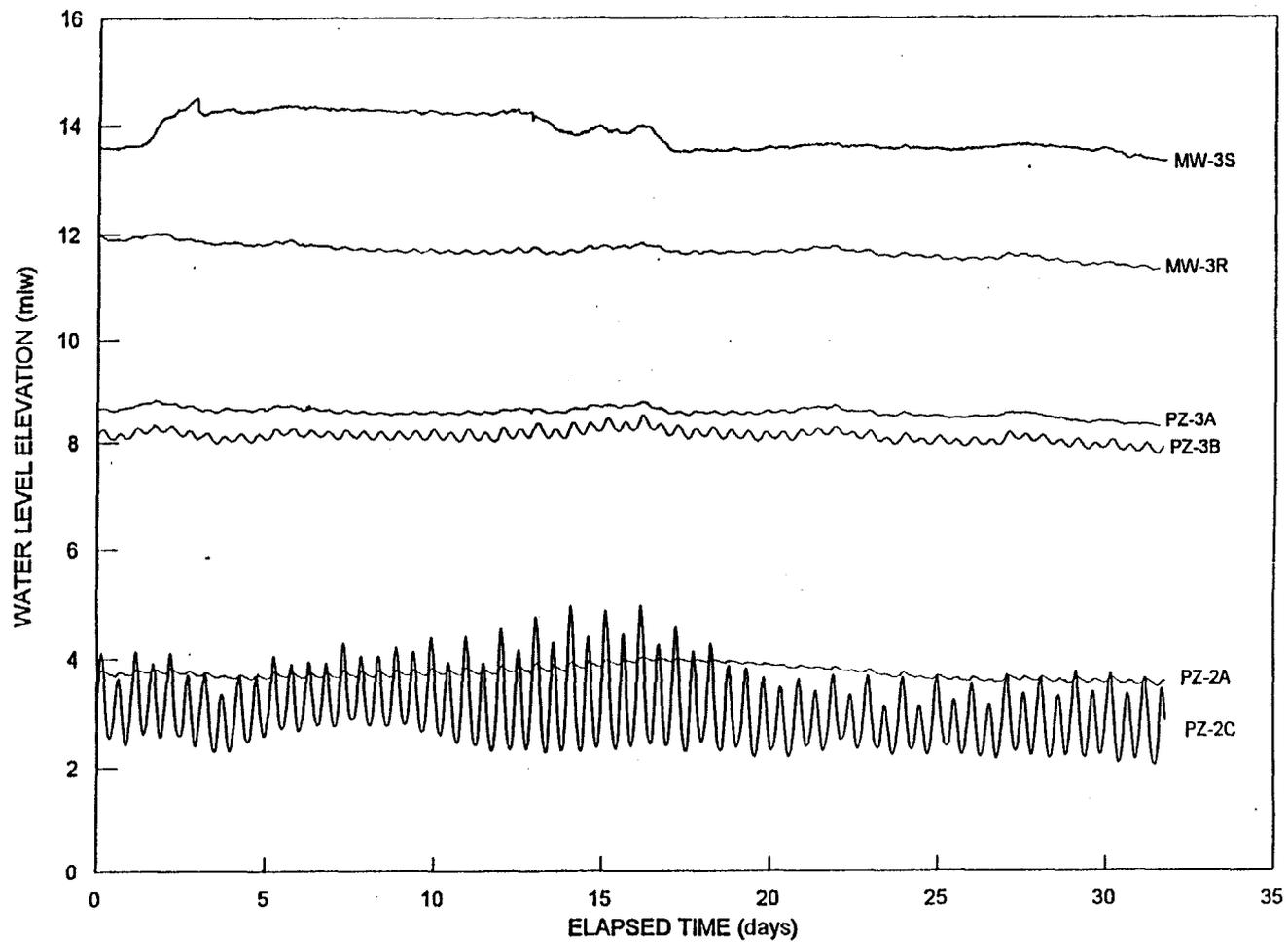
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FIGURE 3-13.
LONG-TERM TIDAL MONITORING
JANUARY, 1994

Date: 6/94

Drawing No. 01043-0060



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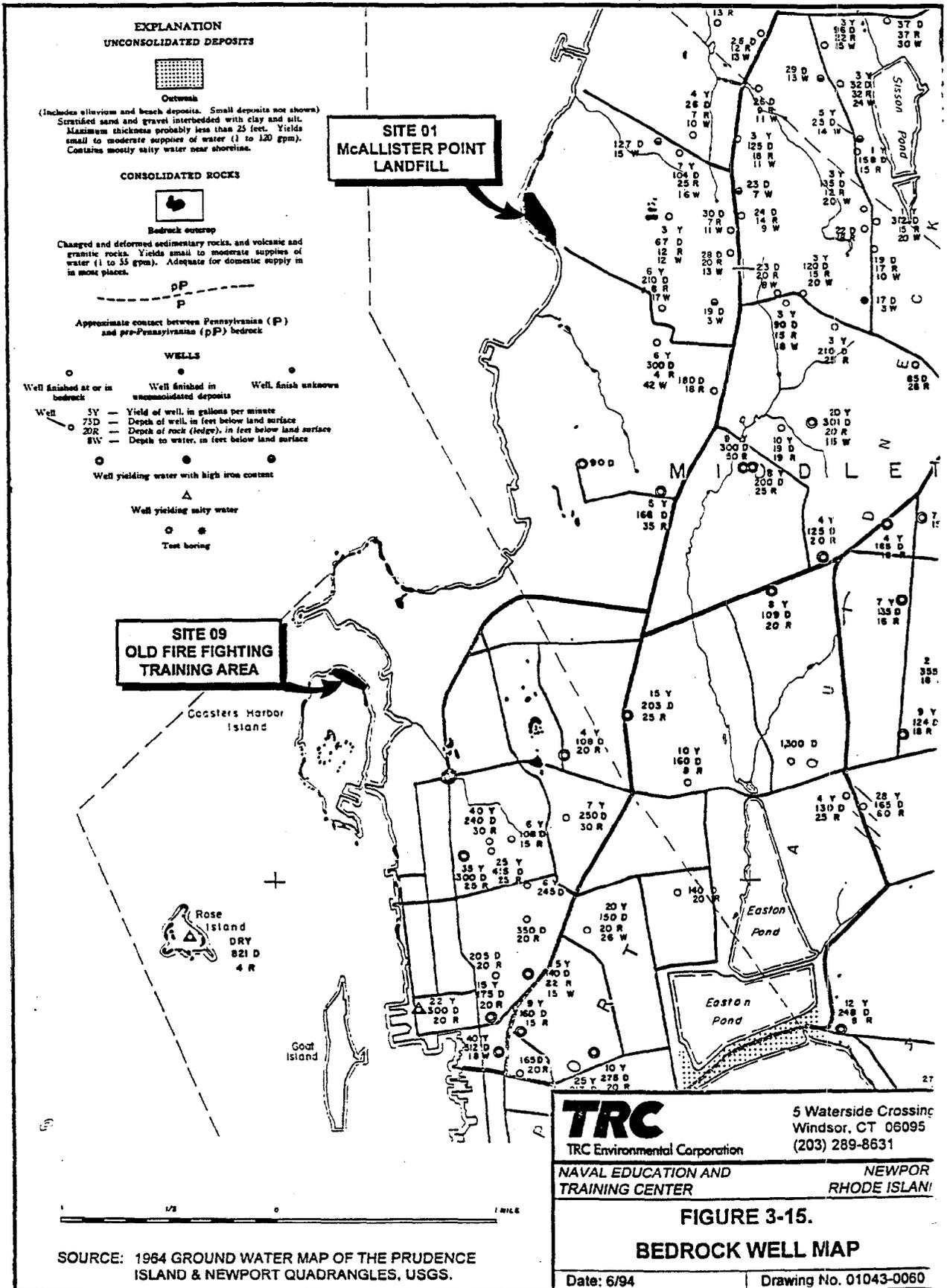
NAVAL EDUCATION AND
TRAINING CENTER

