BRIEFING DOCUMENT

Naval Education and Training Center
Newport, Rhode Island
March, 1993

TRC Environmental Corporation

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NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

- Plan of Action Schedule
- NETC Site Plan and Figures
- Phase II RI/FS Work Plan
- Scope of Work - RI/FS Activities
- Study Area Screening Evaluations
- Soil Investigation Tank Farm Five - Tanks 53 and 56
- Interim Remedial Action - Ground Water Treatment near Tanks 53 and 56 - Tank Farm Five
- Interim Remedial Action - McAllister Point Landfill
- UST Closure Investigation and Conceptual Design - Tank Farm Five

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PLAN OF ACTION SCHEDULE

Naval Education & Training Center, Newport, RI

ACTIVITY COMPLETED
⊗ ACTIVITY STARTS
○ ACTIVITY ON STAND-BY

ACTIVITIES	*FISCAL YEAR 1993*	*FISCAL YEAR 1994*	*FISCAL YEAR 1995*
SITE 01 - McALLISTER POINT LANDFILL			
- Phase II RI/FS Work Plan	●		
- Phase II Field Investigation	⊗	●	
- Focused Feasiblity Study, Proposed Plan, ROD	●		
- Cap Design - Interim Remedial Action	⊗	●	
- Cap Construction		⊗	
SITE 02 - MELVILLE NORTH LANDFILL			
- Oil-Soaked Soil Pile Removal	●		
- Phase II RI/FS Work Plan	●		
- Phase II Field Investigation	○	●	
- Hot Spot Interim Remedial Action Work Plan (=Remedial Design)	⊗	●	
SITE 09 - OLD FIRE FIGHTING TRAINING AREA			
- Phase II RI/FS Work Plan	●		
- ATSDR Surface Soil Sampling	●		
- Phase II Field Investigation	⊗	●	
- Off-site UST CHI Investigation Work Plan	●		
- UST Field Investigation	⊗	●	
SITE 12 - TANK FARM FOUR			
- Phase II RI/FS Work Plan	●		
- Phase II Field Investigation	○	●	
- UST Product Removal	●		
- No Further Action Under CERCLA		●	
- UST Closure Report		●	
- UST Closure Initiation		○	⊗
SITE 13 - TANK FARM FIVE			
- Remedial Design of Ground Water Interim Remedial Action	●		
- Remedial Action of Ground Water Interim Remedial Action		●	
- Tanks 53 & 56 Soil Investigation Report	●		
- Phase II RI/FS Work Plan	●		
- Phase II Field Investigation	○	●	
- Tank Farm Five UST Closure Report	●		
- Tank Farm Five UST Closure Initiation		⊗	⊗
OFF-SHORE SAMPLING EFFORT	●		
STUDY AREAS 4, 8, 17			
- Work Plan	●		
- Field Work	○	●	
STUDY AREAS 7, 10, 11			
- Work Plan	○	●	
- Field Work		●	
DERECKTOR SHIP YARD			
- Work Plan	○	●	
- Field Investigation			

February 1993

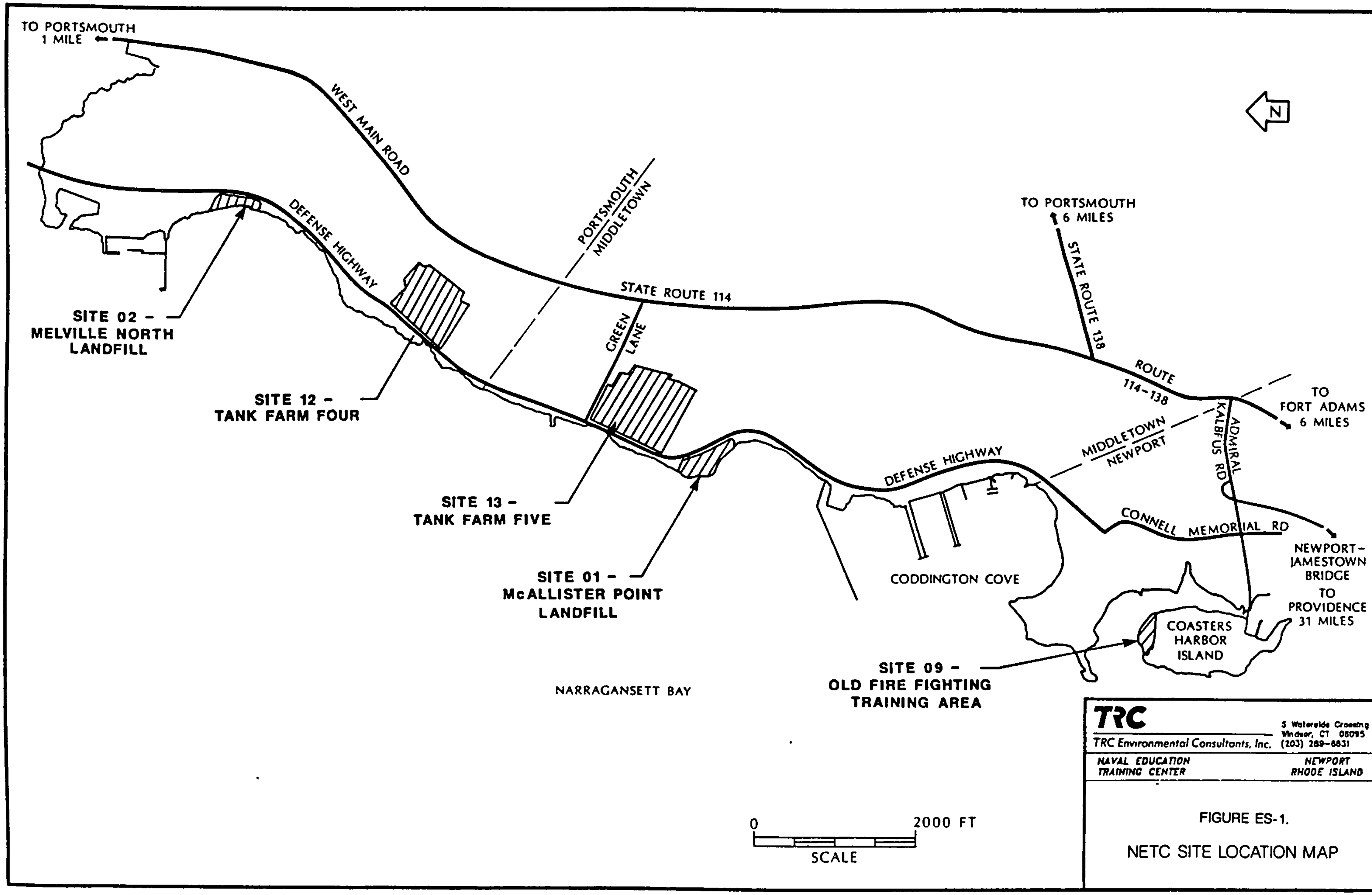


FIGURE ES-1.

NETC SITE LOCATION MAP

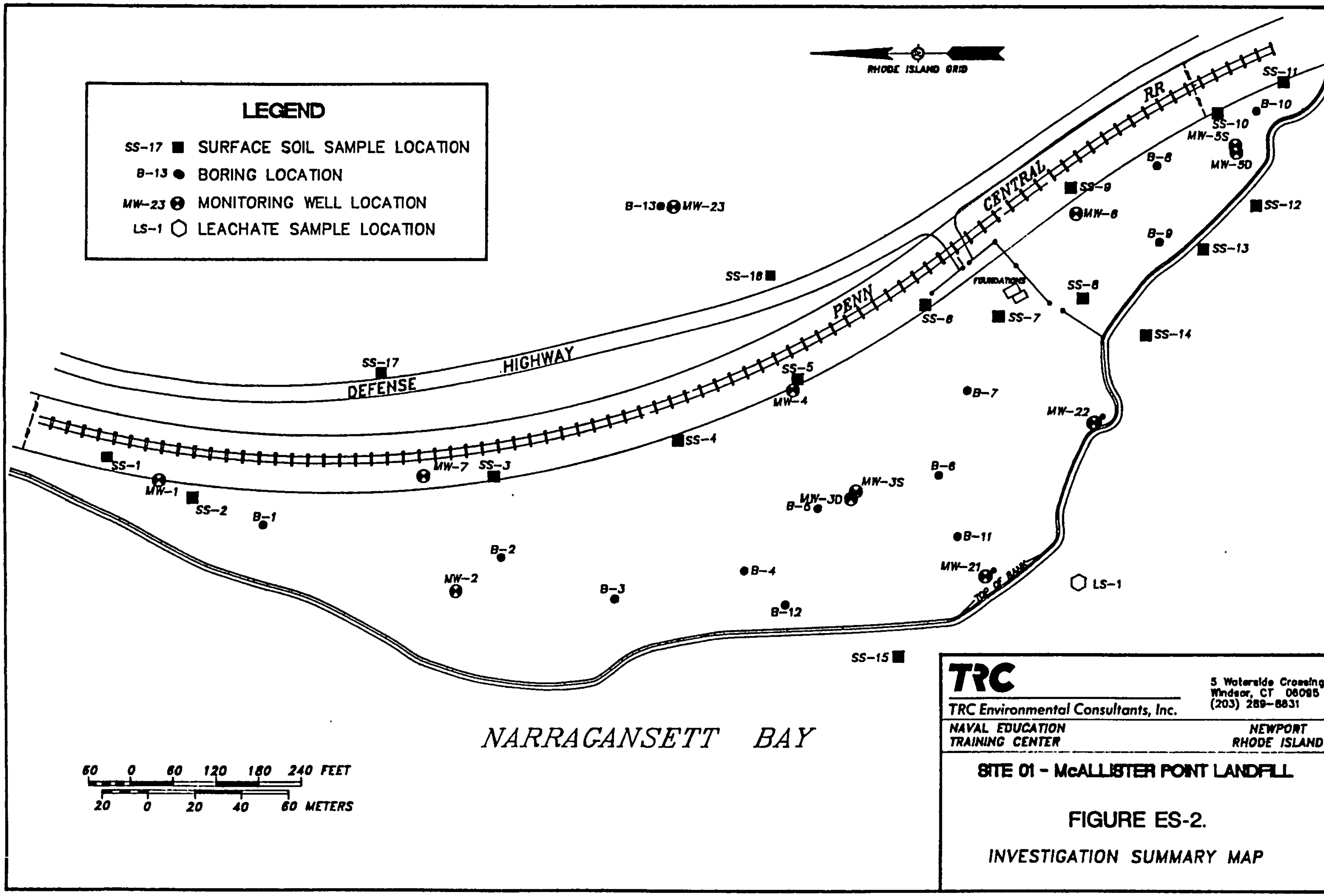
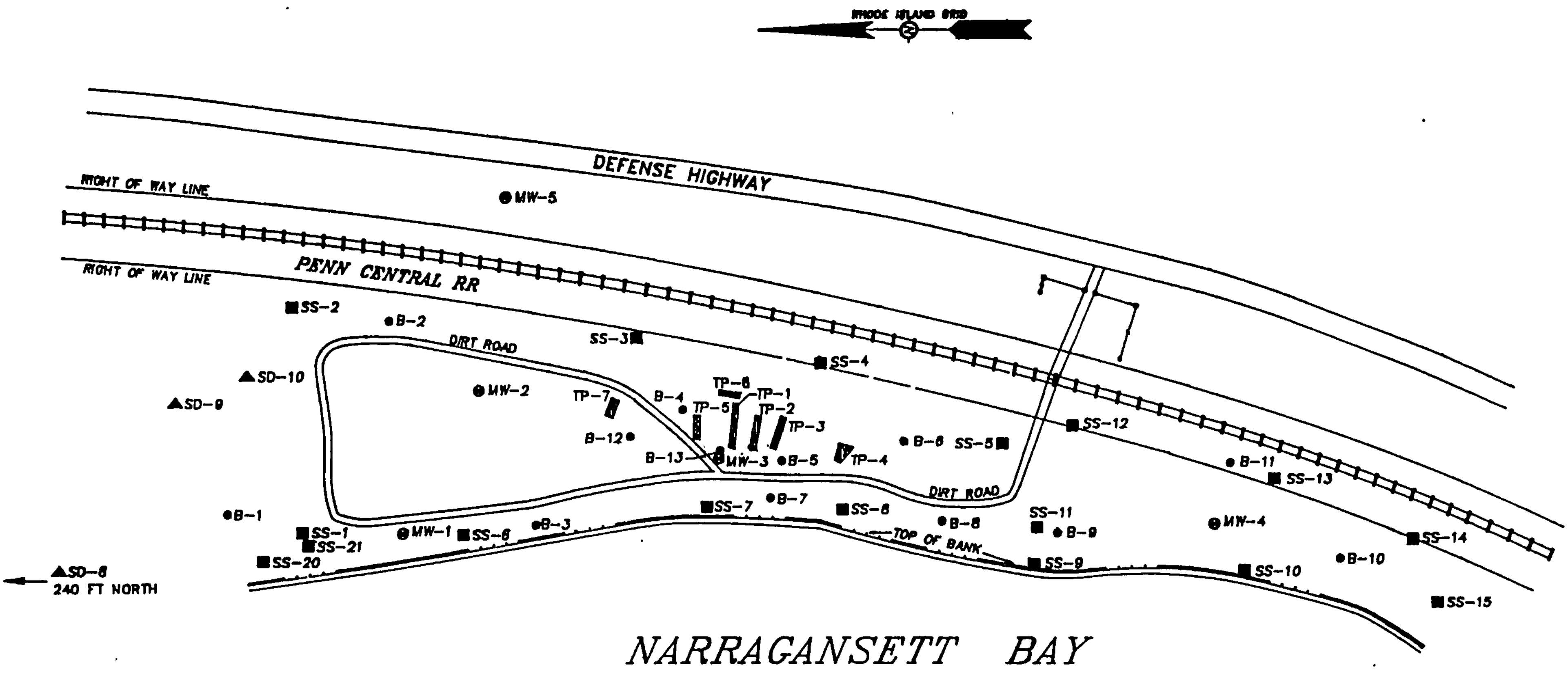


FIGURE ES-2.

INVESTIGATION SUMMARY MAP



60 0 60 120 180 240 FEET
20 0 20 40 60 METERS

LEGEND

- SS-8 ■ SURFACE SOIL SAMPLE LOCATION
- B-7 ● BORING LOCATION
- MW-4 ⊕ MONITORING WELL LOCATION
- SD-10 ▲ SEDIMENT SAMPLE LOCATION
- TP-7 ▮ TEST PIT LOCATION

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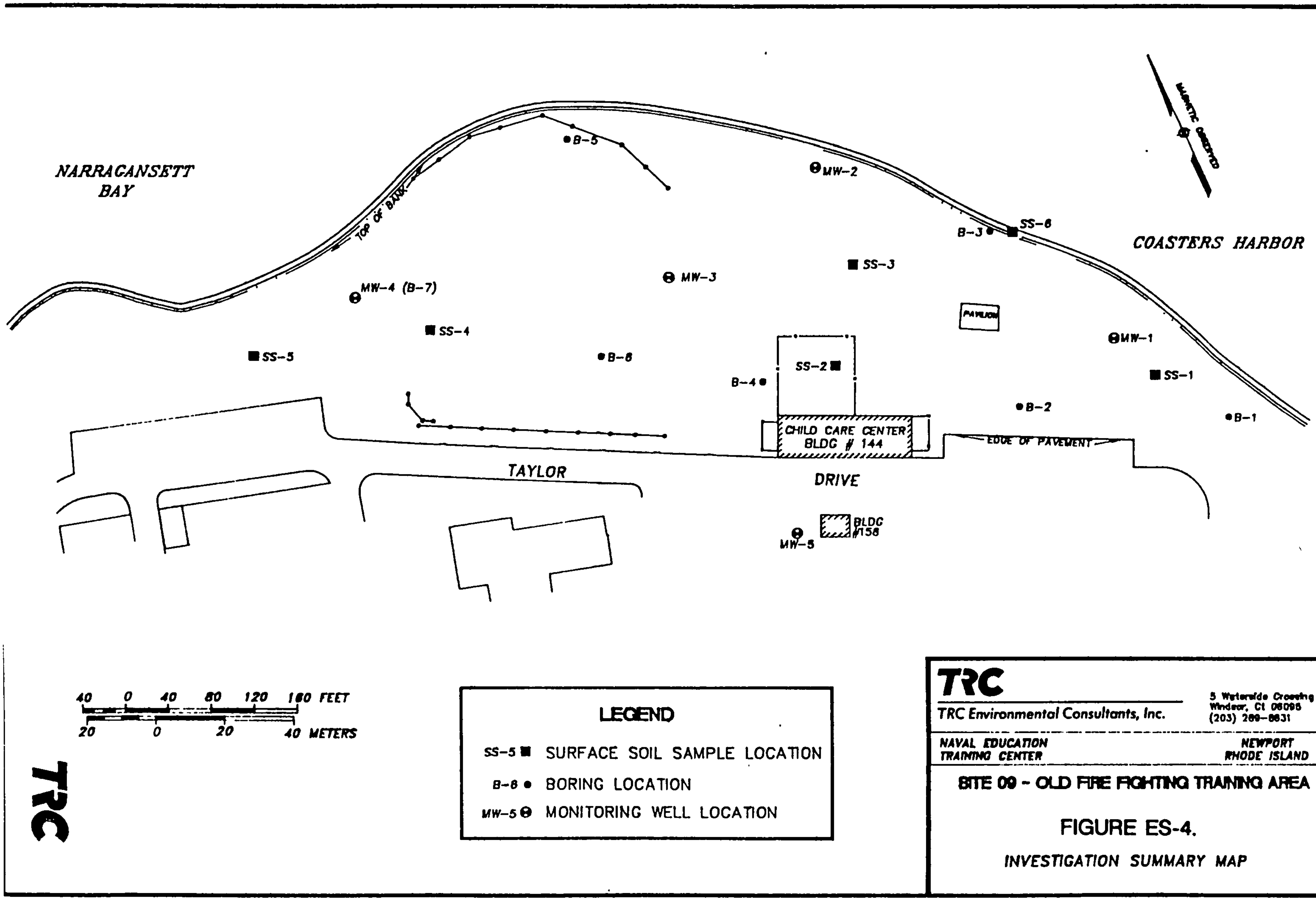
SITE 02 - MELVILLE NORTH LANDFILL

FIGURE ES-3.

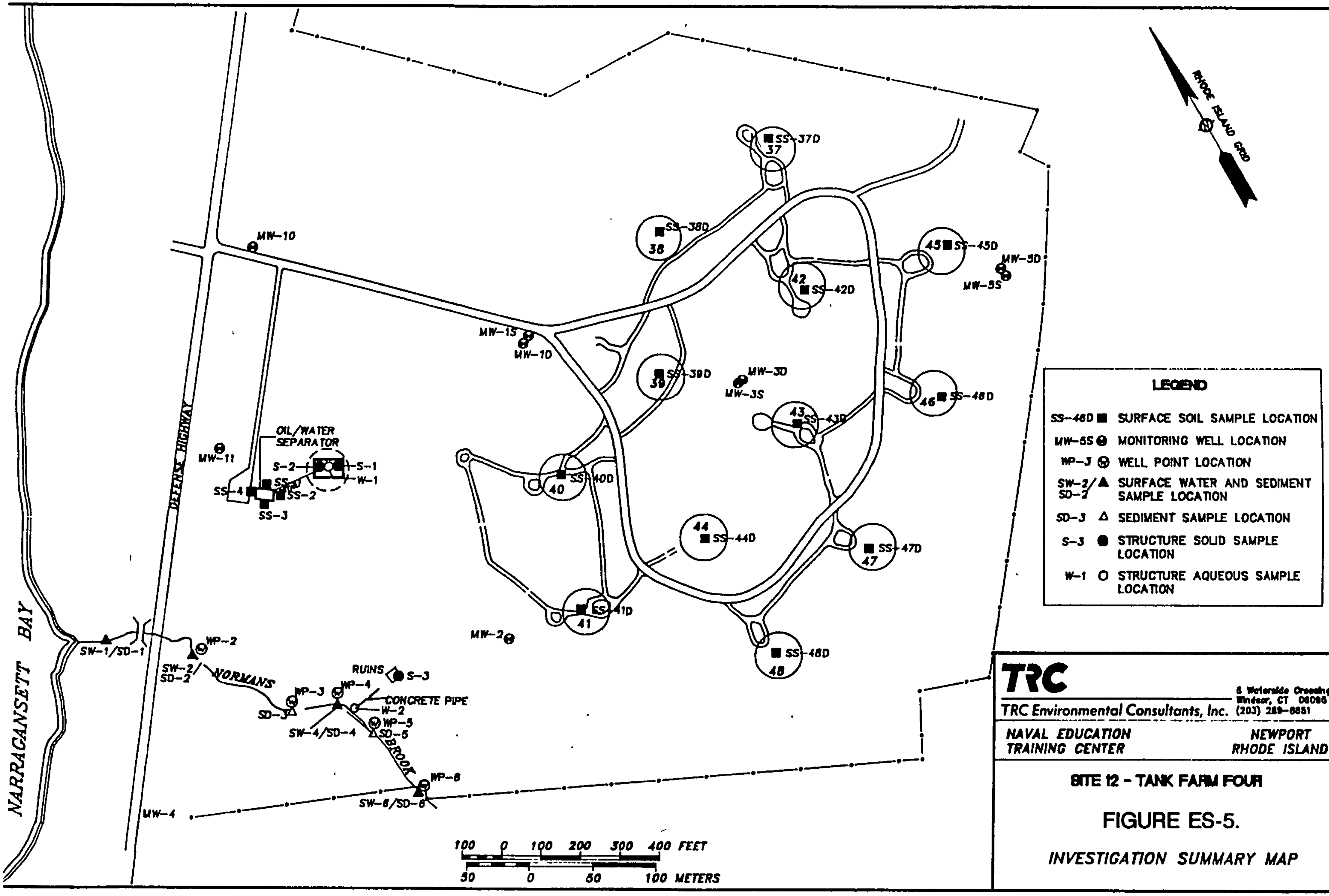
INVESTIGATION SUMMARY MAP



SITE 09 - OLD FIRE FIGHTING TRAINING AREA

FIGURE ES-4.

INVESTIGATION SUMMARY MAP


LEGEND
SS-46D ■ SURFACE SOIL SAMPLE LOCATION
MW-6S MONITORING WELL LOCATION
WP-3 WELL POINT LOCATION
SW-2/SD-2 ▲ SURFACE WATER AND SEDIMENT SAMPLE LOCATION
SD-3 △ SEDIMENT SAMPLE LOCATION
S-3 ● STRUCTURE SOLID SAMPLE LOCATION
W-1 ○ STRUCTURE AQUEOUS SAMPLE LOCATION
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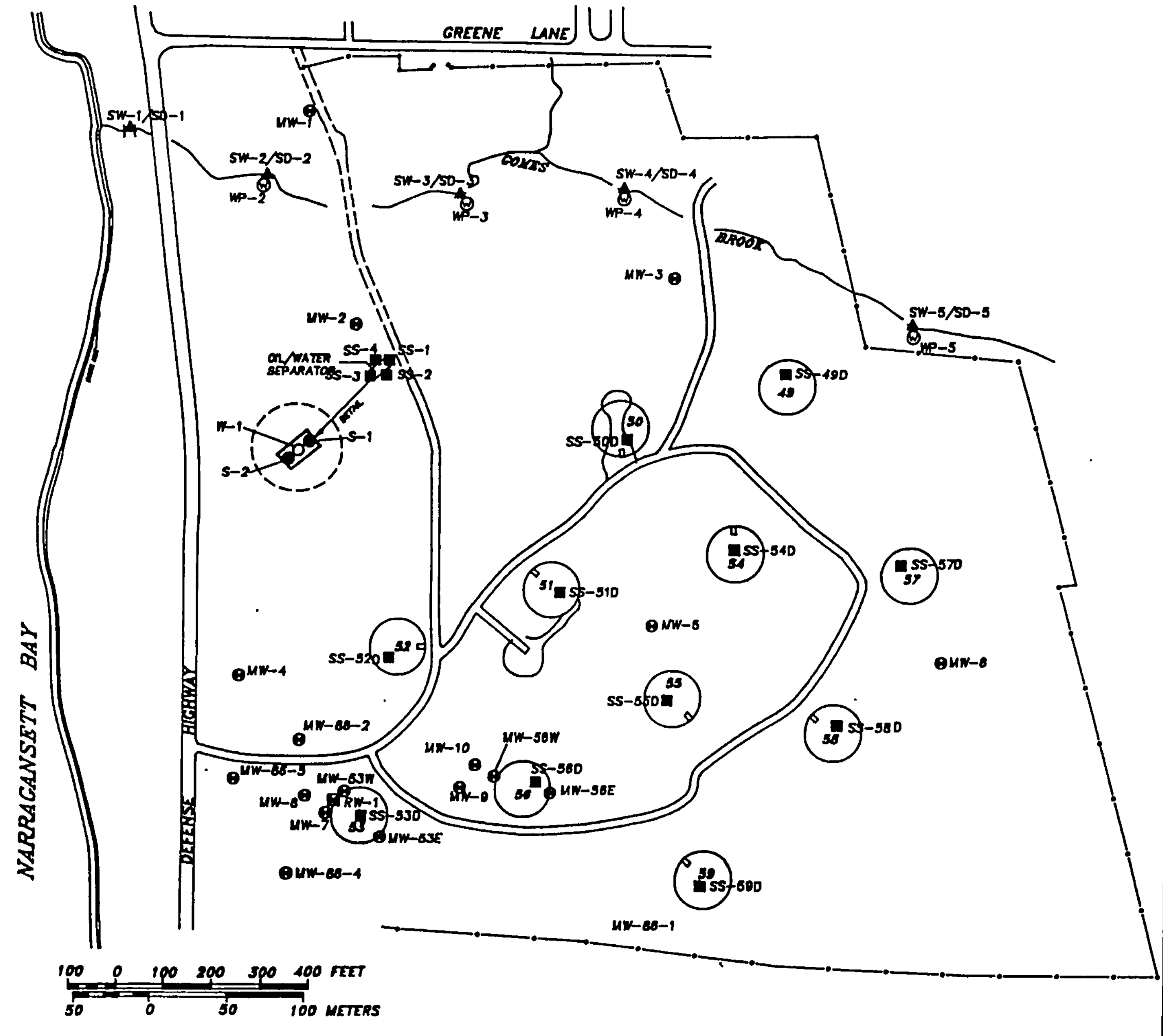
NEWPORT RHODE ISLAND
SITE 12 - TANK FARM FOUR
FIGURE ES-5.
INVESTIGATION SUMMARY MAP
RHODE ISLAND GRID
NARRAGANSETT BAY
DEFENSE HIGHWAY
NORMANS BROOK
OIL/WATER SEPARATOR
RUINS
CONCRETE PIPE
100 0 100 200 300 400 FEET
50 0 50 100 METERS



LEGEND

SS-57 ■	SURFACE SOIL SAMPLE LOCATION
MW-8 ⊖	MONITORING WELL LOCATION
WP-2 ⊛	WELL POINT LOCATION
SW-2/SD-2 ▲	SURFACE WATER AND SEDIMENT SAMPLE LOCATION
S-1 ●	STRUCTURE SOLID SAMPLE LOCATION
W-1 ○	STRUCTURE AQUEOUS SAMPLE LOCATION

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SITE 13 - TANK FARM FIVE

FIGURE ES-6.

INVESTIGATION SUMMARY MAP

PHASE II RI/FS WORK PLAN
NAVAL EDUCATION AND TRAINING CENTER - NEWPORT, RHODE ISLAND

Completion Date:

Scheduled Due Date - Final Work Plan - March 22, 1993

Objective:

The objectives of the NETC site investigations were 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 and the environment exists, and to provide the information required to develop and evaluate remedial action alternatives for the following five sites at NETC.

- McAllister Point Landfill (Site 01)
- Melville North Landfill (Site 02)
- Old Fire Fighting Training Area (Site 09)
- Tank Farm Four (Site 12)
- Tank Farm Five (Site 13)

DRAFT

TABLE 1

SITE 01 – McALLISTER POINT LANDFILL
SITE INVESTIGATION SUMMARY

ACTIVITY / SAMPLE MATRIX	SCOPE OF WORK	NUMBER OF SAMPLES	SAMPLE ANALYSIS
GEOPHYSICS			
EM–31	50' & 10' Spacing	NA	NA
Seismic Refraction	Multiple traverses	NA	NA
SOIL GAS	2 areas	24 Points	Modified 601/602
SURFACE SOIL	32 Locations	32 13	TCL/TAL TOC, Grain Size
TEST BORING SOIL	13 Locations	26 – 39 3	TCL/TAL Dioxins/Furans
WELL BORING SOIL	9 Borings	13 – 18 9	TCL/TAL TOC, Grain Size, Cation Exchange
GROUND WATER	14 new wells at 9 locations:	14 5	14 TCL/TAL, 7 Chloride 5 Dissolved TAL, BOD, COD,TSS
	12 existing wells	12	12 TCL/TAL
LEACHATE	5 Locations Assumed	5	5 TCL/TAL, Total Chloride

Not : "NA" indicates that activity is not applicable.
TCL indicates sample will be analyzed for Target Compound List.
TAL indicates sample will be analyzed for Target Analyte List.
In addition to dissolved (filtered metals), five ground water samples will also be analyzed for BOD, COD, and TSS for treatability information.

TABLE 1

SITE 02 – MELVILLE NORTH LANDFILL
SITE INVESTIGATION SUMMARY

DRAFT

ACTIVITY / SAMPLE MATRIX	SCOPE OF WORK	NUMBER OF SAMPLES	SAMPLE ANALYSIS
GEOPHYSICS Seismic Refraction	Multiple traverses	NA	NA
SOIL GAS	2 areas	30 Points	NA
SURFACE SOIL	10 Locations	10	TCL/TAL
TEST BORINGS	12 Locations	24 – 36	TCL/TAL
WELL BORINGS	9 Borings	18 – 27	TCL/TAL
GROUND WATER	12 wells at 9 new locations: 6 shallow wells, 3 shallow/bedrock wells, & 1 bedrock well	17 (1 per Phase II well + 5 existing wells)	17 TCL /22 TAL

Note: "NA" indicates that activity is not applicable.
TCL indicates sample will be analyzed for Target Compound List.
TAL indicates sample will be analyzed for Target Analyte List.
In addition to dissolved (filtered metals), five ground water samples will also be analyzed for BOD, COD, and TSS for treatability information.

DRAFT

TABLE 1

SITE 09 – OLD FIRE FIGHTING TRAINING AREA
SITE INVESTIGATION SUMMARY

ACTIVITY / SAMPLE MATRIX	SCOPE OF WORK	NUMBER OF SAMPLES	SAMPLE ANALYSIS
GEOPHYSICS			
EM–31	50' & 10' Spacing	NA	NA
Magnetometer	50' & 10' Spacing	NA	NA
Seismic Refraction	Multiply traverses	NA	NA
SOIL GAS	1 Area	16 Points	Modified 601/602
SURFACE SOIL	15 Locations	15	TCL/TAL
		5	TOC, Grain Size
TEST BORING SOIL	11 Locations	22 – 33	TCL/TAL
WELL BORING SOIL	6 Borings	12 – 18	TCL/TAL
		6	TOC, Cation Exchange Grain Size
TEST PIT SOIL	5 Locations	5 – 15	TCL/TAL
GROUND WATER	10 new wells at 6 locations;	10	TCL/TAL, Chloride
	6 shallow wells & 4 shallow bedrock wells	5	Dissolved TAL, BOD, COD, TSS
	5 existing wells	5	Dissolved TAL, BOD, COD, TSS

Note: "NA" indicates that activity is not applicable.
TCL indicates sample will be analyzed for Target Compound List.
TAL indicates sample will be analyzed for Target Analyte List.

TABLE 1

SITE 12 – TANK FARM FOUR
SITE INVESTIGATION SUMMARY

DRAFT

ACTIVITY / SAMPLE MATRIX	SCOPE OF WORK	NUMBER OF SAMPLES	SAMPLE ANALYSIS
SURFACE SOIL	29 Locations	29	TCL/TAL
STRUCTURES (water & soil)	3 Chambers, 2 Water Samples	3 Soil & 5 Water	TCL/TAL
WELL BORING SOIL	10 Locations	20 – 30 10	TCL/TAL TOC, Cation Exchange, Grain Size
GROUND WATER	14 new wells at 10 locations 9 shallow wells & 4 shallow bedrock wells 10 existing wells	14 5 10	TCL/TAL, Chloride Dissolved TAL, BOD, COD, TSS TCL, TOC, Chloride
SURFACE WATER	13 Stations	13	TCL/TAL
SEDIMENT	12 Stations	12	Sediment List (1)

Note: "NA" indicates that activity is not applicable.
TCL indicates sample will be analyzed for Target Compound List.
TAL indicates sample will be analyzed for Target Analyte List.
(1) Sediment List is composed of TCL, TAL, total organic carbon, grain size, and acid volatile sulfides.

TABLE 1

SITE 13 – TANK FARM FIVE
SITE INVESTIGATION SUMMARY

DRAFT

ACTIVITY / SAMPLE MATRIX	SCOPE OF WORK	NUMBER OF SAMPLES	SAMPLE ANALYSIS
SURFACE SOIL	35 Locations	31 4	TCL/TAL Dioxins/Furans
WELL BORINGS	6 Locations	12 – 18 6	TCL/TAL TOC, Grain Size, Cation Exchange
GROUND WATER	10 wells at 6 locations; 6 shallow wells & 4 shallow bedrock wells	10	TCL/TAL, Less Pesticides/ Herbicides and Chloride
	19 existing wells	19	TCL VOCs/TAL and Chloride
	5 locations	5	Dissolved TAL, BOD, COD, TSS
SURFACE WATER	13 Stations	13	TCL/TAL
SEDIMENT	13 Stations	13	Sediment List (1)

Note: "NA" indicates that activity is not applicable.
TCL indicates sample will be analyzed for Target Compound List.
TAL indicates sample will be analyzed for Target Analyte List.
(1) Sediment List is composed of TCL, TAL, total organic carbon, and acid volatile sulfides.

SCOPE OF WORK
RI/FS ACTIVITIES

Completion Date:

Draft Report - December 1992

Objective:

Identify past environmental work completed at the Newport Naval Base - Naval Education and Training Center (NETC) and provide a framework and estimated time frame to complete the remaining investigation/cleanup process.

Summary:

The Scope of Work for RI/FS activities summarizes the history of NETC and previous environmental investigations completed at NETC Newport. Previous investigations have included and Initial Assessment Study (1983), a Confirmation Study (1986), and a Phase I Remedial Investigation (1991). A Phase II Remedial Investigation is planned for each of five sites investigated during the Phase I RI (including the Melville North Landfill). In addition, the SOW summarizes the proposed Study Area Screening Evaluations (SASEs) planned at three areas at NETC. Following the summary of past and planned work, a proposed schedule is presented for initiation and completion of work at RI/FS sites and SASE sites.

U.S. DEPARTMENT OF NAVY
INSTALLATION RESTORATION PROGRAM

DRAFT
SCOPE OF WORK - RI/FS ACTIVITIES
NAVAL EDUCATION AND TRAINING CENTER, NEWPORT, RHODE ISLAND

Prepared by:
TRC Environmental Corporation
Windsor, CT

Prepared for:
Northern Division - Naval Facilities
Engineering Command
Lester, Pennsylvania

December, 1992

TRC-EC Project No. 6760-N81-160
Contract No. N62472-86-C-1282

TABLE OF CONTENTS

SCOPE OF WORK

TABLES

TABLE OF CONTENTS

SCOPE OF WORK

FIGURES

List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
CS	Confirmation Study
CERCLA	Comprehensive Environmental Response Compensation and Liabilities Act
DERP	Defense Environmental Restoration Program
DOD	Department of Defense
EFD	Engineering Field Division
EPA	Environmental Protection Agency
FFA	Federal Facilities Agreement
FUDS	Formerly-Used Defense Site
FS	Feasibility Study
FSP	Field Sampling Plan
HASP	Health and Safety Plan
IAS	Initial Assessment Study
IRA	Interim Remedial Action
IRP	Installation Restoration Program
QAPP	Quality Assurance Project Plan
NACIP	Naval Assessment and Control of Installation Pollutants
NAVFACENGCOM	Naval Facilities Engineering Command
NCP	National Contingency Plan
NETC	Naval Education and Training Center
NEESA	Naval Energy and Environmental Support Activity
NORTHDIV	Northern Division NAVFACENGCOM
NPL	National Priorities List
NUWC	Naval Undersea Warfare Center
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
RI/FS	Remedial Investigation/Feasibility Study
RPM	Remedial Project Manager
SASE	Study Area Screening Evaluation
SER	Shore Establishment Realignment
SOW	Scope of Work
TRC	Technical Review Committee
TRC-EC	TRC Environmental Corporation

1.0 INTRODUCTION

This Scope of Work (SOW) provides an overview of the Remedial Investigation/Feasibility Study (RI/FS) being conducted at the Newport Naval Base in Newport, Rhode Island. This document identifies past environmental work completed at the Newport Naval Base - Naval Education and Training Center (NETC), and provides a framework and estimated time frame to complete the remaining investigation/cleanup process.

The remedial response process that will be followed at NETC Newport is shown in Figure 1.

1.1 PURPOSE

The purpose of the RI/FS process is to:

- Implement a RI to assess the nature and extent of contamination that was caused by the possible release of hazardous substances at NETC Newport.

- Identify and expedite the implementation of Interim Remedial Actions (IRAs) that are appropriate to protect human health and/or the environment prior to implementing the final cleanup remedies.

- Prepare a FS which will systematically evaluate and screen possible site cleanup technologies. This process allows the definition and development of a focused range of comprehensive cleanup techniques. The cleanup techniques will be compared and will provide the basis for the selection of a recommended remedial alternative(s) which will eliminate or minimize potential risks to human health and/or the environment.

- Implement the final remedial alternative(s) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and in compliance with other Applicable or Relevant and Appropriate Requirements (ARARs).

1.2 SCOPE

The SOW encompasses environmental investigation and restoration activities undertaken at NETC, Newport. These include the 1983 Initial Assessment Study (IAS - Envirodyne Engineers), the 1986 Confirmation Study (CS - Loureiro Engineering Associates), the current RI/FS, and the Study Area Screening Evaluations (SASEs). In addition, the Scope of Work addresses the process to be followed to implement selected cleanup activities.

2.0 BACKGROUND

2.1 LOCATION

The NETC is located within the Newport Naval Base, which encompasses approximately six miles of the western shore of Aquidneck Island, Newport County, Rhode Island. Aquidneck Island is comprised of three towns; Newport, Middletown, and Portsmouth. NETC serves as a training facility and provides logistic support for the Newport Naval Base. A plan indicating the location of the Newport Naval Base is provided as Figure 2.

Eighteen potentially contaminated sites at NETC were identified by the IAS in 1983. A summary of site characteristics, studies completed, and plan of action for each of the eighteen sites is provided in Table 1. Table 2 provides a status summary for each of these sites. The location of each of the sites at NETC is provided in Figure 3.

2.2 HISTORY

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 may pose a significant threat to the public health and environment. The listing for NETC also included: i) the real property comprising the Naval Undersea Warfare Center (NUWC formerly the Naval Underwater Systems Command 'NUSC') Division Newport which is contiguous to NETC Newport; and, ii) those portions of Gould Island which are currently owned by the Navy.

A Federal Facilities Interagency Agreement (FFA) was signed by the U.S. Department of 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 Installation Restoration Program at NETC Newport. The FFA was developed, in part, to ensure that environmental impacts associated with past and present activities at NETC Newport are thoroughly investigated and remediated, as necessary.

NETC Newport facilities have been under assessment through the Department of the Navy's Assessment and Control of Installation Pollutants (NACIP) program. The NACIP program was established to identify and control environmental contamination from past use and disposal of hazardous substances at Naval installations. The NACIP program is part of the Department of Defense (DOD) Installation Restoration Program (IRP), which is similar to the U.S. EPA's Superfund program authorized by CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

The NACIP program consists of three phases: Phase I - IAS, Phase II - CS, and Phase III - Remedial Measures phase. The IAS is discussed in Section 3.0, the CS in Section 4.0 and Remedial Measures relative to investigation activities is discussed in Section 5.0.

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 is presented below.

Mid-1960's - 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 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)

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 substantitive 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).

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.

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.

The above chronology pertinent to NETC Newport site investigations was obtained from the 1983 IAS the 1986 CS, the 1988 Draft Tank Closure Plan for Tanks 53 and 56, the 1991 Phase I RI/FS, the March 23, 1992 FFA, and a review of information available in RIDEM files.

3.0 INITIAL ASSESSMENT STUDY

The IAS, conducted by Envirodyne Engineers, Inc. of St. Louis, Missouri, for the Navy in 1983, identified sites where contamination is suspected to exist and which may pose a threat to human health or the environment. This study included a review of archival and activity records, interviews with activity personnel, an on-site survey of the activity, and an off-site activity investigation.

A total of eighteen potential sites were identified by the IAS. The IAS concluded that no further action was required at three of the areas (sites 4, 8, and 9). Two of the areas (sites 3 and 16) were found to be outside of the scope of the NACIP program and were not discussed further in the report. Further investigation was recommended at the remaining thirteen areas. Of the eighteen sites, eight (sites 2, 3, 5, 6, 14, 15, 16, and 18) are outside the real property boundaries of NETC Newport.

4.0 CONFIRMATION STUDY

A CS was conducted at six of the thirteen areas recommended in the IAS for further investigation. The CS was conducted by Loureiro Engineering Associates, Avon, Connecticut, and was completed in 1986. Confirmation studies were conducted 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 - the Gould Island Disposal Area, and
- Site 17 - the Gould Island Electroplating Shop.

The Confirmation Studies were completed in two steps: a Verification Step and a Characterization Step. The objectives of the Verification Step were to identify sources of contamination, assess the presence of specific toxic and hazardous materials, and assess general site hydrogeology characteristics. The objective of the Characterization Step was to develop a quantitative assessment of the extent of any contamination identified in the Verification Step.

Verification Step results were summarized in a report dated May 8, 1984, and Characterization step results were discussed in a report dated July 26, 1985. The final CS findings, which includes results of both the Verification and Characterization steps are presented in a report dated May 15, 1986.

5.0 CURRENT RI/FS PROGRAM STATUS

5.1 PHASE I REMEDIAL INVESTIGATION

A Phase I Remedial Investigation (RI) has been conducted at the following five NETC Newport 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.

Findings of the Phase I RI are presented in a draft Phase I RI report (TRC-EC, 1991). A summary of Phase I RI activities conducted at each of the sites is provided in Table 3.

5.2 PHASE II REMEDIAL INVESTIGATION/FEASIBILITY STUDY

A Phase II Remedial Investigation/Feasibility Study (RI/FS) is planned for each of the five sites investigated during the Phase I RI/FS. A draft Phase II Work Plan was developed for each site in September, 1992. The planned Phase II investigation activities build upon the existing database at each site and are intended to provide site-specific information sufficient to support informed risk management decisions regarding any necessary or appropriate site remedies.

A summary of the currently planned Phase II investigation activities at the following five sites is provided in Table 4. The Phase II RI/FS plan is currently under review by the EPA and RIDEM and will be revised upon receipt of their comments.

Project plans for the Phase II work effort include the site-specific Field Sampling Plan (FSP), a Quality Assurance Project Plan (QAPP), and a project Health and Safety Plan (HASP). In addition, the Phase II Work Plan includes discussions of NETC Newport and site-specific background information which has been updated to include the results of the Phase I RI, a discussion of ARARs and preliminary action alternatives, a Data Evaluation and Assessment Plan which addresses data management and the RI Report outline, a supplemental Human Health Risk Assessment Plan, and an Ecological Risk Assessment Plan. A discussion of treatability studies and pilot testing is also included in a Treatability Study and Feasibility Study Plan.

5.3 STUDY AREA SCREENING EVALUATIONS

The objective of the Study Area Screening Evaluation (SASE) investigations are to assess the presence and any nature of environmental contamination at suspected locations. The site investigations will be conducted at each site to assess the presence of any hazardous substances, the nature of any materials disposed, and the potential for releases of any contamination. The findings of these SASE investigations will be used to assess the need to perform any further environmental investigations at each site.

SASE investigations are currently planned at the following three areas:

- Study Area 04 - Coddington Cove Rubble Fill Area
- Study Area 08 - NUSC Disposal Area
- Study Area 17 - Gould Island Electroplating Shop

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.

6.0 PROJECT ORGANIZATION AND MANAGEMENT

The Naval Facilities Engineering Command (NAVFACENGCOM) has overall responsibility for the Installation Restoration (IR) program at NETC Newport. This responsibility includes identifying the level of funding available for the program and reviewing and commenting on primary and secondary documents. Technical work for NETC Newport will be managed by the Northern Division (NORTHDIV), Engineering Field Division (EFD) of NAVFACENGCOM. NORTHDIV is headquartered in Lester, Pennsylvania.

Several support activities are available to advance NAVFACENGCOM's mission. Support activities include the Naval Energy and Environmental Support Activity (NEESA) among others. In general, NEESA provides technical and administrative support including: guidance documents, technical review and recommendations of RI/FS and Remedial Action plans, field sampling teams if necessary, maintenance of program documents, providing IR related training, and other program and technical analyses as requested.

Coordination and day-to-day management of the NETC Newport IR program is the responsibility of the NORTHDIV Remedial Project Manager (RPM). The RPM is the prime contact for remedial or other response actions at sites in the IR program. The RPM's responsibilities include:

a. Coordinating, directing and reviewing the IR Program work.
b. Assuring compliance with the National Contingency Plan (NCP).
c. Recommending action for decisions.

In addition, the RPM meets with representatives from the U.S. Environmental Protection Agency (EPA), the Rhode Island Department of Environmental Management (RIDEM), project contractors, and other members of the Technical Review Committee (TRC) on a regular basis to discuss the progress of the program. Members of the TRC will review and provide comments of the execution of the IR program at NETC Newport.

7.0 DELIVERABLES AND SCHEDULE

A projected schedule for completion of Study Area Screening Evaluations (SASE) is provided as Figure 4A (Sites 4, 8 and 17). A projected schedule for completion of the Remedial Investigation/Feasibility Studies (RI/FS) is provided as Figure 4B (Sites 1, 9, 12, and 13). A projected schedule for completion of RI/FS activities at Site 1 - McAllister Point Landfill is provided as Figure 4C. Projected schedules were prepared in accordance with Section XIV of the March 23, 1992 FFA between the U.S. Environmental Protection Agency, the State of Rhode Island, and the U.S. Department of the Navy.

A summary of Primary and Secondary Documents as defined in the FFA is provided as Table 5. Flow charts indicating the process which will be used to review Primary and Secondary Documents are provided as Figures 5A and 5B, respectively. Secondary Documents include those documents that are discrete portions of the Primary Documents and are typically input or feeder documents.

8.0 REFERENCES

Envirodyne Engineers, Inc., 1983. Initial Assessment Study Naval Education and Training Center, Newport, RI, prepared for the Navy.

Environmental Resource Associates, Inc., 1987. Tank Closure Plan for Tanks 53 and 56, Tank Farm 5, Naval Education and Training Center, Newport, RI, prepared for the Navy.

Loureiro Engineering Associates, 1986. Confirmation Study Report, Naval Education and Training Center, Newport, RI, prepared for the Navy.

TRC Environmental Corporation, November, 1991, Draft Final Report Remedial Investigation, Naval Education and Training Center, Newport, Rhode Island, prepared for the Northern Division, Naval Facilities Engineering Command.

TABLES

TABLE 1

SUMMARY OF NETC HAZARDOUS WASTE SITES

No.	Site	Characteristics/Studies/Plan of Action
1	McAllister Point Landfill	1955-1970s - 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.
2	Melville North Landfill	WWII-1955 - 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	1980-1982 - Substation #214. The site has been excessed. NETC cleaned the site under a removal action.
4	Cooddington Cove Rubble Fill	1978-1982 - 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 SASE.
5	Melville North Area	1978-1982 - Twenty barrels of waste oil stored on an asphalted area. Oil was spilled in the area. The site has been excessed. An IAS was conducted of the site. NETC cleaned the site under a removal action.
6	STP Sludge Drying Bed	1982-1983 - 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.
7	Tank Farm #1	WWII-1970 - Located in Melville North. Contains six 60,000-barrel underground storage tanks (USTs) for diesel oil, fuel il, 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	Early 1970s - 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	WWII-1972 - 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 th 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	WWII-1970 - Located in Melville. Contains eleven 60,000-barrel USTs for fuel. Approximately 100,000-175,000 gallons of sludg 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	WWII-1970 - Located in Melville. Contains seven 60,000-barrel USTs for fuel. Tank sludg 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.
12	Tank Farm #4	WWII-1970 - Located in Melville. Contains twelv 60,000-barrel USTs for fuel. Approximately 10,000-190,000 gallons of tank sludge bottoms were disposed f on site. An IAS and CS were conducted of the site. Site is being investigated under the current RI/FS.

N .	Site	Characteristics/Studies/Plan of Action
13	Tank Farm #5	WWII-1970 - Located in Midway. 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	WWII - 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	WWII - 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	WWII - Six-ton capacity incinerator. An IAS conducted on the site concluded that no action is required at site.
17	Gould Island Electroplating Shop	WWII - Wastes generated from electroplating and degreasing operations. Wastes included muratic acid, chromic acid, copper cyanide, sodium cyanide, sodium hydroxide, nickel sulfate, Anodex leaner and degreasing solvents. Site has been excessed. An IAS and CS were conducted of the site. The site is being investigated under a SASE.
18	Structure #214 - Melville N rth	1980-1982 - Area adjacent to structure #214. Drums of waste oil and oily spillage. Site has been excessed. NETC cleaned the site under a removal action.

TABLE 2

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
3	Transformer Vault Structure #214 - Melville North	Private	Navy Clean-Up
4	Coddington Cove Rubble Fill	Navy	IAS, SASE(1)
5	Melville North Area	Private	IAS, Navy Clean-up
6	STP Sludge Drying Bed	Private	IAS, Navy Clean-up
7	Tank Farm One	Navy	IAS/CS(2)
8	NUSC Disposal Area	Navy	IAS, SASE(1)
9	Old Fire Fighting Training Area	Navy	IAS, RI/FS(3)
10	Tank Farm Two	Navy	IAS(2)
11	Tank Farm Three	Navy	IAS(2)
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(4)
15	Gould Island Bunker #11	State	IAS, Navy Clean-Up
16	Gould Island Incinerator	State	No Action
17	Gould Island Electroplating Shop	Navy	IAS/CS, SASE(1)
18	Structure #214 - Melville North	Private	IAS, Navy Clean-Up

(1) A Study Area Screening Evaluation (SASE) will be performed on each of these sites to determine need for an RI/FS.

(2) These Tank Farms are currently being investigated under a DFSP contract. SASE's of these sites are awaiting findings of the DFSP investigations.

(3) 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.

(4) Site #14 will be investigated by the Army Corps of Engineers (ACE).

TABLE 3

Summary of Phase I Activities
NETC Newport, Rhode Island

Site	Geophysics Methods	Soil Gas Points	Surface Soil Samples On/Off–Site	Boring Number/ Samples	Wells Numbers/ Samples	Test Pit/ Tank Samples	Ground Water Samples	Surface Water/ Sediment Samples	Structure Samples *(soil/water)*
Site – 01 McAllister Point Landfill	EM Magnetometer	–	15/2 TCL/TAL*	13 / 32 TCL/TAL*	9 / 17 TCL/TAL*	–	12 TCL/TAL	–	–
Site – 02 Melville North Landfill	EM Magnetometer	–	17 TCL/TAL*	13 / 25 TCL/TAL*	5 / 13 TCL/TAL*	4 / – TCL/TAL	5 TCL/TAL	– / 3 TCL/TAL	–
Site – 09 Old Fire Fighting Training Area	EM Magnetometer	81	6 TCL/TAL*	7 / 15 TCL/TAL*	5 / 10 TCL/TAL*	–	5 TCL/TAL	–	–
Site – 12 Tank Farm Four	–	61	28 TCL/TAL* TPH	–	8 / 5 TCL/TAL*	– / 23 TCL/TAL*	8 TCL/TAL	4 / 6 • TCL/TAL	3/2 • TCL/TAL
Site – 13 Tank Farm Five	–	51	26 TCL/TAL* TPH	–	6 / 12 TCL/TAL*	– / 21 TCL/TAL*	13 TCL/TAL*	5 / 5 • TCL/TAL	2/1 TCL/TAL•

Note: "–" indicates that the activity was not conducted at that site.
TCL indicates analysis for Target Compound List parameters
TAL indicates analysis for Target Analyte List parameters
• indicates that some samples were analyzed for a su[illegible]f TCL/TAL parameters, or for additional parameters
TPH indicates analysis for Total Petroleum Hydrocarbons

TABLE 4

Summary of Proposed Phase II Activities
NETC Newport, Rhode Island

Site	Geophysics Methods	Soil Gas Points	Surface Soil Samples	Boring Number/ Samples	Wells Numbers/ Samples	Test Pit Samples	Ground Water Samples	Surface Water/ Sediment Samples	Structure Samples (soil/water)
Site – 01 McAllister Point Landfill	EM Seismic Refraction	30	32 TCL/TAL	13 / 26 – 39 TCL/TAL	9 / 18 – 27 TCL/TAL	–	27 TCL/TAL 3 Filt. TAL	–	–
Site – 09 Old Fire Fighting Training Area	EM Magnetometer Seismic Refraction	–	12 TCL/TAL	11 / 22 – 33 TCL/TAL	6 / 12 – 18 TCL/TAL	4 / 8 – 12 TCL/TAL	14 TCL/TAL 3 Filt. TAL	–	–
Site – 12 Tank Farm Four	–	–	23 TCL/TAL	–	8 / 16 – 24 TCL/TAL	–	21 TCL/TAL 3 Filt. TAL	9 TCL/TAL Sediment List (1)	3 TCL/TAL
Site – 13 Tank Farm Five	–	–	29 TCL/TAL	–	6 / 12 – 18 TCL/TAL	–	22 TCL/TAL 3 Filt. TAL	13 TCL/TAL Sediment List (1)	–

Note: "–" indicates that the activity will not be conducted at that site.
"Filt" indicates field filtered samples for dissolved metals analysis.
TCL indicates sample will be analyzed for Target Compound List
TAL indicates sample will be analyzed for Target Analyte List
(1) Sediment List is composed of TCL, TAL, total organic carbon, and acid volatile sulfides

TABLE 5

PRIMARY AND SECONDARY DOCUMENT SUMMARY

Primary Documents

- **Study Area Screening Evaluation Report**
  (SASE)

- **RI/FS Work Plan**
  (and any RI/FS Work Plan addendums for subsequent phases)

- **Phase I RI Report**
  (including Sampling and Data Results, Risk Assessment, and Preliminary Analysis of Alternatives)

- **Phase II RI Work Plan**

- **Phase II RI Report**
  (including Sampling and Data Results, Risk Assessment Addendum, if warranted by the scope of the Remedial Investigation)

- **RI/FS Report**
  (including Treatability and Pilot Study(s), if warranted by the scope and findings of the Remedial Investigation and the Initial Screening and Detailed Analysis of Alternatives)

- **Proposed Plan**

- **Remedial Design (RD) Work Plan**

- **Sixty Percent (60%) Remedial Design**
  (including QA/QC and Contingency Plan)

- **Final Remedial Design**
  (including Remedial Action Work Plan and Final Construction QA/QC Project Plan)

- **Project Closeout Report**

- **RI/FS Scope of Work**

- **RD/RA Scope of Work**

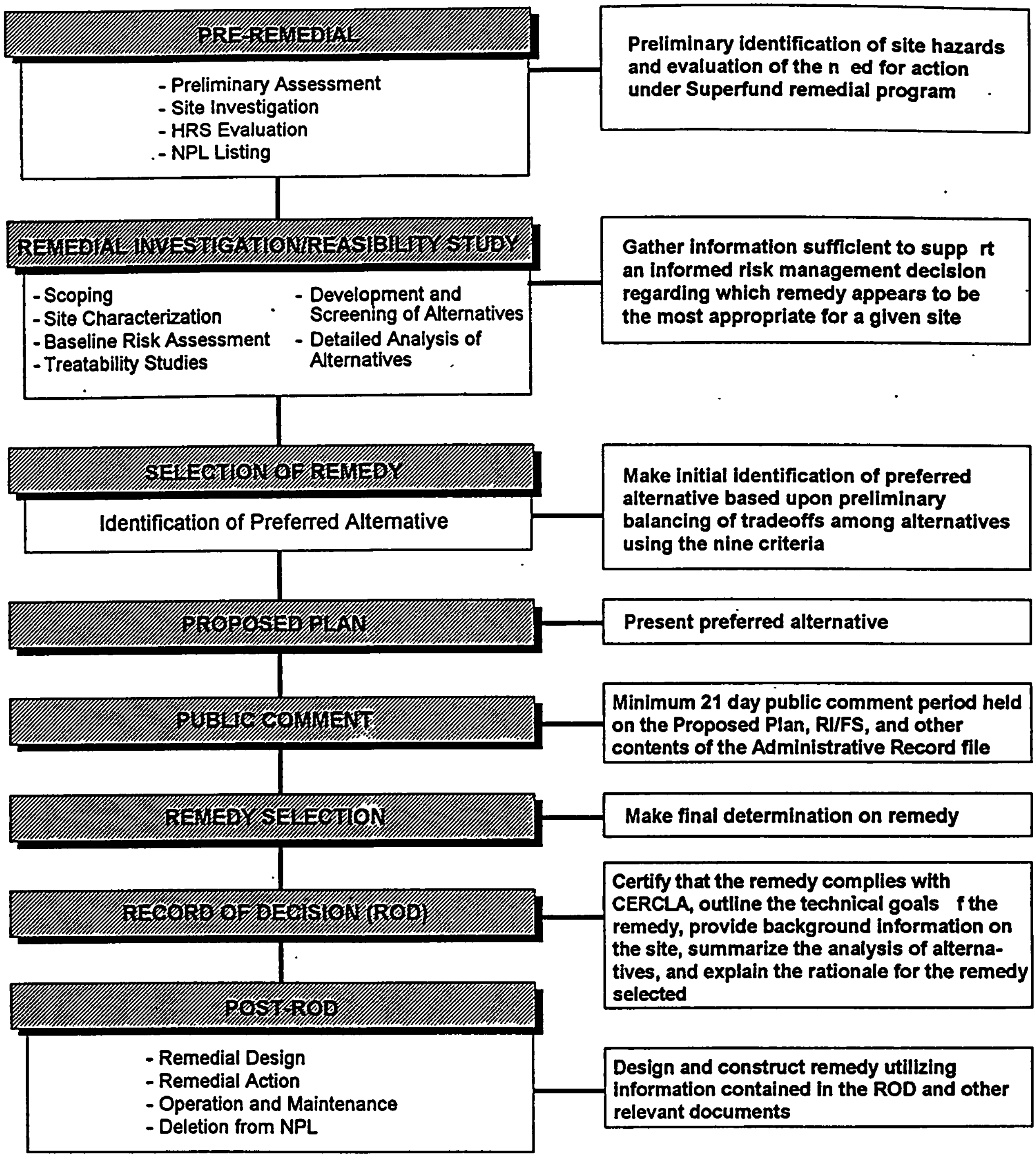
TABLE 5

PRIMARY AND SECONDARY DOCUMENT SUMMARY

Secondary Documents

- **Study Area Screening Evaluation (SASE) Work Plan**
- **Initial Screening of Alternatives**
- **Detailed Analysis of Alternatives**
- **Treatability and Pilot Study Work Plan**
  (if warranted by the scope and findings of the RI/FS)
- **Treatability and Pilot Study(s)**
  (if warranted by the scope and findings of the RI/FS)
- **Sampling and Data Results**
- **Remedial Action Work Plan**
- **Pre-Final Remedial Design (85%)**

FIGURES



SOURCE: U.S. EPA, INTERIM FINAL GUIDANCE ON PREPARING SUPERFUND DECISION DOCUMENTS, JUNE, 1989

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5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631

NAVAL EDUCATION AND TRAINING CENTER — *NEWPORT RHODE ISLAND*

FIGURE 1.

REMEDIAL RESPONSE PROCESS

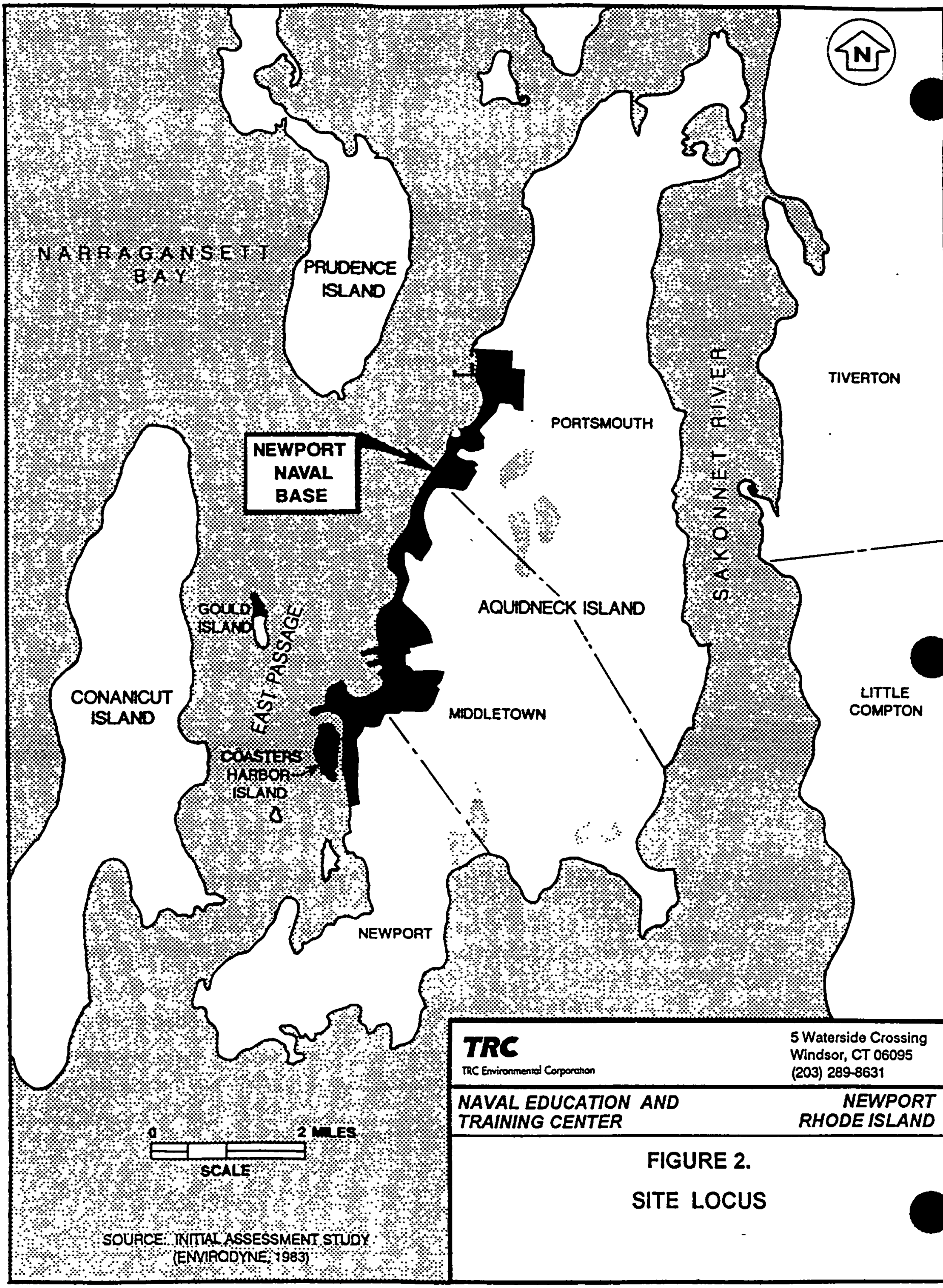

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FIGURE 2.

SITE LOCUS

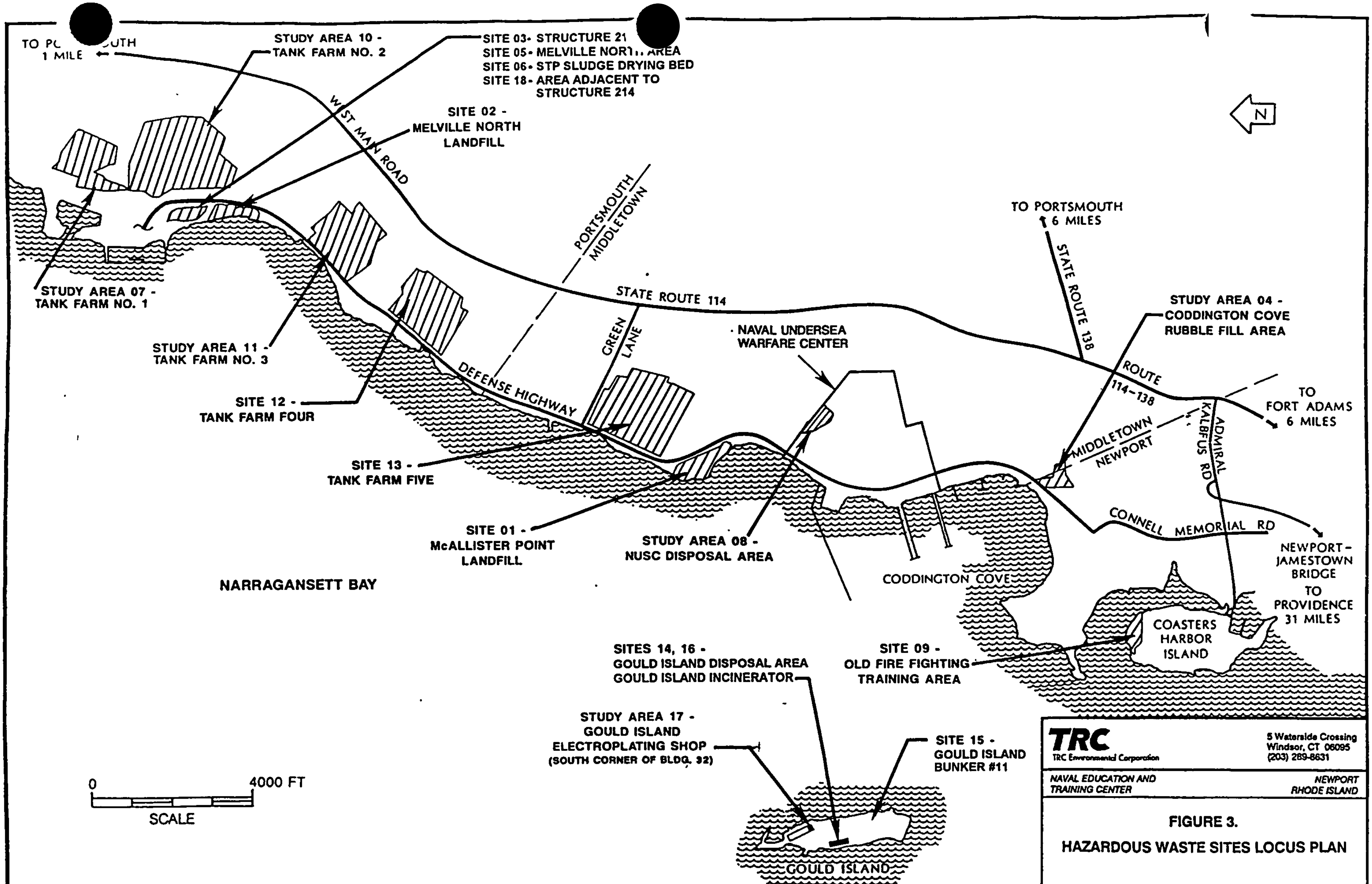
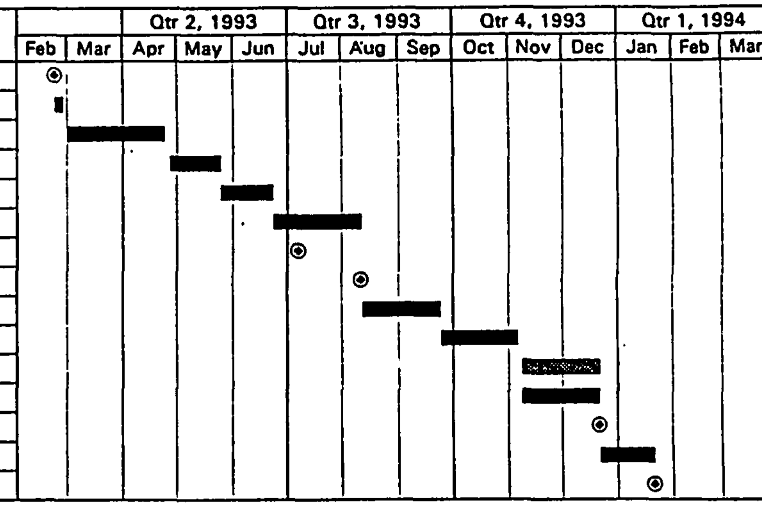


FIGURE 3.

HAZARDOUS WASTE SITES LOCUS PLAN

NETC - Newport, Rhode Island
SASE Activities - Sites 4, 8 and 17
Estimated Project Schedule

ID	Name	Duration	Scheduled Start	Scheduled Finish
1	SASE Project Authorization	0d	February 22, 1993	February 22, 1993
2	Field Team Mobilization	1w	February 22, 1993	February 26, 1993
3	Field Investigations	8w	March 1, 1993	April 23, 1993
4	Laboratory Analysis	4w	April 27, 1993	May 24, 1993
5	Data Validation	4w	May 25, 1993	June 22, 1993
6	Prepare Draft SASE Report	7w	June 23, 1993	August 11, 1993
7	Transmitt Sampling and Data Results	0d	July 7, 1993	July 7, 1993
8	Submit Draft SASE Report	0d	August 11, 1993	August 11, 1993
9	EPA, RIDEM Review of Report	6w	August 12, 1993	September 23, 1993
10	Navy Response to Comments	6w	September 24, 1993	November 5, 1993
11	Meet to Discuss Comments	6w	November 8, 1993	December 21, 1993
12	Prepare Draft Final SASE Report	6w	November 8, 1993	December 21, 1993
13	Submit Draft Final SASE Report	0d	December 21, 1993	December 21, 1993
14	EPA/State Letter of Concurrence	4w	December 22, 1993	January 21, 1994
15	Final SASE Report (No Dispute Resolution)	0d	January 21, 1994	January 21, 1994



Scheduled Start Date for Task 1 is Dependant on Award Negotiation and Project Authorization

Critical — Noncritical — Milestone ◉

December, 1992

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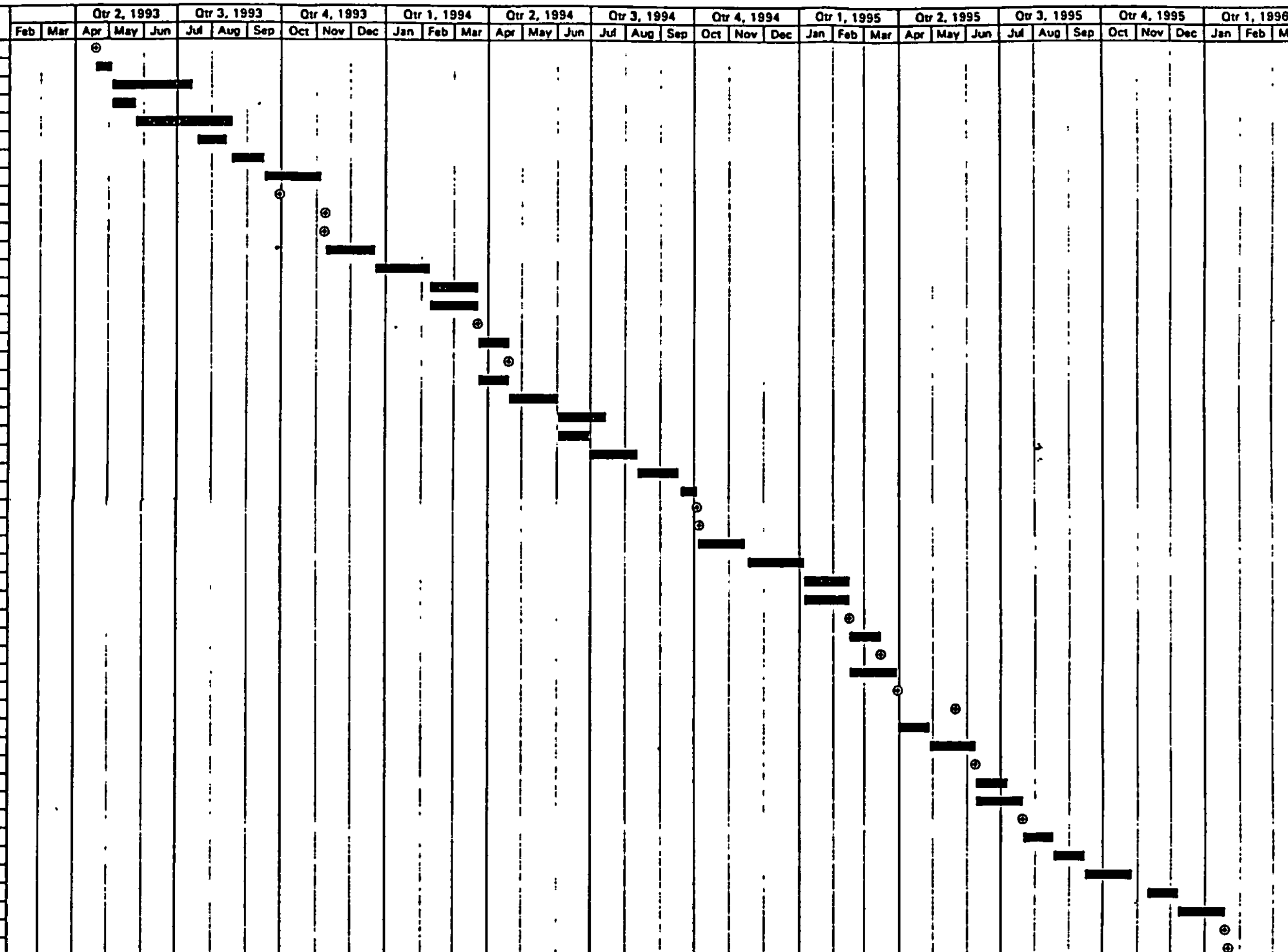
FIGURE 4A

NETC - Newport, Rhode Island
RI/FS Activities - Sites 1, 9, 12 and 13
Estimated Project Schedule

Scheduled Start Date for Task 1 is Dependent on Award Negotiation and Project Authorization

Critical ▬ Milestone ⊕
Noncritical ▬

ID	Name	Duration	Scheduled Start	Scheduled Finish
1	RI/FS Project Authorization	0d	April 19, 1993	April 19, 1993
2	Field Team Mobilization	2w	April 19, 1993	May 3, 1993
3	Field Investigations	10w	May 4, 1993	July 14, 1993
4	Off-Shore Biota Investigations	3w	May 4, 1993	May 24, 1993
5	Biota Analyses/Validation	12w	May 25, 1993	August 18, 1993
6	Laboratory Analysis	4w	July 19, 1993	August 13, 1993
7	Data Validation	4w	August 18, 1993	September 15, 1993
8	Prepare Draft Phase II RI Report	7w	September 16, 1993	November 4, 1993
9	Transmit Sampling and Data Results	0d	September 29, 1993	September 29, 1993
10	Submit Draft Phase II RI Report	0d	November 8, 1993	November 8, 1993
11	FFA Scheduled Due Date Draft Phase II RI	0d	November 7, 1993	November 7, 1993
12	EPA, RIDEM Review of Report	6w	November 9, 1993	December 22, 1993
13	Navy Response to Comments	6w	December 23, 1993	February 7, 1994
14	Meet to Discuss Comments	6w	February 8, 1994	March 22, 1994
15	Prepare Draft Final Phase II RI Report	6w	February 8, 1994	March 22, 1994
16	Submit Draft Final Phase II RI Report	0d	March 22, 1994	March 22, 1994
17	EPA/State Letter of Concurrence	4w	March 23, 1994	April 19, 1994
18	Final Phase II RI Report (No Dispute Res.)	0d	April 19, 1994	April 19, 1994
19	Initial Screening of Alternatives	4w	March 23, 1994	April 19, 1994
20	EPA/RIDEM Review	6w	April 20, 1994	June 1, 1994
21	Navy Response to Comments	6w	June 2, 1994	July 14, 1994
22	Detailed Analysis of Alternatives	4w	June 2, 1994	June 29, 1994
23	EPA/RIDEM Review	6w	June 30, 1994	August 11, 1994
24	Navy Response to Comments	5w	August 12, 1994	September 16, 1994
25	Prepare Draft Phase II RI/FS Report	11d	September 19, 1994	October 3, 1994
26	Submit Draft Phase II RI/FS Report	0d	October 3, 1994	October 3, 1994
27	FFA Scheduled Due Date Draft Phase II RI/FS	0d	October 5, 1994	October 5, 1994
28	EPA, RIDEM Review	6w	October 4, 1994	November 14, 1994
29	Navy Response to Comments	6w	November 17, 1994	January 4, 1995
30	Meet to Discuss Comments	6w	January 5, 1995	February 15, 1995
31	Prepare Draft Final Phase II RI/FS Report	6w	January 5, 1995	February 15, 1995
32	Submit Draft Final Phase II RI/FS Report	0d	February 15, 1995	February 15, 1995
33	EPA/State Letter of Concurrence	4w	February 16, 1995	March 15, 1995
34	Final Phase II RI/FS Report (No Dispute Res.)	0d	March 15, 1995	March 15, 1995
35	Prepare Draft Proposed Plan	6w	February 16, 1995	March 29, 1995
36	Submit Draft Proposed Plan	0d	March 30, 1995	March 30, 1995
37	FFA Scheduled Due Date Draft Proposed Plan	0d	May 21, 1995	May 21, 1995
38	EPA, RIDEM Review	4w	March 31, 1995	April 27, 1995
39	Prepare Draft Final Proposed Plan	6w	April 28, 1995	June 8, 1995
40	Submit Draft Final Proposed Plan	0d	June 8, 1995	June 8, 1995
41	EPA/State Letter of Concurrence	4w	June 9, 1995	July 6, 1995
42	Prepare Final Proposed Plan	6w	June 9, 1995	July 20, 1995
43	Submit Final Proposed Plan	0d	July 20, 1995	July 20, 1995
44	Prepare Draft ROD	4w	July 21, 1995	August 17, 1995
45	EPA, RIDEM Review	4w	August 18, 1995	September 14, 1995
46	Prepare Draft Final ROD	6w	September 15, 1995	October 26, 1995
47	Public Comment on ROD/Proposed Plan	4w	November 10, 1995	December 7, 1995
48	Draft Responsiveness Summary	6w	December 8, 1995	January 18, 1996
49	Final ROD	0d	January 18, 1996	January 18, 1996
50	FFA Scheduled Due Date Final ROD	0d	January 21, 1996	January 21, 1996



December, 1992

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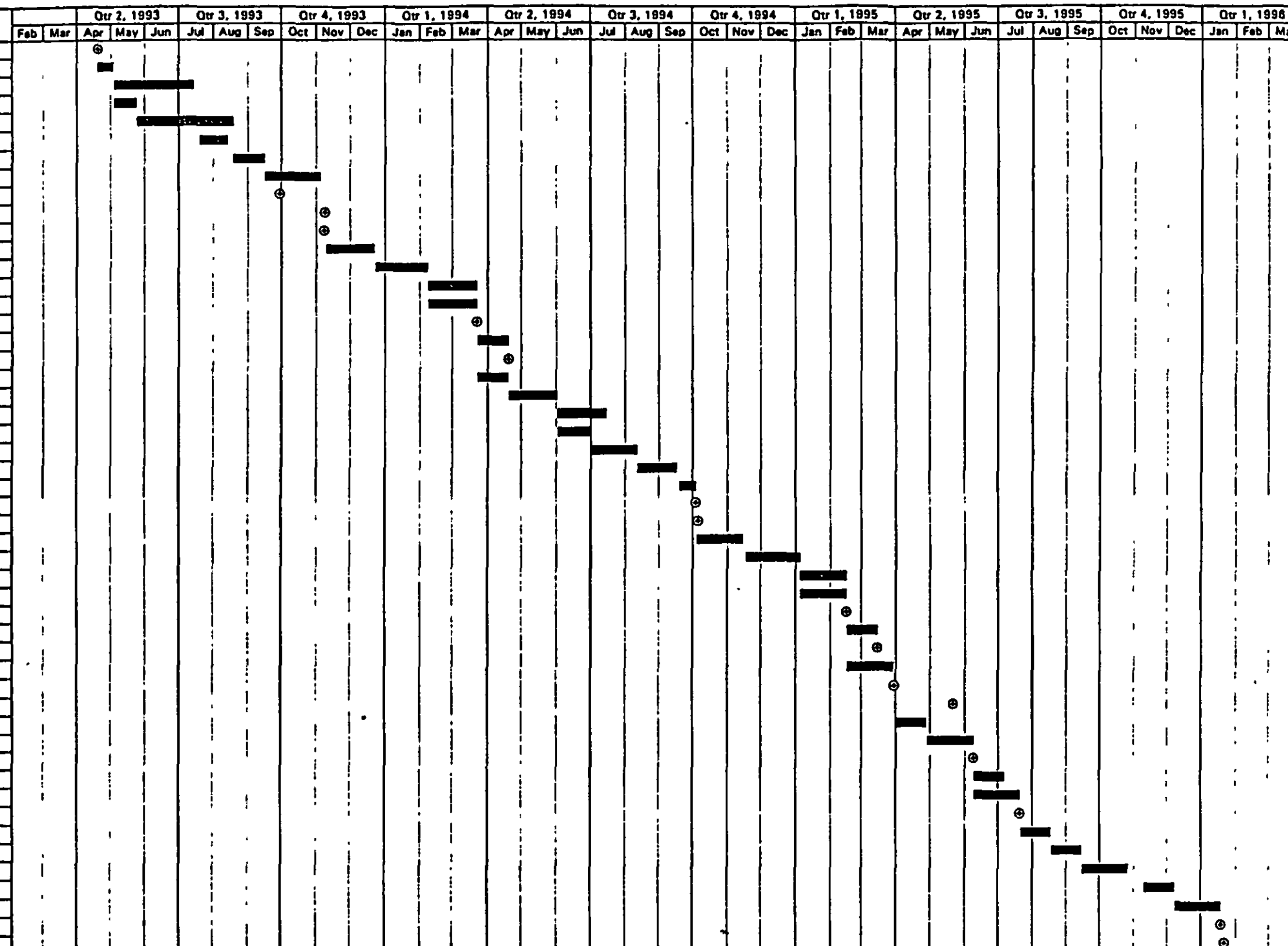
FIGURE 4B

NETC - Newport, Rhode Island
RI/FS Activities - Site 1 - McAllister Point Landfill
Estimated Project Schedule

Scheduled Start Date for Task 1 is Dependant on Award Negotiation and Project Authorization

Critical ▬ Milestone ⊕
Noncritical ▬

ID	Name	Duration	Scheduled Start	Scheduled Finish
1	RI/FS Project Authorization	0d	April 19, 1993	April 19, 1993
2	Field Team Mobilization	2w	April 19, 1993	May 3, 1993
3	Field Investigations	10w	May 4, 1993	July 14, 1993
4	Off-Shore Biota Investigations	3w	May 4, 1993	May 24, 1993
5	Biota Analyses/Validation	12w	May 25, 1993	August 18, 1993
6	Laboratory Analysis	4w	July 19, 1993	August 13, 1993
7	Data Validation	4w	August 18, 1993	September 15, 1993
8	Prepare Draft Phase II RI Report	7w	September 16, 1993	November 4, 1993
9	Transmit Sampling and Data Results	0d	September 29, 1993	September 29, 1993
10	Submit Draft Phase II RI Report	0d	November 8, 1993	November 8, 1993
11	FFA Scheduled Due Date Draft Phase II RI	0d	November 7, 1993	November 7, 1993
12	EPA, RIDEM Review of Report	6w	November 9, 1993	December 22, 1993
13	Navy Response to Comments	6w	December 23, 1993	February 7, 1994
14	Meet to Discuss Comments	6w	February 8, 1994	March 22, 1994
15	Prepare Draft Final Phase II RI Report	6w	February 8, 1994	March 22, 1994
16	Submit Draft Final Phase II RI Report	0d	March 22, 1994	March 22, 1994
17	EPA/State Letter of Concurrence	4w	March 23, 1994	April 19, 1994
18	*Final Phase II RI Report (No Dispute Res.)*	0d	April 19, 1994	April 19, 1994
19	Initial Screening of Alternatives	4w	March 23, 1994	April 19, 1994
20	EPA/RIDEM Review	6w	April 20, 1994	June 1, 1994
21	Navy Response to Comments	6w	June 2, 1994	July 14, 1994
22	Detailed Analysis of Alternatives	4w	June 2, 1994	June 29, 1994
23	EPA/RIDEM Review	6w	June 30, 1994	August 11, 1994
24	Navy Response to Comments	5w	August 12, 1994	September 16, 1994
25	Prepare Draft Phase II RI/FS Report	11d	September 19, 1994	October 3, 1994
26	Submit Draft Phase II RI/FS Report	0d	October 3, 1994	October 3, 1994
27	FFA Scheduled Due Date Draft Phase II RI/FS	0d	October 5, 1994	October 5, 1994
28	EPA, RIDEM Review	6w	October 4, 1994	November 14, 1994
29	*Navy Response to Comments*	*6w*	*November 17, 1994*	*January 4, 1995*
30	Meet to Discuss Comments	6w	January 5, 1995	February 15, 1995
31	Prepare Draft Final Phase II RI/FS Report	6w	January 5, 1995	February 15, 1995
32	Submit Draft Final Phase II RI/FS Report	0d	February 15, 1995	February 15, 1995
33	EPA/State Letter of Concurrence	4w	February 16, 1995	March 15, 1995
34	Final Phase II RI/FS Report (No Dispute Res.)	0d	March 15, 1995	March 15, 1995
35	Prepare Draft Proposed Plan	6w	February 16, 1995	March 29, 1995
36	Submit Draft Proposed Plan	0d	March 30, 1995	March 30, 1995
37	FFA Scheduled Due Date Draft Proposed Plan	0d	May 21, 1995	May 21, 1995
38	EPA, RIDEM Review	4w	March 31, 1995	April 27, 1995
39	Prepare Draft Final Proposed Plan	6w	April 28, 1995	June 8, 1995
40	Submit Draft Final Proposed Plan	0d	June 8, 1995	June 8, 1995
41	EPA/State Letter of Concurrence	4w	June 9, 1995	July 6, 1995
42	Prepare Final Proposed Plan	6w	June 9, 1995	July 20, 1995
43	Submit Final Proposed Plan	0d	July 20, 1995	July 20, 1995
44	Prepare Draft ROD	4w	July 21, 1995	August 17, 1995
45	EPA, RIDEM Review	4w	August 18, 1995	September 14, 1995
46	Prepare Draft Final ROD	6w	September 15, 1995	October 26, 1995
47	Public Comment on ROD/Proposed Plan	4w	November 10, 1995	December 7, 1995
48	Draft Responsiveness Summary	6w	December 8, 1995	January 18, 1996
49	Final ROD	0d	January 18, 1996	January 18, 1996
50	FFA Scheduled Due Date Final ROD	0d	January 21, 1996	January 21, 1996



December, 1992

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FIGURE 4C

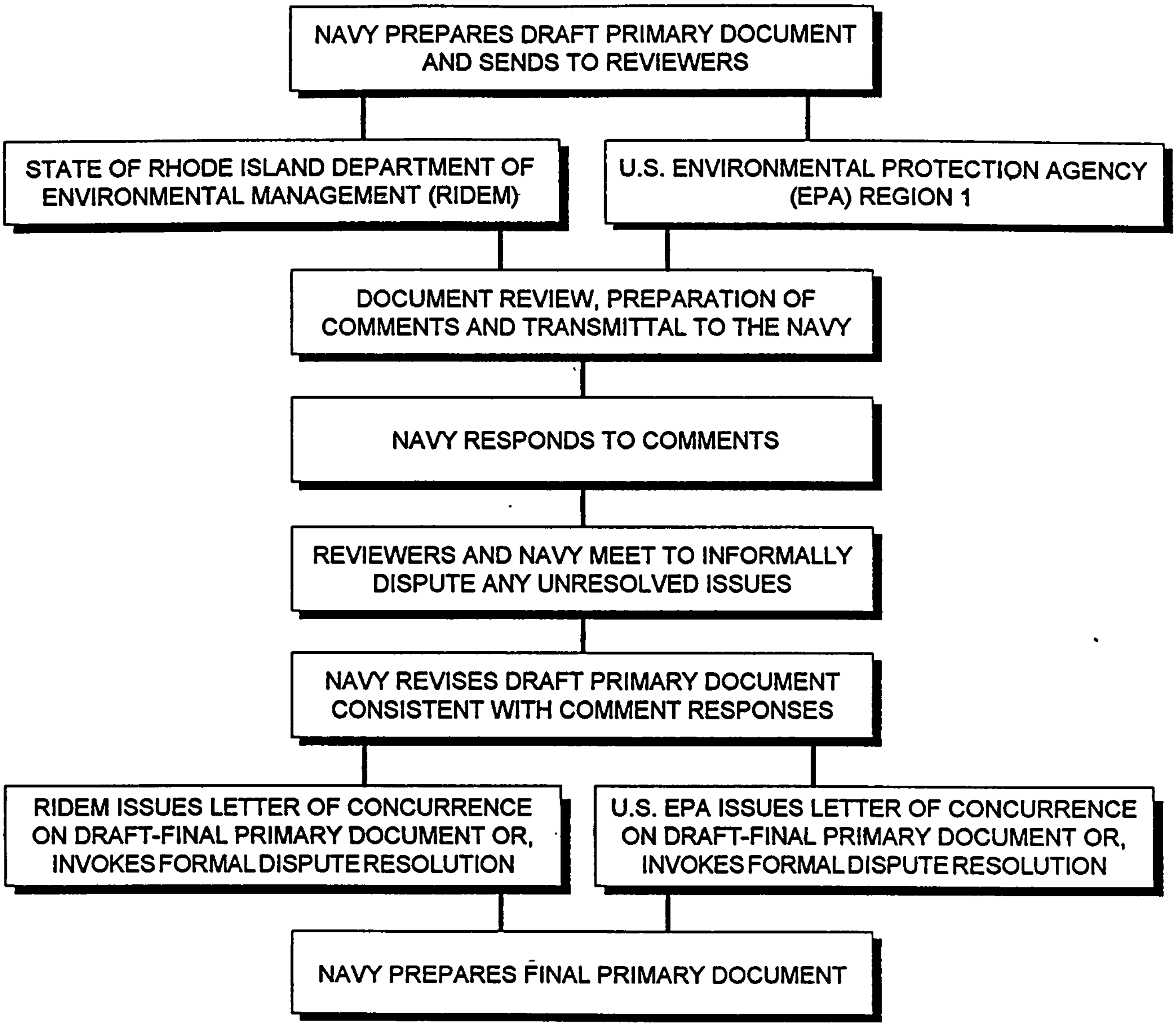

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FIGURE 5A.