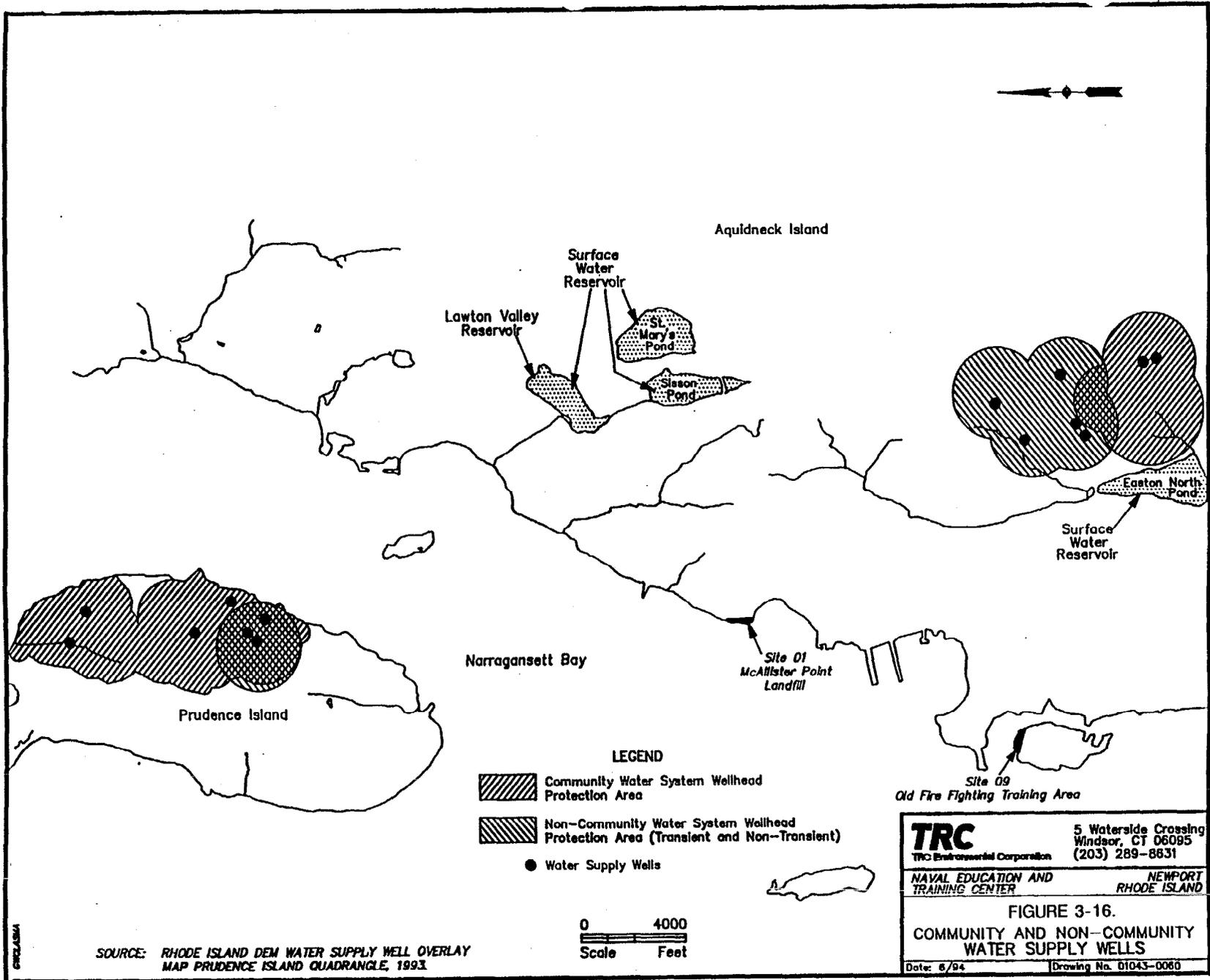
NEWPORT
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FIGURE 3-14.
LONG-TERM TIDAL MONITORING
MAY-JUNE, 1994

Date: 6/94

Drawing No. 01043-0060





Aquidneck Island

Lawton Valley Reservoir
 Surface Water Reservoir
 St. Mary's Pond
 Sisson Pond

Easton North Pond
 Surface Water Reservoir

Narragansett Bay

Site 01
 McAllister Point
 Landfill

Site 09
 Old Fire Fighting Training Area

Prudence Island

LEGEND

-  Community Water System Wellhead Protection Area
-  Non-Community Water System Wellhead Protection Area (Transient and Non-Transient)
-  Water Supply Wells

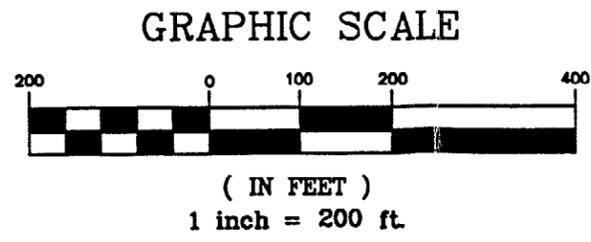
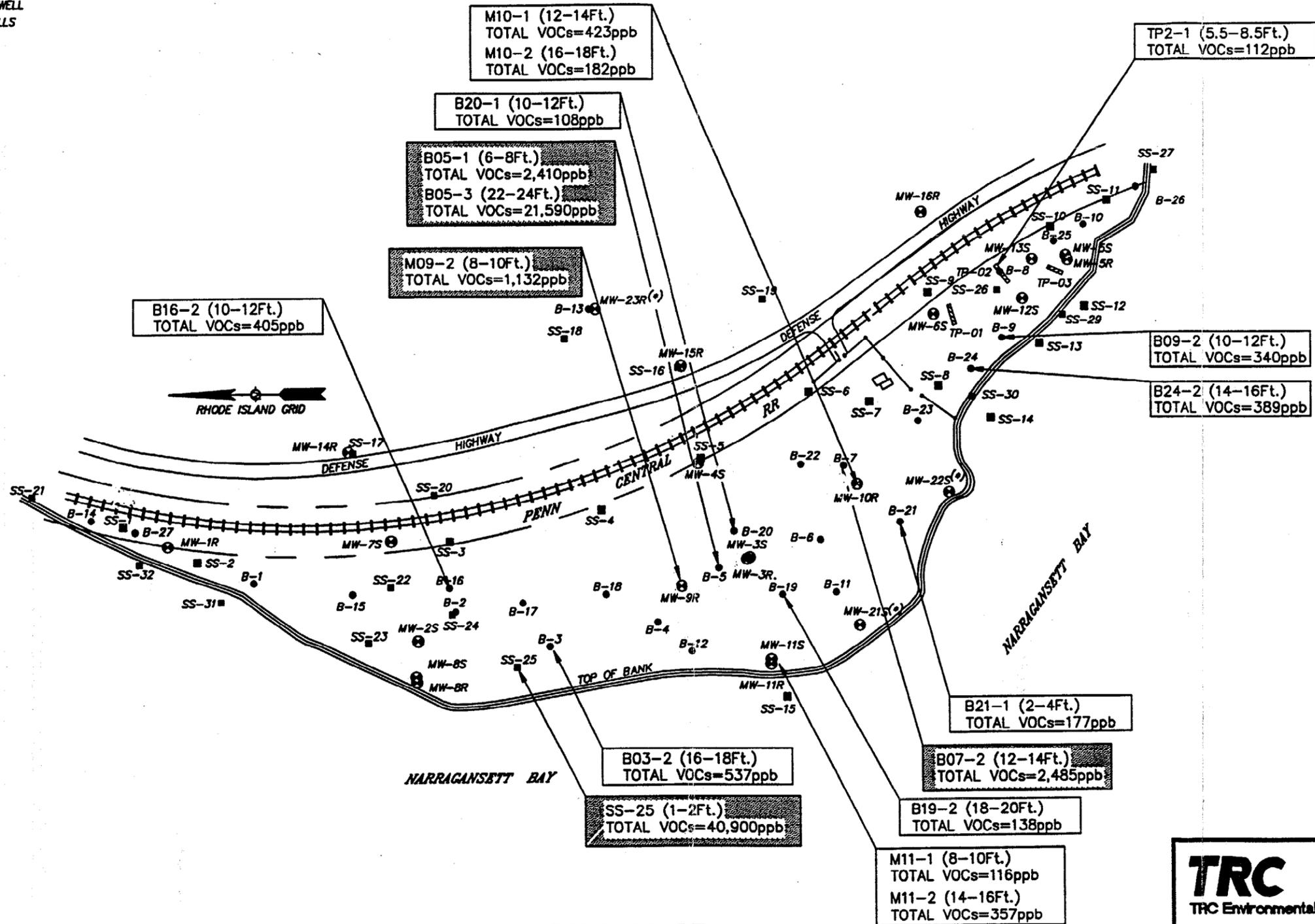
0 4000
 Scale Feet

SOURCE: RHODE ISLAND DEM WATER SUPPLY WELL OVERLAY
 MAP PRUDENCE ISLAND QUADRANGLE, 1993

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FIGURE 3-16. COMMUNITY AND NON-COMMUNITY WATER SUPPLY WELLS	
Date: 6/94	Drawing No. 01043-0060

LEGEND

- CHAIN LINK FENCE
- SS-5 SURFACE SOIL SAMPLE
- B-1 TEST BORING
- ⊙ MW-2 MONITORING WELL
- (*) WELLS PREVIOUS TO PHASE I WELLS
- TP-01 TEST PIT
- 1,132 TOTAL VOCs > 1,000ppb