PRIMARY DOCUMENT REVIEW

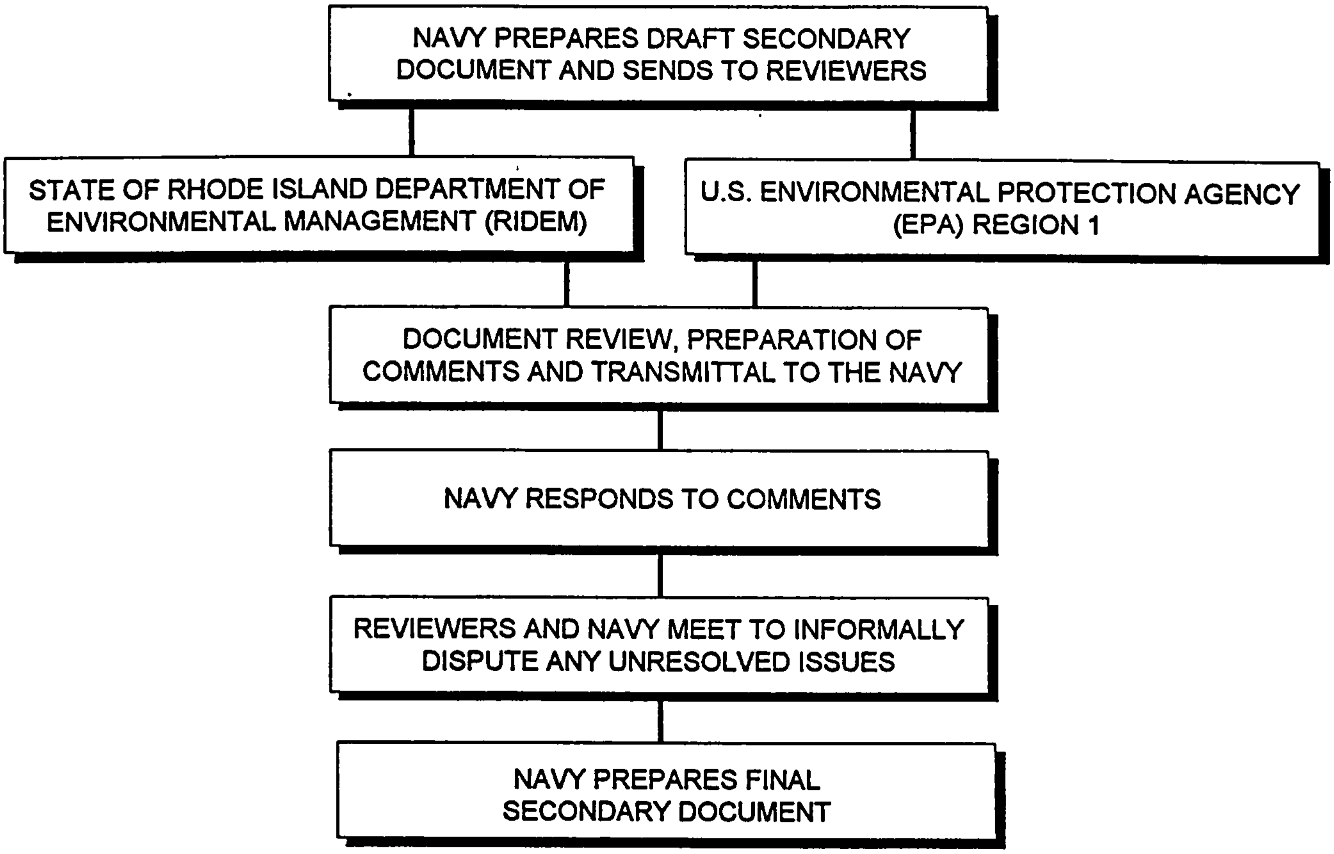

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FIGURE 5B.

SECONDARY DOCUMENT REVIEW

STUDY AREA SCREENING EVALUATIONS
NETC NEWPORT, RHODE ISLAND

Completion Date:

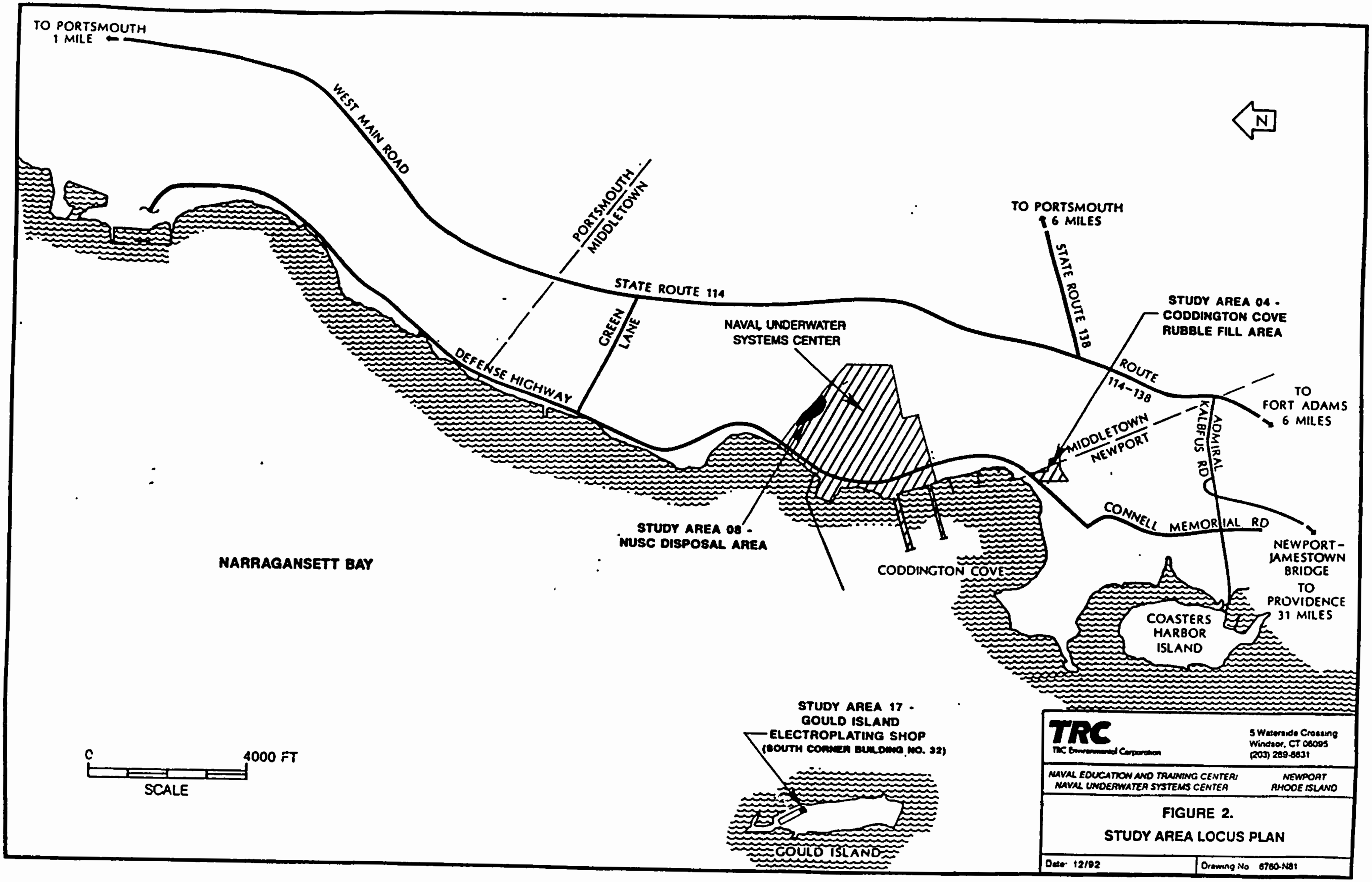
Final Work Plan - December 18, 1992

Objective:

Define the level of investigation planned to assess the presence and nature of environmental contamination at three study areas at NETC Newport. These study areas were listed in the March 23, 1992 Federal Facilities Agreement (FFA) signed by the Navy, USEPA, and RIDEM. The three study areas include:

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

The SASE investigations will be conducted to assess whether the designated Study Areas are a potential threat to human health or the environment. In general, the SASE Work Plans will assess the presence of any releases of hazardous substances to soil, ground water or other media through a focused program of investigation. The investigation activities generally include geophysical and soil gas surveys, test pits, monitoring well installation, and the collection and analysis of surface water, biota and sediment (Gould Island), soil, source, and ground water samples.



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NAVAL UNDERWATER SYSTEMS CENTER

NEWPORT
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FIGURE 2.
STUDY AREA LOCUS PLAN

Date: 12/92 | Drawing No 6760-N81

TABLE 2
NARRATIVE REPORT OUTLINE

INTRODUCTION

State the purpose, scope, and objectives of the SASE.

SITE DESCRIPTION AND REGULATORY HISTORY

Identify the type of site (e.g., plating facility, tank farm, disposal area), whether it is active or inactive, and years of operation. Describe its physical setting (e.g., topography, local land uses). Include the appropriate portion of a USGS 7.5-minute topographic map locating the site and showing a 1-mile radius. On the map, identify the surface water drainage route; nearest well, drinking water intake, and residence; wetlands and other sensitive environments. Include a drafted sketch showing site layout, source areas, and features on and around the site.

Briefly summarize dates and scope of previous investigations (Initial Assessment Study, Confirmation Study, etc.).

Describe prior land use operations and past regulatory activities including the site's RCRA status, permits, permit violations, and inspections by local, State, or Federal authorities. Discuss any citizen complaints.

- Describe the site land use prior to the reported site activities as described or presented in historical documents, aerial photos, and/or maps. Any noted physical/geographical land alterations which appear to have occurred as a result of or after reported site operations will be discussed.

OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

Provide an operational history of the site, and describe site activities. Identify and describe wastes generated, waste disposal practices, waste source areas, waste source containment, and waste quantities (indicate source areas on the site sketch).

Discuss any previous sampling at the site; provide dates of sampling events and sample types. Summarize analytical results in a table. Include a site map of previous sample locations.

Discuss SASE source sampling results. List in a table each waste source sample and summarize analytical results. Include a site map of waste source sample locations.

Ground Water

Describe the local geologic and hydrogeologic setting (e.g., stratigraphy, formations, aquifers, depth to the shallowest aquifer).

Discuss ground water use in vicinity of the sources. Identify the nearest drinking water wells and state the distance from sources. Quantify drinking water populations served by wells in the area, differentiating between private and municipal wells.

Discuss any previous ground water sampling; provide dates of sampling events and the depths.

Discuss SASE ground water sampling results. List in a table each sample and summarize analytical results. (Include a site map of sample locations.) Identify drinking water wells exposed to hazardous substances and quantify the drinking water populations.

Discuss the potential for any discovered contaminant migration from the site via the ground water.

Surface Water

Describe the local hydrologic setting, including site location with respect to floodplains, and the overland and in-water segments of the surface water migration path. State the distance from the site to the probable point of entry into surface water. Include a drafted sketch of the surface water migration path. Describe upgradient drainage areas, on-site drainage (including storm drains, ditches, culverts, etc.), facility discharges into surface water, permits, and historical information.

Indicate whether surface water within the in-water segment supplies drinking water. Identify the location and state the distance from the probable point of entry to each drinking water intake. Quantify the drinking water population served by surface water.

- Indicate whether surface water within the in-water segment contains fisheries.

Indicate whether surface water is used for any recreational purposes and any related concerns.

Indicate whether sensitive environments are present within or adjacent to the in-water segment. Identify and state the frontage length of wetlands on surface water.

Discuss any previous surface water sampling.

- Discuss the potential for any discovered contaminant migration from the site via the surface water.

Discuss SASE surface water sampling results. List in a table each sample and summarize analytical results. Identify surface water intakes exposed to hazardous substances and quantify the drinking water populations served by each. Identify fisheries exposed to hazardous substances. Identify sensitive environments and wetlands exposed to hazardous substances; quantify the frontage of exposed wetlands.

Soil Exposure

State the number of on-site workers and the number of people who live on site and within 200 feet of an area of significant or elevate concentrations with respect to MCLs, permit levels, etc.

Identify terrestrial sensitive environments on an area of observed contamination.

Discuss any previous sources and surficial soils sampling.

Discuss SASE surficial source samples and off-site surficial soil samples. List each sample in a table and summarize analytical results.

Discuss the potential for any discovered contaminant migration from the site via the soil medium.

Air

Identify potential receptors.

Discuss any previous air sampling.

Discuss SASE air sampling results.

Discuss the potential for any discovered contaminant migration from the site via the air medium.

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND RISK EVALUATION

Compare sampling results to ARARs.

Evaluation of site risks to potential human and sensitive environmental concerns.

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

Briefly summarize the major aspects of each site and its history that relate to the release of hazardous substances and the exposure potential receptors. Briefly summarize principal pathways and receptors of concern.

Summarize sampling results, including substances detected in environmental media.

- Recommendation for no further action, additional site investigations, or limited response actions (e.g., removal), where appropriate.

PHOTODOCUMENTATION LOG

As an attachment, provide photographs of the site and pertinent site features taken during the SASE. Useful photographs illustrate waste source areas, containment conditions, stained soil, stressed vegetation, drainage routes, and sampling locations. Describe each photograph in captions or accompanying text. Key each photo to its location on the site sketch.

REFERENCES

List all references cited in the SASE report.

Attach copies of references cited in the SASE report, if appropriate.

TABLE 1

STUDY AREA 04 - CODDINGTON COVE RUBBLE FILL AREA
SITE INVESTIGATION SUMMARY

RECONNAISSANCE SURVEYS:

Walkover, ambient air, and radiological surveys on 50-foot spaced traverses.

GEOPHYSICAL SURVEYS:

Electromagnetic conductivity and magnetometer surveys on a 50-foot spaced traverses.

SOIL GAS SURVEY:

A soil gas survey will be conducted on a 100-foot spaced traverses.

SOIL SAMPLING:

Surface Soil:

Surface soil samples will be collected from five (5) locations, and three background locations. Soil samples will be analyzed for the full TCL/TAL.

Test Pits:

Test pits will be excavated at five (5) locations on-site. One to three samples will be collected per test pit. Test pit soil samples will be analyzed for the full TCL/TAL.

GROUND WATER SAMPLING:

Monitoring Wells:

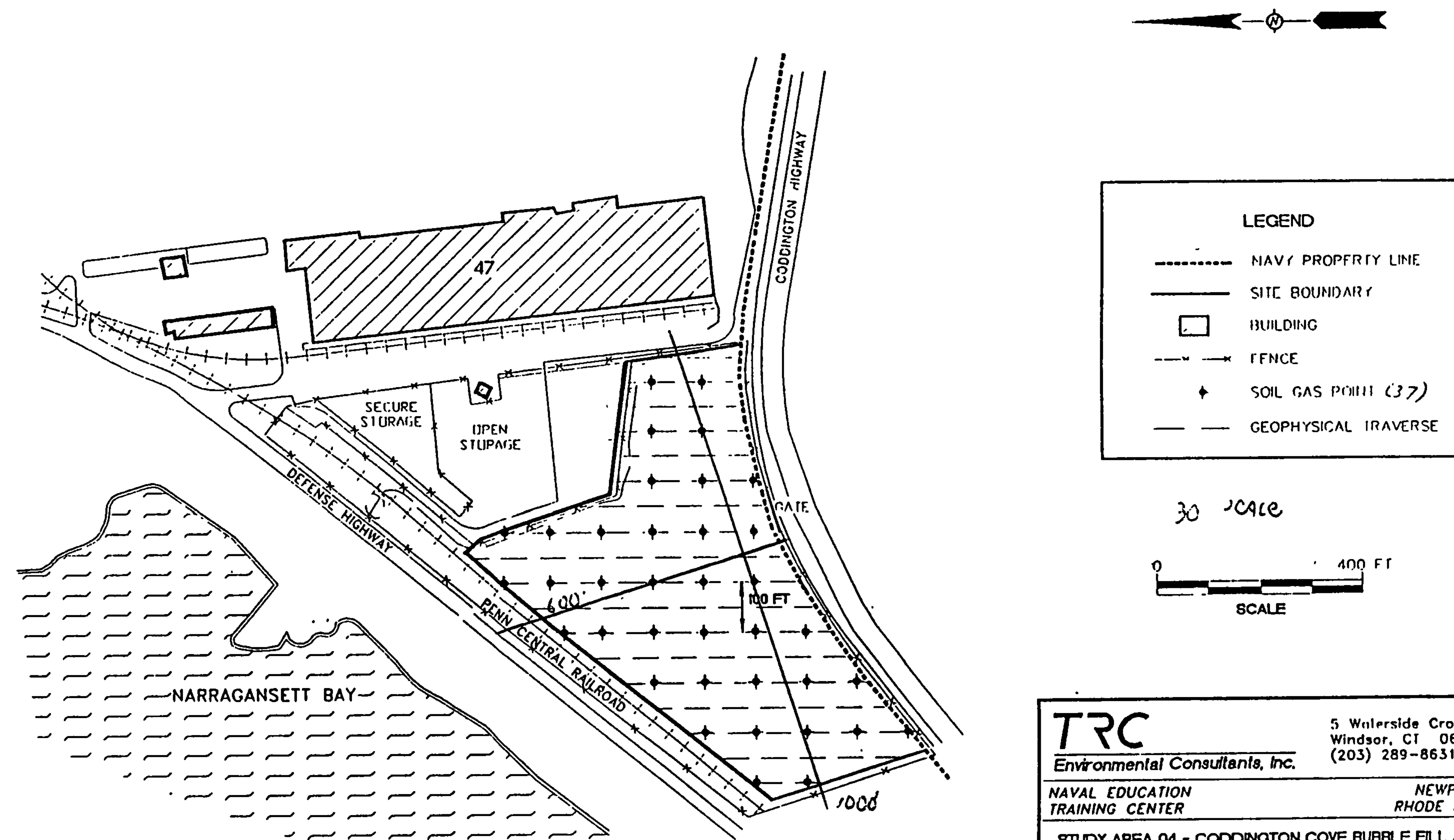
Monitoring wells will be installed at four (4) locations. One well will be installed in the anticipated upgradient location, one through the fill, and the third and fourth wells in the anticipated downgradient location. Samples will be analyzed for the full TCL/TAL and total chloride. Temperature, pH, conductivity, dissolved oxygen, alkalinity, and salinity of ground water samples will be measured in the field.

SURFACE WATER/SEDIMENT SAMPLING:

Surface water/sediment sample pairs will be collected from one upstream location, two locations adjacent to the fill area, and one location downstream of the fill area. The samples will be analyzed for the full TCL/TAL and total chloride. Sediment samples will also be analyzed for TOC and tested for grain size distribution. Temperature, pH, conductivity, dissolved oxygen, alkalinity, salinity, and hardness of samples will be determined.

LAND SURVEY:

A professional land survey will be conducted of site features and sampling points.



NOTE BASE MAP DEVELOPED FROM CODDINGTON COVE EXISTING CONDITIONS MAP, NETC DWG NO. 28056-278, REV. 10/1/91.

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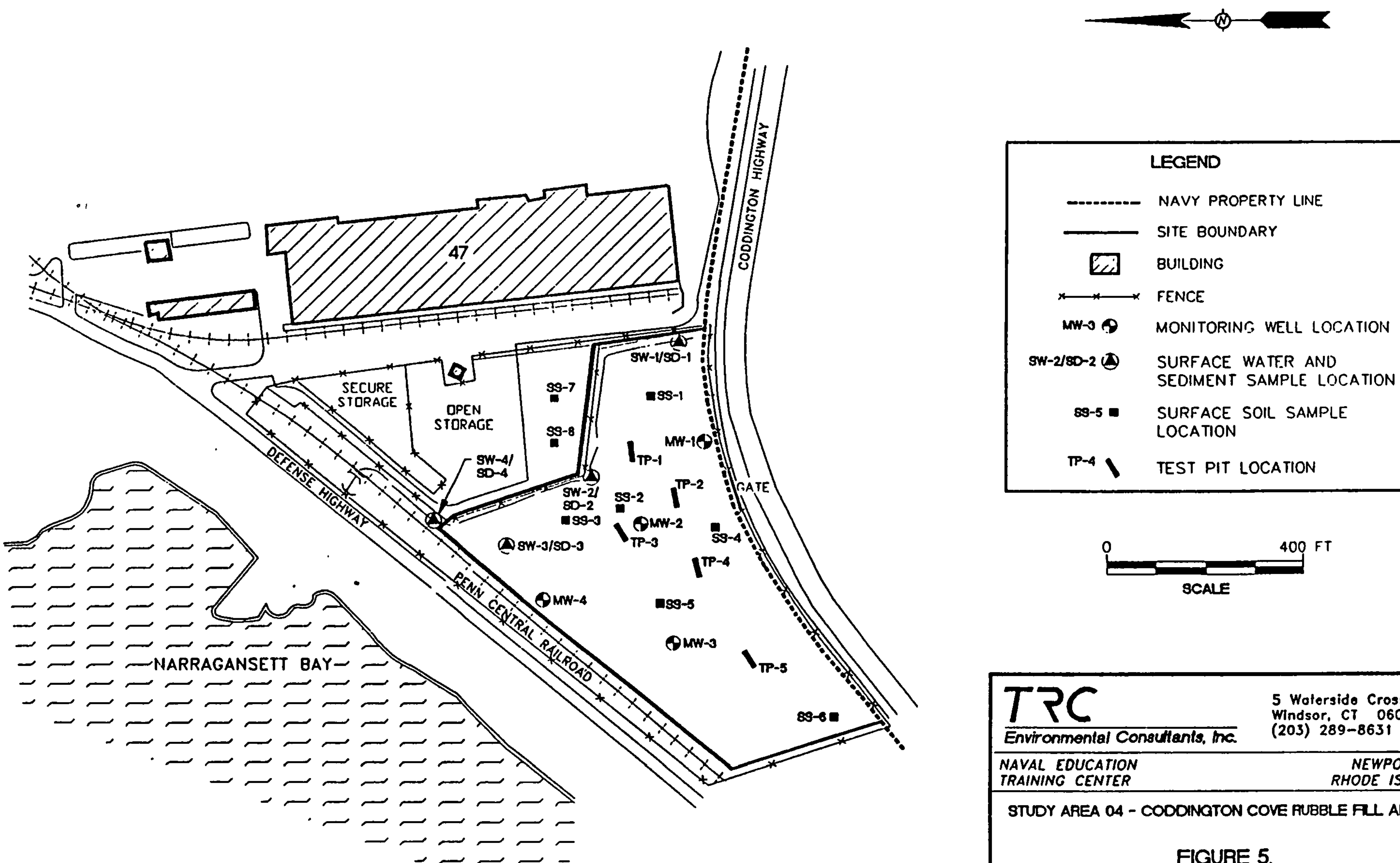
STUDY AREA 04 - CODDINGTON COVE RUBBLE FILL AREA

FIGURE 4.

SITE SURVEY LOCATION MAP

Date: 12/92 | Project No. 6760-N81



NOTE: BASE MAP DEVELOPED FROM
CODDINGTON COVE EXISTING CONDITIONS MAP,
NETC DWG. NO. 28056-278, REV. 10/1/91.

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STUDY AREA 04 - CODDINGTON COVE RUBBLE FILL AREA

FIGURE 5.

SITE INVESTIGATION SUMMARY MAP

Date: 4/92 | Project No. 6760-N81

TABLE 1

STUDY AREA 08 - NUSC DISPOSAL AREA
SITE INVESTIGATION SUMMARY

RECONNAISSANCE SURVEYS:

Reconnaissance, ambient air, and radiological surveys on 50-foot spaced traverses.

GEOPHYSICAL SURVEYS:

Electromagnetic conductivity and magnetometer surveys on 50-foot spaced traverses.

SOIL GAS SURVEY:

A soil gas survey will be conducted on approximately 100-foot spaced traverses.

SOIL SAMPLING:

Surface Soil:

Surface soil samples will be collected from five (5) locations on-site, and two background locations. Samples will be analyzed for the full TCL/TAL.

Subsurface Soil/Test Borings:

Soil samples will be collected from five (5) test borings and four (4) well borings. Samples will be collected continuously from ground surface to the water table and in five foot increments beyond this depth for ten more feet or to bedrock, whichever comes first. Up to three (3) samples per boring will be analyzed for the full TCL/TAL.

GROUND WATER SAMPLING:

Monitoring Wells:

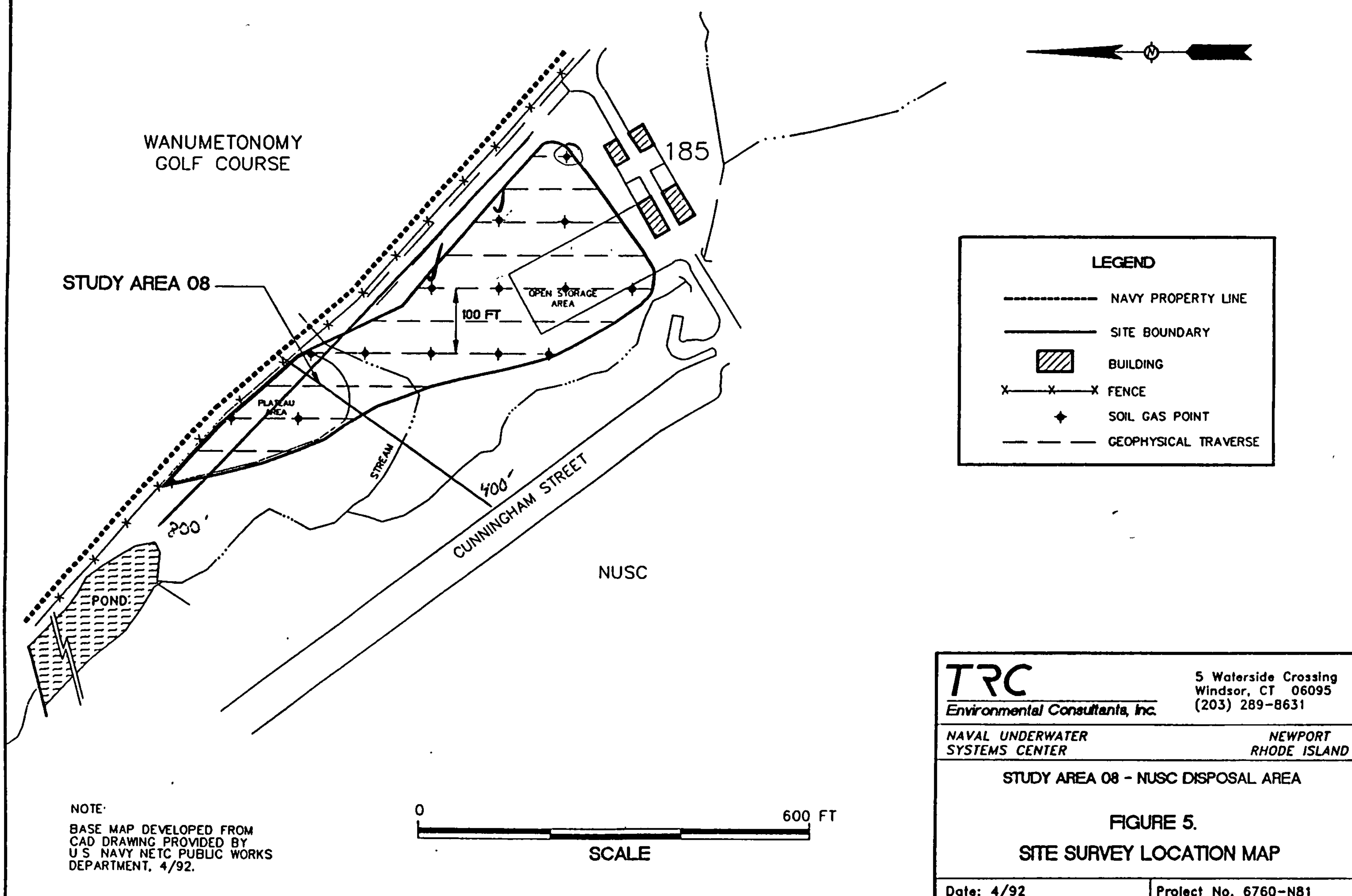
Monitoring wells will be installed in four (4) locations. One well will be installed upgradient, in the central and western portion of the site, and in the anticipated downgradient direction. Ground water samples will be analyzed for the full TCL/TAL and total chloride. Temperature, pH, conductivity, dissolved oxygen, alkalinity, and salinity of samples will also be determined. Piezometers will also be installed at eight locations adjacent to the streams.

SURFACE WATER/SEDIMENT SAMPLING:

Surface water/sediment sample pairs will be collected from eight (8) locations near the site. The samples will be analyzed for the full TCL/TAL, TOC, and grain size distribution. Temperature, pH, conductivity, dissolved oxygen, alkalinity, salinity, and hardness will also be determined.

LAND SURVEY:

A professional land survey will be conducted of site features and sampling points.



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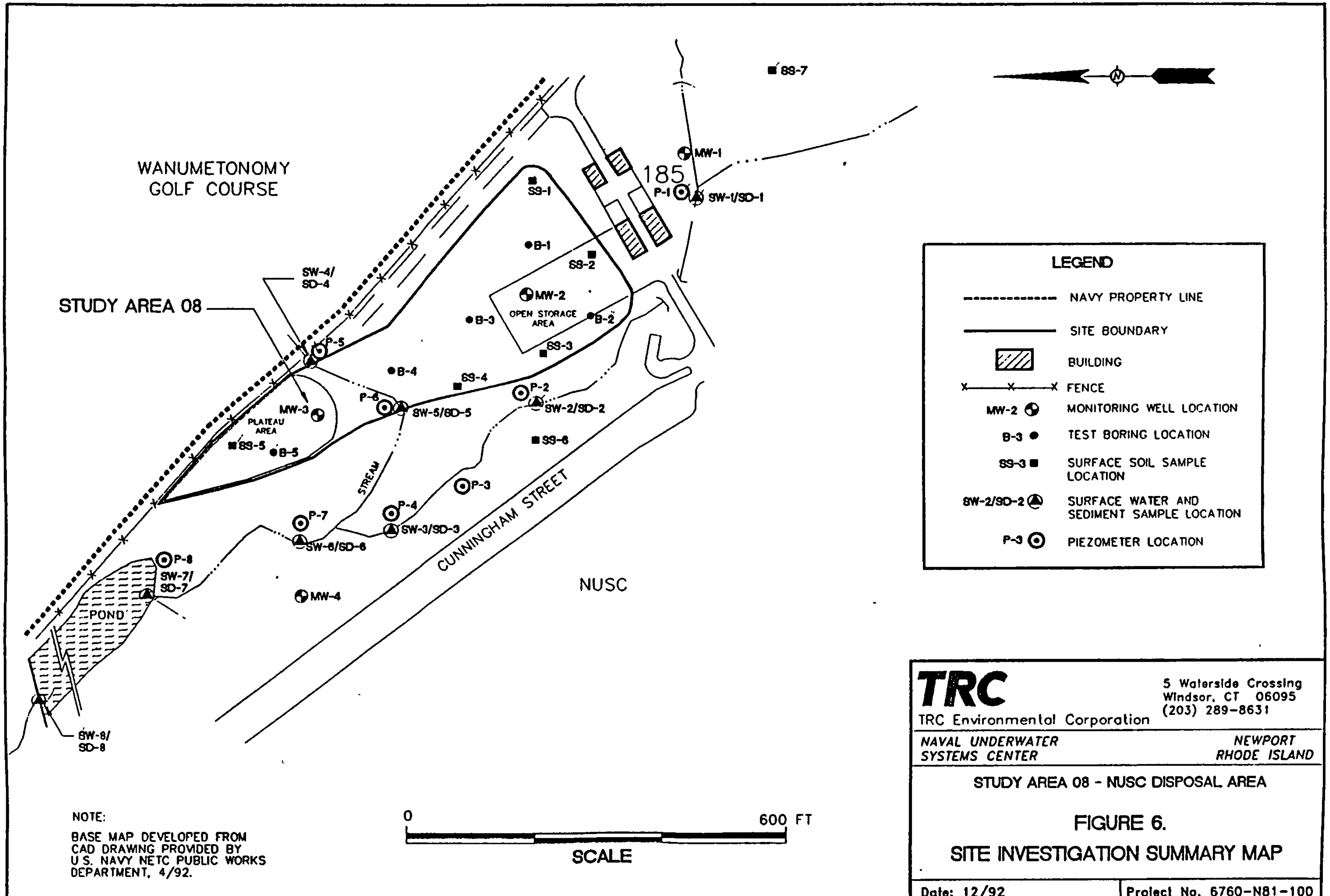
STUDY AREA 08 - NUSC DISPOSAL AREA

FIGURE 5.
SITE SURVEY LOCATION MAP

Date: 4/92 | Project No. 6760-N81



NOTE:
BASE MAP DEVELOPED FROM CAD DRAWING PROVIDED BY U.S. NAVY NETC PUBLIC WORKS DEPARTMENT, 4/92.

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STUDY AREA 08 - NUSC DISPOSAL AREA

FIGURE 6.
SITE INVESTIGATION SUMMARY MAP

Date: 12/92 | Project No. 6760-N81-100

TABLE 1

STUDY AREA 17 - GOULD ISLAND ELECTROPLATING SHOP
SITE INVESTIGATION SUMMARY

RECONNAISSANCE SURVEYS:

Reconnaissance, ambient air, and radiological surveys on-site and in vats, pits and floor penetrations.

GEOPHYSICAL SURVEYS:

Electromagnetic conductivity and ground penetrating radar surveys on 10-foot spaced traverses inside the shop and outside Building 32.

SOIL GAS SURVEY:

A soil gas survey will be conducted on an approximately 20-foot grid inside the shop and outside Building 32.

RESIDUE SAMPLING:

Eleven (11) residue samples will be collected from floor drain trenches, metal vats, and plating pits inside the electroplating room. Residue samples will be analyzed for TCL volatile and semi-volatile organic compounds, TAL metals, and cyanide. At least three solid residue samples will be analyzed for TCLP parameters.

SOIL SAMPLING:

Subsurface Soil/Test Borings:

Soil samples will be collected from five (5) subslab test borings inside the electroplating room and three (3) locations outside Building 32. Two (2) samples per boring will be analyzed for the full TCL/TAL.

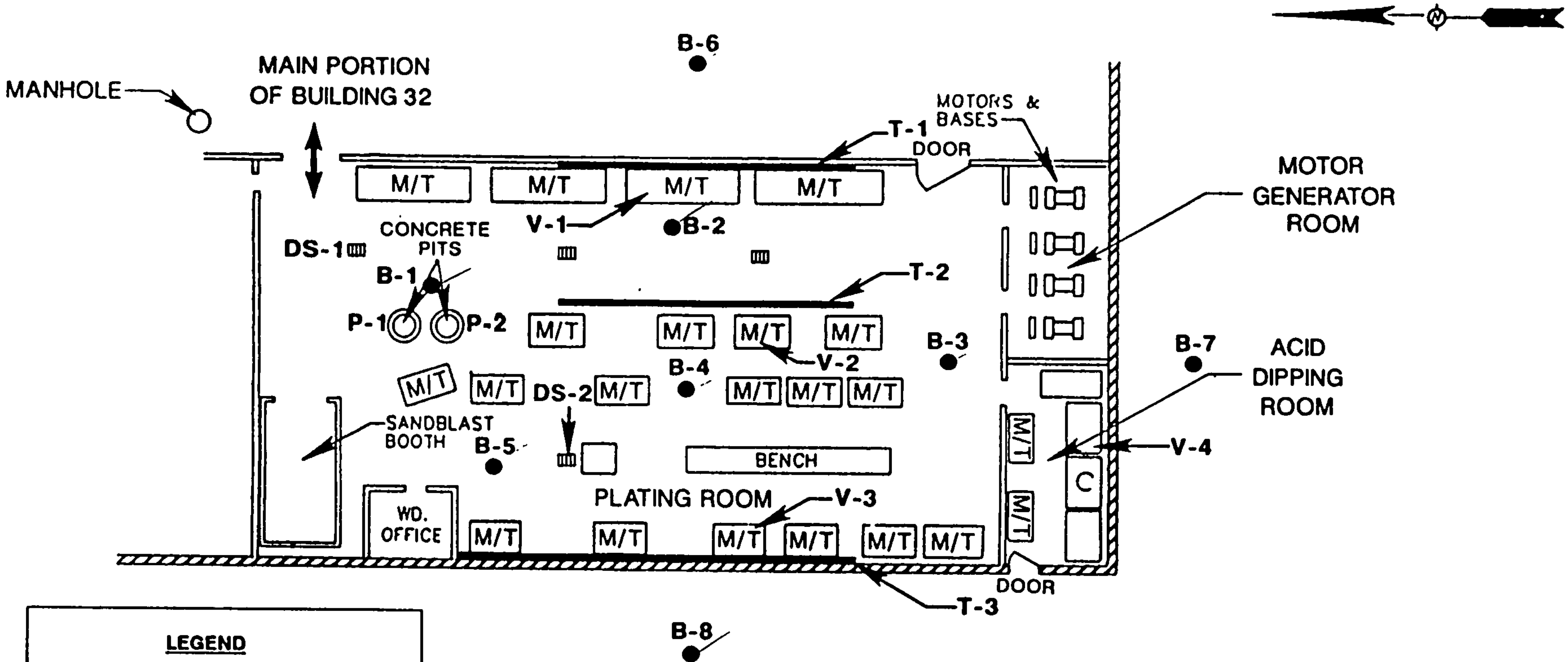
SEDIMENT AND BIOTA SAMPLING:

Sediment and Mussels:

Sediment and mussel samples will be collected from ten (10) locations within Narragansett Bay. These samples will be analyzed for full TCL/TAL parameters. Sediment samples will be submitted for grain size analysis and total organic carbon analysis.

LAND SURVEY:

A professional land survey will be conducted of site features and sampling points.



LEGEND

- OUTSIDE BUILDING WALL
- DRAIN
- TRENCH
- B-1 TEST BORING LOCATION
- T-1 TRENCH RESIDUE SAMPLE
- P-1 PIT RESIDUE SAMPLE
- DS-1 DRAIN SEDIMENT SAMPLE

NOTE: BASE DRAWING FROM PLATE 1,
GOULD ISLAND, BUILDING 32, ENSR
CONSULTING & ENGINEERING, 10/30/91

0 30 FT
SCALE

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STUDY AREA 17 - GOULD ISLAND ELECTROPLATING SHOP

FIGURE 7.

SITE INVESTIGATION SUMMARY MAP

Date: 4/92 | Project No. 6760-N81

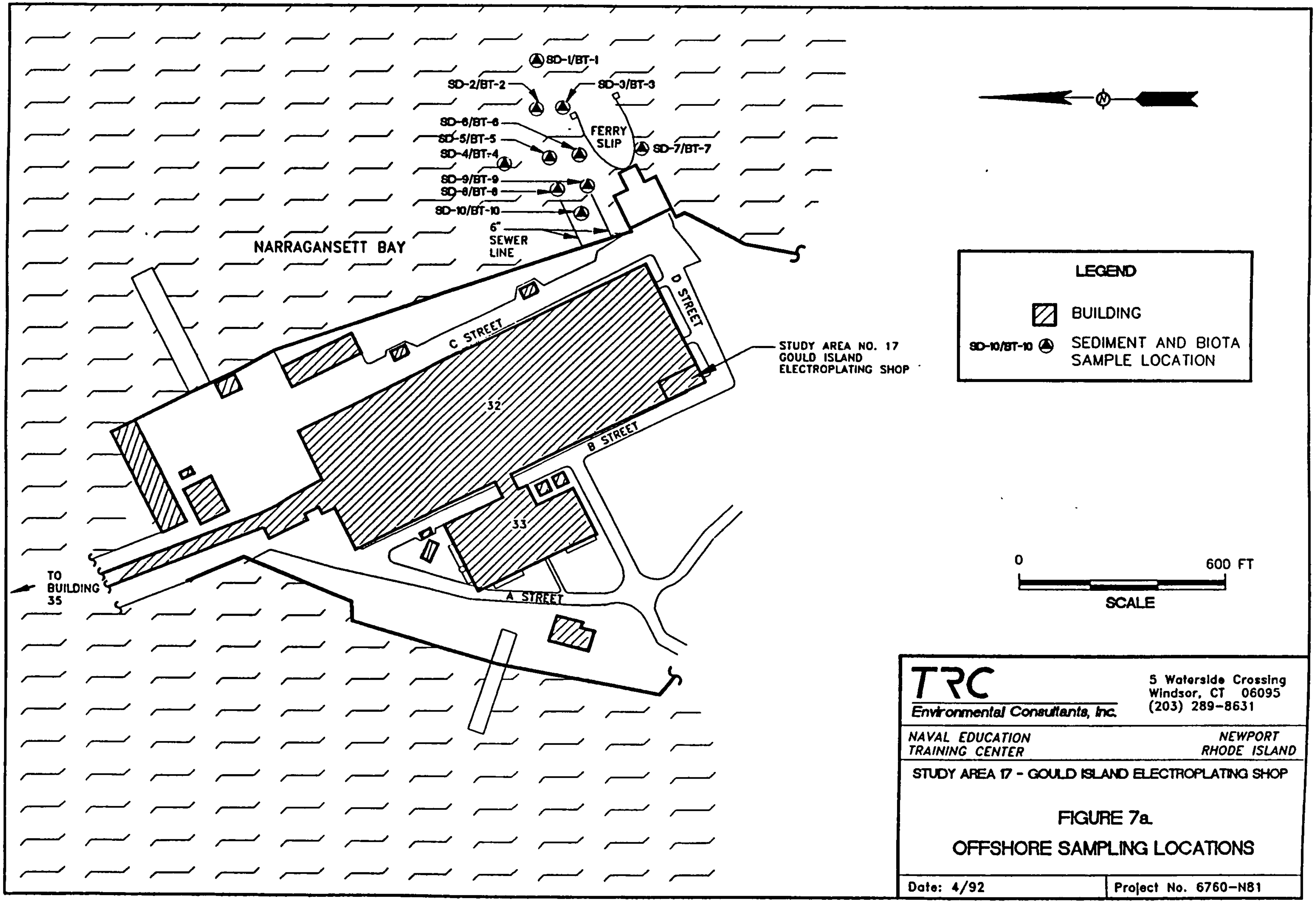

FIGURE 7a.
OFFSHORE SAMPLING LOCATIONS

SOIL INVESTIGATION - TANK FARM FIVE
TANKS 53 AND 56

Completion Date: Draft Report - January 1993

Objective: Assess the extent of petroluem hydrocarbon migration from Tanks 53 and 56 into surrounding soil and propose preliminary alternatives for soil remediation.

Conclusions:

Tank 53: Ring drain material surrounding the tank is contaminated with petroleum hydrocarbons at concentrations on the order of 10,000 to over 30,000 ppm and volatile organic compounds at concentrations ranging from 3 to over 40 ppm. Preliminary estimates indicate that the contaminated soil extends in a ring approximately six feet wide from six feet to 34 feet below ground surface. This results in approximately 2,400 cubic yards of contaminated soil.

Tank 56: No evidence of elevated concentrations of total petroleum hydrocarbons or volatile organic compounds were detected in the soil around Tank 56.

Preliminary Alternatives for Soil Remediation:

Preliminary Alternative	Estimated Cost
No Action	$13,500 (30 year O&M of fence)
Excavation and off-site Landfilling	$440,000
Asphalt Batching	$360,000 to $480,000
In-Situ Vapor Extraction	$70,000 to $170,000
In-Situ Bioremediation	$500,000

Draft Report

SOIL INVESTIGATION TANK FARM FIVE - TANKS 53 AND 56

NAVAL EDUCATION AND TRAINING CENTER NEWPORT, RHODE ISLAND

Contract No. N62472-86-C-1282
January 1993

Prepared For:
Northern Division
Naval Facilities Engineering Command
Lester, Pennsylvania

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

TRC Environmental Corporation (TRC-EC) was retained by the U.S. Department of Navy-Northern Division to investigate soil conditions around Tanks 53 and 56 at the Newport Naval Base. These tanks are located within Tank Farm Five on the Naval Education and Training Center (NETC) portion of the Naval Base in Newport, Rhode Island.

The objective of this soil investigation is to assess the extent of petroleum hydrocarbon migration from the tanks into surrounding soil. Information presented in this investigation may then be used to proceed with closure of the tanks in accordance with State of Rhode Island Department of Environmental Management (RIDEM) underground storage tank (UST) and hazardous waste requirements. While investigation and remediation of soil contamination around Tanks 53 and 56 is subject to RIDEM UST regulations, investigation and remediation of ground water contamination is being addressed under the on-going CERCLA Remedial Investigation/Feasibility Study (RI/FS) at Tank Farm Five.

The soil investigation was conducted in two phases. The first phase consisted of a soil gas survey which was used to assess the extent of volatile organic contamination around the tanks and to efficiently locate soil borings for the second phase. The second phase consisted of the drilling of soil borings around the tanks along with sampling and analysis of subsurface soils.

Included in this report is a summary of background information on Tank Farm Five (Section 2.0), a description of the soil investigation methodology (Section 3.0), results of the soil investigation along with a discussion of the significance of the findings with regard to contaminant migration, regulatory considerations, and public health (Section 4.0) and a presentation of potential soil remedial alternatives (Section 5.0).

2.0 BACKGROUND INFORMATION

2.1 LOCATION AND DESCRIPTION

Tank Farm Five is located in the north-central portion of NETC, in the town of Middletown, Rhode Island. While this investigation focuses on Tanks 53 and 56, a total of eleven underground storage tanks (Tanks 49 to 59) comprise Tank Farm Five. A Locus Plan showing the location of Tank Farm Five at the Newport Naval Base is provided as Figure 1. Tanks 53 and 56 are located in the western portion of the Tank Farm as indicated on Figure 2.

Tank Farm Five occupies approximately 73 acres. The Tank Farm is bordered by the Defense Highway and Narragansett Bay to the west, Greene Lane to the northeast, a residential development to the east, and by a wooded area and cemetery to the south.

Access to the site is from the west, off of Defense Highway through a gate and along a paved entrance way which leads to the central portion of the site. Just inside the entrance and north of the paved road is a Fire Fighting Training area which occupies approximately three acres and is surrounded by a chain link fence. The paved road continues through the site in a loop past the underground storage tank locations. Adjacent to each of the underground tanks are pump/valve houses for the tanks. The entire tank farm is surrounded by a chain-link fence. All of the underground storage tanks at Tank Farm Five are inactive.

Site topography generally slopes downward to the north. The ground elevation ranges from approximately 10 feet above mean low water level (mlw) in the northern corner of the site to 90 feet above mlw at the southern edge of the site. Gomes Brook passes through the northeastern portion of the site and drains east to west into Narragansett Bay. Gomes Brook is located approximately 1,200 feet north of Tanks 53 and 56.

Tank Farm Five is vegetated with grass, weeds, brush, and some trees. The soil overlying Tanks 53 and 56 is also vegetated with grass, weeds, and small brush. The area around the new Fire Fighting Training area is open and grassy with new sod. The northern and southern corners of the site support more mature trees.

Available information indicates that each of the tanks within Tank Farm Five are constructed of pre-stressed, reinforced concrete and are approximately 116 feet in diameter, 33.5 feet deep and have a nominal capacity of 60,000 barrels (2,520,000 gallons). Each of the tanks is covered by approximately four feet of soil and is surrounded by a ring drain. These ring drains were designed to reduce hydrostatic pressure on the tanks (from ground water) during periods of low tank volumes. The drains consist of twelve-inch reinforced concrete drain pipe located within a permeable backfill (native shale fragments) approximately four feet wide. Each drain is connected to a sump pump to remove the ground water from the backfill area.

2.2 HISTORY

The eleven underground storage tanks at Tank Farm Five were constructed in 1942 and 1943. These tanks were used for fuel storage from this time until approximately 1974. Between 1975 and 1982 the Navy stored used oil in Tanks 53 and 56 as part of an oil recovery program. This oil was reportedly used as an alternate heating fuel for Building 86 (ERA, 1988). In 1982, RIDEM adopted hazardous waste regulations which regulated storage tanks which held waste oil. In 1983 the Navy contracted with Tibbetts Engineering Corporation to sample the contents of Tanks 53 and 56. Results of this analysis were transmitted to RIDEM to determine whether the material was considered a hazardous waste. Review of the analytical results by RIDEM indicated that the material within the tanks was considered a hazardous waste (ERA, 1988) (RIDEM letter dated January 12, 1984).

In 1984, the Navy discontinued storage of oil in Tanks 53 and 56. In 1985, RIDEM issued a Hazardous Waste Facility Permit to NETC. This permit stated that Tanks 53 and 56 were to be removed and closed in accordance with both hazardous waste regulations and RIDEM UST requirements. In 1988, a tank closure plan addressing Tanks 53 and 56 was prepared for the Navy by Environmental Resource Associates, Inc. (ERA, 1988). Further investigations relative to Tanks 53 and 56 are discussed in Section 2.3. The contents of Tanks 53 and 56 was removed, and the interiors cleaned by OHM Corporation during the summer of 1992. The tanks are presently empty and inactive.

2.3 PREVIOUS INVESTIGATIONS

Four previous investigations have included activities in the vicinity of Tanks 53 and 56 on Tank Farm Five. These investigations include a tank closure investigation conducted by Environmental Resource Associates, Inc. in 1988 (ERA, 1988), a tank closure investigation conducted by TRC-EC (TRC-EC, 1991a), a Remedial Investigation of the entire tank farm conducted by TRC-EC (TRC-EC, 1991b), and a supplemental ground water investigation around Tanks 53 and 56 by TRC-EC (TRC-EC, 1992a). A discussion of each of these investigations is provided below.

2.3.1 ERA Tank Closure Investigation

Sampling of the water, oil, and sludge in Tanks 53 and 56 was conducted in 1983 by Tibbetts Engineering Corporation (Tibbetts). The presence of three phases (sludge, oil, and water) was observed in the tanks by Tibbetts during sampling activities. According to the ERA report, the results of the sample analyses indicated that the oil phase in both tanks was hazardous due to the concentration of lead in the oil (Tank 53 - 53.0 and 53.2 ppm, Tank 56 - 44.9 and 45.4 ppm). Similarly, the sludge layer in both tanks was also reported to be hazardous due to elevated concentrations of lead, cadmium, chromium, barium, mercury and silver. The results of the 1983 Tibbetts sampling effort are provided with background information in Appendix A.

In 1985, ERA installed a total of four ground water monitor wells (MW-53E, MW-53W, MW-56E, and MW-56W) in the ring drains which surround Tanks 53 and 56 (see Figure 3). Ground water samples collected from wells in the ring drain surrounding Tank 53 indicated the presence of both chlorinated (up to 7,018 parts per billion or ppb) and aromatic hydrocarbons (up to 3,152 ppb) in the ring drain ground water. Ground water samples collected from wells in the Tank 56 ring drain indicated the presence of 339 ppb chlorinated volatile organic compounds (VOCs). VOCs detected in the Tank 56 ring drain included methylene chloride (304 ppb), chloroform (18 ppb), and 1,1,1-trichloroethane (17 ppb). Additionally, trace concentrations of mercury (less than 2 ppb) were detected in the ring drain of Tank 53 (MW-53W = 1.4 ppb) and Tank 56 (MW-56E = 1.2 ppb, MW-56W = 0.8 ppb). Cadmium (7 ppb) was also detected in one ground water sample (MW-53E) from the ring drain of Tank 53. No other metals were detected in the ground water samples from the four wells. While soil samples were not laboratory analyzed under this investigation, fuel oil staining and odors were observed in split spoon soil samples collected from the Tank 53 ring drain.

At the request of RIDEM, six additional monitoring wells (MW-86-1, MW-86-2, MW-86-3D, MW-86-3S, MW-86-4 and MW-86-5) were installed around the tanks and sampled by ERA in 1986; five to the north and west of Tank 53 and one 300 feet south of Tank 56. The location of these wells is provided on Figure 4. The analytical results of the ground water samples from these wells and the other four wells indicated the presence of organic compounds (21 ppb total VOCs - 100% chlorinated) in the ground water at well MW-86-2 located approximately 150 feet to the north of Tank 53. Ground water from monitoring well MW-86-3D contained 229 ppb total VOCs (185 ppb or 81% chlorinated VOCs) northwest of Tank 53. This well was accidentally destroyed and later replaced by monitoring well MW-7 in 1990. At the time of sampling, a floating oil layer was reported to be present in the Tank 53 ring drain wells (wells MW-53E and MW-53W). The hydraulic gradient data developed for the well network indicated a ground water flow direction to the northwest across Tank 53 and a downward vertical hydraulic gradient at a nested well pair (MW-86-3S/3D) installed northwest of Tank 53.

In 1986, the four ring drain monitoring wells (MW-53E, MW-53W, MW-56E, and MW-56W) were re-sampled by ERA. Evidence of a floating oil layer was observed within the two wells (MW-53E and MW-53W) installed within the Tank 53 ring drain. The results of the VOC analysis of these samples were generally consistent with 1985 analytical results. This sampling event confirmed the presence of VOCs in the ground water in the Tank 53 ring drain, and the absence of VOCs in the ground water in the Tank 56 ring drain. The results of ERA's 1985 and 1986 ground water sampling and analysis, along with appropriate boring logs are provided with the background information in Appendix A.

2.3.2 TRC-EC Tank Closure Investigation

A tank closure investigation was conducted during 1991 by TRC Environmental Corporation at Tanks 53 and 56 (TRC-EC, 1991a). The purpose of this investigation was to assess if petroleum hydrocarbons had migrated from the tanks into site soil and/or ground water. As part of this investigation, a total of five new wells (MW-7, MW-8, MW-9, MW-10 and RW-

1) were installed near the two tanks. Boring logs from these wells are provided with background information in Appendix A. Monitoring wells MW-7 and MW-8 replaced damaged wells MW-86-3S/3D and GHR, respectively. Well RW-1 (eight inch diameter) was installed in a manner consistent with possible future product recovery in the ring drain of Tank 53. Monitoring wells MW-9 and MW-10 were installed northwest of Tank 56. Additionally, soil boring and ground water samples were collected and laboratory analyzed under this investigation. The location of these wells is shown on Figure 3. The laboratory results of this sampling event are provided with background information in Appendix A.

Of the six soil samples submitted for laboratory analysis, all six were analyzed for VOCs, five were analyzed for base neutral/acid extractable (BNA) organic compounds and four samples were analyzed for inorganic compounds. Results of these soil analyses indicated the presence of elevated levels of VOCs and BNAs in one sample collected at five to seven feet below ground surface at the boring for well RW-1 located within the Tank 53 ring drain. Detectable concentrations of VOCs and BNA's, although at lower total concentrations, were also reported in all of the other soil samples. Metals were also detected in the subsurface soil samples at concentrations within the range of levels observed for surficial soils.

Two rounds of ground water sampling (July 20 and October 25, 1990) were conducted near Tanks 53 and 56. Once again, evidence of floating oil was observed in the Tank 53 ring drain wells. The ground water sample analytical results indicate the highest concentration of contaminants were observed in the Tank 53 ring drain wells. Ground water samples collected from the Tank 53 ring drain wells indicated up to 888 ppb chlorinated VOCs and 185 ppb aromatic VOCs during the July event and 2,662 ppb of chlorinated VOCs and 902 ppb of aromatic VOCs during the October event.

2.3.3 TRC-EC Tank Farm Five Remedial Investigation

During the Phase I Remedial Investigation (RI) conducted by TRC Environmental Corporation (TRC-EC, 1991b), samples of the tank contents (oil and water) and surface soil above each of the tanks (two per tank) were collected and laboratory analyzed. The laboratory analytical results for this sampling event are provided with the 1991 Tank Closure Investigation background information in Appendix A.

Results of the tank contents sampling indicated, as anticipated, elevated concentrations of VOCs (up to 1.9%) and BNAs (up to 3.3%) in the oil samples. Total inorganic analysis of the oil samples indicated the presence of several analytes, however, the detected levels were generally below 30 ppm. Additionally, an estimated concentration of 1,600 ppb of PCBs (Arochlor-1016) was reported in the oil sample from Tank 56. Results of the tank water samples indicated total VOCs at concentrations of 4,063 ppb and 406 ppb in Tanks 53 and 56, respectively. Chlorinated VOCs comprised approximately 10% (403 ppb) of the total VOC concentration in the Tank 53 water and 8% (33 ppb) of the total VOC concentration in the Tank 56 water.

Analytical results of the surface soil sampling indicated low levels of total petroleum hydrocarbons (TPH) (9.5 - 31 ppm), and several semivolatile organic compounds. No PCB's were detected in the surface soil samples. Several metals were detected in the surface soil samples; however, most of the metals were detected at levels which are naturally occurring in soils.

2.3.4 TRC-EC Supplemental Ground Water Sampling Investigation

A supplemental ground water investigation was conducted in 1992 by TRC-EC (TRC-EC, 1992a) near Tanks 53 and 56 to assess ground water quality and to determine if migration of contaminants had occurred since the last sampling event (October, 1990). During this investigation, a total of sixteen ground water samples were collected on May 7 and 8, 1992 from the existing well network of nineteen wells (three wells were dry). Ground water samples were analyzed for Target Compound List (TCL) and Target Analyte List (TAL) parameters. Results of this sampling effort confirmed that ground water in the vicinity of Tank 53 has been impacted by volatile and semivolatile organic compounds. Free product was also again observed in the wells located within the ring drain of Tank 53. Laboratory results of this sampling effort are provided with background information in Appendix A.

2.3.5 Summary

In summary, the previous four investigations relative to Tanks 53 and 56 at Tank Farm Five indicate the following:

- Both Tanks 53 and 56 held waste oil which contained lead at concentrations which would characterize the oil as a hazardous waste.

- Sampling and analysis of oil and water conducted within Tank 53 during the 1990 RI indicated the presence of both aromatic and chlorinated VOCs in the tank contents.

- Ground water samples collected within the ring drain wells of Tank 53 indicated a predominance of chlorinated VOCs (7 ppm or 75% of the total VOCs) during a sampling event conducted in 1985. Subsequent sampling events have indicated generally lower total VOC concentrations (1986 - 6 ppm, 1990 - 1 ppm, 1992 - 3.6 ppm). However, the relative percentage of chlorinated VOCs of the total VOCs has remained generally consistent (1986 - 59%, 1990 - 82%, 1992 - 58%).

- Free product (oil) was consistently observed within the wells screened within the ring drain of Tank 53.

- A 1985 ground water sampling event indicated the presence of chlorinated VOCs in the Tank 56 ring drain. Of the three VOCs detected, two are common laboratory contaminants (methylene chloride and chloroform) and accounted for 95% (322 ppb out of a total of 339 ppb) of the VOCs detected. Subsequent sampling events indicated low (up to 32 ppb total VOCs) or non-detectable concentrations of VOCs in ground water in the Tank 56 ring drain. However, the VOCs detected during these subsequent sampling events also consisted of common laboratory contaminants (methylene chloride and acetone).

2.4 GEOLOGY

The following information on geologic conditions at Tank Farm Five is summarized from data presented in the Phase I Remedial Investigation (TRC-EC, 1991b), as well as from information available from previous site investigations. Subsurface geologic conditions observed during the installation of borings completed during this tank soil investigation are summarized in Section 4.1.

2.4.1 Topography

As previously noted, Tank Farm Five is located along the east shore of Narragansett Bay. Site topography is variable, but in general the land surface slopes from an elevation of approximately 90 feet above mean low water (mlw) in the southwestern portion of the site to less than 10 ft mlw along the eastern portion of Gomes Brook in the northern area of the tank farm. Topography in the vicinity of Tanks 53 and 56 slopes down to the west from a high of approximately 85 feet mlw near Tank 56 to less than 70 feet mlw near Tank 53. Five foot topographic contours in the vicinity of Tanks 53 and 56 are shown on Figure 3.

2.4.2 Subsurface Conditions

In general, overburden deposits at Tank Farm Five consist of a native sand and silt unit underlain by glacial till just above bedrock. In the vicinity of the underground storage tanks, the sand and silt unit is overlain by a loose fill material consisting of native shale fragments intermixed with sand and silt.

The native unconsolidated soil on the site consists of brown to gray-black fine sand and silt. In many locations the fine sand and silt are mixed with angular shale rock fragments, suggesting disturbance during tank construction and grading. Surficial soils in many locations consist of similar regraded silts and sands with rock fragments. Observed overburden thickness ranges from 11 to 40 feet near Tanks 53 and 56.

The till unit observed on-site ranged from approximately one foot in thickness (MW-3) to greater than 20 feet (MW-8).

Site-specific geologic data gathered during the Phase I RI and from previous investigations indicates that the bedrock surface slopes to the north and west across the site from an elevation of over 70 feet above mlw near Tank 59 (Boring B-9), to approximately 40 feet above mlw near Tank 49 (Boring B-7). The bedrock was reportedly excavated at most, if not at all, of the underground storage tank locations during the tank construction/installation activities. In some instances, this may have required excavation 10 to 30 feet into bedrock, for a total depth of approximately 40 feet below ground surface at the tank locations. As a result, the existing bedrock surface at the tank farm is expected to be irregular near the tanks.

The bedrock at the site consists of gray, highly weathered to competent, slightly metamorphosed shale, with quartz lenses (the Rhode Island Formation). Zones of weathered bedrock were observed above the more competent bedrock. Bedrock cores collected during the 1986 boring program were reported to consist of near horizontally bedded and stratified shales schist, schistose sandstone and vein quartz. The shales and fine grained schists were reported to be very soft and erosive and exhibiting staining along with a weathered and weakened fabric along discernable joint surfaces. The more coarse grained schistose sandstone was reported to be fragmental in recovery and exhibited both oxidation staining and a pitted texture. The observed thickness of the weathered rock ranges up to 27 feet (MW-86-3; ERA, 1988). Depth to weathered bedrock ranged from 1 foot (at MW-3) to 36 feet (in B-20) away from the tanks.

2.5 GROUND WATER HYDROLOGY

2.5.1 Ground Water Flow Patterns

Ground water levels were measured in sixteen existing monitoring wells at Tank Farm Five during the May 1992 ground water sampling event. This information was used to develop a contour map of the ground water table across the entire Tank Farm Five site. This ground water table contour map is provided as Figure 4.

As indicated on the ground water table contour map, the shallow ground water at the site appears to be affected by the presence of Gomes Brook at the northern end of the site. The ground water contours also generally reflect the site topography. Ground water from the southern end of the site (near Tanks 53 and 56) flows to the west-northwest (directly toward the bay). A review of ground water elevation data indicate that the wells immediately adjacent to Tanks 53 and 56 appear to be affected by the presence of the tank and the subsurface ring drain.

2.5.2 Hydraulic Conductivity

Single well hydraulic conductivity tests (slug tests) were performed at five of the shallow monitoring wells (MW-1, MW-2, MW-3, MW-5, and MW-6) on the site during the Phase I Remedial Investigation. Each of these monitoring wells are screened in weathered bedrock, except MW-6 which is screened in till (overburden).

The hydraulic conductivities determined for the weathered bedrock ranged from 0.16 ft/day (MW-2) to 0.21 ft/day (MW-3). The hydraulic conductivity estimated for the overburden well (MW-6) was 0.25 ft/day. These values indicate that the weathered bedrock at the site is almost as conductive as the overburden at the site.

2.5.3 Horizontal Hydraulic Gradients

Horizontal hydraulic gradients at Tanks 53 and 56 were calculated based on water level measurements conducted on May 6, 1992. These measurements were used to prepare the ground water table contour map provided as Figure 4. Average horizontal hydraulic gradients for Tank 53 and Tank 56 were calculated based on the distances and elevations provided on Figure 4. Calculations indicate an average horizontal gradient of approximately 0.047 ft/ft (Tank 53) and 0.049 ft/ft (Tank 56).

2.5.4 Average Linear Velocities

The calculated average horizontal hydraulic gradients, along with hydraulic conductivity and effective porosity values estimated during the Phase I Remedial Investigation (TRC, 1991b) were used to calculate average linear ground water velocity values at the site.

Using a form of Darcy's Law, and estimates of effective porosity (15%, Freeze & Cherry) and hydraulic conductivity (0.25 ft/day) developed on the basis of the Phase I Remedial Investigation, ground water flow velocity can be estimated as follows:

$$v = Ki/n$$

where
- v = average ground water flow rate (ft/day)
- i = hydraulic gradient (unitless or ft/ft)
- n = effective porosity (unitless)
- K = hydraulic conductivity (ft/day)

Using the values above, the ground water is conservatively estimated to flow at an average rate of approximately 0.078 feet per day (29 ft/yr) at Tank 53 and 0.082 feet per day (30 ft/yr) in native overburden material near Tank 56. However, flow rates may vary in localized areas due to the presence of the permeable ring drains around each tank and the variability of hydraulic conductivity in natural soils.

2.6 ENVIRONMENTAL SETTING

A brief discussion of the environmental setting of the site is provided below. This information has been extracted from previous reports (TRC-EC, 1992b) and will be used to establish the sensitivity of the environmental setting of the site when evaluating analytical data generated during this investigation. The site's ground water and surface water classification are discussed below along with a summary of area water use.

2.6.1 Ground Water Classification

RIDEM has classified ground water in the area of Tank Farm Five as Class GAA-NA. Ground water classified GAA includes those ground water resources 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 wellhead protection area of each well, as delineated by RIDEM;

3. Ground water dependent 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.

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.

2.6.2 Surface Water Classifications

Most of the Narragansett Bay, including that in close proximity to Tank Farm Five is classified as Class SA surface water by RIDEM, which means it is suitable for bathing and contact recreation, shellfish harvesting for direct human consumption, and fish and wildlife habitat. The freshwater stream (Gomes Brook) at Tank Farm Five has been classified as a Class B surface water. 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.

2.6.3 Area Water Use

Public water in the Town of Middletown, where Tank Farm Five is located, is supplied and managed by the Newport Water Department. While no specific records exist as to private well use in the vicinity of Tank Farm Five, background information (TRC-EC 1992b) suggests the majority of private wells are located on the eastern portion of Aquidneck Island, approximately two miles east of Tank Farm Five.

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 on the mainland. The reservoir closest to Tank Farm Five is the Sisson Pond Reservoir. This reservoir is located approximately one mile northeast and is 80 feet higher in elevation than Tank Farm Five. The closest known public water supply well (February 1992 RIDEM Ground Water Section Facilities Inventory Map for the Prudence Island quadrangle) is located over three miles north of Tank Farm Five.

3.0 SOILS INVESTIGATION SCOPE

3.1 INTRODUCTION

The purpose of this soil investigation was to determine the vertical and horizontal extent of soil contamination around Tanks 53 and 56 on Tank Farm Five. To meet this objective, a soil gas survey and soil borings were completed around the tanks. The quality assurance/quality control procedures for the field sampling activities and laboratory analyses are presented in the project Quality Assurance Project Plan (QAPP).

3.2 SOIL GAS INVESTIGATION

As part of the tank closure investigation, a soil gas survey was conducted around Tanks 53 and 56. A total of 299 soil gas samples were collected from 101 individual locations at depths between 6 and 24 feet below ground surface. Each soil gas sample was then analyzed by Target Environmental Services, Inc. of Columbia Maryland with an on-site laboratory grade gas chromatograph (GC) equipped with both a flame ionization detector (FID) and electron capture detector (ECD) for detecting both aromatic and chlorinated VOCs. The purpose of the soil gas survey was to screen and identify areas of possible VOC-contaminated soil. A summary of soil gas sampling procedures is provided below.

Each of the soil gas samples collected during field investigations was analyzed in a mobile laboratory immediately following collection. Individual samples were subject to two analyses. One analysis was conducted according to EPA Method 601 (modified) on a laboratory-grade GC equipped with an ECD using a direct injection technique. Specific analytes standardized for this analysis included:

- 1,1-dichloroethene,
- methylene chloride,
- trans-1,2-dichloroethene,
- 1,1-dichloroethane,
- cis-1,2-dichloroethene,
- chloroform,
- 1,1,1-trichloroethane,
- carbon tetrachloride,
- trichloroethene,

- 1,1,2-trichloroethane, and
- tetrachloroethene.

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

The second analysis was conducted according to EPA Method 602 (modified) on a GC equipped with an FID, again using a direct injection technique. The analytes selected for standardization in this analysis included:

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

These compounds were chosen because of their utility in evaluating the presence of fuel products, or petroleum-based solvents.

3.2.1 Soil Gas Sample Locations

The configurations of the soil gas sampling locations around Tanks 53 and 56 are provided on Figures 5 and 6, respectively. Two concentric rings were established at distances of approximately twenty-five and fifty feet out from the edge of each tank, respectively. Twenty evenly spaced soil gas sampling points were surveyed onto each ring, thus initially establishing forty possible soil gas sampling locations for each tank.

Prior to beginning the soil gas survey, ground water levels at the site were measured from existing monitoring wells and found to be approximately 30 feet below ground surface. An attempt to sample the soil gas down to thirty feet (just above the water table) was planned; however, soil gas probe refusal due to the presence of weathered shale was typically encountered at a depths of approximately twenty feet below ground surface. Therefore, the three soil gas samples collected per location were generally collected at depths of six, twelve, and twenty-one feet below ground surface. These depths varied as conditions warranted. Specific sampling depths are summarized with results in Appendix C.

The soil gas survey was initiated by sampling survey points on the downgradient (northwest) side of Tank 53, a known area of subsurface contamination to verify the ability of the soil gas sampling to detect subsurface contamination at the site. These first points were established at distances of five, ten, fifteen, and twenty-five feet radially outward from the edge of the tank. The findings from soil gas analysis of these initial points indicated that the survey was effective in detecting the subsurface VOC contamination. The soil gas survey proceeded around Tank 53 on the sampling ring established 25-feet from the tank.

Soil gas investigations at Tank 56 were planned and conducted in a similar manner as those at Tank 53; however, the number of outer soil gas points was significantly reduced given the relative absence of VOCs at the inner points. A number of soil gas points originally planned for Tank 56 were instead located around Tank 53 to further investigate the subsurface VOC contamination detected around that tank. This approach resulted in 63 soil gas points being completed around Tank 53 and 38 points around Tank 56. Soil gas probe refusal around Tank 56 typically occurred at approximately twenty to twenty-four feet below ground surface.

3.2.2 Soil Gas Sampling Methods

Prior to the collection of each sample, the entire sampling system (including down-hole probe, tubing, syringe, and associated plumbing) was purged with ambient air drawn through an organic filter cartridge. To collect samples, a van-mounted hydraulic probe was used to advance 3-foot sections of 1-inch diameter threaded steel casing to the desired 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 probe. A teflon line with a perforated hollow stainless end was inserted into the casing to the bottom of the hole and isolated from the steel casing annulus by an inflatable packer. A sample of in-situ soil gas would then be withdrawn through the probe and used to purge atmospheric air from the sampling system. A second sample of soil gas was withdrawn through the probe, and encapsulated in a pre-evacuated glass vial at two atmospheres of pressure (29 psia). The self-sealing vial was detached from the sampling system, packaged, labelled, and held for subsequent field laboratory analysis.

3.3 SOIL BORING INVESTIGATION

A total of 40 test borings were completed and sampled around the two tanks. The plan provided for thirty (30) borings around Tank 53 (Borings B-1 to B-30), where more evidence of potential subsurface contamination was indicated by the soil gas survey findings, and ten (10) borings around Tank 56 (B-32 to B-41). No boring labelled B-31 was completed on-site. In addition, three shallow borings were completed in soil on top of Tank 53 (B-42 to B-44) to investigate soil quality on the top of the tank. Figures 7 and 8 indicate the relationship of soil borings to soil gas survey points at Tanks 53 and 56, respectively.

Three (3) "background" test borings were also completed on the site. The borings were located south of the Tank 53 and 56 area, and their locations are shown on Figure 3 (B-50 to B-52). An attempt was made to select background soil boring locations believed to be representative of site background soil conditions and away from potential sources of contamination (e.g., tanks, pipelines). The locations for the background borings were discussed with representatives from EPA and RIDEM prior to the soil boring activities. In summary, a total of 46 soil borings were completed as part of this soil investigation.

Soil Boring Sampling Methods

Split spoon soil samples were collected continuously at 2.0-foot intervals from each borehole to the depth of auger refusal (typically 20 to 24 feet below grade). Borings located within the ring drain were completed to the water table (approximately 32-34 feet below ground surface). Standard penetration tests [ASTM D1586-84 (1984)] were conducted for every 2.0-foot sampling interval.

Split spoon soil samples were screened with an OVA immediately upon opening. The physical characteristics of each soil sample were geologically logged and described in a field notebook. General observations which were recorded included staining, odors, oily soils, depth to water, and OVA readings.

An aliquot of each split spoon sample was placed in a glass sample container for on-site volatile gas/vapor headspace readings with an OVA. The sample container was filled approximately three-quarters full and a foil liner was placed on the top prior to closing the container's cover. Each soil sample collected for headspace readings was partially submerged in an on-site warm water bath for approximately five minutes prior to measuring the sample headspace. The container volatile headspace was measured by carefully removing the container's cap and inserting the FID tip through the container's foil cap liner. The peak, 15 second, and 30 second headspace measurements were recorded for each sample.

To reduce the potential for the loss of volatile organics, a soil sample was collected from each of the split spoons and placed into sample containers as if it was being submitted for laboratory analyses. Thus, after logging the sample, a sample aliquot of the entire split spoon was immediately transferred from the split spoon to appropriate sample containers with a dedicated stainless steel spoon.

Generally, three split spoon samples were selected from each boring for laboratory analysis. Samples collected for laboratory analysis included those believed to be the most contaminated, as well as samples from various depths within the zone of contaminated material. The most contaminated soil samples were identified based upon measured headspace readings and any visual observations of signs of potential contamination (e.g., oil stains, odors, sheens). In the event of multiple high headspace readings, samples were generally chosen from the top, middle, and bottom of the observed interval of potential contamination.

Each of the soil samples, except those collected from background borings (B-50 to B-52) were submitted for laboratory analysis for total petroleum hydrocarbons (TPH). In addition, at least one soil sample from each boring which exhibited elevated TPH values was analyzed for Target Compound List (TCL) VOCs. Soil samples from six boring locations (B-14, B-16, B-18, B-20, B-21, and B-27) exhibited elevated TPH values (above 100 mg/kg) and were analyzed for TCL VOCs. Additionally, soil samples from seven other boring locations, were also analyzed for TCL VOCs to more fully characterize the soils around the tank. Soil samples from these seven borings indicated either elevated field headspace results (B-10 and B-17), TPH values between 50 and 100 ppm (B-13, B-23, B-33), or were located on the top of Tank 53 (B-43 and B-44).

Full Toxicity Characteristic Leaching Procedure (TCLP) analysis, except herbicide analysis, was conducted on soil samples from eleven boring locations for soil disposal/characterization purposes. These boring locations included B-10, B-13, B-14, B-16, B-17, B-20, B-21, B-23, B-27, B-43 and B-44 and were selected to characterize soils within the ring drain (B-14, B-16, B-21, B-23 and B-27), on top of the tank (B-43 and B-44), at locations exhibiting somewhat elevated TPH or VOC readings (B-13, B-17 and B-20), or represented nearby soil conditions (B-10).

The nine soil samples collected from the three background locations were analyzed for the full list of EPA target compounds and analytes (TCL/TAL). In addition, one sample from each of two background locations (B-50 and B-52) was analyzed for TCLP parameters, except herbicides. These samples were collected from near surface soil (0-2 and 2-4 feet below ground surface) and where subsurface soil indicated evidence of moisture. All laboratory analyses were conducted by Weston - Analytics Division, of Lionville, Pennsylvania.

A sample index providing sample intervals and associated chemical analyses is provided as Table 1. Drill cuttings and unused soil samples from the soil borings were backfilled into their respective borings at the completion of the drilling activities.

4.0 RESULTS

4.1 SUBSURFACE MATERIALS ENCOUNTERED

In general, subsurface conditions observed during the installation of soil borings in the vicinity of Tanks 53 and 56 were consistent with the geologic information gathered from previous investigations, as presented in Section 2.4. Geologic units encountered during field explorations consisted of an upper fill material underlain by a native sand and silt unit, which was in turn underlain by till and weathered bedrock. Boring logs for the thirty three borings conducted near Tank 53 (B-1 to B-30, and B-41 to B-43) and the ten borings near Tank 56 (B-32 to B-41) are provided in Appendix B. Included on the boring logs are VOC readings which were measured immediately upon opening the split-spoon soil samples.

The fill material consists of a medium to very dense, brown to gray-brown to gray-black, fine to medium sand with numerous rock fragments. This unit generally extended from the ground surface to a depth of between six to ten feet below grade. However, in several instances this heterogeneous mixture of soil and native rock fragments extended to over 20 feet below ground surface. It is likely that this material represents the mixing of native soils and bedrock fragments which occurred during tank construction activities. Field screening of soil samples from this unit for total VOCs provided variable total VOC readings, ranging from non-detectable to over 1,000 ppm in soil around Tank 53. Where high total VOC readings were encountered, field observations of site soil indicated the presence of petroleum odors or staining. Low to non-detectable VOC readings were reported in the surficial fill unit around Tank 56.

The sand and silt unit consisted of a medium to dense, gray-black to gray, fine sand material with variable quantities of silt and gravel. On several occasions, lenses of orange-brown fine sand were observed within this unit. Where present, the sand and silt is located in the range of six to fourteen feet below ground surface. Field screening of soil samples from this unit for total VOCs around both Tank 53 and 56 indicated the presence of low to non-detectable VOC readings.

The till unit consists of a dense to very dense, brown to gray-black, fine to medium sand with variable amounts of gravel, bedrock fragments and silt. The till unit directly overlies the bedrock at approximately fourteen to twenty feet below ground surface. VOC field screening results for this unit were similar to those described for the overlying sand and silt unit, with low to non-detectable VOC readings.

During this soil investigation, bedrock was encountered at depths between 16 and 36 feet below ground surface. Several of the borings drilled in close vicinity to the tanks did not encounter bedrock and likely reflect a low bedrock surface due to the rock excavation activities during the tank construction. In most locations, the depth to the weathered bedrock was in the vicinity of 16 to 20 feet below ground surface. The upper contact between the till unit and upper bedrock zone was difficult to assess due to the weathered nature of the upper zone of shale bedrock. At locations where petroleum hydrocarbon contamination was visually observed, elevated field VOC readings were noted within the upper weathered bedrock unit.

4.2 SOIL GAS RESULTS

Soil gas results are discussed below on a tank by tank basis. For each tank, results of the analysis are discussed for total aromatic VOCs (the sum of benzene, toluene, ethylbenzene and xylene) followed by total chlorinated VOCs (the sum of all the chlorinated VOCs identified in Section 3.2). All of the soil gas data is presented in Appendix C. The results of the soil gas analyses are reported in micrograms per liter of gas (ug/l). For low molecular weight gasses, under normal ambient temperature and pressure conditions, these units are approximately equivalent to parts per billion (ppb).

4.2.1 Tank 53 Soil Gas Results

The soil gas survey conducted around Tank 53 identified 30 points where greater than 10 ppb of aromatic VOCs were reported. All but six of these points are located immediately adjacent to the tank. The other six points are located northwest of the tank. In general, on a percentage basis, toluene was the most prevalent aromatic VOC detected in the soil gas samples, followed by either ethylbenzene or xylenes, and then benzene. Concentrations of individual VOCs detected in the samples are provided in the data tables in Appendix C.

Detectable concentrations of chlorinated VOCs were reported in nearly all the soil gas points analyzed during the survey around Tank 53. As anticipated, concentrations of chlorinated VOCs were higher immediately adjacent to the tank, as opposed to those locations further away from the tank. Two exceptions were at soil gas points located south (SG-13, SG-15, SG-17 and SG-18) and north (SG-34, SG-35, TG-4, etc.) of the tank. The compound 1,1-dichloroethene was the most prevalently detected chlorinated VOC in the soil gas samples, followed by either 1,1,1-trichloroethane, trichloroethene or tetrachloroethene. The detection of higher concentrations of chlorinated VOCs relative to aromatic VOCs in subsurface soil near Tank 53 is consistent with the findings of previous investigations, which indicated the presence of chlorinated VOC contamination in the ground water in this area.

4.2.2 Tank 56 Soil Gas Results

The soil gas survey conducted around Tank 56 did not identify any points with detectable levels of aromatic VOCs (the sum of benzene, toluene, ethylene and xylene). Similarly, with the exception of the reported detection of 13 ug/l of methylene chloride at soil gas point SG-11 (21 feet below ground surface), no evidence of total chlorinated VOC compounds above 1 ug/l was reported around Tank 56. This information is generally consistent with the prior reported lack of VOC contamination in the vicinity of Tank 56.

4.3 SUBSURFACE SOIL INVESTIGATION RESULTS

4.3.1 Headspace Screening Results

As described in Section 3.3, headspace VOC readings were measured for each soil sample collected from borings B-1 through B-41. The results of the headspace OVA-FID screening are provided in Appendix D. The headspace results are discussed for each tank in the following sections.

Tank 53 Results

VOC headspace readings for soil samples from fifteen of the 33 soil borings located around Tank 53 were greater than 10 OVA-FID units (ppm) during the VOC headspace screening of the soil boring samples. As expected, five of these fifteen borings (B-14, B-18, B-16, B-21 and B-27) are located immediately adjacent to the tank, within the tank's peripheral ring drain. Nine more borings (B-2, B-4, B-6, B-7, B-8, B-10, B-17, B-29 and B-30) are located on the downgradient, northwest side of the tank. The remaining boring, B-20, is located just southeast of Tank 53.

Tank 56 Results

Only one soil boring sample from the ten borings completed around Tank 56 exhibited a total VOC headspace reading greater than 10 OVA-FID units (ppm). Soil sample B34-3 collected from four to six feet below ground surface, had a total OVA-FID reading of 50 ppm. Soil samples collected from immediately above (2-4) and below (6-8) sample B34-3 exhibited 5 ppm and non-detectable FID readings, respectively. Boring B-34 is located adjacent to Tank 56, on its northwest side (see Figure 8).

4.3.2 Total Petroleum Hydrocarbons (TPH)

Three soil samples were collected and analyzed for total petroleum hydrocarbons (TPH) from each of 40 soil borings (B-1 to B-30, B-32 to B-41) completed around the two tanks. A fourth sample was collected and analyzed for TPH from boring B-27 due to the continuous elevated headspace readings observed in this deep (36 feet) boring. Only two soil samples were collected from borings B-42, B-43, and B-44 completed on the top of Tank 53. Collection of a third sample was not possible at these three locations due to the limited depth of cover material (four feet) above the tank.

In summary, a total of 143 soil samples, including 16 duplicates, were collected from borings installed near Tanks 53 and 56 and analyzed for TPH. Of the total 112 samples (including 15 duplicates) were collected from borings near Tank 53 and the remaining 31 samples (including 1 duplicate sample) were collected from borings near Tank 56. A summary of the TPH results is provided in Table 2.