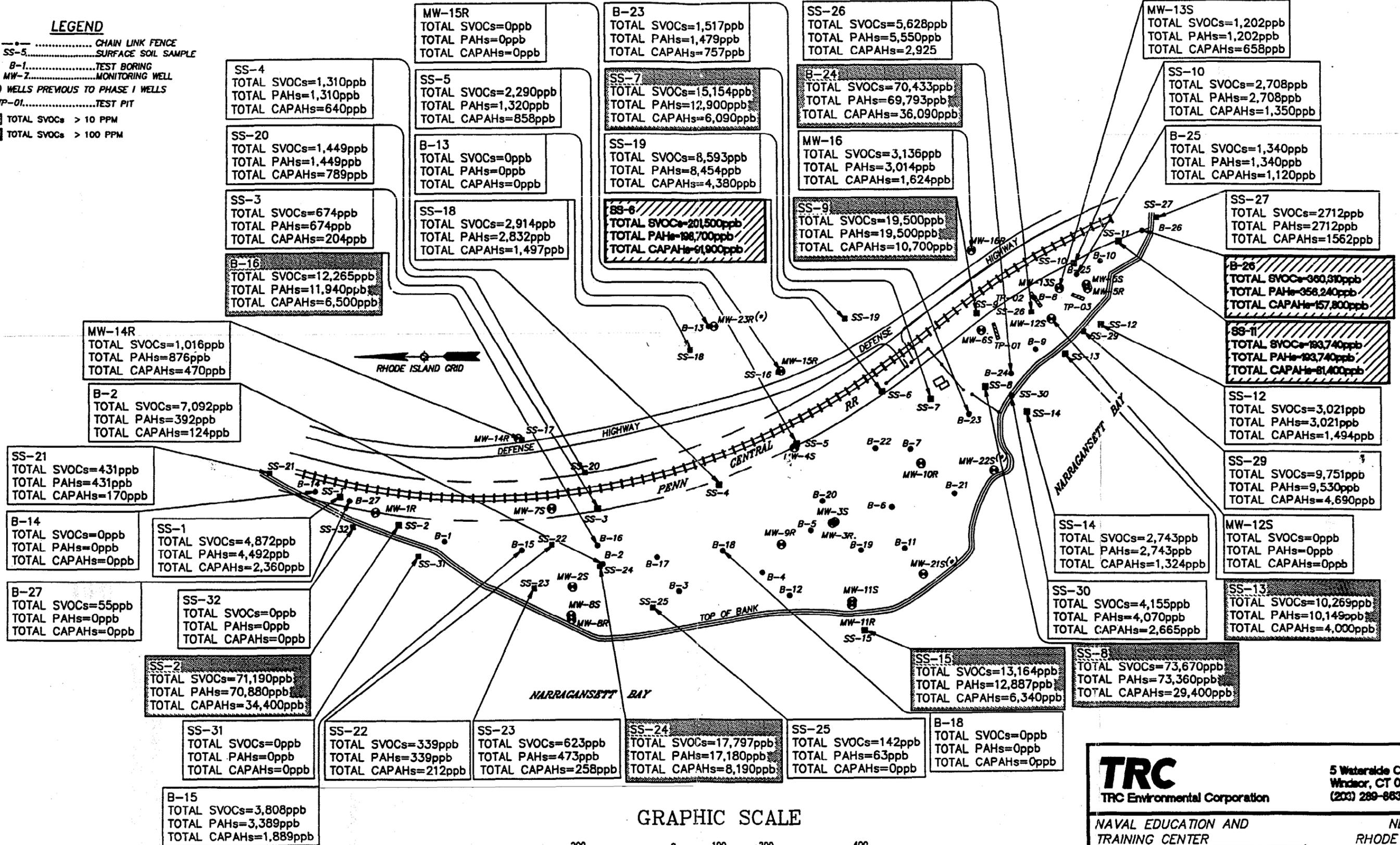


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	<p>NAVAL EDUCATION AND TRAINING CENTER NEWPORT RHODE ISLAND</p>
<p>SITE 01 - McALLISTER POINT LANDFILL FIGURE 4-1 ELEVATED SOIL TOTAL VOLATILE ORGANICS RESULTS MAP (SAMPLES EXCEEDING 100 ppb TOTAL VOCs)</p>	
Date: 6/94	Drawing No. 01043-0060-0040

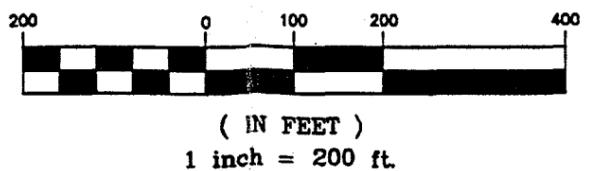
00088KB42

LEGEND

- CHAIN LINK FENCE
- SS-5 SURFACE SOIL SAMPLE
- B-1 TEST BORING
- ⊙ MW-2 MONITORING WELL
- (*) WELLS PREVIOUS TO PHASE I WELLS
- TP-01 TEST PIT
- ▨ TOTAL SVOCs > 10 PPM
- ▩ TOTAL SVOCs > 100 PPM



GRAPHIC SCALE



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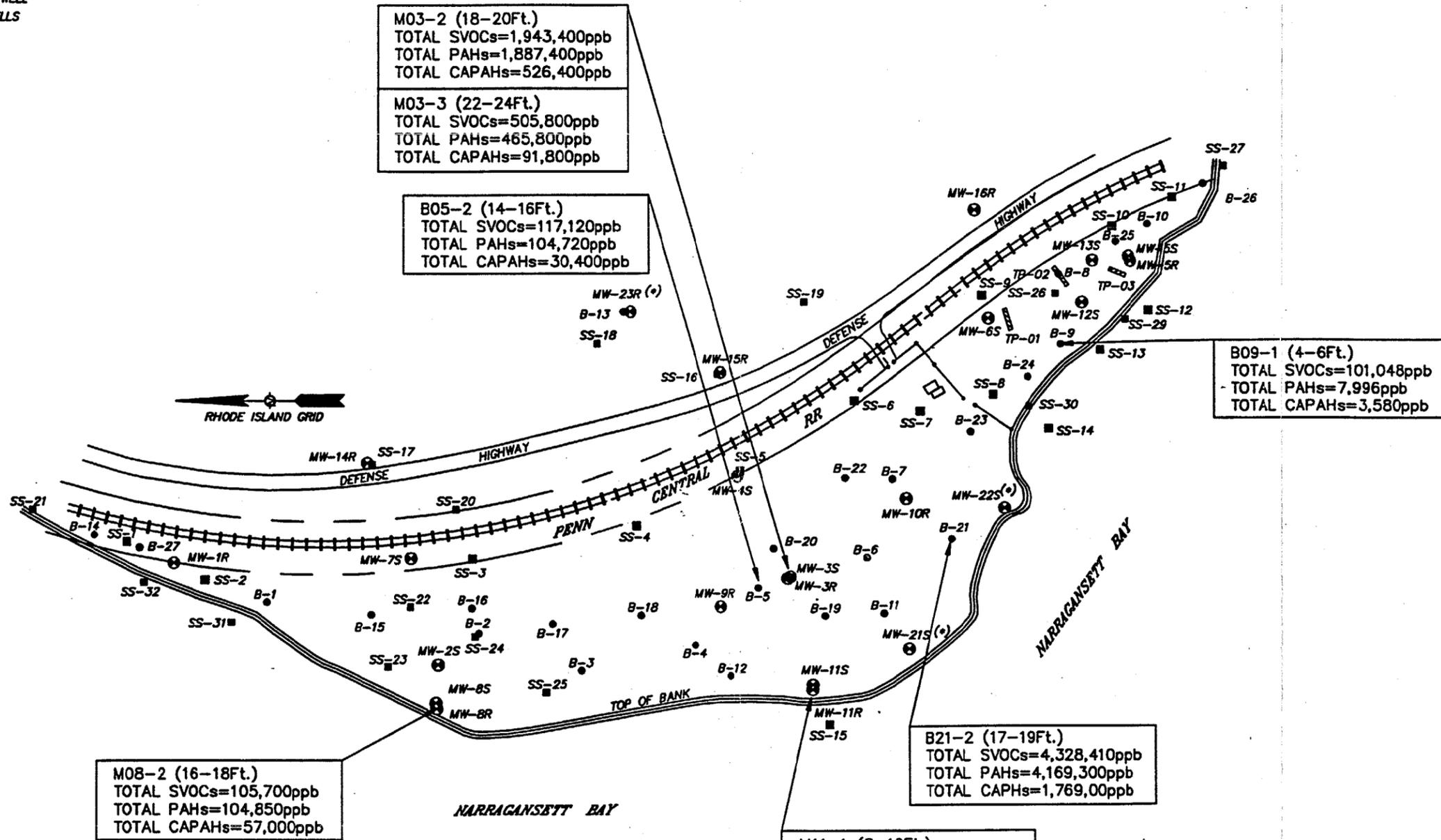
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NEWPORT RHODE ISLAND

SITE 01 - McALLISTER POINT LANDFILL
FIGURE 4-2
SURFACE SOIL SEMIVOLATILE ORGANICS RESULTS MAP

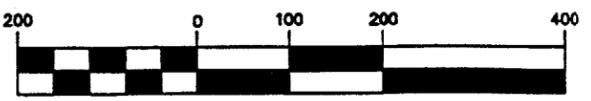
Date: 6/94 | Drawing No. C-043-0060-0040

LEGEND

- CHAIN LINK FENCE
- SS-5 SURFACE SOIL SAMPLE
- B-1 TEST BORING
- ⊕ MW-7 MONITORING WELL
- (*) WELLS PREVIOUS TO PHASE I WELLS
- TP-01 TEST PIT