Consistent with RIDEM policy, TPH data was evaluated taking into consideration the environmental setting of the site. According to this policy, a standard of 100 mg/kg (ppm) for TPH should be used to evaluate the extent of TPH contamination within an area classified as one of high environmental impact, while a higher standard of 300 ppm may be used within areas of low environmental impact. In general, areas of high environmental impact are those which are close to public or private water supplies or sensitive environments. Areas of low environmental impact are typically within urban areas where public water is available. Based on information presented in Section 2.6, the site was considered to be within an area which could be classified as environmentally sensitive. This classification is based on the established ground water classification of GAA-NA, which implies RIDEM's long term goal is to obtain GAA (drinking water) standards within ground water, and the proximity of Gomes Brook and Narragansett Bay. Therefore, the 100 ppm standard was used in the evaluation of TPH contamination in the vicinity of Tanks 53 and 56.

Tank 53 - TPH Results

The results of the TPH soil analyses indicate that, of the 97 samples collected from the 33 borings completed in the vicinity of Tank 53, TPH concentrations greater than 100 ppm were reported at six locations (B-14, B-16, B-18, B-20, B-21, and B-27). Of the six locations, five are located within the ring drain surrounding Tank 53. The remaining boring, B-20, was located approximately 100 feet southeast of the tank. The Tank 53 soil boring locations at which TPH results were greater than 100 ppm are shown on Figure 9.

Five soil samples collected from five other borings (B-12, B-13, B-15, B-17 and B-23) exhibited TPH concentrations between 50 and 100 ppm. Of these samples, three were collected from within the upper four feet of soil (2-4' @ B-13, 0-2' @ B-15, and 2-4' @ B-17), while at the other two borings, the soil samples were collected from depths of 20 to 22 feet (B-12) and 16 to 18 feet (B-23) below the ground surface.

In summary, the highest TPH levels were generally measured in ring drain borings. At those boring locations where TPH was detected above 100 ppm, TPH soil concentrations were generally to be in the range of 1,000 to 20,000 ppm, indicating the presence of residual fuel oil within the ring drain material. The only boring location not within the ring drain where TPH concentrations exceeded 100 ppm was B-20, where TPH was detected at concentrations of 380 and 200 ppm in the soil samples collected from 30 to 34 feet below the ground surface. This boring is located approximately 50 feet southeast of Tank 53.

● Tank 56 - TPH Results

The results of the TPH soil analysis indicate that of the 30 samples collected from the 10 borings completed in the vicinity of Tank 56, no TPH concentrations greater than 100 ppm were detected in any of the samples. The highest concentration of TPH reported in these samples, 66 ppm at boring B-33, was detected within the surface soil interval (0-2 feet deep). The only other soil sample having a TPH concentration greater than 50 ppm was a soil sample collected from boring B-39 (58 ppm @ 6-8 foot depth).

In summary, no evidence of TPH contamination greater than 100 ppm was detected in soil samples collected from the borings completed in the vicinity of Tank 56, including the four borings (B-33, B-34, B-36 and B-37) completed within the Tank 56 ring drain.

4.3.3 Data Validation Results

Data validation was performed on soil and aqueous blank samples collected and analyzed for TCL and TAL parameters. Data validation is a process where the analytical results of laboratory analyses are reviewed to determine their usability and also their compliance with project QA/QC requirements and deliverables. The data validation was conducted by Heartland Environmental Services, Inc. of St. Peters, Missouri. A full 100% of the TCL and TAL data was validated. Validation was performed on the following analytical fractions for the following samples:

- TCL Volatile Organic Compounds - 33 Soil + 9 Water
- TCL Semivolatile Organic Compounds - 10 Soil + 4 Water
- TCL Pesticides/PCBs - 10 Soil + 2 Water
- TAL Metals - 10 Soil + 3 Water

In general, the findings of the data validation were as follows:

- The overall system performance was fair. The laboratory did not encounter any large problems. The data reviewer estimated that less than 10% of the data is qualified.

- Reanalyzed samples were rejected in favor of the results from the original analysis due to non-compliant internal standards and/or surrogate recoveries.

- Methylene chloride, acetone, and phthalates, which are known laboratory contaminants, were found in many samples and blanks and were appropriately qualified as estimated or rejected.

The discussion of data below and the data presented in the report tables and appendices incorporates information provided by the data validation. Copies of the validated data summary sheets are provided in Appendix E.

4.3.4 Volatile Organic Compounds (VOCs)

Based on the TPH soil sample results, 23 of the soil samples collected from 14 borings completed around both Tanks 53 and 56 were also analyzed for TCL VOCs. The analyses along with the VOC analysis of soil samples collected from background borings (nine samples from borings B-50 to B-52), aqueous field blanks (three samples), and trip blanks (five samples) are summarized in Table 3 and discussed below.

- Background Boring and Blank Sample Results

In general, the three background soil borings, B-50 to B-52, indicated consistent VOC results. Total VOCs varied in these boring samples from a high of 20 ug/kg (ppb) in the surficial (0-2 foot) sample from B-51 to non-detectable levels of VOCs in a near surface sample (2-4 foot) from boring B-52. On average, the total VOC concentration detected in the nine background soil boring samples was 6.4 ppb. The VOCs in these samples were comprised of only three compounds: methylene chloride, acetone, and toluene. All three of these compounds are common laboratory solvents which were detected at concentrations typically attributed to laboratory induced contamination.

The three field blanks (FB-1 to FB-3) and five trip blanks (TB-1 to TB-5) indicated total VOC concentrations ranging from 3 to 20 ppb. The average VOC concentration detected in the eight samples was 8.6 ppb. Again, one suspected laboratory contaminant, methylene chloride, was detected in every sample, while the second suspected laboratory contaminant, acetone, was detected in three of the eight samples.

A source water sample (SW-1) of the tap water used in field decontamination indicated the presence of 126 ppb of total VOCs in the water. VOCs detected in the tap water sample were chloroform (81 ppb), bromodichloromethane (34 ppb), and dibromochloromethane (11 ppb).

Tank 53 - VOC Results

The VOC results of the 21 soil samples analyzed for VOCs near Tank 53 varied widely. Total VOC concentrations ranged from a high of 44,920 ppb (B27-3) to non-detectable (B11-7). As depicted on Figure 10, soil samples collected from five locations (B-14, B-16, B-18, B-21 and B-27) indicated greater than 1,000 ppb total VOCs. Each of these borings is located within, or in close proximity to the Tank 53 ring drain. Aromatic VOCs, most notably total xylenes, comprised the majority of the total VOCs detected in the soil samples around Tank 53.

Tank 56 - VOC Results

The single soil sample analyzed for VOCs from the vicinity of Tank 56, the surficial sample (0-2 feet) from boring B-33, exhibited 5 ppb of methylene chloride, a suspected laboratory contaminant.

4.3.5 Toxicity Characteristic Leaching Procedure (TCLP) Results

To assess whether the contaminated soil around Tank 53 would be considered a characteristically hazardous waste, select soil samples were analyzed for TCLP parameters. Of the seventeen (17) samples analyzed for TCLP parameters, none exceeded the regulatory criteria which define the soil as a hazardous waste. The TCLP sample results are summarized in Table 4.

Results from the TCLP volatile fraction analysis (17 samples) indicated the detection of chloroform in two samples, B13-2 and B27-3, at 11 ppb each. As previously noted, chloroform was also detected in laboratory blank samples. Trichloroethene, which was the only other TCLP VOC detected in the samples, was reported at a concentration of 14 ppb in sample B-149.

TCLP BNA analysis indicated detection of both pyridine (81 ppb in sample B-215) and pentachlorophenol (64 ppb in sample B-431) in two of the samples. Both results were qualified as approximate (J qualifier). No TCLP pesticides were detected in the soil samples.

TCLP metals analysis indicated the presence of barium in five of the soil samples. However, the maximum barium concentration reported (572 ppb) was nearly three orders of magnitude lower than the TCLP criteria limit (100,000 ppb) which defines a material as characteristically hazardous. No other TCLP metals were detected in the samples.

4.3.6 TCL/TAL Results

To assess the quality of background soils near Tanks 53 and 56, a series of ten soil samples collected from background boring locations were analyzed for Target Compound List (TCL) base/neutral and acid/extractable (BNA) compounds, pesticides and PCBs, and inorganic compounds. Additionally, three aqueous field blanks and one source water blank were analyzed for these parameters. Results of these analyses are summarized in Table 5.

With the exception of two compounds, di-n-butylphthalate and bis(2-ethylhexyl)phthalate, no BNA compounds were detected in the samples analyzed. Both of the phthalate compounds are common laboratory contaminants, and the reported concentrations were qualified by the laboratory and through the data validation process as approximate values. Di-n-butylphthalate was detected at concentrations ranging from 3 ppb to 83 ppb in the 13 samples where it was detected. Bis(2-ethylhexyl)phthalate was detected in 13 of the 14 samples analyzed at concentrations ranging from 0.8 ppb to 99 ppb. No pesticides or PCBs were detected in any of the samples which were tested. Inorganic analysis indicated the presence of several inorganic analytes. However, in general, concentrations detected in these samples were similar to concentrations reported for soil samples in previous investigations.

4.4 DATA EVALUATION

Based on a review of previous investigation results, the results of the soil gas program and the sampling and analysis of the soil boring samples, the estimated extent of soil contamination near Tank 53 and Tank 56 is discussed below.

4.4.1 Tank 53 - Preliminary Extent of Soil Contamination

Previous investigations conducted near Tank 53 have indicated that the oil and sludge within the tank were considered hazardous wastes due to their lead content. Ground water sampling conducted in 1985 indicated the presence of free product in wells installed within the ring drain of the tank. In addition, up to 7,018 ppb of chlorinated VOCs and 3,152 ppb of aromatic VOCs were detected within ground water in the Tank 53 ring drain. Three subsequent ground water sampling events (July and October 1990 and May 1992) of wells within the ring drain indicated somewhat lower chlorinated VOC concentrations: 888 ppb - July 1990, 2,662 ppb - October 1990, and 2,065 ppb - May 1992. In addition, aromatic VOC concentrations varied over this same period: 185 ppb - July 1990, 902 ppb - October 1990, and 1,512 ppb - May 1992. Surface soil sampling conducted in 1990 in the vicinity of Tank 53 indicated low levels (9.5 to 31 ppm) of TPH.

Results of the recent soil sampling and analysis program conducted near Tank 53 are summarized in Table 6. The soil gas program indicated the detection of aromatic VOCs above 10 ppb at 30 points located around the tank. Chlorinated VOCs were detected in at least one sample from every point completed near the tank. This result is consistent with the documented ground water contamination near Tank 53. Soil headspace analysis results were comparable with the soil gas results, in that more locations on the downgradient side of the tank indicated headspace readings greater than 10 ppm than on the upgradient side of the tank.

Laboratory analysis of soil samples collected near Tank 53 indicated the presence of elevated (greater than 100 ppm) concentrations of TPH at six boring locations. Five of these boring locations are within or in close proximity to the tank ring drain. The sixth boring location (B-20) is approximately 50 feet southeast of the tank. The two soil samples from this location which exhibited TPH concentrations (380 and 200 ppm) were collected from depths of 30 to 32 and 32 to 34 feet below ground surface, respectively. Samples collected at these depths are nearly at, or within the seasonal water table depth at this location. Therefore, it is possible that the elevated TPH values may reflect some migration of TPH contamination outward from the ring drain in a southeasterly direction. While regional ground water flows in a north-northwesterly direction, a component of local flow may be to the southeast due an apparent dip in the bedrock surface near boring B-20.

Analysis of soil samples for TCL VOCs indicated that elevated levels (greater than 1,000 ppb) were reported at the same five boring locations where elevated TPH values were observed within the Tank 53 ring drain. In addition, while an elevated concentration of TPH was detected at boring B-20, TCL VOC analysis indicated only 14 ppb of suspect total VOCs (5 ppb of methylene chloride and 9 ppb of acetone, both common laboratory contaminants).

Figure 11 summarizes laboratory data collected from the soil investigation near Tank 53. This figure indicates that the ring drain, and an area near boring B-20 appear to be contaminated with oil constituents from Tank 53. Using an estimated width of four feet for the ring drain material, and assuming that two feet of soil immediately adjacent to the drain are contaminated, a six-foot ring area of contamination has been plotted around Tank 53. A review of available data indicate that the estimated six foot horizontal zone of contamination around the tank is reasonable given the relatively low TPH (59 ppm) and VOC (12 ppb) concentrations detected in boring B-23, which was completed approximately ten feet away from the edge of the tank. Boring logs of soil borings completed within the ring drain (B-14, B-16, B-18, B-21 and B-27) were utilized to develop an estimate for the vertical extent of contamination around Tank 53. This information is presented on Figure 12. The estimated vertical extent of petroleum impacted soil was plotted for each boring as the zone which indicated field VOC readings greater than 100 ppm. In general, this zone extended from approximately 6 to 34 feet (approximate depth of the water table within the ring drain) below ground surface.

Using the six-foot horizontal zone of contamination around the 116 foot diameter tank coupled with the cross-sectional geologic information plotted on Figure 12, a volume of 2,400 cubic yards of contaminated soil is estimated around Tank 53.

4.4.2 Tank 56 - Preliminary Extent of Soil Contamination

Previous investigations conducted near Tank 56 have indicated that the oil and sludge within the tank were considered hazardous wastes due to their lead content. Ground water sampling conducted in 1985 indicated the presence of up to 339 ppb of chlorinated VOCs in ground water near the tank. However, 95% of the total amount of VOCs detected during the 1985 sampling event were from the presence of VOCs typically associated with laboratory induced contamination (methylene chloride and chloroform). The presence of VOCs was not confirmed during three proceeding sampling events, during which time only methylene chloride (maximum of 19 ppb) or acetone (maximum of 13 ppb), were detected in ground water.

Results of the recent soil sampling and analysis program conducted near Tank 56 are summarized in Table 7. The soil gas survey results indicated no evidence of aromatic VOCs (sum of benzene, ethylbenzene, toluene and xylenes), and only a single occurrence of chlorinated VOCs (13 ppb of methylene chloride at SG-11). Similarly, only a single soil sample (B34-3) exhibited a total VOC field headspace reading greater than 10 ppm. Boring B-34 was completed on the opposite side of Tank 56, across from soil gas point SG-11.

Laboratory analysis of soil samples collected in the vicinity of Tank 56 did not indicate evidence of TPH contamination greater than 100 ppm. Only two soil samples from two different borings (B-33 and B-39) indicated TPH concentrations greater than 50 ppm. These two soil samples were collected from borings B33-1 (66 ppm) and B39-4 (58 ppm). Analysis of the sample with the higher TPH concentration (B-33) for TCL VOCs indicated the detection of just 5 ppb of methylene chloride, which may be due to laboratory induced contamination.

In summary, no evidence of elevated concentrations of total petroleum hydrocarbons or volatile organic compounds were detected in the soil around Tank 56. Therefore, based on these findings, remediation of soil near this tank is not considered necessary.

5.0 PRELIMINARY ALTERNATIVES FOR SOIL REMEDIATION

5.1 INTRODUCTION

Review of data from the soil sampling investigation conducted near Tanks 53 and 56 indicates evidence that subsurface soil next to Tank 53 has been impacted by releases from the tank. Analytical results from subsurface soil samples indicates that the ring drain material is contaminated with total petroleum hydrocarbons at concentrations on the order of 10,000 to over 30,000 ppm, and volatile organic compounds at concentrations ranging from approximately 3,000 (3 ppm) to over 40,000 ppb (40 ppm). However, analysis of this same soil for TCLP parameters has indicated the soil does not meet the regulatory criteria for a hazardous waste and, in general low levels of TCLP constituents were detected.

Preliminary estimates indicate that the contaminated soil around Tank 53 extends in a ring approximately six feet wide around the tank's perimeter. Vertically, the petroleum-impacted soil begins approximately six feet below ground surface and extends to a depth of 34 feet. This information was used to develop a preliminary estimate of the volume of petroleum-impacted soil near Tank 53 of 2,400 cubic yards.

5.2 PRELIMINARY TANK 53 SOIL REMEDIATION ALTERNATIVES

A range of alternatives from no action to complete removal and off-site treatment of the impacted soil are provided below. Following a description of each alternative a brief evaluation of the alternative is conducted with respect to effectiveness, implementability and cost.

The effectiveness evaluation reviews the ability of each alternative to protect human health and the environment through reduction of toxicity, mobility or volume of the impacted soil. The implementability evaluation takes into consideration the technical and administrative feasibility of constructing, operating, and maintaining the alternative. The final evaluation criterion, cost, involves development of qualitative estimates for both capital and operation and maintenance (O&M) costs associated with each alternative. Finally, after the individual alternative evaluations are presented, the alternatives are evaluated against each other in a comparative analysis.

Previous experience with similar contaminants and review of available literature suggests that the following five alternatives are potentially viable for soil remediation near Tank 53.

- No Action
- Excavation and Off-Site Landfilling
- Excavation and Off-Site Asphalt Batching
- In-Situ Vapor Extraction
- In-Situ Bioremediation

5.2.1 No Action Alternative

The no action alternative would involve no remedial response activities for contaminated soils at the site. No removal or treatment of contaminated soil would be conducted near Tank 53. This alternative is included to establish a baseline for evaluation of other remedial alternatives.

Effectiveness - The no action alternative would provide no reduction in the toxicity, mobility or volume of contaminants in site soil. It would also provide no direct protection of human health or the environment. However, maintenance of the existing site fencing and establishment of deed restrictions on the potential future use of the site would provide a degree of protection of human health based on the limitation of potential exposures due to direct contact with contaminated site media.

Implementability - The no action alternative would require no implementation, other than that needed to maintain the existing site fencing and establishment of deed restrictions.

Cost - The cost associated with the no action alternative is limited to that needed to maintain the fencing (assumed at about $550 per year) and the cost to establish land use restrictions (assumed $5,000 for legal and administrative fees). These estimates result in approximately $5,000 of up-front capital costs and approximately $8,500 of operations and maintenance costs, assuming a 30-year maintenance period.

5.2.2 Excavation and Off-Site Landfilling Alternative

This alternative involves the excavation and off-site transportation of petroleum-impacted soil to a suitable landfill. Factors which are considered in the cost evaluation of this alternative include the replacement and compaction of clean backfill and the premium cost involved with engineering oversight and the monitoring of worker health and safety during excavation operations. Analytical costs are also factored into this option, since landfills typically require the completion of testing prior to acceptance of a waste material. In the case of the off-site disposal of soil at a landfill, appropriate analytical tests include those associated with RCRA hazardous waste determinations (TCLP, ignitability, corrosivity, and reactivity), to confirm the testing (TCLP analyses) conducted during the soil investigation which indicated the soils were not a characteristically hazardous waste. The excavation of soil near boring B-20 is not included in this alternative since the elevated TPH concentrations were detected near the water table and may represent ground water rather than soil contamination.

Certain restrictions apply in the application of this option to disposal of site soil. These include federal Land Ban restrictions, which prohibit the acceptance of certain waste types at landfills. Restricted waste types include dioxin-contaminated materials and materials which contain free-liquids, among others.

Effectiveness - Excavation and off-site disposal of contaminated subsurface soil at an off-site landfill would eliminate the need for long-term management of soil on-site. This alternative would reduce the volume of material on-site, but would not reduce its mobility or toxicity. The long-term effectiveness of this alternative is dependent on the setting and operation and maintenance of the receiving landfill.

Implementability - The technical implementability of excavation of contaminated soil at depths of up to 35 feet below ground surface would be difficult due to the complicating presence of the adjacent concrete tank structure. While select earth working equipment (specialty backhoe) has the capability to excavate to these depths, the nature of site soils (broken shale bedrock) may reduce the efficiency of excavation operations.

The administrative implementability of off-site disposal of contaminated soil would be directly dependent on the ability of the receiving facility to accommodate up to 2,400 cubic yards of waste oil-contaminated soil. Discussions with RIDEM and Massachusetts DEP personnel indicate that no landfills within these states are able to accept waste oil contaminated soil. Therefore, disposal would occur out of state. A landfill in Gonic, New Hampshire, the Turnkey Landfill operated by Waste Management, Inc., has been preliminarily identified as the closest landfill able to contaminated soil from the site. Acceptance is subject to excavated soils meeting the following criteria:

- Total VOCs less than 100 ppm;
- PCBs preferably non-detectable, but will accept up to 50 ppm;
- TPH less than 20,000 ppm; and
- No Characteristically Hazardous Waste (toxicity, corrosivity, ignitability, or reactivity.

Cost - Excavation of approximately 3,000 cubic yards of soils (includes the upper six feet of clean soil) around Tank 53 is estimated to cost on the order of $6.00 to $10.00 per cubic yard. Replacement of the excavated soil with clean backfill is estimated to cost on the order of $12.00 per cubic yard in-place.

Information from the Waste Management Turnkey Landfill indicates that the approximate cost to transport and dispose of waste oil contaminated material would be approximately $85 per ton. Assuming a density of 1.5 tons per cubic yard (cy), the unit cost per cubic yard to transport and dispose of the contaminated soil from the Newport Rhode Island area to Gonic, New Hampshire is approximately $128/cy.

Therefore, to excavate 3,000 cubic yards of soil, backfill the excavation with 2,400 cubic yards of soil, and then transport and dispose of the excavated 2,400 cubic yards of soil to the Turnkey Landfill in New Hampshire a cost of approximately $366,000 is estimated. Assuming that an additional 20% of this amount would be needed to cover costs associated with laboratory testing and engineering oversight ($73,200), a total preliminary cost of $439,000 is estimated for this alternative.

5.2.3 Asphalt Batching Alternative

Asphalt batch processing is a technique whereby petroleum-contaminated soils are used as a raw material for the production of roadway asphalt. As with the off-site landfill process, excavation of the contaminated soil must occur first. The excavation of soil near boring B-20 is not included in this alternative since the elevated TPH concentrations were detected near the water table and may represent ground water rather than soil contamination.

The asphalt batch process may either be conducted on-site within a mobile asphalt batch facility, or the contaminated soil may be transported from the site to a permitted off-site batch facility. In general, asphalt batching may be conducted using either an ambient temperature process (cold batching) or with the addition of heat (hot batching). Given the elevated concentrations of VOCs detected in site soil, hot batch processing will not be evaluated given the potential for volatilization and air permitting limitations. A process schematic of a representative on-site cold batch asphalt stabilization system is provided as Figure 13. A process summary is provided below.

In cold batch asphalt processing, contaminated soil is transferred from an existing stockpile to a crusher into which aggregate may be added to increase the strength of the final product on an as-needed basis. The crusher serves to break-up lumps of soil and reduce rocks or debris to a size less than 3.5 inches in diameter. From this point the crushed soil mixture is transferred via conveyor belt to a mobile treatment unit. Once at the mobile treatment unit a series of proprietary asphalt emulsions are added at ambient temperature and mixed with the soil and aggregate. The binding of the soil contaminants into the asphalt matrix is both a physical and chemical process. The mixing process is conducted at ambient temperatures to minimize volatilization of soil contaminants. At this point, treatment is completed and the resultant material is stockpiled for appropriate testing and analysis prior to final placement. Final placement is typically conducted on-site in four- to eight-inch thick lifts which are allowed to cure (water in the emulsion will evaporate) prior to compaction. Following placement, curing and compaction, the asphalt mixture may be topped with a bituminous concrete wearing course to form the base of a roadway or parking lot.

Available information indicates the processing rate for mobile treatment units is on the order of 1,000 tons (600 cy) of contaminated soil per day. Analytical testing of the impacted soil on-site and the resultant asphalt mixture would be required to assess the effectiveness of the process and to demonstrate compliance with appropriate State requirements.

Effectiveness - Asphalt batching would result in the reduction of the mobility of site contaminants by their chemical and physical incorporation into an asphalt matrix. A reduction in the toxicity of site contaminants would be achieved by the chemical fixation of certain contaminants. No reduction in the volume of contaminated material would occur. On the contrary, an overall increase in the volume of material generated from the asphalt batching facility would occur as aggregate and/or bulking agents are intermixed with the contaminated soil. The batching of 2,400 cubic yards of contaminated soil, increased by 100% by the addition of aggregate or other bulking agents, results in the generation of approximately 4,800 cubic yards of asphaltic material. This amount of material would cover an area of approximately 195,000 square feet (4.5 acres) with two four-inch lifts of asphalt. To assess the overall effectiveness of asphalt batching, pilot or bench scale testing would be required to assess the degree to which site-specific contaminants are bound in the asphalt product.

Implementability - A review of Rhode Island regulations which address the permitting and operation of asphalt batch facilities indicates that their use is limited to spill residues resulting from virgin petroleum spills. Therefore, on-site treatment of residues from spills or leaks of waste oil using an asphalt batch system may not be permitted within Rhode Island. However, treatment of the contaminated soil at an off-site asphalt batch facility may be possible. Several facilities permitted to operate asphalt batching systems are located within the southeastern portion of Massachusetts. However, preliminary discussions with these facilities indicate that acceptance of waste oil contaminated soil is prohibited within the State of Massachusetts. Therefore, this alternative would only be viable if an asphalt batch facility permitted to accept oil-contaminated soil can be located within an economical haul distance from the site.

Cost - Available information indicates that the cost to treat petroleum-contaminated soil in an asphalt batch facility ranges from approximately $45 to $75 per ton. Excavation and backfill costs previously described in the landfill alternative ($60,000) would be added to the asphalt batch treatment costs. While an asphalt batch facility permitted to accept the contaminated soil has not currently been identified within the site vicinity, an assumed transportation cost of $30 per ton will be added to the cost for this alternative to provide a basis for comparison to other soil remediation alternatives.

Assuming that an additional 10% of the treatment cost would be allocated to laboratory analysis and permitting costs ($16,000 to $27,000), and a 20% contingency of the excavation and backfill cost covers engineering costs ($12,000), an overall cost on the order of $357,000 to $476,000 is estimated for off-site asphalt batching.

5.2.4 In-Situ Vapor Extraction Alternative

The in-situ vapor extraction of petroleum impacted soil is included as a remedial alternative since this technique is widely adaptable to treatment of VOC impacted soils, and also, under select process conditions (addition of heat) may be amenable to extraction of heavier organic compounds. In general, soil vapor extraction involves inducing air flow within the subsurface soil environment thereby providing a means for the preferential evaporation of volatile compounds from the soil into the airstream. Vapor extraction would be conducted through a series of manifolded vacuum extraction wells established within the zone of impacted soil. The extraction wells would be placed at intervals and depths determined through completion of pilot scale testing. Soil gas vapor extracted from the wells by vapor blowers would be sent to a vapor/liquid separator at which point liquid condensate would be removed from the vapor. The blowers would create the suction necessary to extract subsurface vapors from the vacuum extraction wells. After the blowers, vapor could be discharged to a carbon adsorption unit or catalytic incinerator unit for polishing prior to discharge to the atmosphere. The ultimate purpose of the vapor extraction system is to effectively and efficiently extract and capture the volatile vapors in the petroleum-impacted soil zone.

Effectiveness - Soil vapor extraction from petroleum-impacted soils near Tank 53 would be effective in reducing the mobility and volume of volatile contaminants. No reduction in toxicity would be achieved unless the vapor off-gas unit was outfitted with an incinerator which would thermally destroy the contaminants. Available literature indicates that vapor extraction is a commonly employed and readily accepted means of remediating VOC-contaminated soils. However, this technique is less proven for heavier contaminant mixtures (i.e. fuel oil-contaminated soils). Additionally, the effectiveness of soil vapor extraction would be influenced by the air permeability of subsurface soils. The presence of the petroleum-impacted soil within and above the permeable ring drain surrounding Tank 53 would appear to offer favorable air permeability conditions.

Implementability - The soil vapor extraction system would be relatively easy to implement based on the limited area of contamination identified and the anticipated presence of favorable process conditions (high air permeability soil). The administrative feasibility of implementing this alternative should also not be difficult. However, the identification and remediation of air permitting issues associated with the off-gas system may be a complicating factor in the implementation of this alternative.

Cost - Costs for the implementation of this alternative would vary depending on the number of extraction wells installed within the petroleum-impacted soils. However, an order-of-magnitude cost estimate provided in the literature indicates that capital costs for implementation of this type of alternative would range from approximately $30 to $70 per ton of impacted material. Therefore, treatment of 2,400 cy of impacted soil would cost on the order of $72,000 to $168,000. Factors which would influence the overall cost of this alternative would include the potential need to add heat to the vapor extraction process, the need for incineration of the off-gas, or a low soil air permeability.

5.2.5 In-Situ Bioremediation Alternative

Bioremediation is a process where oxygen and nutrients are added to contaminated soil to promote the growth of indigenous microbe populations which would degrade organic contaminants in the soil. Specially bred microorganisms may also be added to soils to degrade particular site contaminants. For remediation of unsaturated zone soils, nutrient- and oxygen-enhanced water is typically introduced through infiltration systems or recharge wells. The water used to transport the nutrients can also dissolve sorbed contaminants, transporting them to the water table. Therefore, ground water treatment is often combined with a bioremediation treatment system. Extraction wells are used to collect the impacted ground water, which is then mixed with nutrients, and recirculated back to the unsaturated zone.

Oxygen and nutrients are typically added to the water using chemicals such as hydrogen peroxide, ammonia nitrogen or orthophosphate. The treatment system requires the installation of a ground water injection system, ground water extraction system, and treatment equipment such as mixing tanks and chemical supplies. If the extracted ground water is recirculated through the injection system and if there is a possibility that all of the nutrient-laden water may not be captured by the extraction system, chemical treatment of the extracted water may be required before nutrient addition and recirculation.

Often bioremediation is combined with vapor extraction in a system where the bioremediation is used to treated contaminated soils within the saturated zone while vapor extraction is used to treat the unsaturated soils. Such a system could also be coupled with a free product extraction system, if necessary.

Bioremediation has been proven successful with petroleum-contaminated soils, although site-specific chemical, geological and microbiological factors can preclude its use. Treatability studies could further define its applicability to petroleum-impacted soils in the vicinity of Tank 53.

Effectiveness - Bioremediation is effective in the treatment of most aromatic compounds although it is not as effective in treating chlorinated hydrocarbons.

In actual implementation, the effectiveness of this alternative can be very site-specific. Permeability, geochemistry (the interaction of the chemicals used in the bioremediation process with the site soils), the availability of oxygen (stability of the oxygen source in the subsurface) and presence of existing microbial populations can impact the feasibility and effectiveness of this process. As mentioned previously, additional site characterization and treatability studies could further define some of these site-specific characteristics.

Implementability - The implementability of an in-situ bioremediation system is dependent on the site conditions and the treatment system requirements. Prior to system design, the conduct of treatability studies and, potentially, additional hydrogeologic characterization of the ring drain area may be required. To implement the system, construction of injection and extraction wells may be required, as well as the construction of an on-site treatment building in which chemical supplies and the mixing system would be housed. Reinjection of the nutrient-laden water would have to be conducted in compliance with associated regulations.

Cost - Costs of implementation of a bioremediation system can vary widely, depending on the specific site conditions. Reported costs for soil treatment range from \$60 to \$125 per cubic yard, with unit costs generally decreasing with the volume of soil to be treated. Including treatability studies, engineering design and contingency costs, it is estimated that implementation of an in-situ bioremediation system could cost approximately \$500,000.

5.3 SUMMARY OF SOIL ALTERNATIVES

In summary a total of five soil remediation alternatives were preliminarily evaluated for effectiveness, implementability and cost. These alternatives include:

- No Action,
- Excavation and Off-Site Landfilling,
- Excavation and Off-Site Asphalt Batching,
- In-Situ Vapor Extraction, and
- In-Situ Bioremediation.

The effectiveness of alternatives which excavate and treat or dispose of the material off-site (landfill or asphalt batching) is highest with respect to reducing the volume of contaminated soil on-site. The effectiveness of the off-site landfill would be directly related to its setting and long-term operation and maintenance. Next in terms of effectiveness would be either vapor extraction or bioremediation, or a combination of the two. Vapor extraction is best-suited for the treatment of volatile organic compounds in unsaturated soils, while in-situ bioremediation typically utilizes water as the media with which to distribute nutrients and oxygen to enhance in-situ biological degradation of soil contamination. Bioremediation is more applicable to aromatic hydrocarbons and less effective for the treatment of chlorinated organic compounds. A combination of the two alternatives could be effective by treating contaminated soils in the ring drain area and also providing treatment in the saturated and capillary zones in the area of boring B-20. The no-action alternative is least effective since it does not reduce the volume, toxicity or mobility of the petroleum-impacted soil.

The no-action alternative would be the easiest alternative to implement, as it does not involve the design or operation of any active remediation system. Long term monitoring could be required under this alternative, however. The next alternative in terms of ease of implementation would be vapor extraction. This system could be designed and placed within the identified zone of impacted soil with relative ease if soil properties are conducive to vapor extraction (air permeability is high). The control of air discharges from the vapor extraction system would add a degree of complexity to the implementation of this alternative. An in-situ bioremediation system would be more difficult to implement, requiring the installation of ground water extraction, injection and treatment systems. Each of the excavation alternatives would follow the other alternatives in terms of implementability since each involves a relatively complex excavation of soils near the concrete tank to a depth of approximately 34 feet below ground surface. The implementation of off-site asphalt batching is further complicated by the current lack of identification of facilities permitted to accept such a waste.

In terms of cost, the no action alternative has the lowest estimated cost (less than $10,000) associated with its implementation. The vapor extraction system cost is the next lowest cost alternative to implement, involving the installation of vapor extraction wells and operation of a blower and potential vapor treatment system. The estimated cost for implementation of a vapor extraction system is approximately $70,000 to $170,000. The off-site landfill and off-site asphalt batching alternatives are similar in terms of cost, with implementation estimated at approximately $440,000 for off-site landfilling and $360,000 to $480,000 for off-site asphalt batching. In-site bioremediation is estimated to have the highest cost associated with its implementation and operation (estimated at $500,000).

5.4 EFFECT OF SOIL REMEDIATION ALTERNATIVES ON PRODUCT REMEDIATION

During each ground water sampling event in which ground water was present within the ring drain wells (MW-53E and MW-53W) around Tank 53, free product was also present. However, data on the rate at which the product recharges into the ring drain area are not available at this time. Without information with which to evaluate separate phase removal, the feasibility of remedial alternatives which address free product alone cannot be evaluated. A qualitative discussion of the soil remediation alternatives developed in the previous section and their abilities to address the free product is provided below.

The no action alternative would have no effect on the presence of free product in the ring drain around Tank 53. Potential exposures to the product would be limited through site fencing and deed restrictions on future site use.

Excavation and off-site landfilling or off-site asphalt batching might provide a degree of treatment of soils contaminated by the free product but, since excavation would not extend into the water table to any great depth, some free product might remain in the subsurface following completion of excavation activities. Free product could be minimized during excavation activities through the use of absorbents or skimmer pumps, as necessary.

In-situ vapor extraction would provide removal of the free product through volatilization, simultaneous to the removal of volatile contaminants sorbed to subsurface vadose-zone soils. These contaminants would all be treated within the ex-situ vapor treatment system.

In-situ bioremediation might provide some degradation of the free product, although the concentrated nature of the product could prove toxic to the bacteria. The ground water extraction system which would be a component of the bioremediation system could potentially enhance the collection of the free-phase product and its removal as a separate phase.

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FIGURES

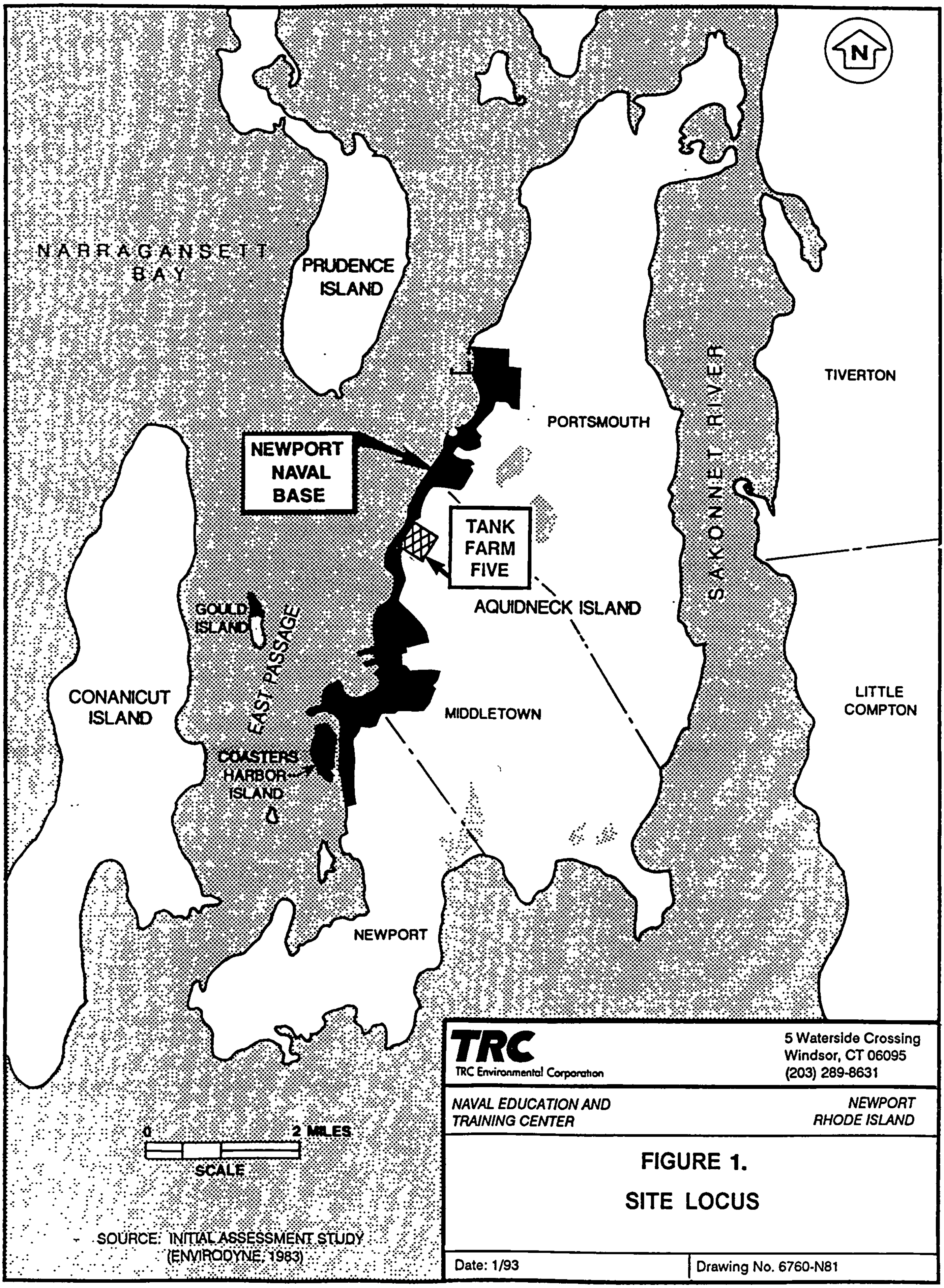
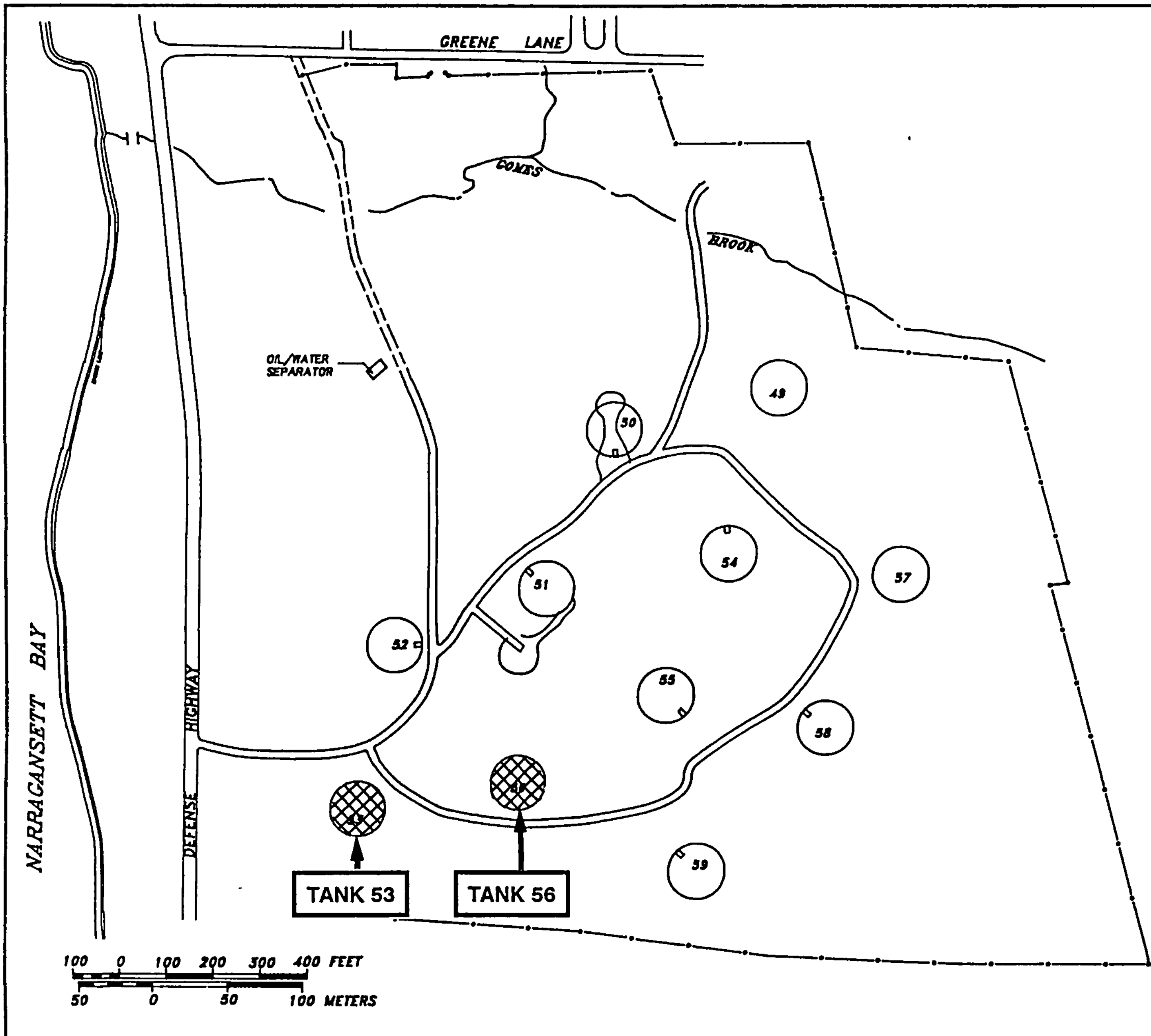


FIGURE 1.
SITE LOCUS



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SITE 13 - TANK FARM FIVE

FIGURE 2.
SITE PLAN

Date: 1/93 | Drawing No. 6760-N81

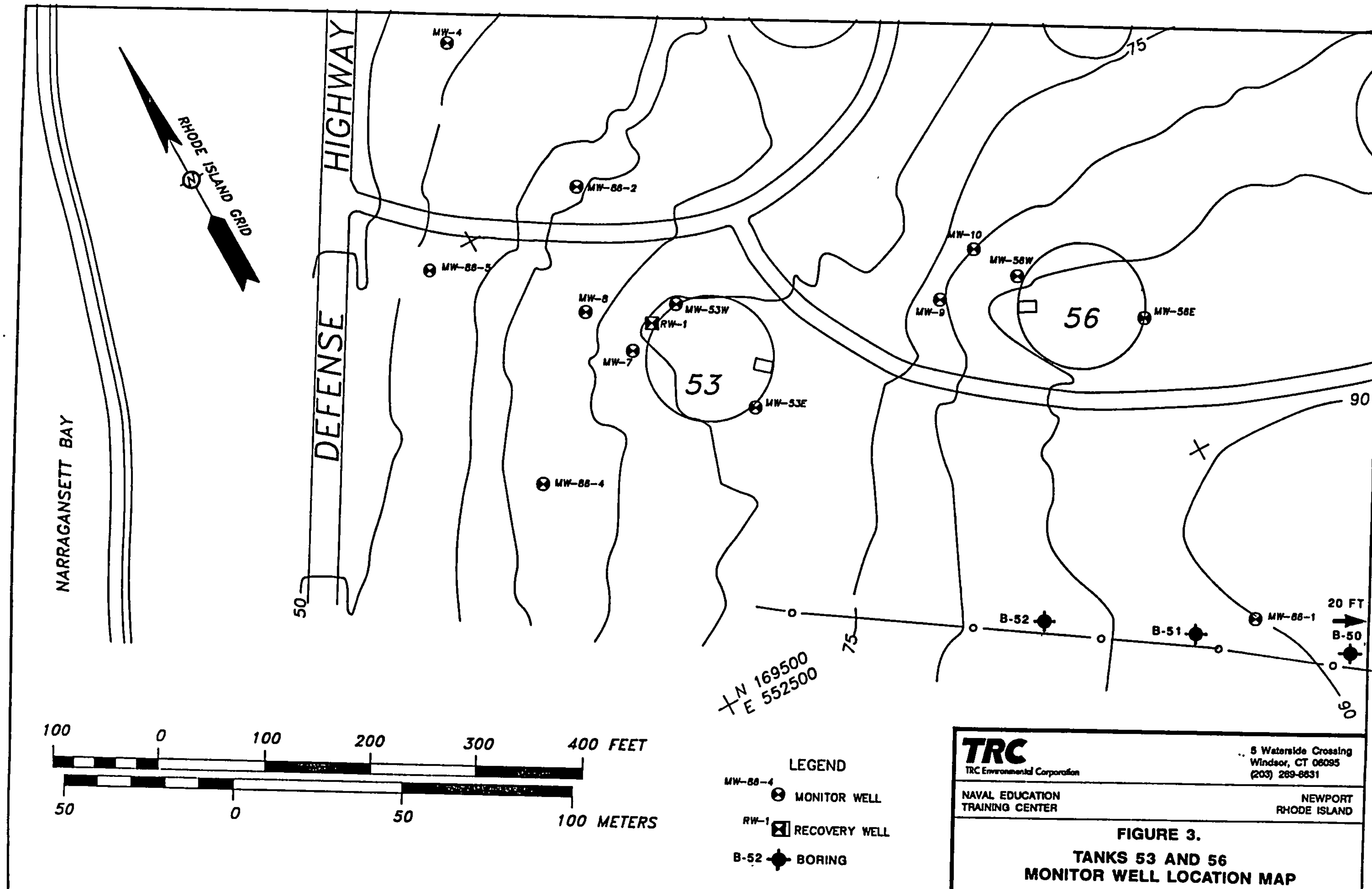

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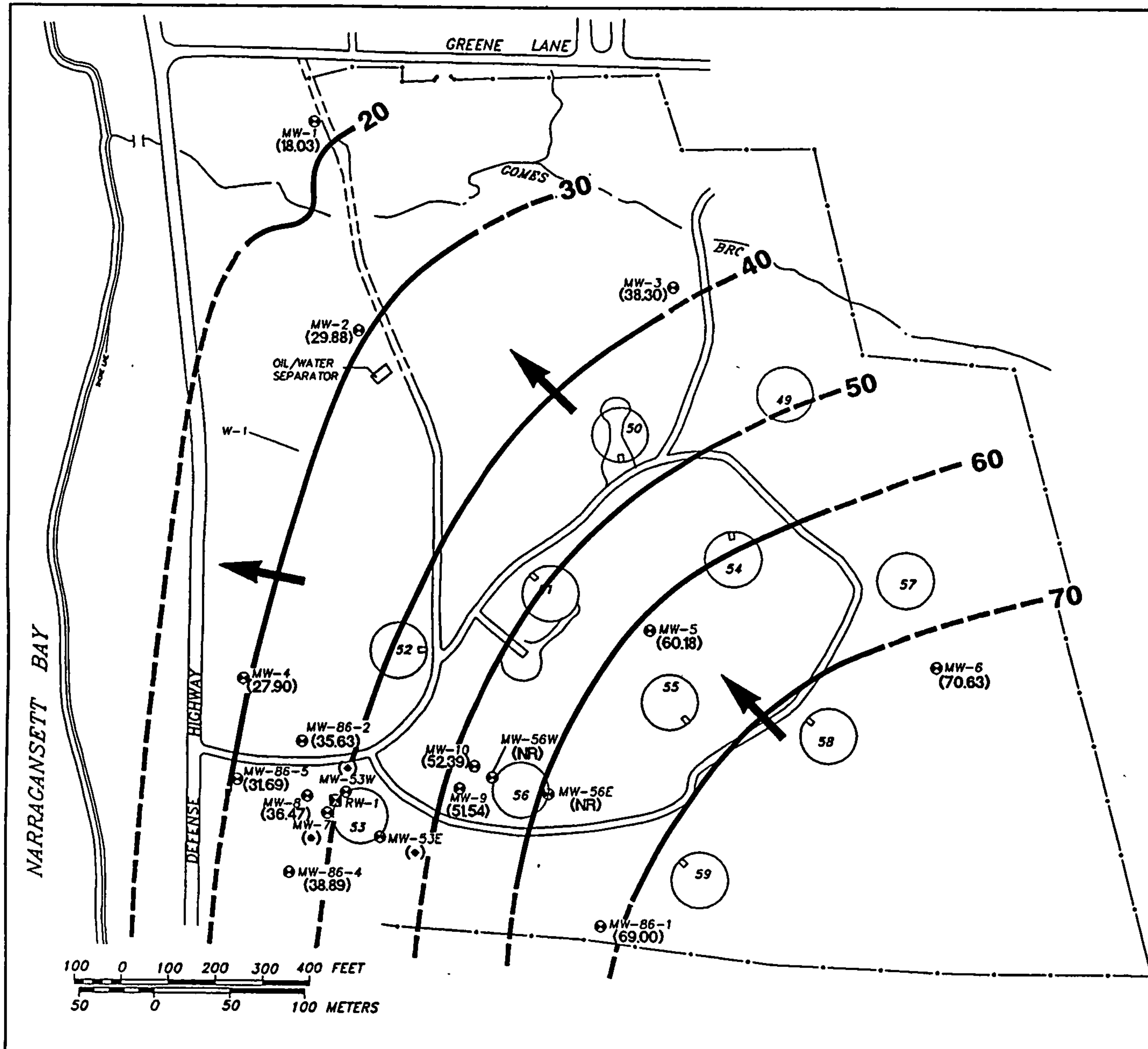
FIGURE 3.