GRAPHIC SCALE

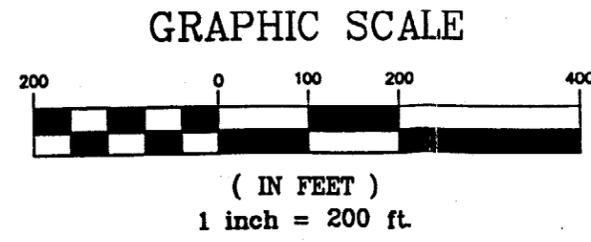
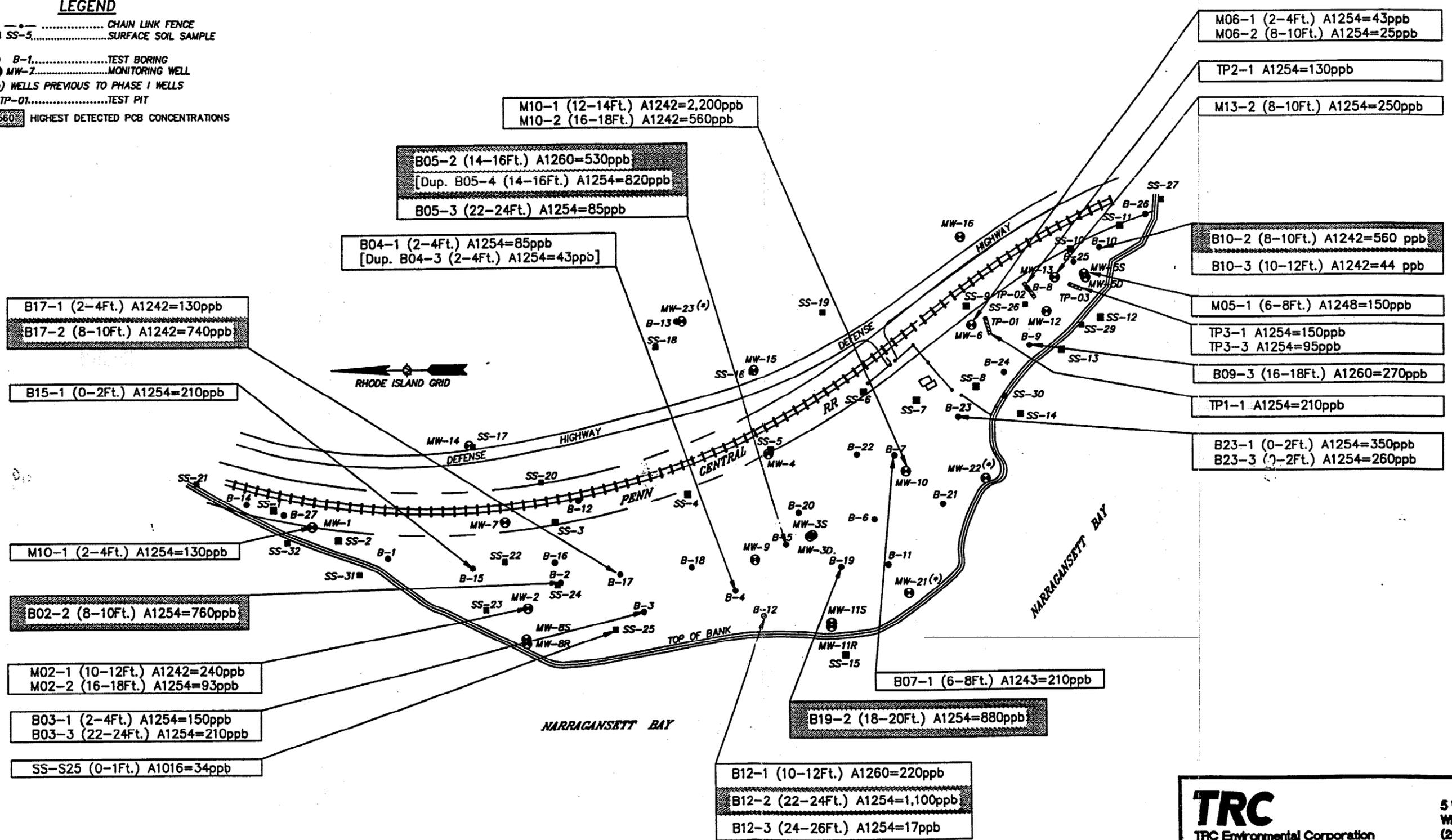


(IN FEET)
 1 inch = 200 ft.

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SITE 01 - McALLISTER POINT LANDFILL FIGURE 4-3 ELEVATED SUBSURFACE SOL SEMIVOLATILE ORGANICS RESULTS MAP (SAMPLES EXCEEDING 100 ppm TOTAL SVOCs)	
Date: 6/94	Drawing No. 01043-0060-0040

LEGEND

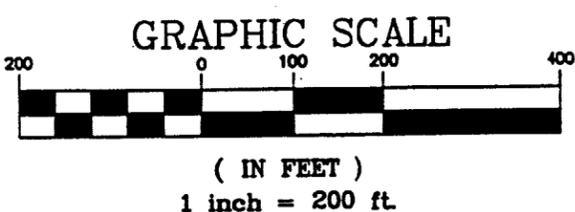
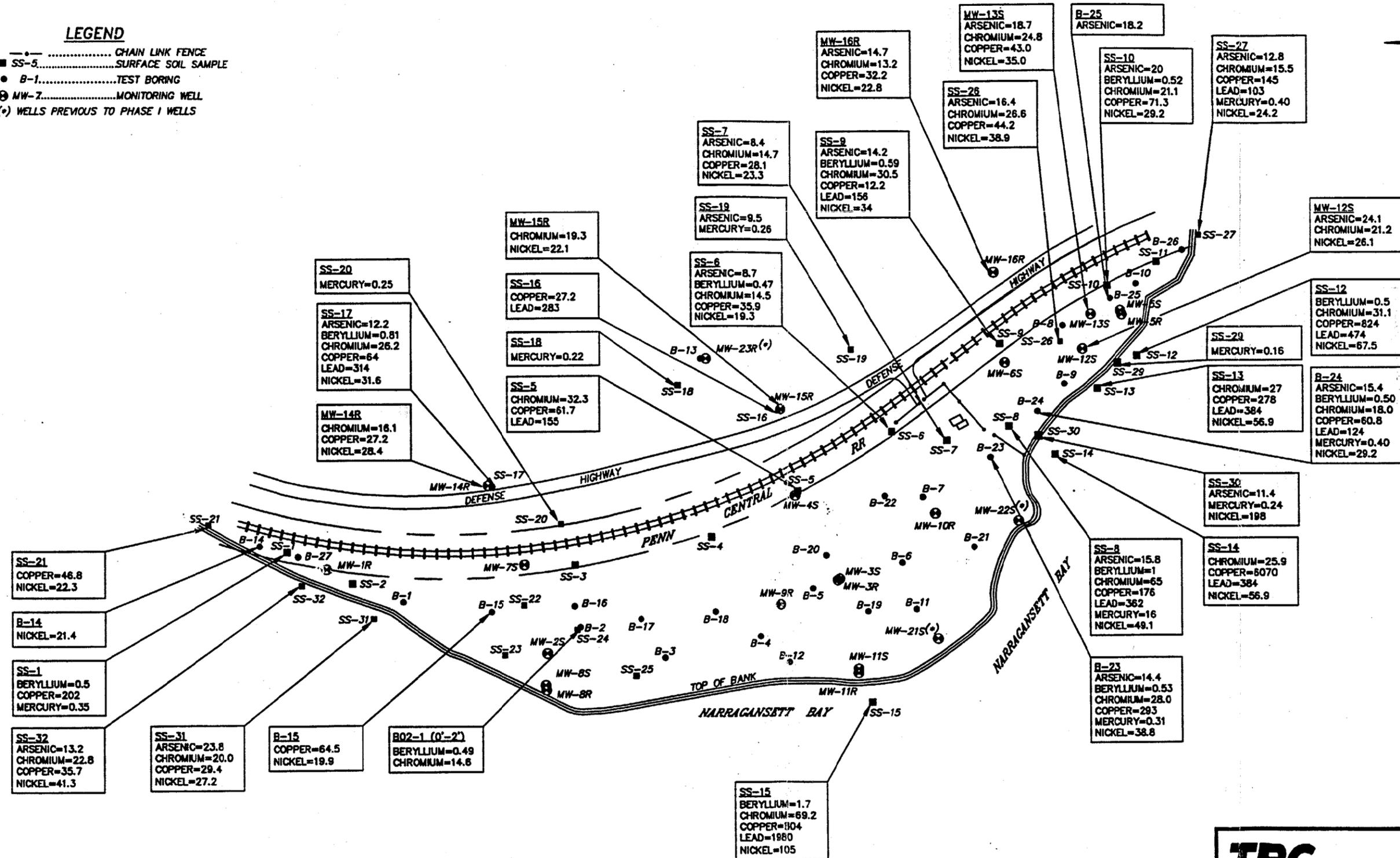
- CHAIN LINK FENCE
- SS-5.....SURFACE SOIL SAMPLE
- B-1.....TEST BORING
- ⊙ MW-7.....MONITORING WELL
- (*) WELLS PREVIOUS TO PHASE I WELLS
- TP-01.....TEST PIT
- 560 HIGHEST DETECTED PCB CONCENTRATIONS



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<p>SITE 01 - McALLISTER POINT LANDFILL</p>	
<p>FIGURE 4-4</p>	
<p>SOIL PCB RESULTS MAP</p>	
<p>Date: 6/94</p>	<p>Drawing No. 01043-0060-0040</p>

LEGEND

- CHAIN LINK FENCE
- SS-5.....SURFACE SOIL SAMPLE
- B-1.....TEST BORING
- ⊙ MW-7.....MONITORING WELL
- (*) WELLS PREVIOUS TO PHASE I WELLS