TANKS 53 AND 56 MONITOR WELL LOCATION MAP

Date: 1/93

Drawing No. 6760-N81



LEGEND

- MW-6 ⊖ MONITORING WELL LOCATION
- (70.63) GROUND WATER ELEVATION (feet above mean low level)
- —20 GROUND WATER CONTOUR
- ← GROUND WATER FLOW DIRECTION

NOTES:

1. (DATUM) – MLW; MEAN LOW WATER
2. (•) WATER LEVEL NOT USED IN DEVELOPING SITE CONTOUR MAP
3. (NR) WATER LEVEL NOT RECORDED – DRY WELL

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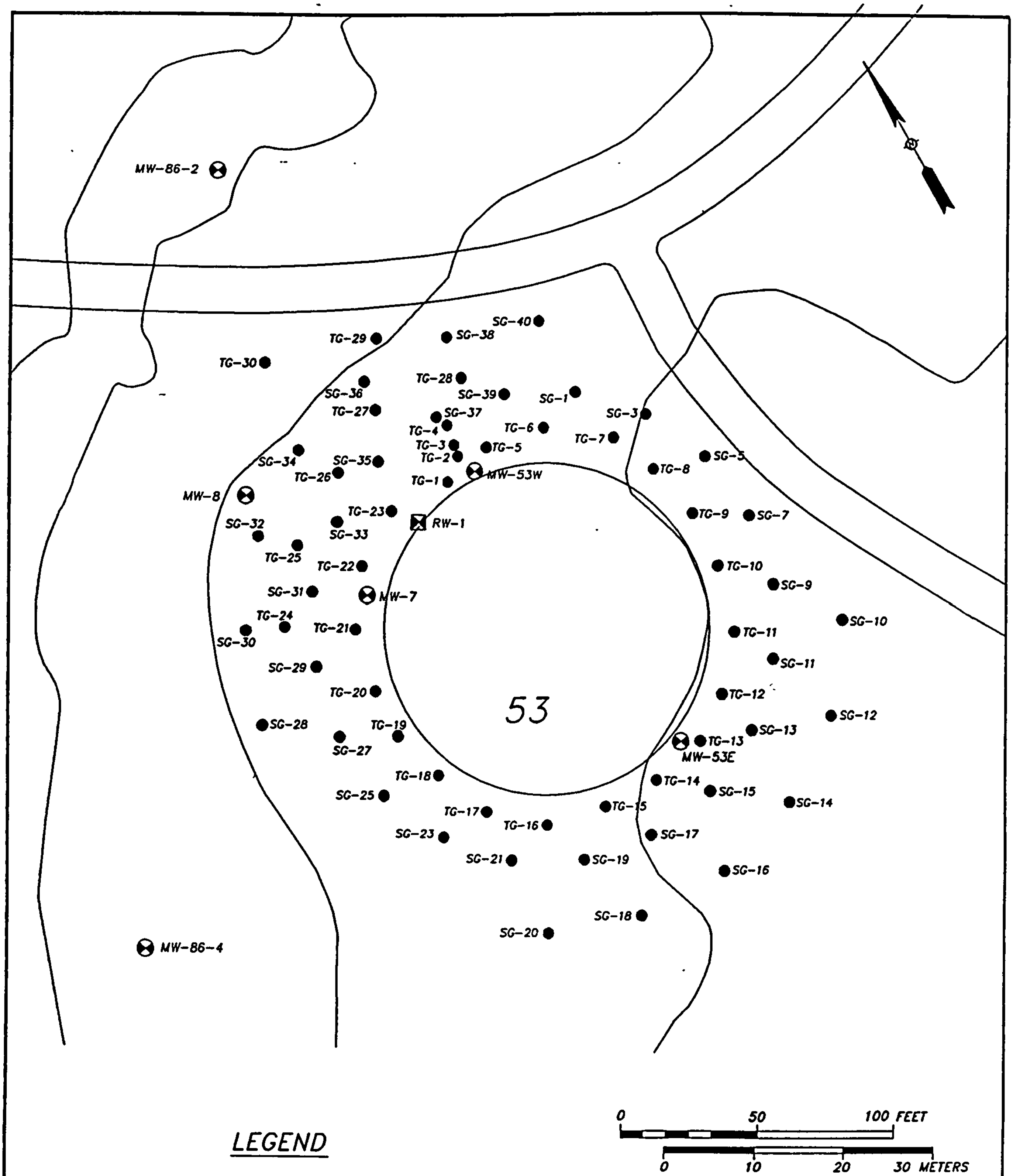
FIGURE 4.

GROUND WATER TABLE CONTOUR MAP - TANK FARM FIVE 5/6/92



LEGEND

MW-7	RECOVERY WELL
RW-1	MONITOR WELL
53	UNDERGROUND STORAGE TANK
● SG-20	SOIL GAS POINT LOCATION

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FIGURE 5.
TANK 53
SOIL GAS POINT LOCATIONS

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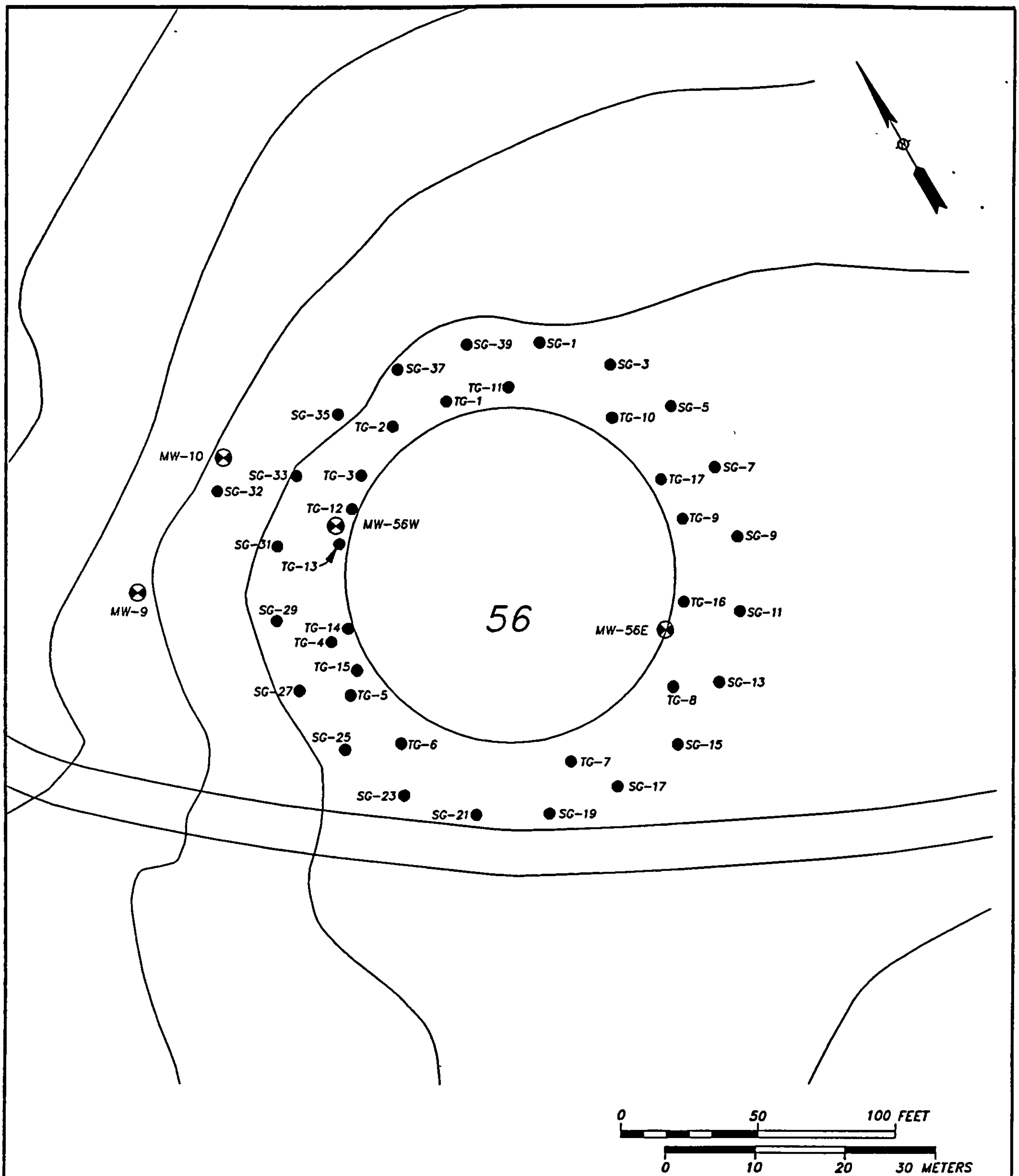

LEGEND

MW-9 MONITOR WELL

56 UNDERGROUND STORAGE TANK

SG-39 SOIL GAS POINT LOCATION

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FIGURE 6.
TANK 56
SOIL GAS POINT LOCATIONS

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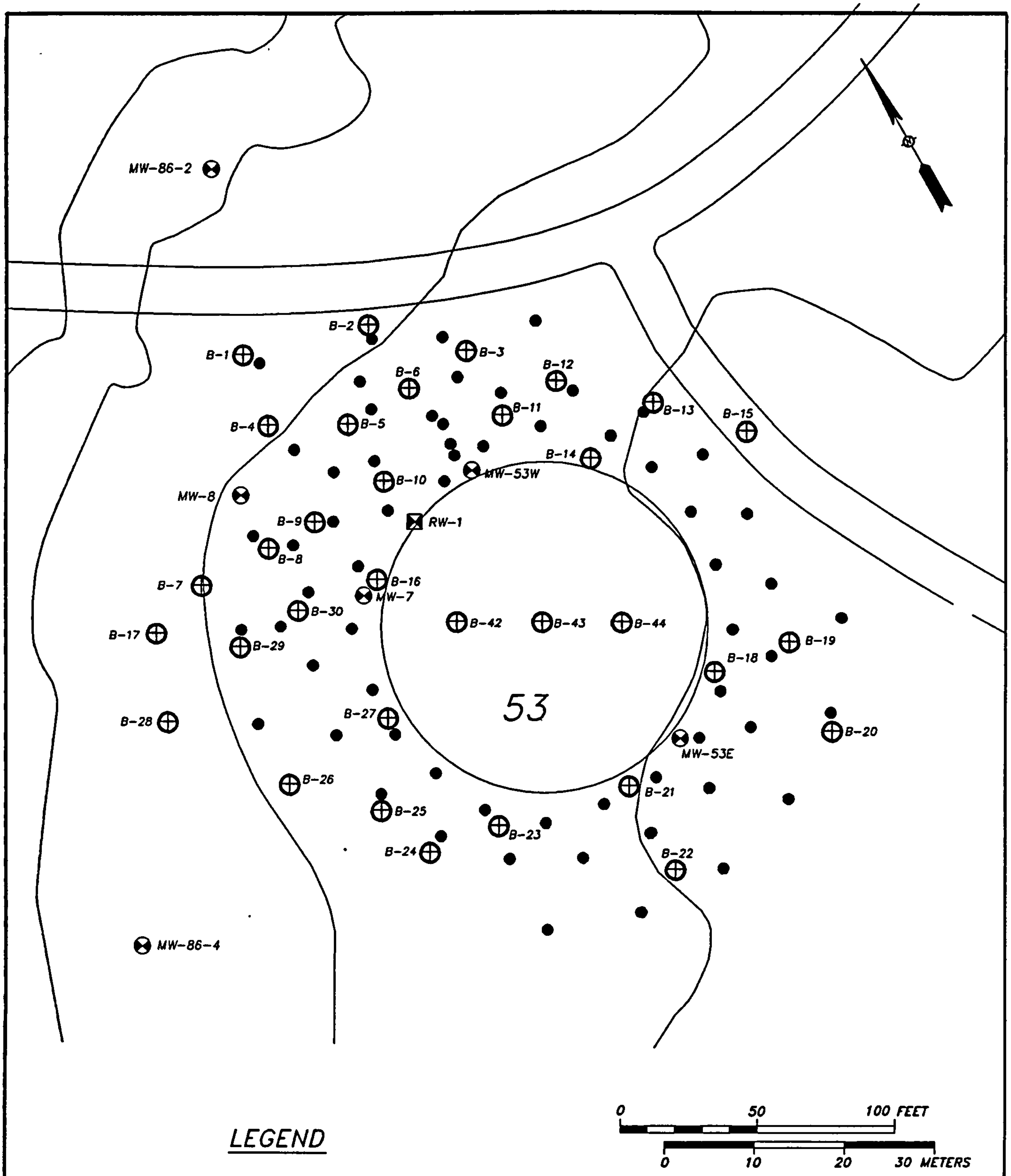

LEGEND

MW-7	RECOVERY WELL
RW-1	MONITOR WELL
53	UNDERGROUND STORAGE TANK
SG-20	SOIL GAS POINT LOCATION
B-2	SOIL BORING LOCATION

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FIGURE 7.
TANK 53
SOIL BORING LOCATIONS

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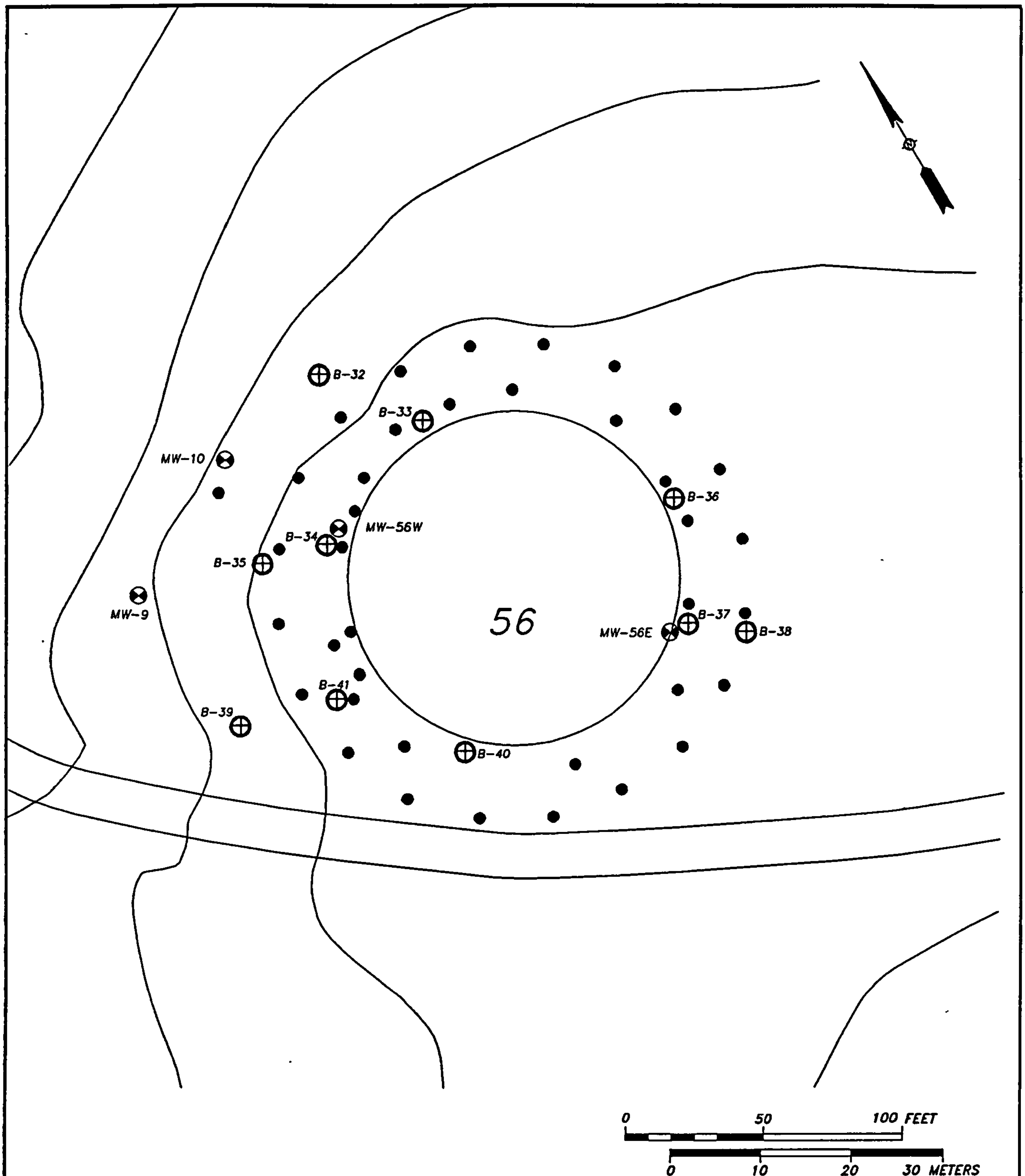

LEGEND

- MW-9 MONITOR WELL
- 56 UNDERGROUND STORAGE TANK
- SG-39 SOIL GAS POINT LOCATION
- B-39 SOIL BORING LOCATION

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FIGURE 8.

TANK 56
SOIL BORING LOCATIONS

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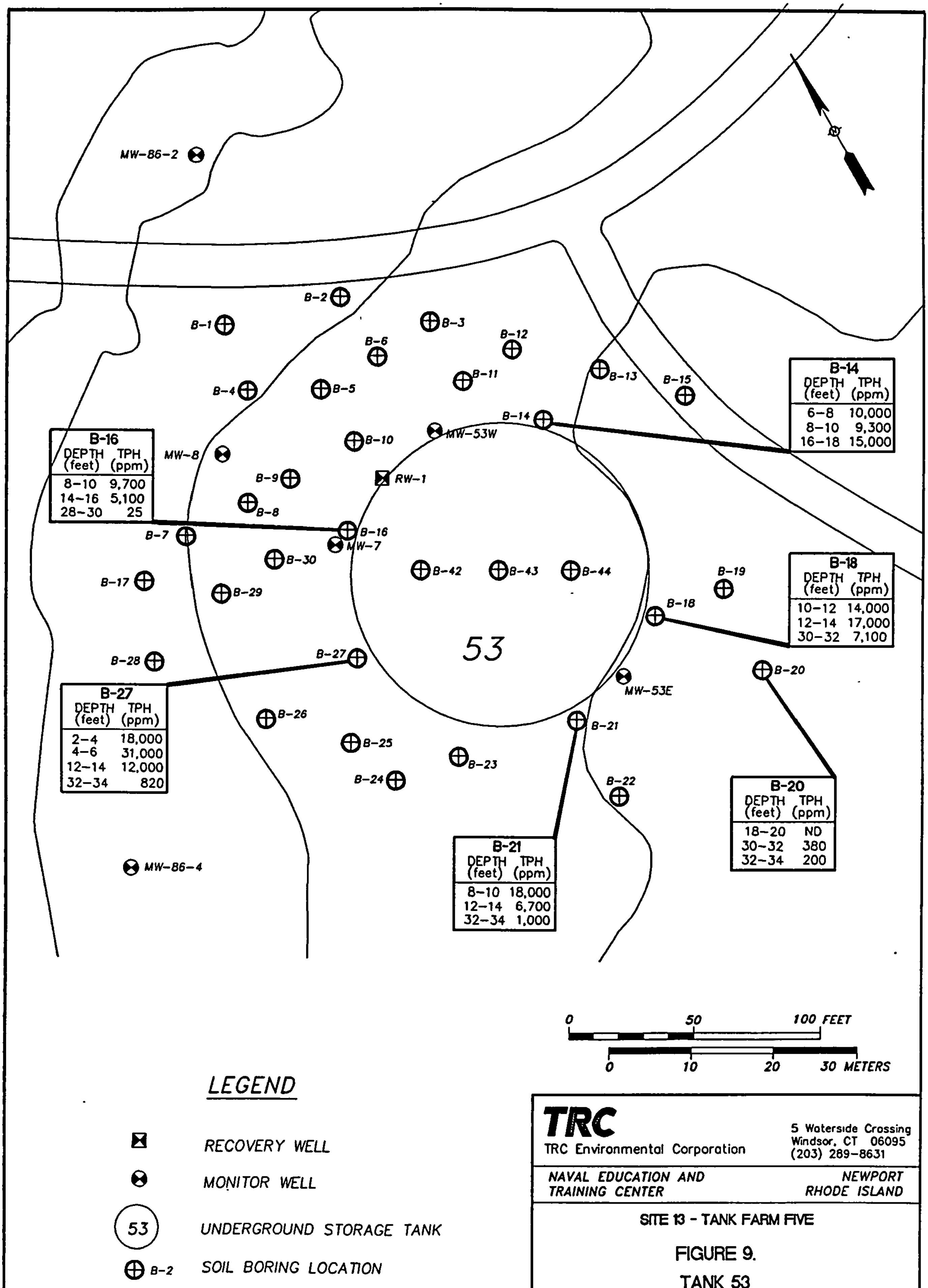

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FIGURE 9.
TANK 53
ELEVATED SOIL TPH RESULTS (mg/kg)

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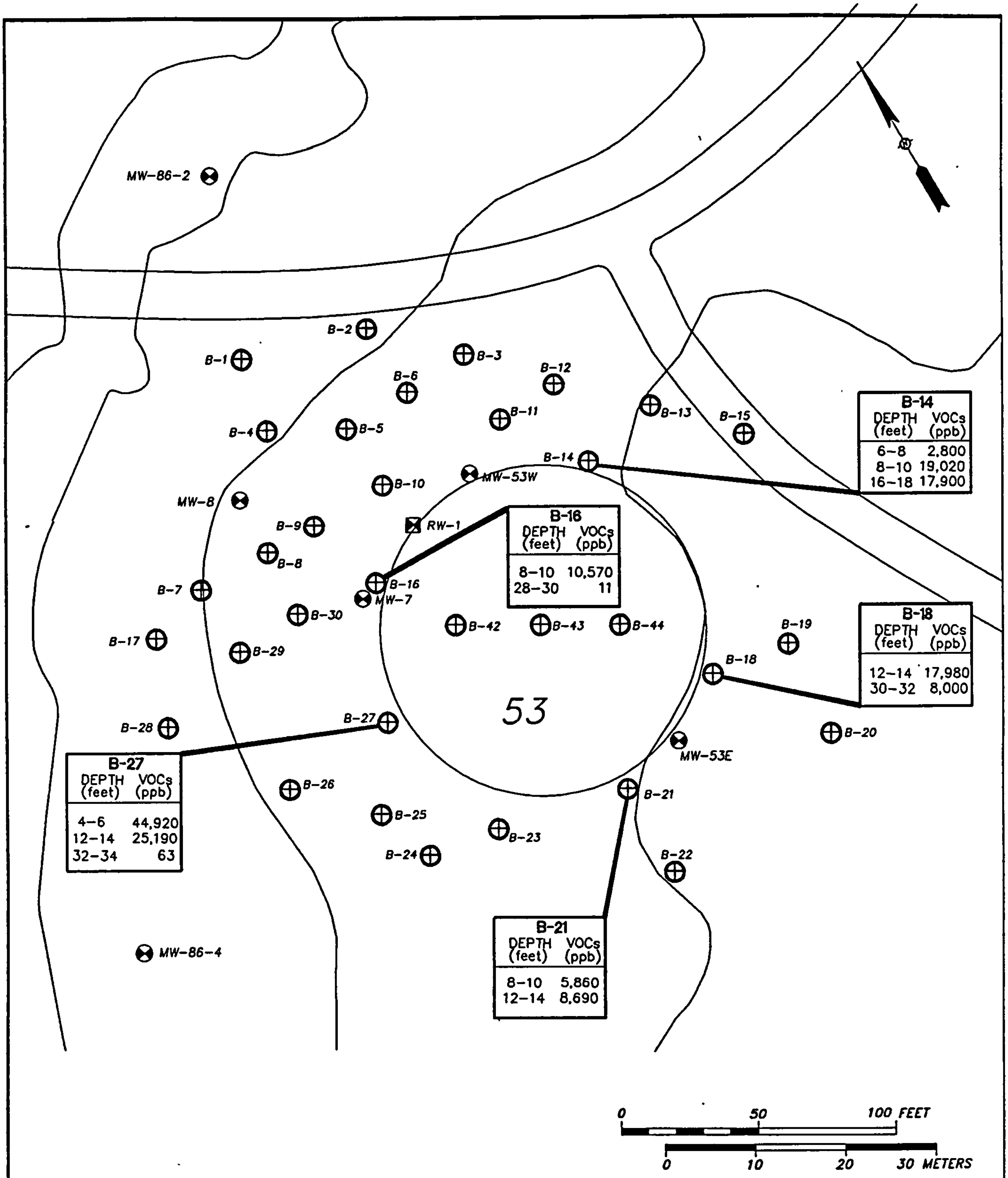

LEGEND

RECOVERY WELL

MONITOR WELL

53 UNDERGROUND STORAGE TANK

B-2 SOIL BORING LOCATION

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FIGURE 10.

TANK 53
ELEVATED SOIL VOC RESULTS (mg/kg)

Date 1/93 | Drawing No 6760-N81

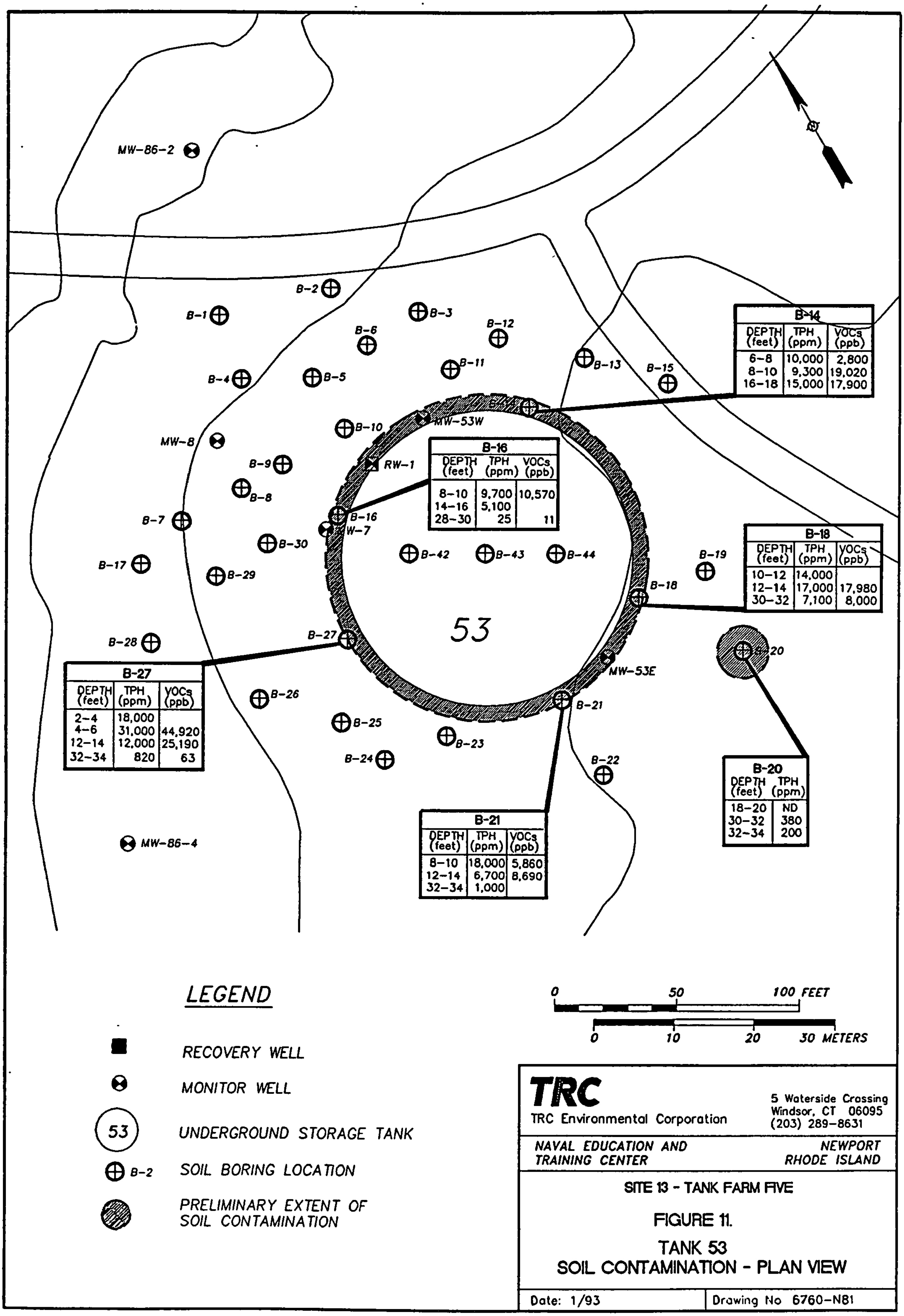
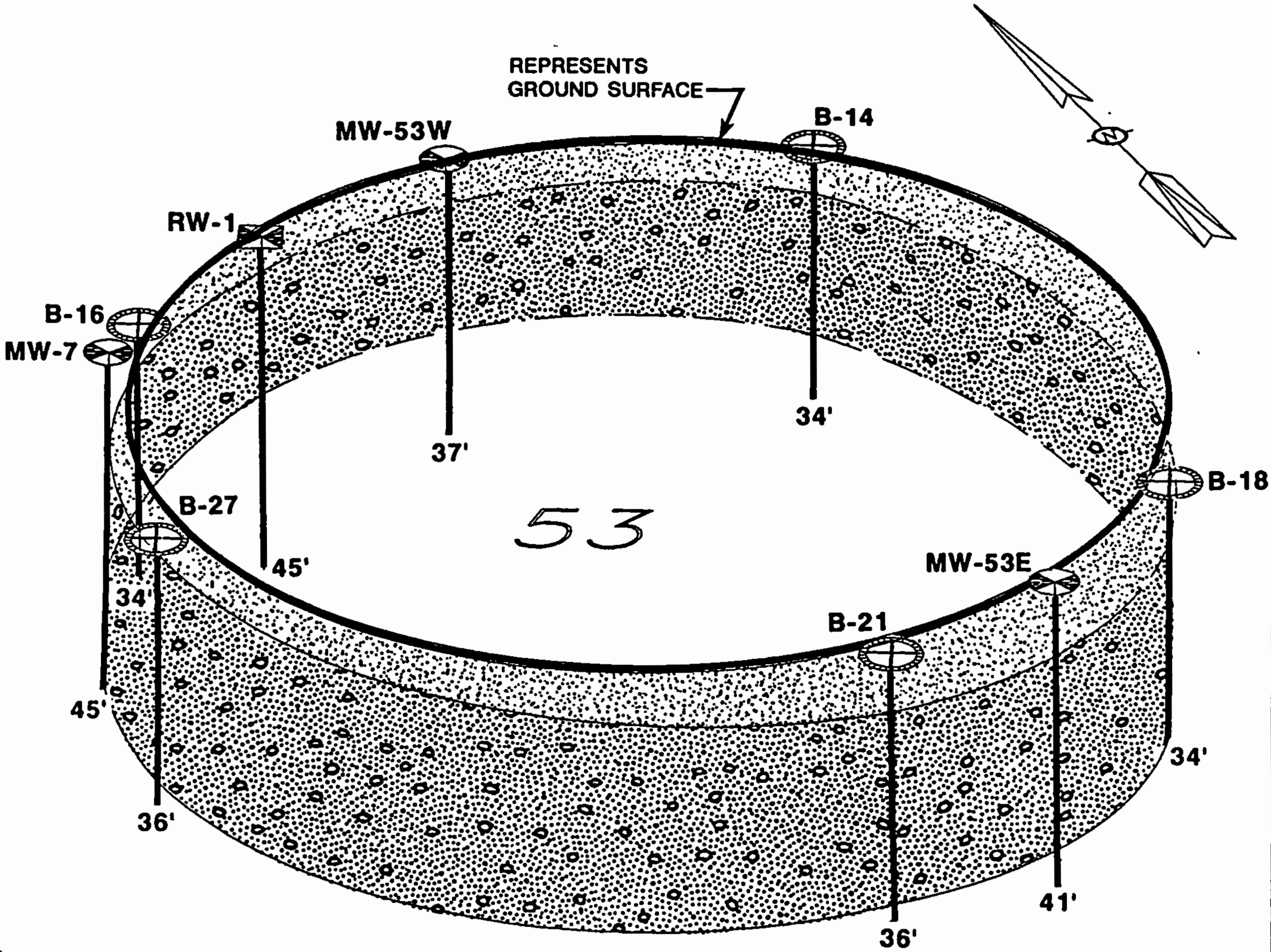


FIGURE 11.
TANK 53
SOIL CONTAMINATION - PLAN VIEW



LEGEND

UNIMPACTED SOIL

ESTIMATED EXTENT OF PETROLEUM IMPACTED SOIL

0 50 FT

SCALE

BORING	TOTAL[1] DEPTH	ZONE OF[2] IMPACTED SOIL
B-14	34	6 - 26
B-16	34	6 - 22
B-18	34	8 - 34
B-21	36	8 - 34
B-27	36	2 - 34

(1) FEET BELOW GROUND SURFRACE.
(2) FIELD VOC READINGS ABOVE 100 ppm

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FIGURE 12.

TANK 53 SOIL CONTAMINATION - CROSS-SECTION

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INTERIM REMEDIAL ACTION - GROUND WATER TREATMENT
TANK FARM FIVE near TANKS 53 AND 56

Completion Date:

Design Analysis for 35% Design Development Submission
- January 1993

Objectives:

The interim remedial action is intended to contain ground water contamination in the vicinity of Tanks 53 and 56 and to prevent it from migrating further toward Naragansett Bay. Specific cleanup objectives include:

1. Minimize further migration of contaminated ground water.
2. Minimize further adverse impacts to Gomes Brook and Naragansett Bay resulting from discharge of contaminated ground water.
3. Reduce the potential risk associated with future ingestion of contaminated ground water.
4. Reduce the time required for restoration of the aquifer.

Overview of IRA:

Ground water will be extracted from the vicinity of Tanks 53 and 56 and treated to remove metals and volatile organic compounds. Metals will be removed using a coagulation/filtration process so that they do not interfere with volatile organic treatment. Metals removal will be accomplished by adding chemicals to precipitate the metals in a clarifier. Following metals removal an oxidant will be to the ground water prior to treatment in an ultra-violet (UV) light treatment cell to oxidize organic compounds. Additional treatment of organic compounds will be achieved with a carbon adsorption system prior to discharge to a sanitary sewer served by the City of Newport publicly owned treatment works (POTW).

Design Analysis
for
35% Design Development Submission

Ground Water Treatment
Interim Remedial Action

near
Tanks 53 and 56 at Tank Farm Five
Naval Education and Training Center
Newport, Rhode Island

Submitted to:
Northern Division
Naval Facilities Engineering Command
Lester, Pennsylvania
Contract No. N62472-86-D-1282

Prepared by:
TRC Environmental Corporation
5 Waterside Crossing
Windsor, Connecticut 06095

January 1993

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LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS

2.0 REMEDIAL PLAN OVERVIEW

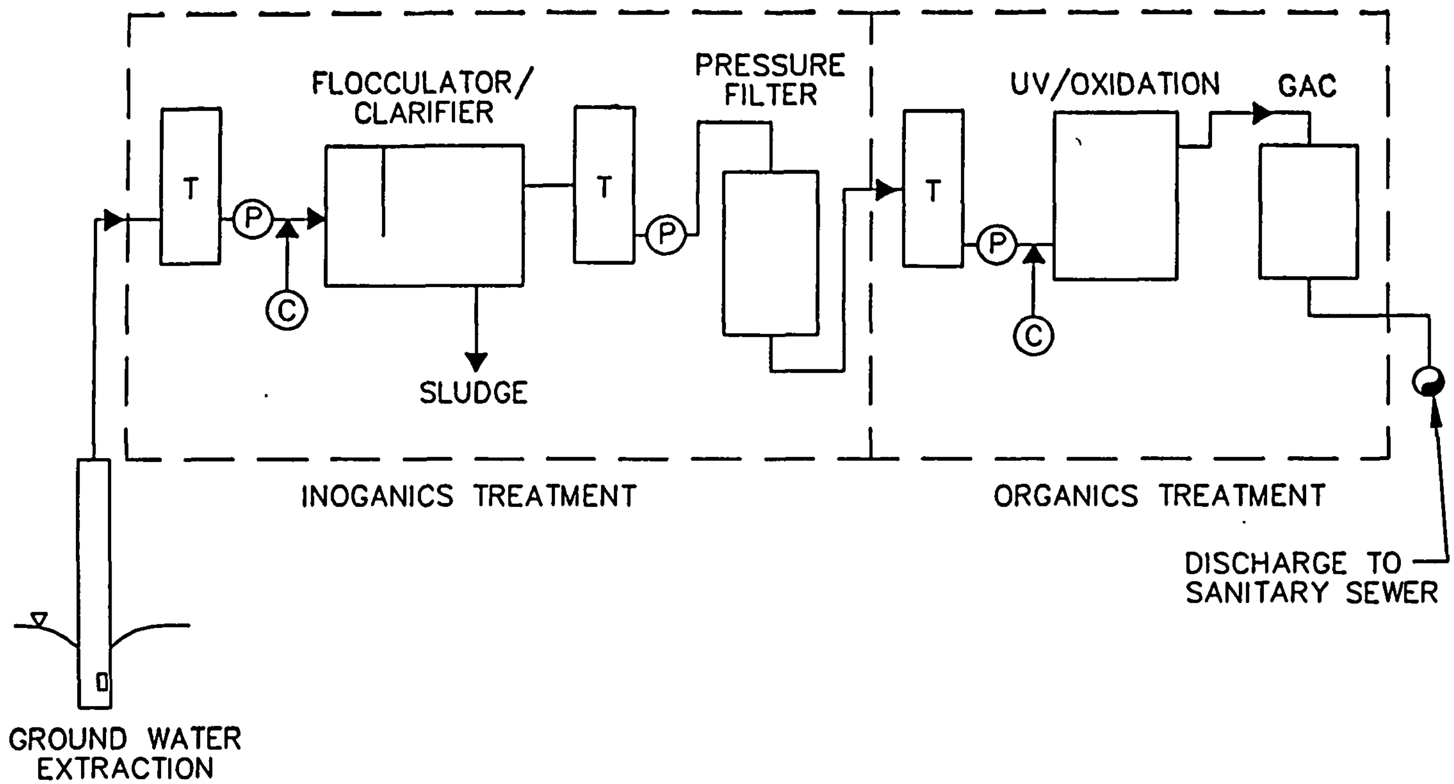
2.1 Summary

As detailed in the Record of Decision, the proposed treatment process includes removal of metals and volatile organic compounds (VOCs) from the water as follows: dissolved metals concentrations in the extracted ground water will be significantly reduced using a coagulation/filtration process so that they do not interfere with the VOC treatment process. Metals removal is acc mplished by adding chemicals to precipitate the metals out of solution in a clarifier tank. The remainder of the precipitated metals will be separated from the water by passing the flow through filters. Following filtration, the water will be injected with an oxidant and pumped into a reactor exposing the contaminants to ultraviolet (UV) light to destroy VOCs. Additional treatment with a granular activated carbon adsorption system ensures that the discharge water meets the pretreatment standards of the publicly owned treatment plant (POTW) before discharge to the sanitary sewer. A block flow diagram of the treatment process is shown as Figure 10.