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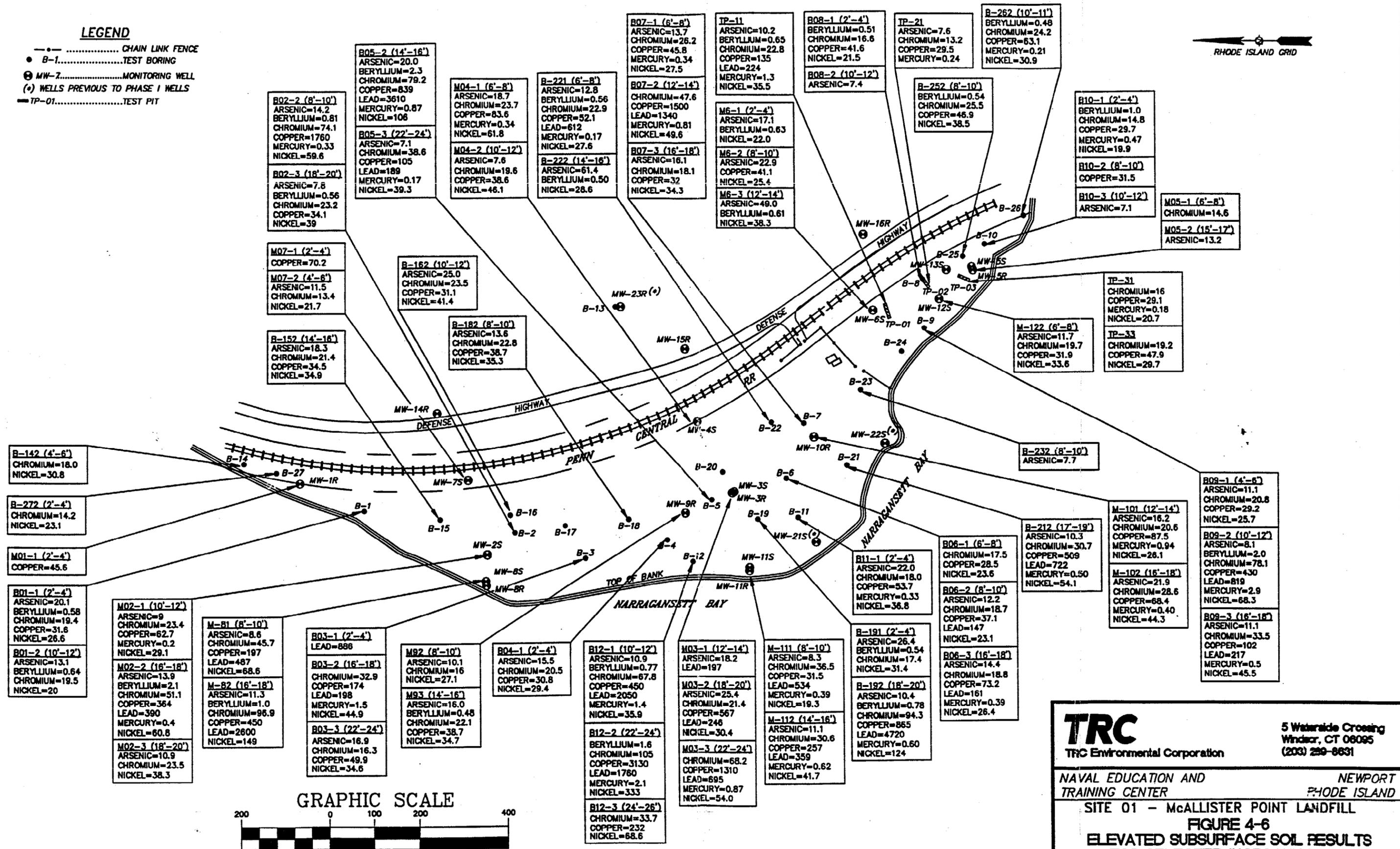
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SITE 01 - McALLISTER POINT LANDFILL
FIGURE 4-5
ELEVATED SURFACE SOIL RESULTS FOR SELECTED INORGANICS MAP
(SAMPLES EXCEEDING MEAN BACKGROUND CONCENTRATIONS)

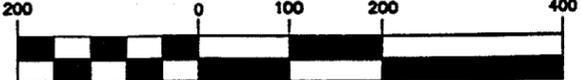
Date: 6/94
Drawing No. C-043-0060-0040

LEGEND

- - - CHAIN LINK FENCE
- B-1.....TEST BORING
- ⊕ MW-2.....MONITORING WELL
- (*) WELLS PREVIOUS TO PHASE I WELLS
- TP-01.....TEST PIT



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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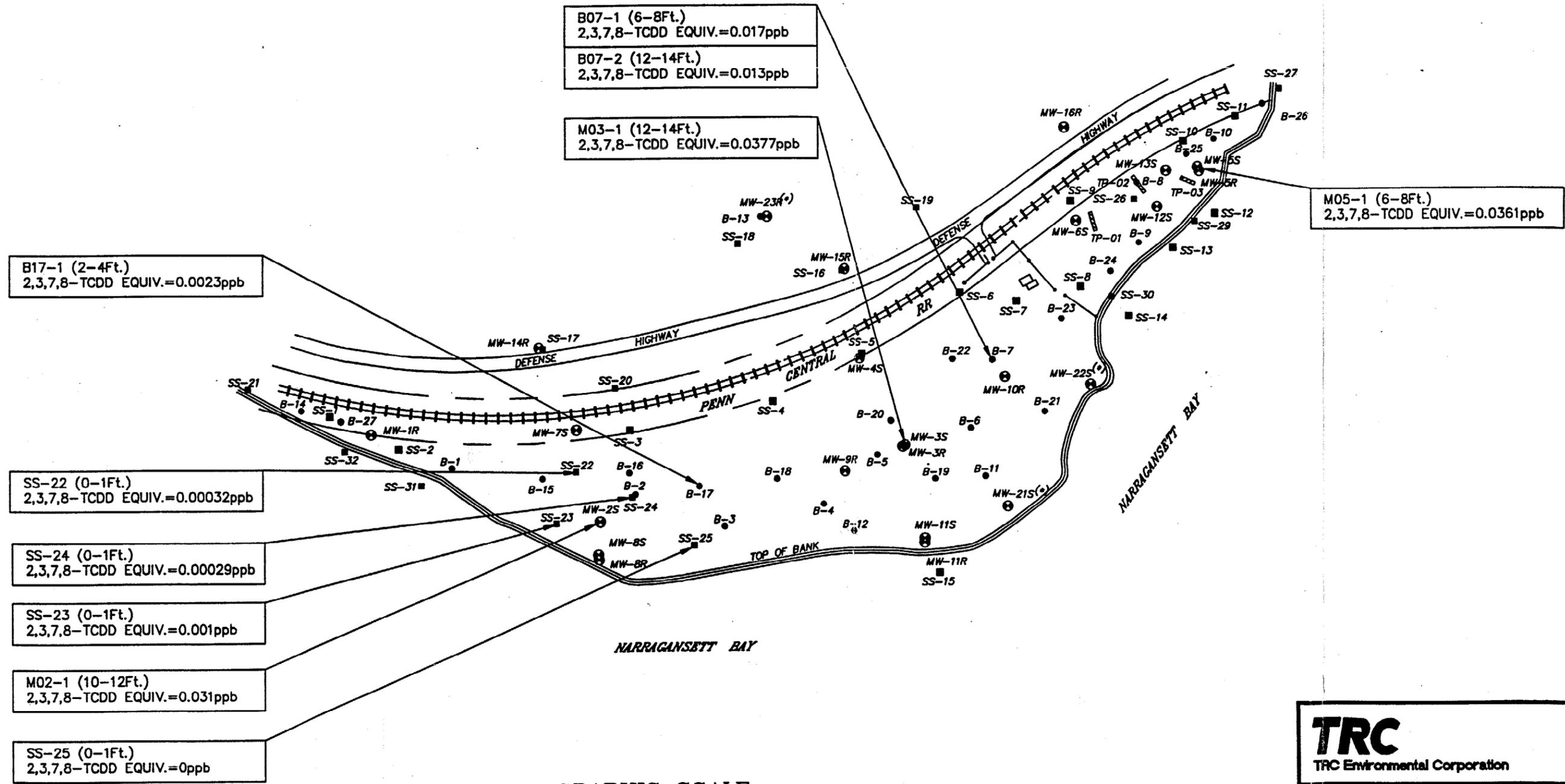
SITE 01 - McALLISTER POINT LANDFILL

FIGURE 4-6
ELEVATED SUBSURFACE SOIL RESULTS
FOR SELECTED INORGANICS MAP
(SAMPLES EXCEEDING MEAN BACKGROUND CONCENTRATIONS)

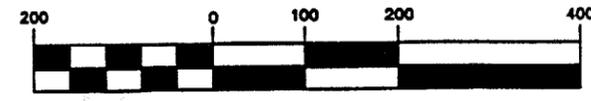
Date: 6/94 Drawing No. 01043-0060-0040

LEGEND

- CHAIN LINK FENCE
- SS-5.....SURFACE SOIL SAMPLE
- B-1.....TEST BORING
- ⊕ MW-7.....MONITORING WELL
- (*) WELLS PREVIOUS TO PHASE I WELLS
- TP-01.....TEST PIT