Existing wells and additional observation wells will be monitored during the interim remedial action to confirm the capture of contaminated ground water (see Figure 4). A monitoring program will be developed during the design and submitted for regulatory approval.

2.1.1 Discharge Requirements

Discussions with the City of Newport POTW officials indicate that the plant can accept the predicted minor hydraulic and chemical loading from this Interim Remedial Action. The POTW has established pretreatment standards for inorganic contaminants and a stated limit of 0.0 mg/l for "solvents". The POTW has not adopted a newer standard for allowable organic loading despite



KEY

T = TANK

(P) = PUMP

(C) = CHEMICAL FEED

GAC = GRANULAR ACTIVATED CARBON

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FIGURE 10.
TREATMENT PROCESS
BLOCK FLOW DIAGRAM

having been upgraded to secondary treatment in 1991. Discussion with the Newport POTW has allowed an interpretation of pretreatment requirements for organics to be below drinking water MCL or MCLG levels for those compounds with established limits or below analytical detection limits for others. Further discussion and permit application is in progress. Table 1 shows the expected influent concentrations from the wells (by calculating an average value from the sampling results of wells in the area of proposed ground water extraction) and the required pretreatment for discharge to the POTW.

2.2 Ground Water Extraction

Based on the results of previous sampling to determine the location of the contaminated plume, extraction wells have been located at the leading edge to control further downgradient migration (see Figure 9). Additionally, a row of extraction wells has been sited adjacent to the downgradient side of Tank 53 to intercept contaminant migration.

Pump test results and capture zone modeling will dictate the spacing and predicted withdrawal rates of the extraction wells. Data from well development of monitoring wells indicates a well spacing of approximately 35 feet and flow range of one to five gallons per minute (gpm) from each well can be expected. Based on this information, seven extraction wells have been placed along the downgradient extent of the plume and five extraction wells near Tank 53 producing a predicted combined maximum pumping rate of 50 gpm. This information will be updated when modeling results become available during the design process.

The extracted ground water will be discharged from each well with an electric submersible pump to a common force main feeding the treatment building.

TABLE 1

CONTAMINANT CONCENTRATIONS AND TREATMENT REQUIREMENTS

Contaminant	Predicted Influent Ground Water Concentrations	Preliminary Newport POTW Discharge Limits
Inorganics (ppm)		
Aluminum	26	2.0
Arsenic	0.02	2.0
Barium	0.05	2.0
Beryllium	--	2.0
Cadmium	--	0.8
Calcium	--	--
Chromium	0.06	1.0
Cobalt	0.10	2.0
Copper	0.05	1.0
Iron	90	1.0*
Lead	0.04	0.1
Magnesium	20	2.0
Manganese	4	2.0
Mercury	0.001	0.5
Nickel	0.07	3.0
Potassium	--	--
Selenium	--	2.0
Silver	0.02	3.0
Sodium	--	--
Vanadium	0.04	2.0
Zinc	0.24	1.2
Total Suspended Solids	400	5*
Organics (ppb)		
Vinyl Chloride	<1	2
Methylene Chloride	18	10**
Acetone	15	10**
1,1-Dichloroethane	17	10**
1,2-Dichloroethene	60	70
Chloroform	<1	100

TABLE 1

CONTAMINANT CONCENTRATIONS AND TREATMENT REQUIREMENTS
(CONTINUED)

Contaminant	Predicted Influent Ground Water Concentrations	Preliminary Newport POTW Discharge Limits
Organics (ppb) (Continued)		
1,1,1-Trichloroethane	107	200
Trichloroethene	75	5
Tetrachloroethene	28	5
Benzene	12	5
Toluene	11	40
Ethylbenzene	29	30
Xylenes	147	20
Naphthalene	16	10**
2-Methylnaphthalene	58	10**
Di-N-Butylphthalate	8	10**
Butylbenzylphthalate	2	10**
Bis(2-Ethylhexyl)Phthalate	53	10**

* Discharge limit established for UV oxidation pretreatment. POTW limit = 15 ppm for iron and 285 ppm for suspended solids.

** Discharge limit established as analytical detection limit.

2.3 Inorganic Contaminants Treatment

The extracted ground water will empty into an atmospheric pressure equalization tank. A caustic solution will be added to raise the pH to ≈8.5 producing conditions where metals become less soluble and easier to precipitate as solids. A transfer pump will deliver the ground water to a flocculator/clarifier (F/C) treatment unit. In the pressure line, a polyelectrolyte and oxidizing agent will be injected to enhance particle formation and break down any chelated metals that are complexed with organic compounds that would not precipitate otherwise.

Bench scale testing of the metals treatment process will be required of the equipment manufacturer to optimize the chemical loading requirements. It may be possible to reduce or eliminate the polyelectrolyte because the high ir n concentration may produce particles suitable for flocculation. The xidizing agent strength will be selected to match the complexed organic compounds. It is expected that a strong oxidizer such as sodium hypochlorite or hydrogen peroxide will be necessary.

A rectangular F/C unit with upflow settling tubes has been selected for the high relative settling rates and compact design. A clarifier is necessary because of the high suspended solids, iron and other metals that exist in the ground water that must be removed. Paddles in the flocculator zone will slowly mix the chemicals and precipitates of metal hydroxides will form. Settleable solids will collect on the clarifier bottom to be pumped to a sludge holding tank. A filter press will be batched as necessary to reduce sludge volume for disposal. The sludge will be tested using the TCLP extraction method and to determine if it has to be disposed of as hazardous waste. Clarified water will flow to a storage tank necessary to prime a second transfer pump. Water pressure of 35 psi is necessary for pressure filtration.

Mixed media pressure filters will remove unsettleable and other fine particles necessary to meet discharge limits and final pre-treatment requirements to prevent fouling the UV/oxidation process. Bench scale testing will be required of the filter manufacturer to determine loading rates required and effective media size. When the solids have clogged the filter bed to the extent that head loss becomes unacceptable, a backwash process will be initiated with high reverse flow rates to remove the particles. The backwashed water will be pumped to the influent equalization tank for recycling.

Alternative means of metals contaminant removal were considered during the screening design process. Most notably the membrane filtration technology offered the benefits of physical removal with minimal chemical addition and therefore less sludge generation. However, the relatively high solids loading rate of the water to be treated results in an operating inefficiency to the extent that the proposed "conventional" removal is estimated to be more cost effective.

2.4 Organic Contaminants Removal

Filtered water from the inorganics treatment process will then be cycled through the ultraviolet light chamber where an oxidant such as hydrogen peroxide or ozone will be added. In this high energy (predicted 30 kilowatt demand) environment, hydroxyl radicals are formed which act to break down organic contaminants into simpler, non-hazardous substances such as carbon dioxide, water, salts, sulfates, nitrates, and organic and inorganic acids. UV/oxidation works well to destroy most organic contaminants but requires significantly longer residence times with aliphatic alcohols and saturated hydrocarbon compounds such as 1,1,1-trichloroethane and methylene chloride.

Rather than versize the UV reactor for these few compounds resulting in excessive electrical energy useage, a granular activated carbon (GAC) absorption system will be utilized to remove the remaining untreated organics. The UV/oxidation unit will be sized to remove nearly all of the VOCs from the water. The usage rate of GAC is expected to be relatively low thereby minimizing the frequency of carbon changeout and regeneration.

2.5 Treated Water Discharge

The final treated ground water will be tested for compliance with the POTW pretreatment permit standards and discharged by gravity to the sanitary sewer in the vicinity of the Fire Fighter Training Center.

2.6 Support Facilities

All systems will be equipped with appropriate instruments and controls to protect equipment, monitor flow and treatment. Control interlocks will shut down the entire treatment system for safety and issue an alarm signal.

Extraction wells will be equipped with float controls to protect against motor burnout and flow meters and throttling valves to enable measurement and adjustment of flow.

The treatment system will be housed in a pre-engineered metal building with heating and ventilation to minimize exterior environmental stress that can affect treatment processes.

Fire protection will be provided by extending a fire service line and hydrant near the treatment building. Fire extinguishers will be placed appropriately in the building. There are no flammable chemicals which will be used inside the building. This coupled with the small size (<5,000 sq. ft.), low occupancy and fire resistive construction eliminates the need for a sprinkler system.

2.7 Monitoring Plans

Routine sampling and analysis of the ground water in and adjacent to the contaminant plume will be performed on a quarterly basis to monitor the changes and reduction in contaminant concentrations. Water level measurements in observation wells will be used to monitor the effective capture zone.

Well flow rates will be recorded to enable a hydraulic analysis of the ground water system and determine necessary adjustments.

Sampling ports will be installed between treatment process steps to enable testing for monitoring and optimization of chemical feed and loading rates. A laboratory setup at the treatment plant will be equipped to allow routine chemical analysis. More complex testing will be performed at an approved laboratory.

2.8 Additional Information Requirements

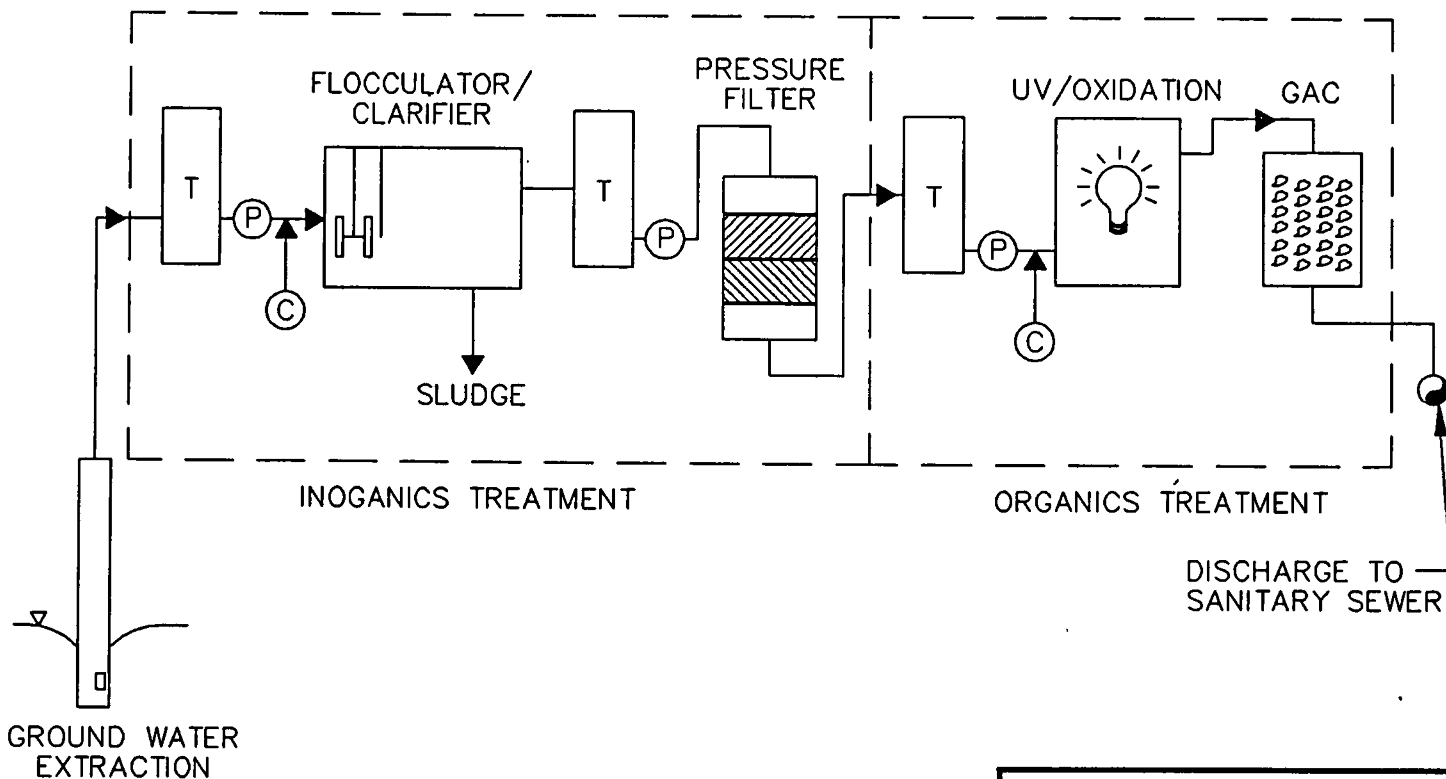
Aquifer yield characteristics and soil structural bearing capacity testing must be completed to enable determination of final treatment plant capacity and building foundation design.

A discharge permit must be secured from the Newport POTW that sets allowable contaminant concentration standards and flow rates for discharge to the sanitary sewer.

2.9 Free Product Source Recovery

Free product has been identified in the ring drain at Tank 53 during the remedial investigation phase. The record of decision does not require source removal of free product and the current design package does not include any provision for free product recovery.

A separate study is underway regarding clean-up options for source removal at Tank 53. A draft report presenting findings and recommendations is in preparation.



KEY

T = SURGE TANK

P = PUMP

C = CHEMICAL FEED POINT

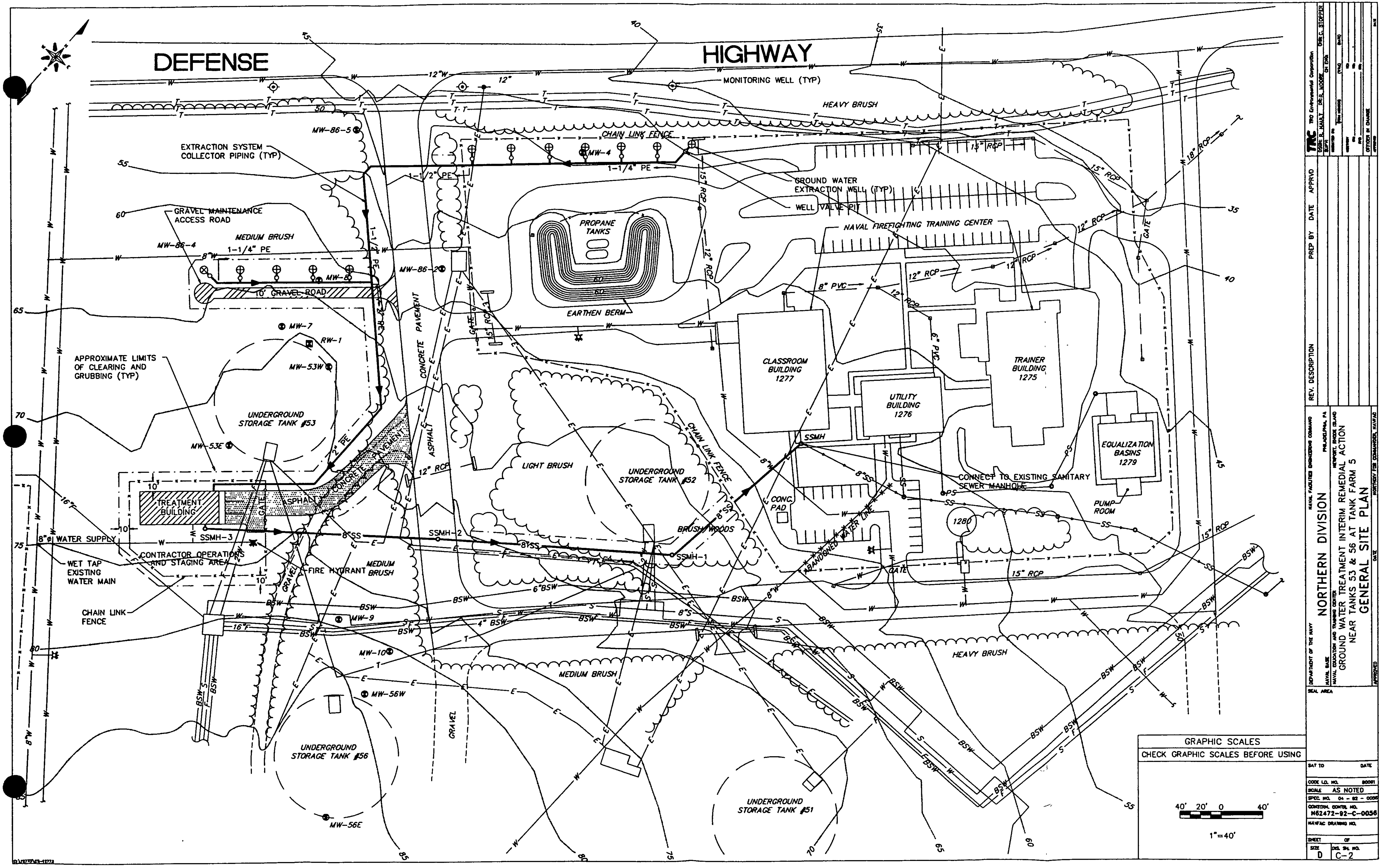
GAC = GRANULAR ACTIVATED CARBON

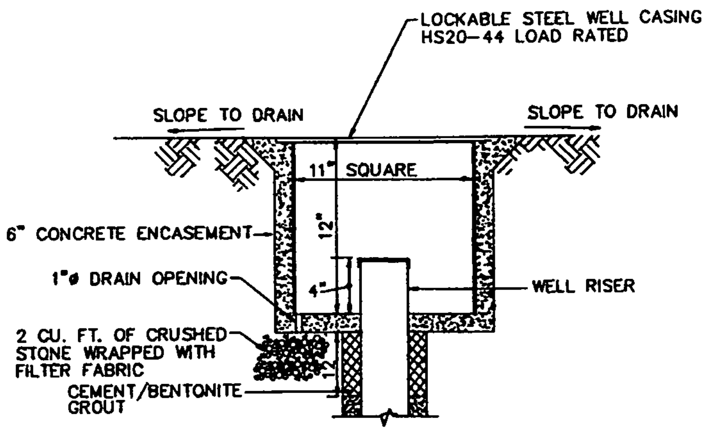
TRC
TRC Environmental Corporation
5 Watersid Crossing
Windsor, CT 06095
(203) 289-8631

NAVAL EDUCATION AND TRAINING CENTER — NEWPORT RHODE ISLAND

SITE 13 - TANK FARM FIVE
FIGURE 2.
TREATMENT PROCESS BLOCK FLOW DIAGRAM

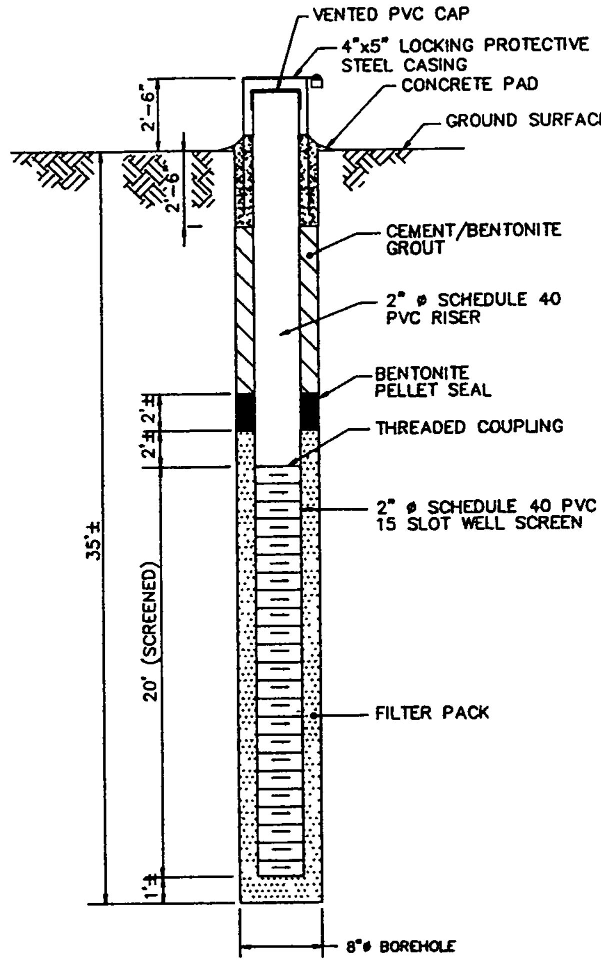
Date: 3/93 | Drawing No. 12773-Q41-01


DEFENSE HIGHWAY
MONITORING WELL (TYP)
HEAVY BRUSH
CHAIN LINK FENCE
EXTRACTION SYSTEM COLLECTOR PIPING (TYP)
GROUND WATER EXTRACTION WELL (TYP)
WELL VALVE PIT
GRAVEL MAINTENANCE ACCESS ROAD
MEDIUM BRUSH
10' GRAVEL ROAD
PROPANE TANKS
EARTHEN BERM
NAVAL FIREFIGHTING TRAINING CENTER
CLASSROOM BUILDING 1277
UTILITY BUILDING 1276
TRAINER BUILDING 1275
EQUALIZATION BASINS 1279
PUMP ROOM
CONNECT TO EXISTING SANITARY SEWER MANHOLE
APPROXIMATE LIMITS OF CLEARING AND GRUBBING (TYP)
UNDERGROUND STORAGE TANK #53
UNDERGROUND STORAGE TANK #52
UNDERGROUND STORAGE TANK #56
UNDERGROUND STORAGE TANK #51
CONCRETE PAVEMENT
ASPHALT
LIGHT BRUSH
BRUSH/WOODS
TREATMENT BUILDING
8"ø WATER SUPPLY
CONTRACTOR OPERATIONS AND STAGING AREA
WET TAP EXISTING WATER MAIN
FIRE HYDRANT
CHAIN LINK FENCE
ABANDONED WATER LINE
GRAVEL
GRAPHIC SCALES
CHECK GRAPHIC SCALES BEFORE USING
1"=40'
REV. DESCRIPTION PREP BY DATE APPRVD
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
PHILADELPHIA, PA
NAVAL BASE
NAVAL EDUCATION AND TRAINING CENTER NEWPORT, RHODE ISLAND
GROUND WATER TREATMENT INTERIM REMEDIAL ACTION
NEAR TANKS 53 & 56 AT TANK FARM 5
GENERAL SITE PLAN
SEAL AREA
SCALE AS NOTED
N62472-92-C-0056
SIZE D
C-2



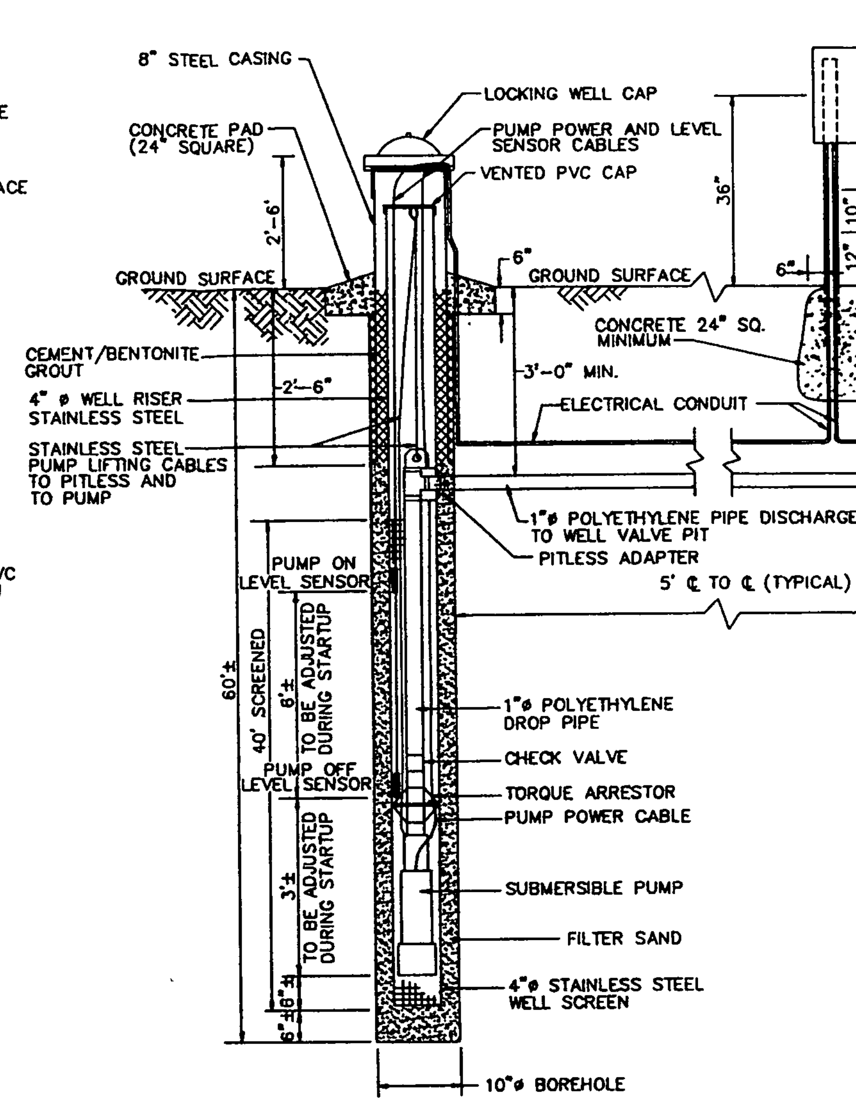
WELL CASING FOR FLUSH MOUNT DESIGN

N.T.S.



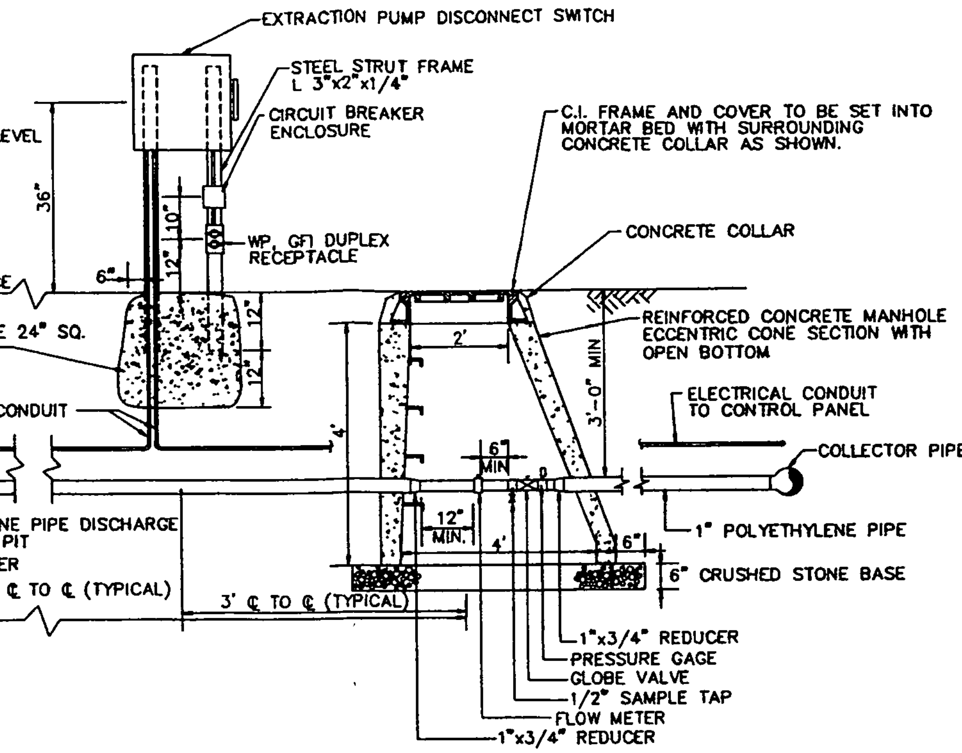
GROUND WATER MONITORING WELL WITH STICK UP CASING

N.T.S.



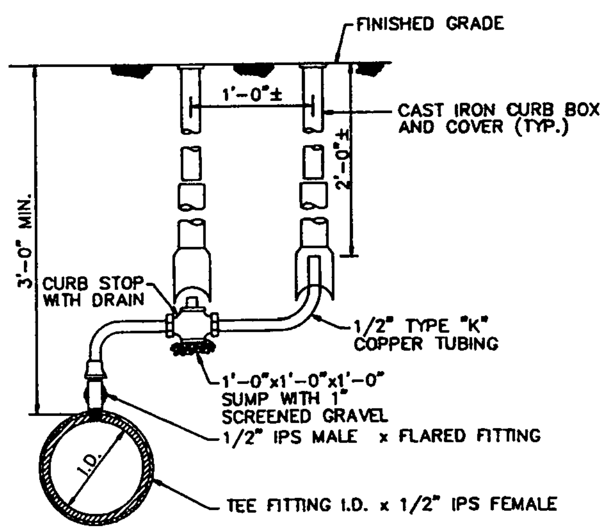
GROUND WATER EXTRACTION WELL WITH STICK UP CASING

N.T.S.



WELL VALVE PIT

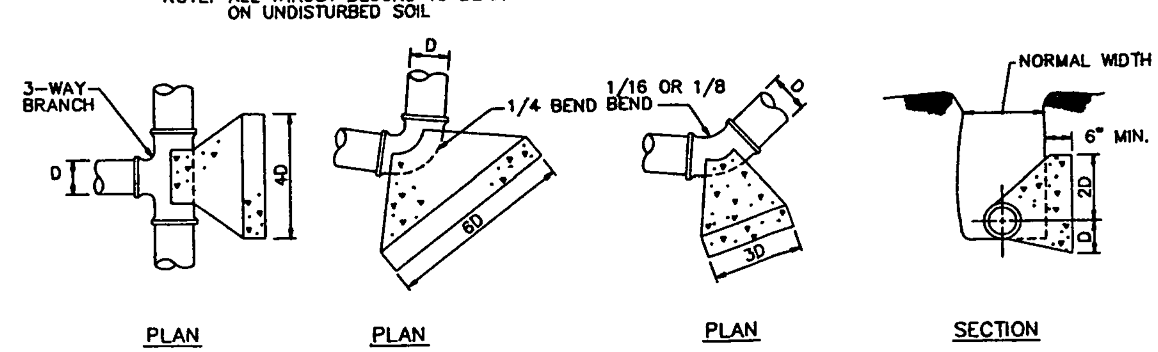
N.T.S.



MANUAL AIR RELEASE VALVE DETAIL

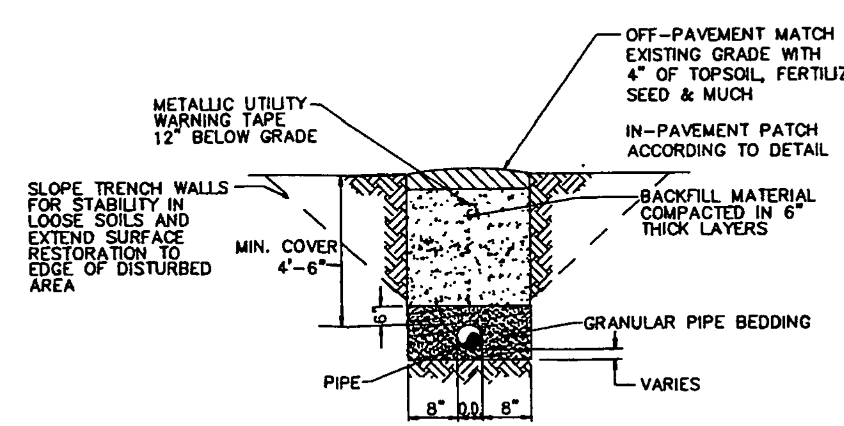
N.T.S.

NOTE: ALL THRUST BLOCKS TO BEAR ON UNDISTURBED SOIL



THRUST BLOCKS ON BENDS AND TEES

N.T.S.



PIPE TRENCH

N.T.S.

PUMP SCHEDULE

ITEM	QUANT.	TYPE	SERVICE	PIPE SIZE		FLOW (GPM)	TDH (FEET)	ELECTRICAL					REMARKS
				SUCTION	DISCHARGE			HP	RPM	VOLTS	PH	HZ	
ALL EXTRACTION WELLS	12	SUBMERSIBLE TURBINE	GROUND WATER EXTRACTION	–	1" I.D.	70	50	1/3	3450	208	1	60	SUBMERSIBLE WELL PUMP

NORTHERN DIVISION

NAVAL FACILITIES ENGINEERING COMMAND

GROUND WATER TREATMENT INTERIM REMEDIAL ACTION NEAR TANKS 53 & 56 AT TANK FARM 5

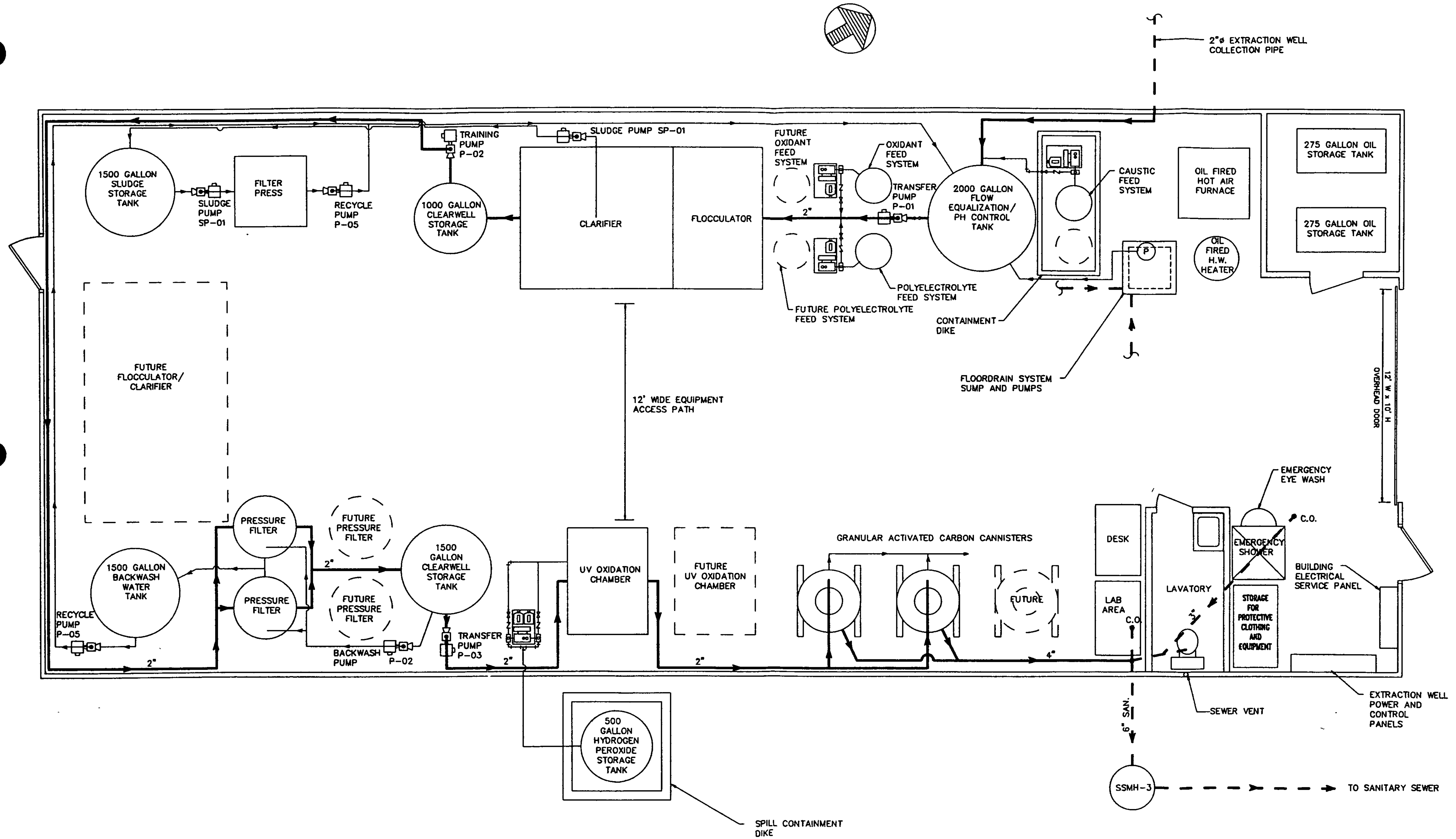
GROUND WATER EXTRACTION DETAILS

SCALE: AS NOTED

CONSTR. CONTR. NO. N62472-92-C-0056

SIZE D

C-4



GRAPHIC SCALES

CHECK GRAPHIC SCALE BEFORE USING

4' 0 4'

3/8"=1'

EQUIPMENT LAYOUT PLAN

SCALE: 3/8"=1'-0"

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
PHILADELPHIA, PA
NAVAL CONSTRUCTION BATTALION CENTER
DAVISVILLE, RHODE ISLAND
NAVAL EDUCATION TRAINING CENTER
IRM-TANK FARM #5 TANKS 53 & 56
TREATMENT BUILDING EQUIPMENT LAYOUT

TRC Environmental Corporation

SCALE AS NOTED

SPEC. NO. 04 - 92 - 0056

CONSTR. CONTR. NO. N62472-92-C-0056

SIZE D

DWG. SH. NO. M-1

INTERIM REMEDIAL ACTION
MCALLISTER POINT LANDFILL - NETC, NEWPORT

Completion Date: Summary Report - January 18, 1993

Objective: Provide a framework and plan for developing an Interim Remedial Action for the site.

Summary:

The summary report presents background information on existing conditions, history, environmental assessment and geologic/hydrogeologic conditions that would impact discussions regarding potential Interim Remedial Measures at the McAllister Point Landfill. Based on existing conditions and background information, an Interim Remedial Action to isolate soil/waste material is outlined. The interim remedial action outlined is a cap. This remedy is intended to minimize the production and movement of leachate pending design of a final comprehensive clean-up program for all affected media at the site. The cap would limit leachate production and prevent exposure to contaminated surface soil.

INTERIM REMEDIAL ACTION
MCALLISTER POINT LANDFILL - SITE 01

OVERVIEW

The McAllister Point Landfill is located adjacent to Narragansett Bay. Erosion is evident along the shore and it is apparent that the landfill is a potential source of contamination to the Bay. Therefore, it is considered prudent to remediate soil/water at the landfill on a "fast-track" basis pending design of a Comprehensive Final Clean-Up program for all affected media. The purpose of this summary report is to provide a framework and plan for developing an Interim Remedial Action for the site.

The report presents background information on existing conditions, history, environmental assessment and geologic/hydrogeologic conditions that would impact discussions regarding potential Interim Remedial Measures for the site. The summary report include brief sections on:

- Site Location/Description
- Site History
- Previous Site Investigations, Soil Assessment, and Ground Water Assessment
- Site Geology
- Site Hydrology
- Focus Feasibilty Study
- Interim Remedial Action (Capping and Slope Protection)

SITE LOCATION AND DESCRIPTION

The McAllister Point Landfill is located along the shoreline of Narragansett Bay and encompasses approximately 11.5 acres. The site is situated between Defense Highway and Narragansett Bay.

The site is 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 to 35 feet above mean low water level (mlw). Along the western edge of the site the surface slopes steeply to the shoreline. Erosion of the slope has been noted.

The surface of the site is vegetated with grass, weeds, and some small diameter trees. A small, lightly wooded area is present at the northern end of the mounded area. Several depressions are present in the central portion of the site where standing water collects during heavy precipitation events.

SITE HISTORY

From 1955 through the mid-1970's, this site was used as a landfill which received industrial and domestic-type wastes such as domestic refuse, spent acids, paints, solvents, waste oils, and PCB-contaminated oil. Wastes from the operational areas (machine shops, electroplating operations, etc.), navy housing areas, and from the ships homeported at Newport prior to 1973 were disposed of in the landfill. 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 1970-1971, some 98 percent of all the wastes were burned before being disposed of in the landfill. The incinerator was closed about 1970. During the remaining years that the site was operational, all wastes were again disposed of directly into the landfill. The landfill was closed during 1973.

Aerial photos and facility maps were reviewed covering the years from 1938 to 1988. Activity on the site dates back to 1938, with a railroad spur entering the site near the current site entrance, and running north into the center of the site. Throughout the 1940's and 1950's, large open depressions are visible on the site, along with material storage areas and what appeared to be above-ground tanks. From 1958 through 1970, an incinerator was visible in the north-central portion of the site. From 1965 through 1975, the shoreline of the central portion of the site changed shape, indicating the filling of Narragansett Bay in this area. In the 1981 and 1988 aerial photos, the site appeared to be generally inactive.

PREVIOUS INVESTIGATIONS

An Initial Assessment Study (Envirodyne Engineers, 1983) and Confirmation Study (Lourero, 1985) indicated that the site was used historically for disposal of hazardous materials and the presence of contamination was confirmed. The Phase I - Remedial Investigation was conducted by TRC Environmental Corporation (TRC-EC) during late-1989 through 1990.

The findings and results of the Phase I RI for the McAllister Point Landfill are summarized below.

<u>Soil Assessment</u> - Volatile organic compounds (VOCs), base neutral extractable organic compounds (BNAs) including polynuclear aromatic hydrocarbons (PAHs), pesticides, PCBs, and inorganics were all detected in on-site soils. Figures 1 through 4 are attached for reference. 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.

The extent of soil contamination is shown on Figures 1 through 4 (attached).

Significant VOC contamination (i.e., greater than 1 ppm total VOCs) was detected in 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 surface soils along the shoreline and in subsurface soils in the north-central and southern portions of the site.

Concentrations of inorganics 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 potion 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 concentrations exceeding potential 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 located in the southern portion of the site five months after it was originally sampled. No BNAs were detected above ground water action levels and no pesticides were detected in ground water samples. A PCB concentration of 150 ppb was detected in the same well (southern portion of the site) in which oil was also observed. The highest levels of inorganic analytes were detected in wells form the north-central to southern portions of the site.

SITE GEOLOGY

The soil boring activities performed at the site under the Phase I site RI, as well as under previous subsurface investigations, provided information on the site geology.

The overburden soils on this site consist of fill and glacial till deposits. All of the soil borings except for off-site borings (off-site and upgradient) and all of the monitoring well borings, encountered fill material. The thickness of the fill material ranged from 3 feet near the periphery of the site, to 24 feet in the central portion of the landfill. The central portion of the landfill may contain up to 38 feet of fill material. The fill material encountered consisted of a wide variety of municipal and industrial wastes (e.g., plastic, wood, paper, garbage, construction debris, paints), as well as what appears to be ash from the incinerator which reportedly operated on the site. The fill material appears to have been deposited directly upon the bedrock surface across a majority of the site.

Overlying the fill material, at several locations across the landfill, is a clay-silt layer 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. The cover material is discontinuous across the site, and was found primarily in the central portion of the landfill. A clay-silt layer was also encountered overlying the fill material at the southern end of the landfill, and in the northern portion of the landfill; however, this material did not appear to be the same "cap" material encountered in the central landfill area.

Glacial till deposits were observed directly beneath the fill and overlying the bedrock at the periphery of the site. Till was encountered in borings in the central landfill area and in the southern portion of the site. These borings were completed within the till layer. The till encountered consisted primarily of a dense fine to coarse sand and silt, with some horizons containing weathered shale fragments. The till when encountered varied in thickness from 4.5 feet to 11.5 feet.

The bedrock encountered at the McAllister Point Landfill consists of a gray-green to black, highly weathered to competent, carboniferous shale. Cores of the shale exhibited a high degree of fracturing with quartz and iron-oxide deposits common along fractures. The depth to bedrock at the site varied from 4 feet to 24 feet. The bedrock surface exhibits a uniform, westward slope, towards Narragansett Bay.

SITE HYDROLOGY

The following are discussions on the site surface water hydrology and ground water hydrology.

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 small depressions located in the north-central portion of the site. The western edge of the site (bordering Narragansett Bay), is at an elevation approximately 10 feet higher than the beach shoreline along the bay. A slightly mounded area along the top of slope may limit direct surface runoff (overland flow) into the bay. Springs (leachate) have been observed discharging from the bottom of the landfill bank along the western edge of the site, into the bay.

Ground Water Hydrology

Ground water levels were measured in the nine monitoring wells installed during the Phase I site RI in April, July, and September of 1990, and in January of 1991. The ground water contour maps developed for this site (April, July, September 1990, and January 1991) indicate that the site ground water is flowing from east to west, towards the Narragansett Bay.

Single well hydraulic conductivity tests (slug tests) were performed in four of the monitoring wells at the site. All of these wells are screened within the bedrock at the site. The hydraulic conductivities determined from the slug tests range from 0.07 ft/day to 0.20 ft/day. These hydraulic conductivity value are much higher than values normally attributed to shale (10^{-4} to 10^{-8} ft/day) and probably reflect the highly weathered and fractured nature of the upper portion of the bedrock at the site. Slug tests were not conducted in monitoring wells screened in the fill material at the site, due to the shallow ground water levels (i.e., insufficient water) in the shallow wells.

Vertical Hydraulic Gradients

Vertical hydraulic gradients were determined at the two sets of nested monitoring wells installed during Phase I. Vertical hydraulic gradients were used to evaluate whether contamination will potentially migrate downward.

A downward (negative) hydraulic gradient was observed in both of the well pairs. This indicates that ground water from above the bedrock surface (in the fill or overburden) would tend to flow downward into the bedrock at these locations.

Horizontal Hydraulic Gradients

Horizontal hydraulic gradients were also determined from the water level measurements at the site. Horizontal gradients were used, along with the aquifer hydraulic conductivity and effective porosity, in determining horizontal ground water flow velocities. This allows an estimate of and hence the rate at which an aquifer may transport dissolved contaminants.

Horizontal gradients were calculated from the shallow wells (screened in the fill and overburden materials), and the three deep wells at the site (screened in bedrock) on the basis of the average of the four sets of ground water level measurements taken at the site. The horizontal gradient represents the change in head, measured in feet, per horizontal foot of travel through the medium.

Calculated shallow average horizontal hydraulic gradients ranged from 0.0056 ft/ft to 0.038 ft/ft. Deep average horizontal gradients were calculated as 0.0077 ft/ft and 0.0049 ft/ft.

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.

Calculated average linear velocities for the shallow ground water ranged from 0.0061 ft/day to 0.04137 ft/day. The average linear velocities of the deep ground water were calculated as 0.0091 ft/day and 0.0057 ft/day. It is important to note that the calculated average linear velocity values are 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).

Tidal Influence

Continuous ground water level measurements were recorded in five of the monitoring wells during the Phase I RI for three days (August 21 to August 24, 1990). Ground water levels were recorded every 15 minutes during the three-day time period. At the same time, continuous surface water levels were recorded at a gauging station located in Narragansett Bay, adjacent to the site.

Tidal influences were observed in most of the on-site monitoring wells. However, the influence on some wells was small and considered negligible. The strongest tidal influence was encountered in the deep wells. The water level fluctuations in the wells closely matched the six-hour tidal period observed in the Narragansett Bay tidal station adjacent to the site. The amount of tidal fluctuation was determined to be is a function of proximity to Narragansett Bay and whether the well screen intercepts the bedrock.

When the landfill was active, the surface was extended into the Bay apparently using the wastes as fill material. The site historically was subject to periodic flooding until the elevation of the site was increased above flood levels.

EVALUATION

Based on the results of investigations conducted to date, remediation of the McAllister Point Landfill is required. An Interim Remedial Action to isolate soil/waste material is recommended. In designing a cap, the objective is to limit the infiltration of water to the waste to minimize leachate generation and prevent contamination that could possibly discharge to surface water (Narragansett Bay) and ground water sources.

Where the waste is above the ground water zone, a properly designed and maintained cover can prevent (for practical purposes) water from entering the landfill, minimizing the formation of leachate. Any existing leachate must be collected and removed.

Based on a preliminary evaluation of existing data; the Remedial Action Objectives are as follows:

- Prevent migration of contaminated ground water to Narragansett Bay
- Minimize off-site migration of surface soil contaminants and subsurface fill material

In order to meet these objectives an approach to prevent continued formation of leachate (capping) and minimize erosion (slope protection) is suggested as a realistic approach. This would involve grading, capping, and erosion protection as in Interim Remedial Action.

It is understood that a Focused Feasibility Study and development of a Proposed Plan are necessary steps to implement this program. The Final Proposed Plan is released for public comment prior to the preparation and submission of the draft ROD/Responsiveness Summary for EPA and State of Rhode Island review and comment.

The Scope of Work would be tailored to this specific effort and be performed on a "fast-track" basis. The steps that are necessary to implement the remediation are outlined below:

Step 1 - Discuss with EPA and RIDEM an approach to expedite the remedial action at McAllister Point Landfill (January 28, 1993)

Step 2 - Prepare Focus Feasibility Study and Proposed Plan

Step 3 - EPA/RIDEM Submits Letter of Concurrence

Step 4 - Public Meeting and Public Comment Period

Step 5 - Record of Decision/Responsiveness Summary

Step 6 - EPA/RIDEM Submits Letter of Concurrence

Step 7 - Design Development and Preparation of Plans and Specifications

Step 8 - Construction Activities

Focus Feasibility Study (FFS)/Proposed Plan

The FFS will provide the framework for the development of the proposed plan and support an Interim Remedial Action for soil/waste contamination at McAllister Point Landfill. Clearly the work effort will be tailored to evaluate process-options necessary to prevent infiltration (cap) and erosion (slope protection). The FFS will provide the information necessary to develop a ROD that will meet CERCLA requirements. The objective of the FFS is to evaluate alternatives for implementing an interim remedy for soil/waste contamination. This Interim Remedial Action will prevent contact, minimize leachate generation and control erosion of the landfill slopes.

A Phase II Remedial Investigation to further define the nature and extent of contamination at the site and a Feasibility Study examining all media including air, ground water and soils and sediment not addressed by the interim remedy to evaluate alternatives for a comprehensive plan for site remediation will be conducted.

Focus Feasibility Study (Phase I) - Development and screening of alternatives:

- Identification of Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) requirements.
- Develop Remedial Action Objectives.
- Develop general response:
  - No Action
  - Treatment Alternatives
  - Excavation Alternatives
  - Disposal Alternatives
  - Hot Spot Removal/Treatment
  - Containment Alternatives:
    - Site Grading
    - Surface drainage

- -- Capping
  - -- Vegetative Cover
  - -- Fencing
  - -- Deed Restrictions
  - -- Combination of the Above
- Identification and Screening of Technologies
- Technology Process-Options Evaluation:
  - -- Effectiveness
  - -- Implementability
  - -- Cost Evaluation
- Assemble Alternatives/Screening

<u>Focus Feasibility Study (Phase II)</u> - Detailed Evaluation of Alternatives:

- Redefinition of Alternatives

- Individual Analysis of Alternatives Against Evaluation Criteria:

  - Overall Protection of Human Health and The Environment
  - Compliance with ARARs
  - Long-Term Effectiveness and Permanence:
    - -- Magnitude of Residual Risk
    - -- Adequacy and Reliability of Controls

- Reduction of Toxicity, Mobility on Volume Through Treatment

- Short-Term Effectiveness

<u>Implementability</u>

- Construction and operation
- Reliability
- Ease of Undertaking Additional Remedial Action (if necessary)
- Monitoring Consideration
- Administrative Feasibility
- Availability of Services and Materials

<u>Cost</u>

- Capital Costs (direct and indirect)
- Annual O&M Costs

<u>Community Acceptance</u>

INTERIM REMEDIAL ACTION SOIL/WASTE CONTAMINATION - OPERABLE UNIT

The capping of McAllister Point Landfill will isolate the buried waste and fill to avoid surface infiltration, thereby minimizing the generation of leachate. Capping may also control the emission of gases and odors, reduce erosion and improve aesthetics. Capping will probably be selected since the extensive subsurface contamination will preclude complete excavation and removal of wastes due to potential hazards and/or unrealistic costs.

Data Collection Requirements

Phase I Remedial Investigations have provided the database to allow the preparation of a Focus Feasibility Study and Proposed Plan for soil remediation operable unit (Interim Remedial Action - Soil/Waste Contamination). Data collection requirements for capping are presented on Table 1-A majority of required data has already been collected during the Phase I - RI. Additional data can be obtained during the Design Phase.

Engineering Considerations for Implementation

Design specifications will describe in detail the type of cap material including synthetic membranes and construction requirements (compaction, sequence, etc.).

The final cover minimum thicknesses recommended by EPA for a multilayered cap (U.S. EPA, 1989) from final grade are as follows:

- Vegetative and protective layer - A 24-inch thick layer of topsoil or soil fill
- Drainage layer - 12 inches of sand (permeability 1 x 10^{-2} cm/sec)
- First barrier layer component - Synthetic membrane (20 mil thickness minimum)

- Second barrier layer component - 24 inches of low permeability compacted soil with a maximum in-place permeability of 1 x 10^{-7} cm/sec

- Gas vent layer (optional based upon site-specific conditions) - 12 inches of native soil or sand to act as a foundation for the cap or to vent/control gas

- Waste.

The following are key design considerations for a cap:

- The slope of the low-permeability layer should be between 3 and 5 percent to prevent erosion and ponding of rain water on the top of the cap. The perimeter side slopes are final grades and should be no steeper than three (horizontal) to one (vertical). For each 20-foot increase in vertical heights, a bench should be constructed in the slope to control surface water runoff and subsequent erosion.

- The impermeable barrier portion of the cap should be located beneath the average depth of frost penetration for the site.

- The vegetative layer should be thick enough to contain the effective root depth or irrigation depth for the type of vegetation planted.

- The drainage layer should be designed and constructed to discharge flow freely in the lateral direction to exit the cap.

- Surface seals required long-term maintenance. Periodic inspections should be made for settlement, ponding of liquids, erosion, and invasion of deep-rooted vegetation. Concrete barriers and bituminous membranes are vulnerable to cracking, but the cracks can be relatively easily repaired.

- Several materials and design are available for capping. Factors influencing the proper selection of materials and design include desired functions of cover materials, waste characteristics, climate, hydrogeology, projected land use, and availability and costs of cover materials.

Surface Water Controls

Grading of the McAllister Point Landfill will probably be required prior to construction of the Cap. This will reduce infiltration and erosion while re-directing runoff from the site.

The grading will be designed to reduce ponding and control runoff velocity and soil erosion. Where an impermeable cap is constructed, surface waters should be directed away from the surface to prevent ponding.

Gas Venting

Gas venting (active or passive) is applicable to the containment (control of migration) of VOCs in soil. The vents may be required in conjunction with a cap to control methane gas. However, this requirement for venting will depend on identification of potential receptors and associated risks.

Slope Protection

Slope protection may be required adjacent to Narragansett Bay. This will prevent erosion from tidal action and surface runoff. This will reduce the threat of introducing contaminated material to the Bay.

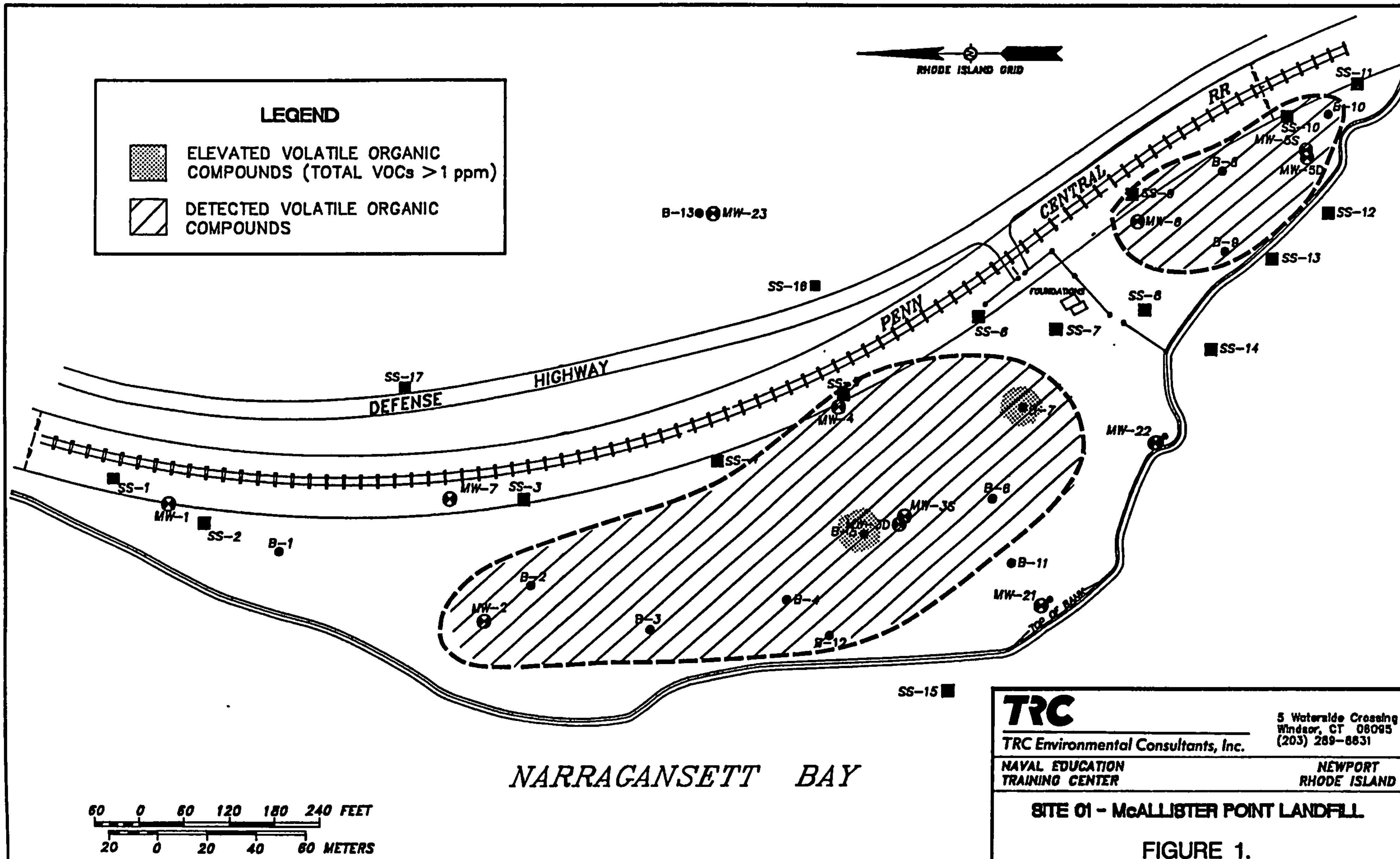
Various methods will be investigated:

- Surface water diversion trenches/berms (top of slope)
- Rip-rap
- Gabion walls
- Sheet pile wall (backfill)

TABLE 1

DATA REQUIREMENTS FOR CAPPING

Data Description	Purpose(s)	Source(s)/Method(s)
Extent of contamination	Determine cost-effectiveness of cap vs. excavation/removal	Surficial soil and borehole sampling and analysis to determine depth and lateral extent of contamination -- Phase I - RI
Depth to ground water table	May not be effective in areas with a high ground water table	Hydrogeologic maps, observations wells, and borehole logs -- Phase I - RI
Availability of cover/ capping materials	Implementability and cost	Local borrow pits/quarries, surficial geology maps -- Design
Soil characteristics	Suitability for: - Drainage layers - Impermeable soil layer - Mixing with bentonite	Laboratory testing of soil samples -- Design
Gradation		Sieve analysis, Atterberg Limits -- Design
• Permeability (percent compaction, moisture content)		Moisture/density relationships, permeability testing in triaxial cell per Army Corps of Engineers procedure -- Design
• Strength	Slope stability	Triaxial shear, direct shear testing -- Design
Climate (precipitation)	Expected infiltration rate; design criteria	NOAA records; local rainfall records -- Phase I - RI
Final land use	Selection of proper cap design	



NOTE: LOW LEVEL VOCS DETECTED IN REANALYSIS OF SURFACE SOIL SAMPLES SS-01, SS-04 AND SS-06

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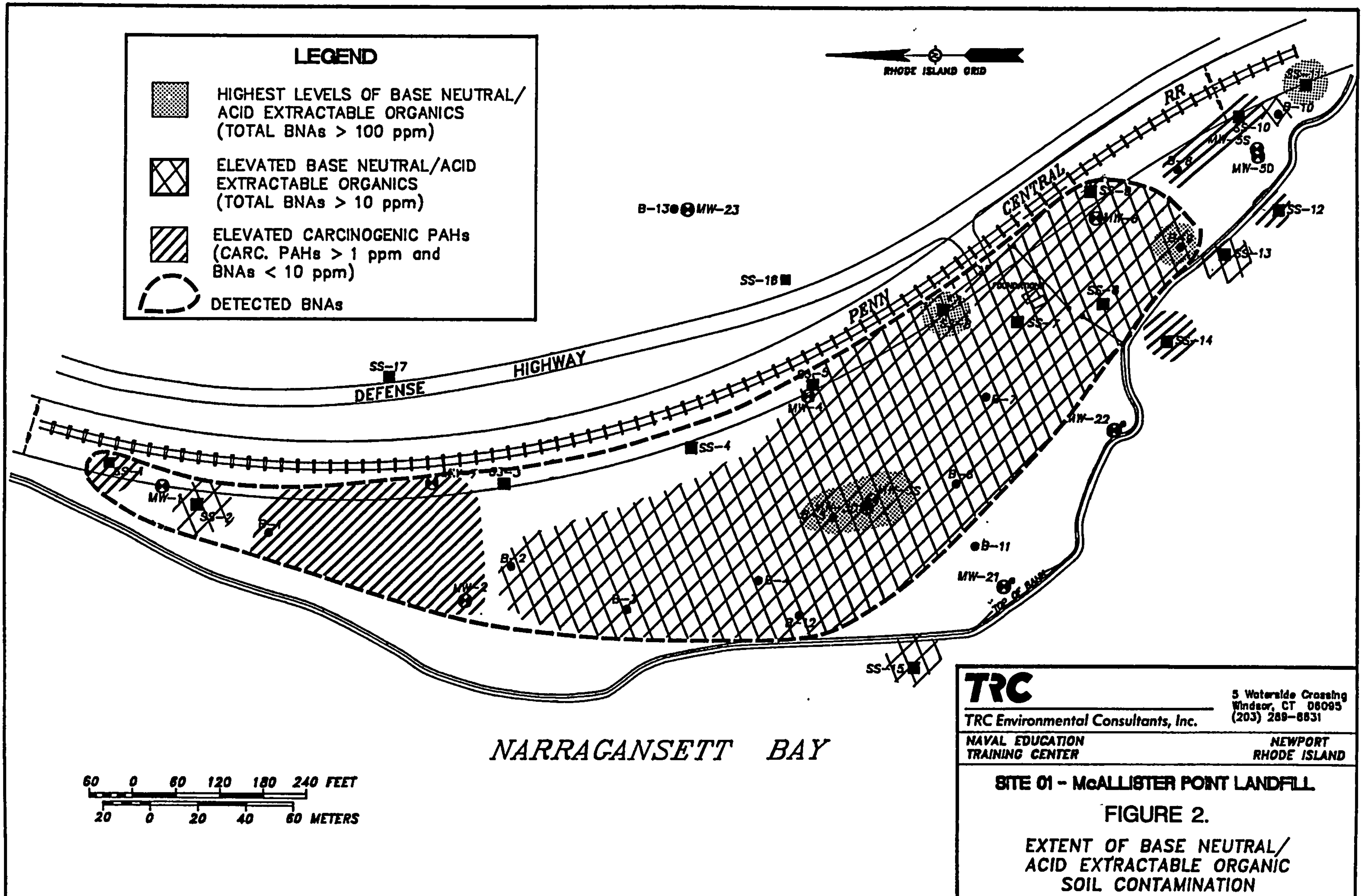
SITE 01 - McALLISTER POINT LANDFILL

FIGURE 1.

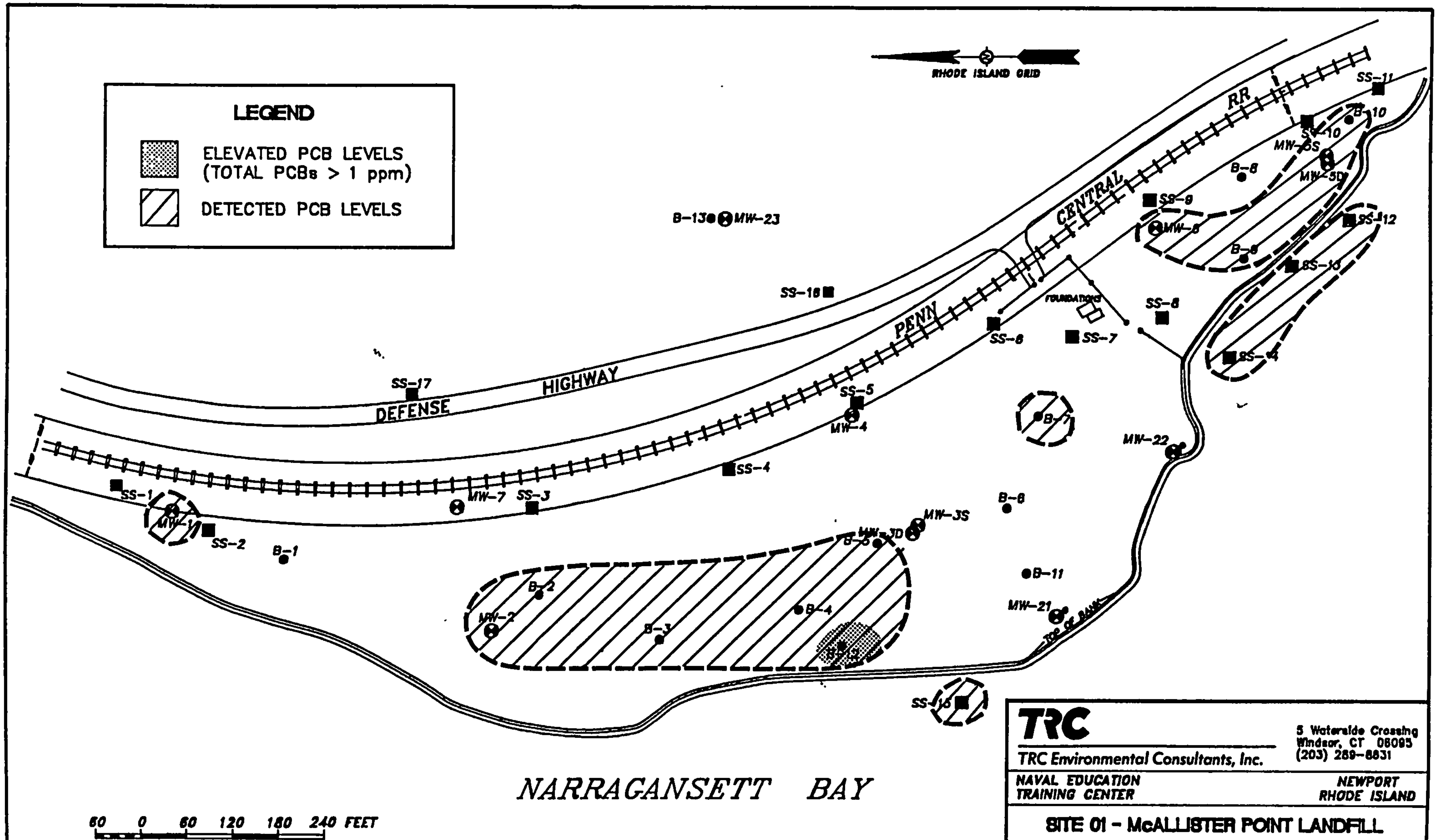
EXTENT OF VOLATILE ORGANIC SOIL CONTAMINATION



SITE 01 - McALLISTER POINT LANDFILL

FIGURE 2.

EXTENT OF BASE NEUTRAL/ ACID EXTRACTABLE ORGANIC SOIL CONTAMINATION



NOTE: PCBs WERE NOT DETECTED IN ANY ON-SITE SURFACE SOIL SAMPLES; ONLY IN THE SHORELINE SURFACE SOIL SAMPIES.

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FIGURE 3.

EXTENT OF PCB SOIL CONTAMINATION

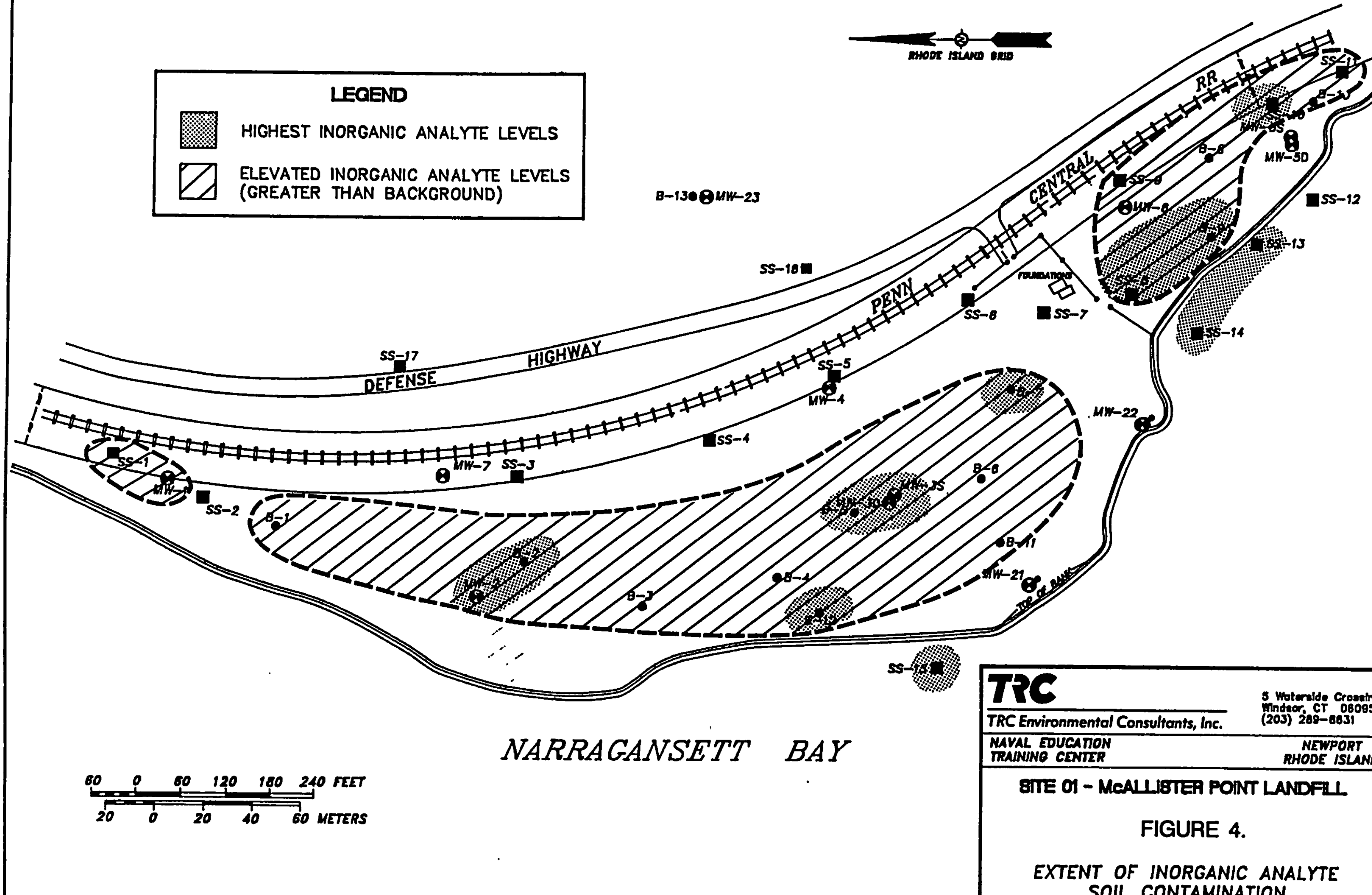

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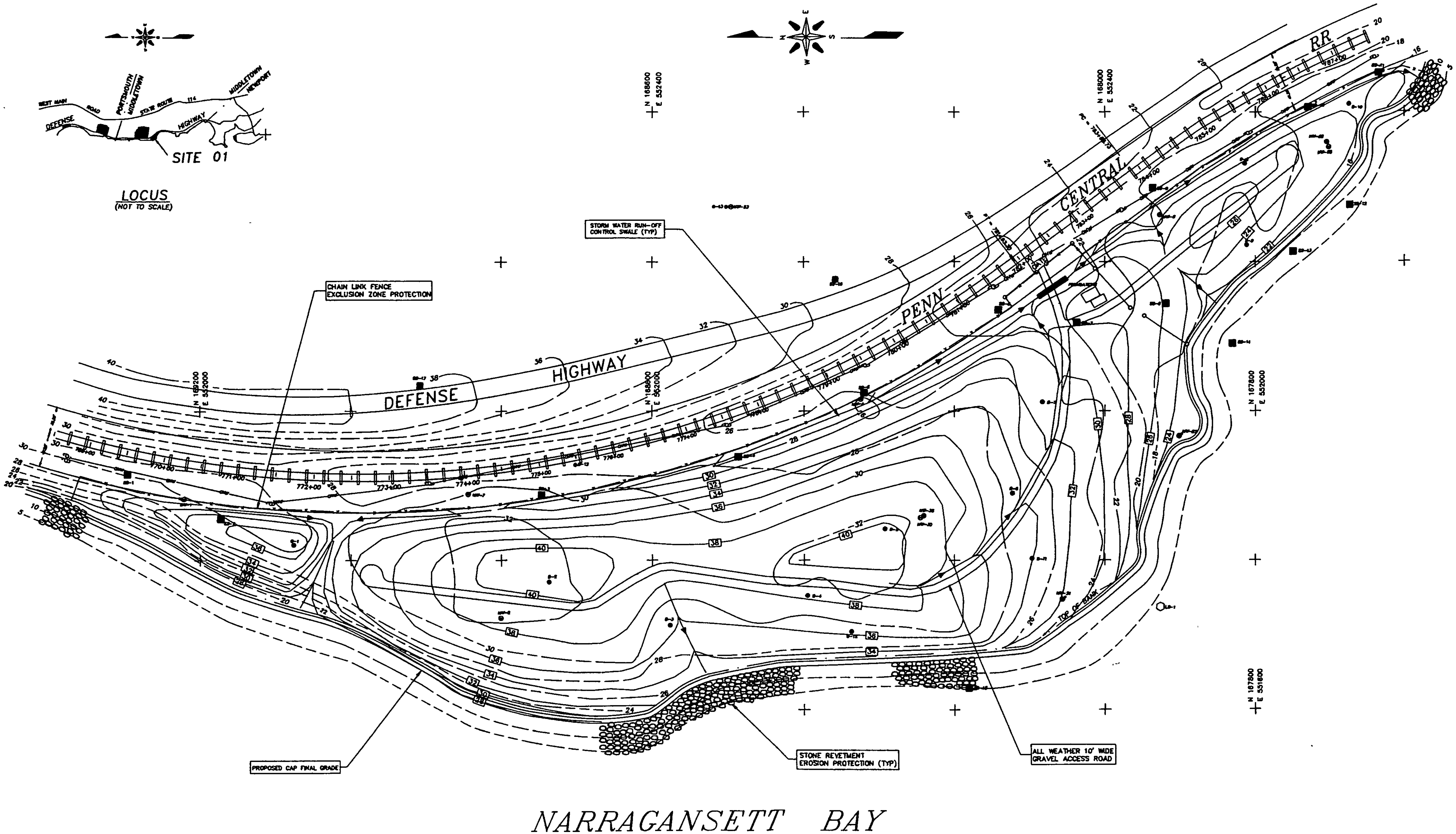
FIGURE 4.

EXTENT OF INORGANIC ANALYTE SOIL CONTAMINATION



LEGEND

- MONITORING WELL
- EXISTING MONITORING WELL
- LEACHATE SPRING
- SURFACE SOIL SAMPLE
- TEST BORING
- GRID TICK MARK
- CHAIN LINK FENCE
- UTILITY POLE
- OVERHEAD WIRES

60 0 60 120 180 240 FEET

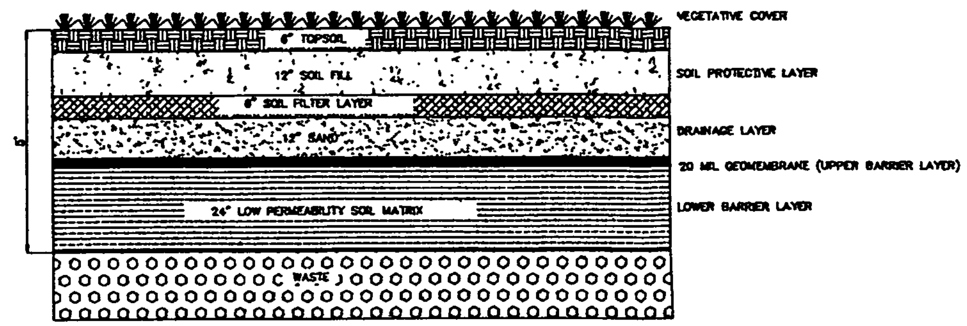
20 0 20 40 60 METERS

TRC Environmental Corporation

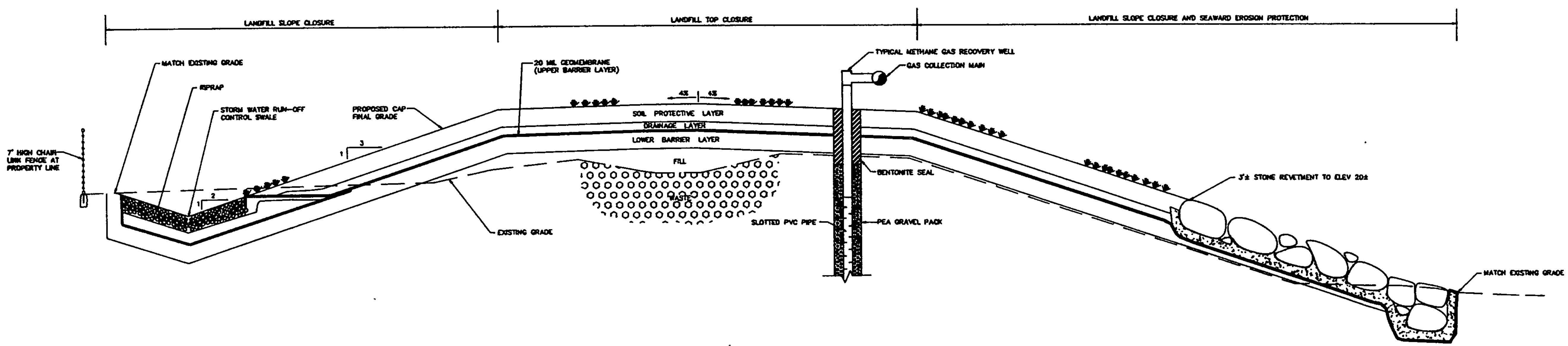
NAVAL EDUCATION & TRAINING CENTER — NEWPORT RHODE ISLAND

SITE 01
McALLISTER POINT LANDFILL
PROPOSED CLOSURE PLAN

		SCALE 1"=50'	PROJ. NO.
DRAWN	RFM	DATE	DWG. NO.
APPROVED	RJN	FEBRUARY 19, 1993	C1-LNDFL



CAP DETAIL
NOT TO SCALE



TYPICAL SECTION THROUGH LANDFILL CAP
NOT TO SCALE

TRC TRC Environmental Corporation			
NAVAL EDUCATION & TRAINING CENTER			NEWPORT RHODE ISLAND
SITE 01 McALLISTER POINT LANDFILL PROPOSED CLOSURE DETAILS			
		SCALE	PROJ. NO.
DRAWN	RFM	DATE	DWG. NO. C2-LNDFL
APPROVED	RJN		

c:\12773\c2-lndfl

UST CLOSURE INVESTIGATION AND CONCEPTUAL DESIGN
TANK FARM FIVE - NETC NEWPORT, RHODE ISLAND

Completion Date:

Under Development - Scheduled Due Date - June 1, 1993

Objective:

The purpose of the investigation and conceptual design is to evaluate the status and condition of all eleven (11) underground storage tanks (USTs) at Tank Farm Five and prepare conceptual closure plans, closure methodology, cost estimates and evaluate permit needs in a closure report. Alternative closure methods which are consistent with applicable regulations will be presented.

PROJECT OUTLINE

UST CLOSURE INVESTIGATION AND CONCEPTUAL DESIGN
TANK FARM FIVE
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

TRC-EC Project No. 14114-N81-90
Contract No. N62472-91-D-1408 (Amendment #5)

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

General Introduction - work being performed by TRC-EC for Navy to close tanks at Tank Farm Five. Note that Tank Farm is located at NETC Newport, the Tank Farm is inactive, and additional investigations (Phase II RI) are planned to further define the nature and extent of contamination at the Tank Farm. Briefly summarize format of report.

1.2 OBJECTIVES

The purpose of the investigation and conceptual design is to evaluate the status and condition of all eleven (11) underground storage tanks (USTs) at Tank Farm Five and prepare conceptual closure plans, closure methodology, cost estimates and permit evaluation. Alternative closure methods which are consistent with applicable regulations are presented.

2.0 BACKGROUND INFORMATION

2.1 SITE LOCATION AND DESCRIPTION

Describe the physical setting of Tank Farm Five at NETC. Reference Site Locus and Site Plan Figures.

2.2 SITE HISTORY AND OPERATIONS

2.2.1 Individual Tank Construction

Describe the construction of the 11 tanks at Tank Farm Five including materials of construction, wall thicknesses, etc. Note any differences in construction of any tanks or that they are all the same.

2.2.2 Tank Farm Construction

Same as Section 2.2.1 except describe interconnecting piping, fill and drain lines, water, sewer, electrical lines, etc. Once again provide enough data to support cost estimates to be developed later in the report. Reference a Figure or set of Figures which reference pertinant underground utility lines, etc.

2.2.3 History and Operations

Describe the history of operations at the Tank Farm.

2.2.4 Aerial Photography

Summarize information from the review of historic aerial photoghraphs of the Tank Farm.

2.3 PREVIOUS INVESTIGATIONS

Provide a brief introduction to this section which indicates that several investigations have been performed at Tank Farm Five and each investigation will be briefly summarized in this section as it relates to the potential impact on the costs of closure.

2.3.1 Initial Assessment Study

2.3.2 Tank Closure Plan - Tanks 53 and 56

2.3.3 Tank Closure Investigation - Tanks 53 and 56

2.3.4 Phase I Remedial Investigation

2.3.5 Supplmental Ground Water Sampling Investigation

2.3.6 Soil Investigation - Tanks 53 and 56

2.3.7 Phase II RI/FS Work Plan

2.3.8 Summary

Briefly summarize information from above investigations/documents which may impact closure costs or methodologies. This section should provide information and reference tables on the volume of water/oil/sludge present within the tanks.

2.4 GEOLOGY

Provide introduction that states that the geology of the site is summarized from information presented in the previous investigations.

2.4.1 Topography

2.4.2 Subsurface Conditions

Reference a Figure or Figures which locate site monitoring wells, borings, cross sections, etc.

2.5 GROUND WATER HYDROLOGY

Information provided in this section will provide background information on the depth to water, water flow patterns, permeabilities, etc. The emphasis in this section should be on information which will be important in the cost and methodology portions of the report (i.e. how fast will water flow into any open excavations, etc.) Reference a Figure or Figures which indicate locations of monitoring wells, borings, etc.

2.5.1 Ground Water Flow Patterns

2.5.2 Hydraulic Conductivity

2.5.3 Horizontal Hydraulic Gradients

2.5.4 Average Linear Velocities

2.6 ENVIRONMENTAL SETTING

Information in this section will provide the basis for selection of appropriate clean-up standards described later in the report.

2.6.1 Ground Water Classification

2.6.2 Surface Water Classifications

2.6.3 Area Water Use

2.7 REGULATORY SUMMARY

Provide information on how the closure of the tanks will be regulated. Note that closure of Tanks 53 and 56 will be accomplished under hazardous waste regulations. Describe Rhode Island's UST Closure Regulations and Federal RCRA Closure requirements. The description of these requirements will provide the framework for the separation of requirements for Tanks 53/56 and other tanks in the following sections.

3.0 PERMIT EVALUATION

3.1 INTRODUCTION

Provide a brief introduction which describes the process used to identify necessary permits to achieve project objectives (i.e. reviewed available regulations met with representatives from RIDEM's UST Group, etc.)

3.2 TREATMENT PERMITS

3.2.1 On-Site

3.2.2 Off-Site

3.3 <u>TRANSPORTER PERMITS</u>

Describe manifest requirements, state transporter requirements. Include copies of blank manifests, lists of licensed transporters, etc.

3.3.1 Hazardous Waste

3.3.2 Non-Hazardous Waste

3.4 <u>OFF-SITE DISPOSAL PERMITS</u>

3.4.1 Hazardous Waste

3.4.2 Non-Hazardous Waste

3.4.3 Non-Hazardous Debris

3.5 <u>CLOSURE PERMITS</u>

3.5.1 Hazardous Waste Tanks (Tanks 53/56)

3.5.2 Non-Hazardous Waste Tanks

4.0 ALTERNATIVE EVALUATION

4.1 <u>INTRODUCTION</u>

4.2 <u>TANK CLEANING ALTERNATIVES</u>

4.3 <u>TREATMENT/DISPOSAL OF TANK CONTENTS</u>

4.3.1 On-Site Alternatives

4.3.2 Off-Site Alternatives

4.4 HAZARDOUS WASTE TANK CLOSURE ALTERNATIVES (TANKS 53/56)

4.5 NON-HAZARDOUS TANK CLOSURE ALTERNATIVES

4.6 SUBSURFACE UTILITY CLOSURE ALTERNATIVES

4.7 TRANSPORTATION AND DISPOSAL ALTERNATIVES

5.0 CONCEPTUAL CLOSURE PLANS AND METHODOLOGY

5.1 INTRODUCTION

5.2 SUMMARY OF ALTERNATIVE EVALUATION

5.3 COST ESTIMATES

5.4 RECOMMENDATIONS

5.5 CLOSURE METHODOLOGY

5.6 PERMIT REQUIREMENTS

6.0 REFERENCES