GRAPHIC SCALE

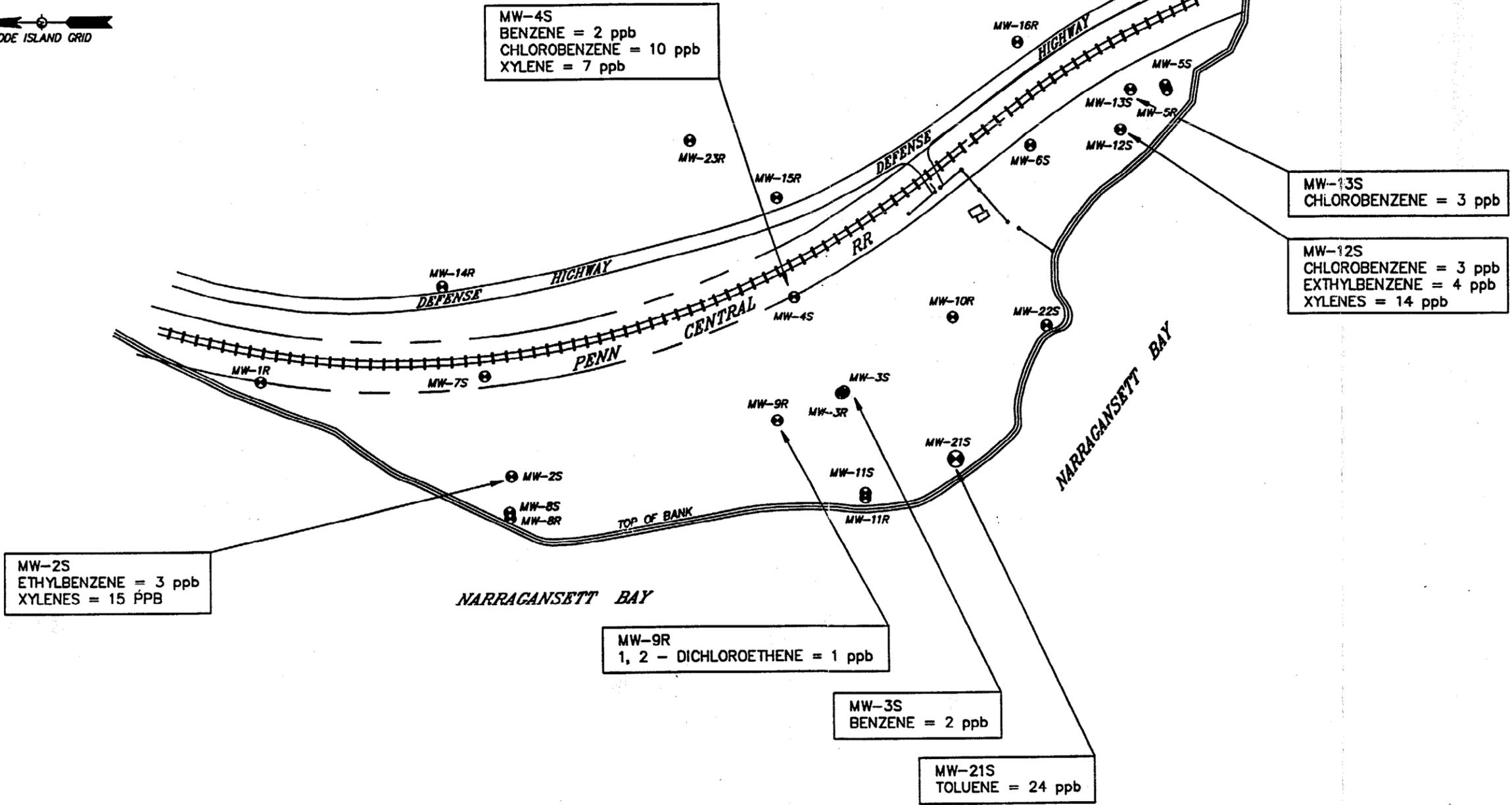


(IN FEET)
1 inch = 200 ft.

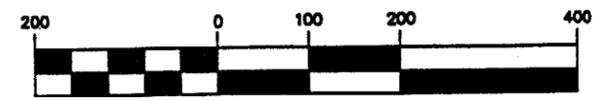
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SITE 01 - McALLISTER POINT LANDFILL	
FIGURE 4-7 SOIL DIOXINS AND FURANS RESULTS	
Date: 6/94	Drawing No. C-043-0060-0040

LEGEND

- CHAIN LINK FENCE
- MW-7 MONITORING WELL



GRAPHIC SCALE

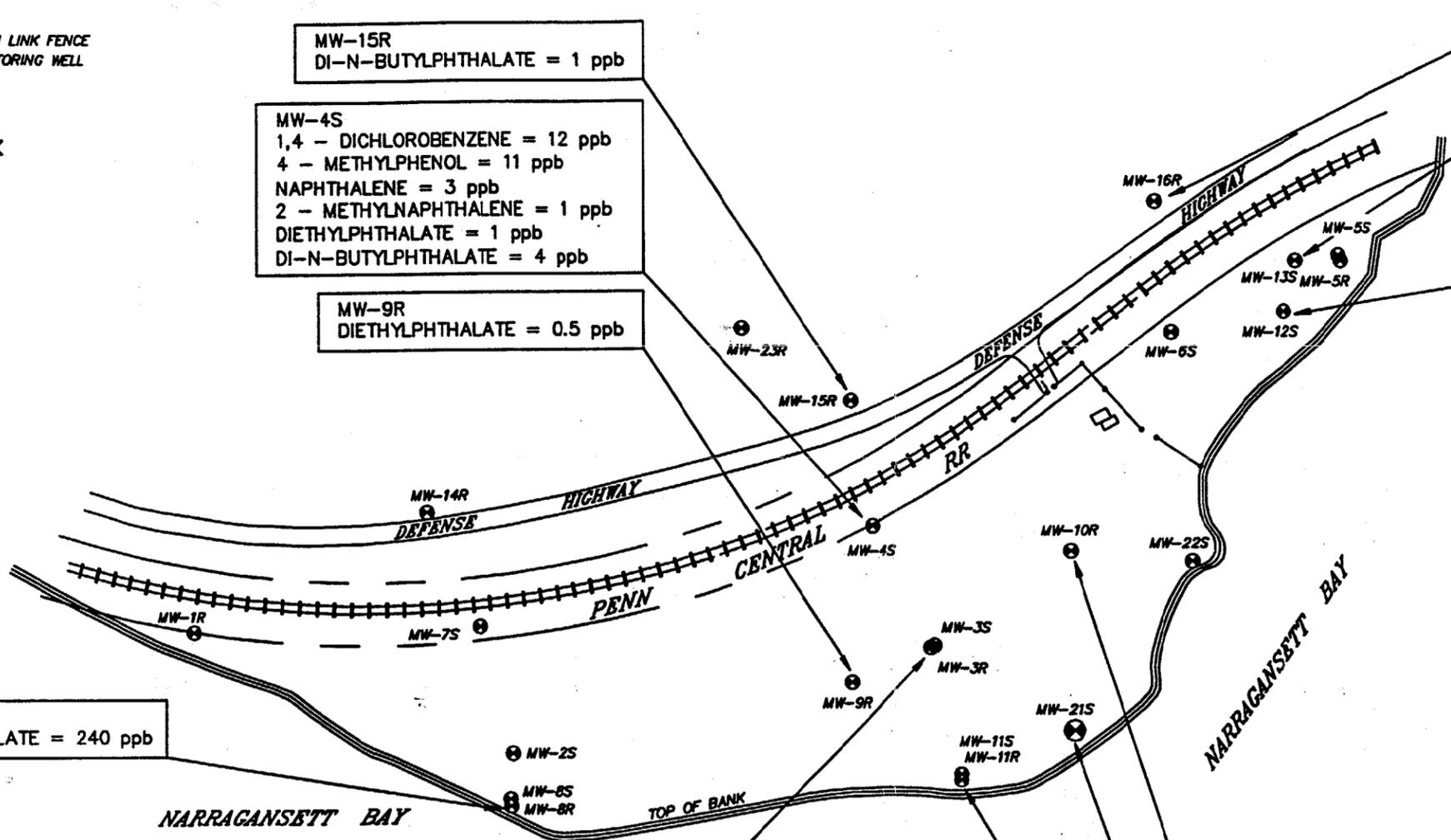


(IN FEET)
1 inch = 200 ft.

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<p>SITE 01 - McALLISTER POINT LANDFILL</p>	
<p>FIGURE 4-8 SUMMARY OF VOLATILE ORGANIC COMPOUNDS DETECTED IN GROUND WATER</p>	
<p>Date: 6/94</p>	<p>Drawing No. 01043-0060-0C40</p>

LEGEND

--- CHAIN LINK FENCE
 ● MW-7 MONITORING WELL



MW-15R
 DI-N-BUTYLPHthalate = 1 ppb

MW-4S
 1,4 - DICHLORO BENZENE = 12 ppb
 4 - METHYLPHENOL = 11 ppb
 NAPHTHALENE = 3 ppb
 2 - METHYLNAPHTHALENE = 1 ppb
 DIETHYLPHthalate = 1 ppb
 DI-N-BUTYLPHthalate = 4 ppb

MW-9R
 DIETHYLPHthalate = 0.5 ppb

MW-16R
 PHENANTHRENE = 0.7 ppb

MW-13S
 1,3 - DICHLORO BENZENE = 0.5 ppb
 1,4 - DICHLORO BENZENE = 2 ppb
 4 - METHYLPHENOL = 1 ppb
 NAPHTHALENE = 0.9 ppb
 2 - METHYLNAPHTHALENE = 1 ppb

MW-12S
 1,3 - DICHLORO BENZENE = 2 ppb
 1,4 - DICHLORO BENZENE = 13 ppb
 2 - METHYLNAPHTHALENE = 1 ppb
 PYRENE = 1 ppb

MW-8R
 BIS(2-ETHYLHEXYL)PHthalate = 240 ppb

NARRAGANSETT BAY

NARRAGANSETT BAY

MW-3S
 2 - METHYLPHENOL = 3 ppb
 2,4 - DIMETHYLPHENOL = 1 ppb
 NAPHTHALENE = 98 ppb
 2 - METHYLNAPHTHALENE = 9 ppb
 ACENAPHTHENE = 28 ppb
 DIBENZOFURAN = 15 ppb
 FLUORENE = 20 ppb
 PHENANTHRENE = 23 ppb
 ANTHRACENE = 3 ppb
 CARBAZOLE = 24 ppb
 DI-N-BUTYLPHthalate = 1 ppb
 FLUORANTHENE = 5 ppb
 PYRENE = 4 ppb

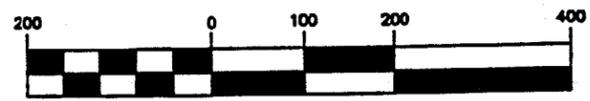
MW-11R
 NAPHTHALENE = 8 ppb
 2 - METHYLNAPHTHALENE = 1 ppb
 ACENAPHTHENE = 2 ppb
 DIBENZOFURAN = 2 ppb
 FLUORENE = 2 ppb
 PHENANTHRENE = 5 ppb
 ANTHRACENE = 1 ppb
 DI-N-BUTYLPHthalate = 1 ppb
 FLUORANTHENE = 2 ppb
 PYRENE = 1 ppb

MW-3D
 PHENANTHRENE = 1 ppb
 DI-N-BUTYLPHthalate = 1 ppb
 FLUORANTHENE = 1 ppb
 PYRENE = 0.9 ppb
 BENZO(A)ANTHRACENE = 0.7 ppb

MW-10R
 DI-N-BUTYLPHthalate = 1 ppb

MW-21S
 1,4 - DICHLORO BENZENE = 0.5 ppb
 2 - METHYLPHENOL = 2 ppb
 DIETHYLPHthalate = 2 ppb

GRAPHIC SCALE



(IN FEET)
 1 inch = 200 ft.

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SITE 01 - McALLISTER POINT LANDFILL

FIGURE 4-9

**SUMMARY OF SEMIVOLATILE ORGANIC
 COMPOUNDS DETECTED IN GROUND WATER**

Date: 6/94

Drawing No. 01043-0060-0040

LEGEND

----- CHAIN LINK FENCE
 ● MW-7..... MONITORING WELL



MW-1R
 BERYLLIUM = 4.1 ppb
 CHROMIUM = 176 ppb
 LEAD = 275 ppb
 NICKEL = 256 ppb

MW-7S
 BERYLLIUM = 114 ppb
 CHROMIUM = 4.3 ppb
 LEAD = 190 ppb
 NICKEL = 501 ppb

MW-8R
 BIS (2-ETHYLHEXYL)
 PHTHALATE = 240 ppb
 BERYLLIUM = 1.8 ppb
 LEAD = 26.9 ppb
 NICKEL = 235 ppb

MW-15R
 BERYLLIUM = 1.5 ppb
 LEAD = 21.9 ppb
 NICKEL = 175 ppb

MW-4S
 CADMIUM = 6.2 ppb
 LEAD = 42.3 ppb

MW-9R
 ARSENIC = 84.3 ppb
 BERYLLIUM = 3.3 ppb
 CHROMIUM = 163 ppb
 LEAD = 58 ppb
 NICKEL = 386 ppb

MW-3S
 ANTIMONY = 176 ppb
 ARSENIC = 176 ppb
 BERYLLIUM = 5.9 ppb
 CADMIUM = 28 ppb
 CHROMIUM = 256 ppb
 COPPER = 1730 ppb
 MERCURY = 4.5 ppb
 LEAD = 4060 ppb
 NICKEL = 386 ppb

MW-3R
 BERYLLIUM = 5.9 ppb
 LEAD = 4060 ppb
 NICKEL = 386 ppb

MW-10R
 LEAD = 65.5

MW-21S
 ARSENIC = 129 ppb
 LEAD = 56.5 ppb

MW-11R
 BERYLLIUM = 2 ppb
 LEAD = 548 ppb
 NICKEL = 122 ppb

MW-16R
 ANTIMONY = 19 ppb
 ARSENIC = 64.8 ppb
 BERYLLIUM = 1.6 ppb
 CHROMIUM = 144 ppb
 LEAD = 148 ppb
 NICKEL = 386 ppb

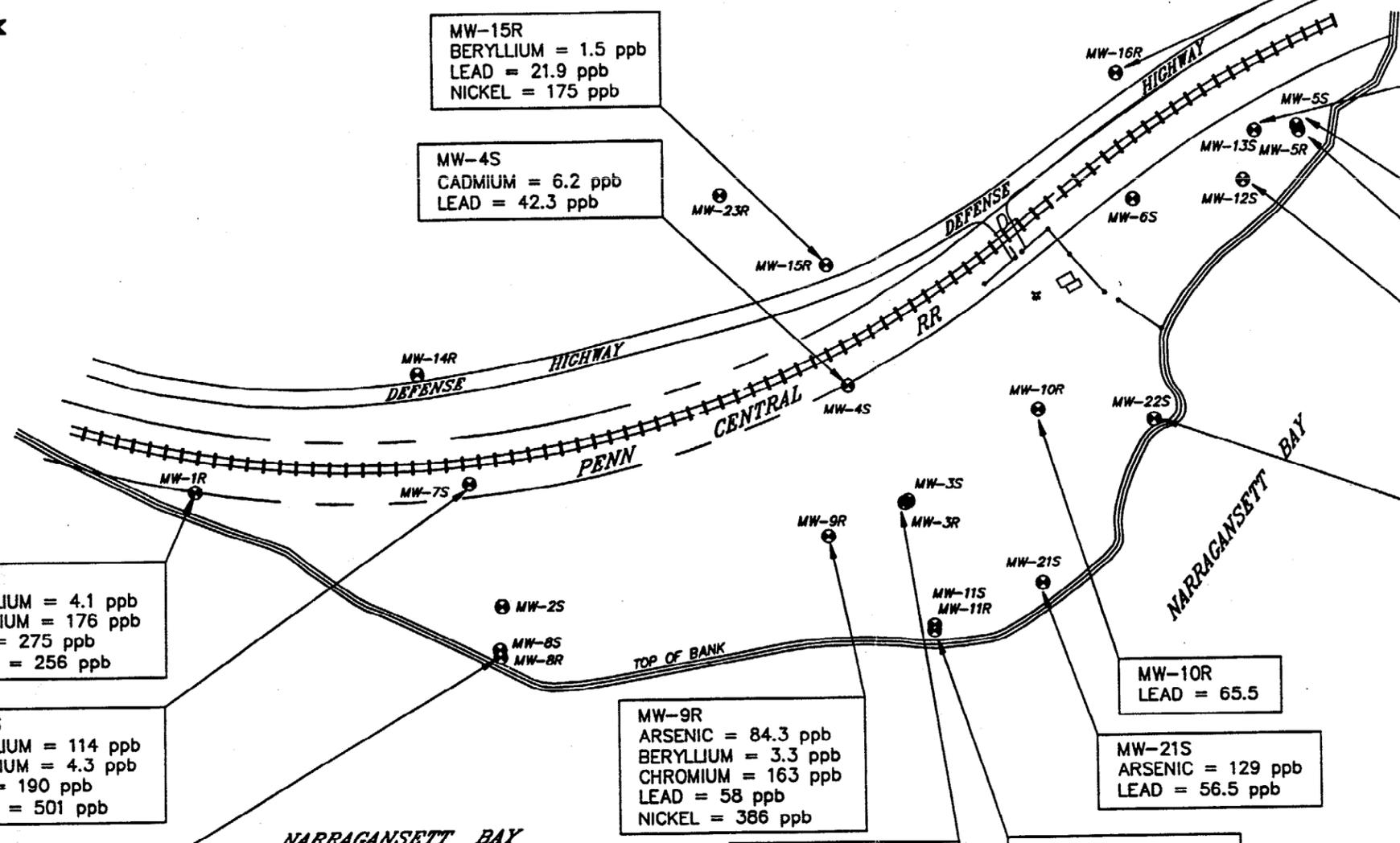
MW-13S
 PCBs = 1.8 ppb
 ANTIMONY = 176 ppb
 ARSENIC = 176 ppb
 BERYLLIUM = 5.9 ppb
 CADMIUM = 28 ppb
 CHROMIUM = 256 ppb
 LEAD = 4060 ppb
 NICKEL = 386 ppb

MW-5S
 PCBs = 1 ppb

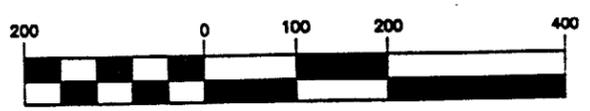
MW-5R
 BERYLLIUM = 1.1 ppb

MW-12S
 PCBs = 0.76 ppb
 ANTIMONY = 26.5
 CADMIUM = 10 ppb
 LEAD = 375 ppb

MW-22S
 LEAD = 34.1 ppb



GRAPHIC SCALE

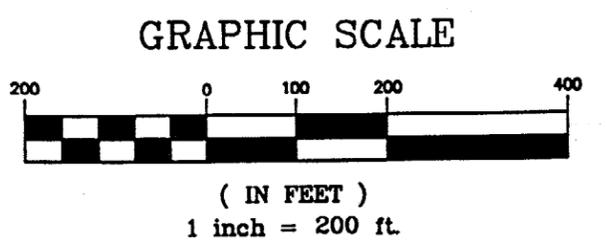
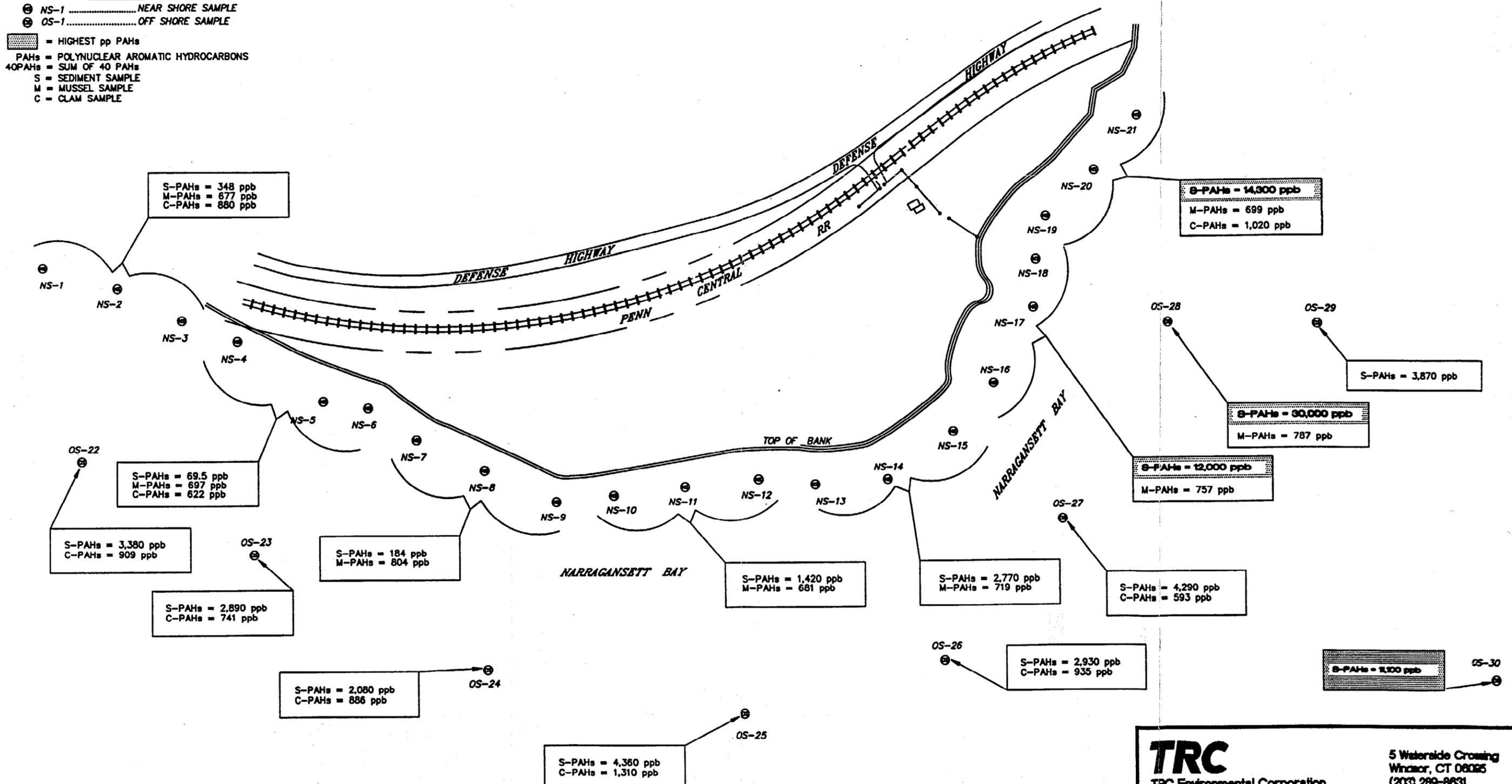


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<p>SITE 01 - McALLISTER POINT LANDFILL FIGURE 4-10 GROUND WATER CONTAMINANTS EXCEEDING FEDERAL MCLs AND STATE OF RHODE ISLAND GROUND WATER QUALITY STANDARDS</p>	
<p>Date: 6/94</p>	<p>Drawing No. 01043-0060-0040</p>

LEGEND

- ⊙ NS-1 NEAR SHORE SAMPLE
- ⊙ OS-1 OFF SHORE SAMPLE
- ▨ = HIGHEST pp PAHs
- PAHs = POLYNUCLEAR AROMATIC HYDROCARBONS
- 40PAHs = SUM OF 40 PAHs
- S = SEDIMENT SAMPLE
- M = MUSSEL SAMPLE
- C = CLAM SAMPLE



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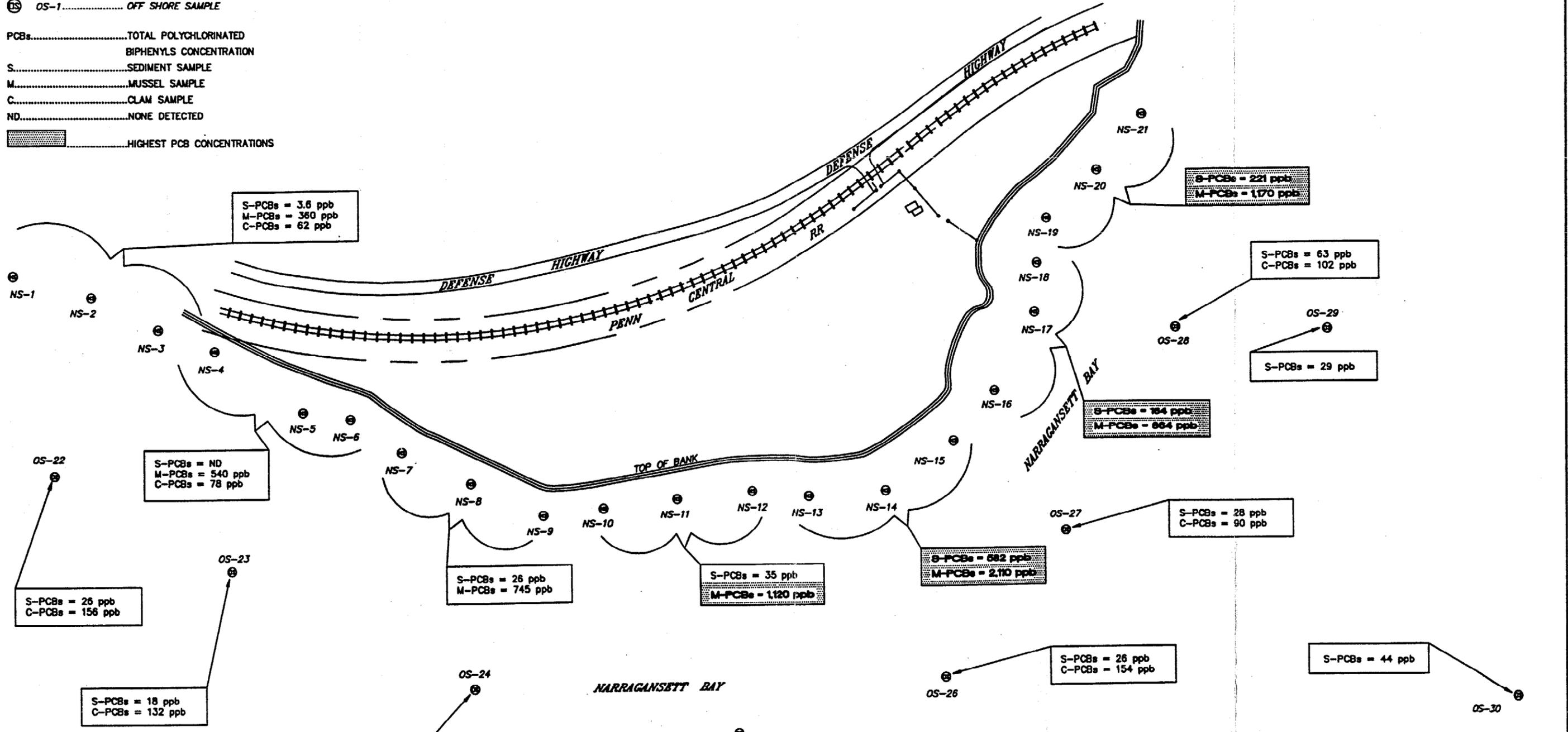
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SITE 01 - McALLISTER POINT LANDFILL
FIGURE 4-11
SEDIMENT AND BIVALVE PAHs RESULTS MAP

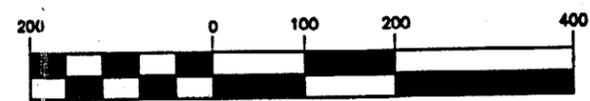
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LEGEND

- NS-1..... NEAR SHORE SAMPLE
- OS-1..... OFF SHORE SAMPLE
- PCBs.....TOTAL POLYCHLORINATED BIPHENYLS CONCENTRATION
- S.....SEDIMENT SAMPLE
- M.....MUSSEL SAMPLE
- C.....CLAM SAMPLE
- ND.....NONE DETECTED
- .....HIGHEST PCB CONCENTRATIONS



GRAPHIC SCALE



(IN FEET)
1 inch = 200 ft.

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FIGURE 4-12 SEDIMENT AND BIVALVE PCB RESULTS MAP	
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Figure 4 - 13

Marine ERA Sampling Locations and Zones of Ecological Concern

